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An Investigative Study of Effect of Scientific Literacy on the Academic Achievement of Higher Secondary Learners

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Abstract

The teaching of science in school education has failed to prepare learners for using science in day to day life. It seems that the Science Teachers have not thoroughly comprehended that the perception of scientific instructions which initiate leading to the foundation of scientific literacy among the learners. Henceforth the science education needs to be reformed certainly needs to be reformed so as to enable scientific literacy as a foremost aim of science education.

A survey was conducted on 338 junior college student regarding the promotion of scientific literacy. The aim of the study was to understand the existent status of scientific literacy among junior college learners, to compare the scientific literacy among the learners on the bases of gender, type of board and type of stream. To study academic achievement wise significant difference between the scientific literacy among the male learners and female learners, to study academic achievement wise significant difference in the scientific literacy among the learners of CBSE and SSC board, to study academic achievement wise significant difference between the scientific literacy among the learners of Arts, Commerce as well as Science stream.

The study reveals that there is significant difference in the scientific literacy of male learners and female learners. Female learners are more scientifically literate than the male learners. CBSE board learners are more scientifically literate than SSC board learners. Commerce stream learners are more scientifically literate than Science and Arts stream learners.

Key words: *Scientific Literacy, Higher Secondary Learners, Gender, Boards, Stream*

Introduction

Science has been a complete and systematic body of knowledge in itself which epitomizes the existing discernment of natural structures. It also characterizes the procedure by which that body of knowledge is recognized and is being incessantly protracted, distinguished, and reformed. Both the elements are equally indispensable. Lone can't create advancement in science starved of the insight of both. Similarly, one needs to recognize both the body of knowledge and the procedure whereby this knowledge is proven, protracted, refined, and revised as well.

The Knowledge, perception as well as application of science is critical for everyone in the contemporary modern world. Science has to be as immutable component of basic

education as like the language, arts along with mathematics. It is vital to teach science since it is a substantial aspect of human culture. It denotes one of the peaks of thinking ability of mankind. Science delivers a workshop of collective experience for the development of language, reasoning, and problem-solving abilities in the classrooms.

The democratic society requires citizens to perform individual and public decisions about the issues in which scientific information shows a central part. Therefore, they require scientific knowledge along with the perception of scientific methodology. Every country depends upon the scientific together with technical capacities of its citizens towards its commercial competitiveness as well as national needs.

People have to follow and maintain with the rapid advances in science and technology in the neo-millennium. It is crucial for the information societies to utilize these expansions for the benefit of their future. There is a desperate need to educate our youth to be able to use new scientific and technological tools in the briskly changing era of 21st Century. In fact, this has to be the fundamental goal of every education system across the world.

Science education is one of the key aspects of life which relates to the advancement in science and technology. The scientific literacy has become a pivotal element of contemporary education attributable to rapid development in the field of science and technology. Hence it is necessary to teach science to all the citizens, along with those who vigorously participate in careers related to science.

Science is present in every activity, in every field so modern life could not be imagined without Science. Technology is driven by Science which is part of mankind's history. Science and technology have reshaped the lifestyle and thinking of entire human society. Science has become an integral component of every human activity. There is necessity of perception the value of science for its cultural implications along with its economic impact. Consequently, the promotion of scientific literacy, an ability that should be added as elementary capability for human in contemporary times is inevitable among the people and youth in particular through education.

Scientific Literacy is classified into components viz. the knowledge of science, the methods of science, the science as a way of knowing and the interaction between the science and technology besides society.

1. Knowledge of Science: It involves facts, definitions, concepts, theories and laws from science.

2.Methods of Science: It involves application of scientific methods and processes for instance observation, measurement, classification, inference, as well as recording and analyzing the data. It also comprises of communicating through diverse means for instance speaking, writing, by means of graphs, tables, and charts, etc., doing calculations, in consort with experimentation as well.

3. Science as a way of knowing: This implies the emphasis upon rational thinking, reasoning, and reflection in the process of construction of scientific knowledge and the efforts of scientists.

4. Empirical nature of science: It ensures the objectivity in science, usage of assumptions in science, along with inductive as well as deductive reasoning. It also comprises of causal relationships between evidence and proof, the role of self-analysis in science and description of how scientists experiment.

5. Interaction of science, technology and society: This embraces the influence of science on the society, inter-relationships amid society, science and technology, career avenues and opportunities as well as social issues related to science. It also consists of personalized application of science for making routine decisions, solving daily problems, along with improving one's life as well as ethical issues related to science.

Title of the study

An Investigative Study of Effect of Scientific Literacy on the Academic Achievement of Higher Secondary Learners

Variables of the study

- Scientific Literacy
- Academic achievement
- Gender
- Type of board (SSC, CBSE)
- Stream of the study (Arts, Science, Commerce)

Operational Definition of the terms used in the present study

1. **Scientific Literacy**

It is the knowledge and perception of scientific concepts and procedures which are prerequisite for the individual decision-making, involvement in civic, cultural affair and financial efficiency (Carrier, R., 2001).

2. **Academic achievement:**

It is the score obtained by learners in science subject in X^{th} board examination.

Objectives of the Study

- To study scientific literacy of higher secondary learners.
- To study academic achievement of higher secondary learners.
- To study academic achievement wise significant difference in scientific literacy of male learners and female learners.
- To study academic achievement wise significant difference in the scientific literacy of learners of CBSE and SSC boards.
- To study academic achievement wise significant difference in the scientific literacy of learners of Arts, Commerce and Science stream.

Methodology of Present Study

For present study, Descriptive methodology is used because present study deals with the present status of Scientific Literacy and Academic achievement of Higher Secondary Learners.

Sample and Sampling Technique

The present study included total sample of 338 Higher Secondary learners. Three colleges were selected randomly for the study. Learners were selected by cluster sampling technique. The division of STD XI was taken as a sample from each College. One intact class was taken as sample. The size of the final sample included 150 male learners and 188 female learners.

Scope and Delimitations of Study

This study is applicable to Higher Secondary learners. This study is limited for the learners of standard XI standard. This study is limited only for SSC and CBSE board learners. This study is limited for Mumbai region only.

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Analysis of data

Descriptive and inferential analysis was carried out for analyzing data. Data was analyzed by using Two-way ANOVA. Learners level of scientific literacy and Academic achievement was calculated by using percentage.

Levels of Scientific Literacy of Total Sample

Three levels were determined to study the levels of scientific Literacy of learners. The scores between11-14 indicate low level, scores between 15-19 indicate moderate level and scores between 20-24 indicate high level of scientific literacy.

Table 1

Levels of Scientific Literacy of Total Sample

Levels of Scientific Literacy	Sample	Percentage
Low (11-14)	84	24.85
Moderate (15-19)	212	62.72
High (20-24)	42	12.42

From the above table, it can be seen that maximum (62.72%)learners have moderate level of scientific literacy.

Levels of Academic Achievement of Total Sample

Three levels determined to study the levels of academic achievement. Scores between36-57 indicate low level, scores between58-79 indicate moderate level and scores between 80-101 indicate high level of academic achievement.

Table 2

Levels of Academic Achievement of Total Sample

Levels of Academic Achievement	Sample	Percentage
Low (36-57)	40	11.83
Moderate (58-79)	179	52.96
High (80-101)	119	35.20

1. **There is Academic Achievement wise no significant difference in the Scientific Literacy of Male learners and Female learners.**

In order to test this hypothesis, Two Way ANOVA was used. Following table shows the Academic Achievement wise significant difference in Scientific Literacy of male learners and female learners.

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Table 3

Academic Achievement wise Significant Difference in Scientific Literacy of Male learners and Female learners

Sources of Variation	SS	df	MSS	F Value	Significance level
Among rows (Gender)	106.54	1	106. 64	57.24	Significant at 0.01 level
Among column (Academic achievement)	31.15	**1**	31.15	16.73	Significant at 0.01 level
Interaction	78.74	**1**	78.74	42.13	Significant at 0.01 level
Within	623.72	335	1.861		
		338			

Interpretation:
Gender wise obtained F value is 57.24 which is greater than table value 6.70 at 0.01 significance level. Academic achievement wise attained F-value is 16.73 which is greater than table value 6.70 at 0.01 significance level, attained value for interaction between Gender and Academic achievement is 42.13 which is greater than table value 6.70 at 0.01 significance level. So null hypothesis is rejected.

Conclusion:
There is academic achievement wise significant difference in scientific literacy of male learners and female learners.

2. **There is Academic Achievement wise no significant difference in Scientific Literacy of SSC and CBSE board learners.**

In order to test this hypothesis, Two Way ANOVA was used. Following table shows the Academic Achievement wise significant difference in Scientific Literacy of SSC and CBSE Board learners.

Table 4

Academic Achievement wise Significant Difference in SL of SSC and CBSE board learners

Sources of Variation	SS	df	MSS	F Value	Significance level
Among rows (Board)	16.85	1	80.38	10.32	Significant at 0.01 level
Among column (Academic achievement)	89.57	1	89.57	11.50	Significant at 0.01 level
Interaction	37.12	1	37.12	4.78	Significant at 0.01 level
Within	2608.02	335	7.785		
		338			

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Interpretation:

Board wise obtained F value is 10.32 which is greater than table value 6.70 at 0.01 significance level. Academic achievement wise obtained F-value is 11.50 which is greater than table value 6.70 at 0.01 significance level, obtained value for interaction between board and academic achievement is 4.78 which is greater than table value 3.86 at 0.05 significance level.So null hypothesis is rejected.

Conclusion:

There is Academic Achievement wise significant difference in Scientific Literacy of SSC and CBSE board learners.

3. **There is academic achievement wise no significant difference in scientific literacy of the learners of Arts, Commerce and Science stream.**

In order to test this hypothesis, Two Way ANOVA was used. Following table shows the Academic Achievement wise significant difference in Scientific Literacy of learner of Arts, Commerce and Science stream.

Table 6

Academic Achievement wise Significant Difference in SL of learners of different streams

Sources of Variation	SS	df	MSS	F Value	Significance level
Among rows (Stream)	60278.2	2	30139.1	1.74	Not significant
Among column (Academic achievement)	45066.8	1	45066.8	2.60	Not Significant
Interaction	105495.63	1	105495.63	6.10	Significant at 0.05 level
Within	623.72	335	1.861		
		338			

Interpretation:

Stream wise obtained F value is 1.74 which is less than table value 6.70. Academic achievement wise obtained F-value is 2.60 which is less than table value 6.70. Obtained F-value for interaction between Stream and academic achievement is 6.100 which is greater than table value 6.70 at 0.05 significance level so null hypothesis is rejected.

Conclusion:

There is academic achievement wise significant difference in scientific literacy of learners of Arts, Commerce and Science stream

Findings of the study

- Junior College learners have moderate level of Scientific Literacy.
- Junior College learners have moderate level of Academic Achievement.

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- There is academic achievement wise significant difference in Scientific Literacy of male learners and female learners.
- There is academic achievement wise significant difference in scientific literacy of learners of SSC and CBSE boards.
- There is academic achievement wise significant difference in scientific literacy of learners of different Streams.

Significance of the Study

The present study will have significance for the following stakeholders.

Parents:

Parents can encourage child to read newspaper, science magazines and to listen news related to science. Parents can visit to science garden and science center with child. They can create learning environment at home so as learners could feel the interest to learn the subject.

Teachers:

Teachers play an important role in molding the learners. Due efforts should be made to invite the learners to inculcate love of science subject by familiarizing concepts through read aloud of science text.

- Provision of hands-on experiences
- Group collaboration, which facilitates the discourse of science.
- Organizing field-trips
- Use of high quality trade books

This study can be helpful for the teachers for enhancing, developing and building up learners' scientific concepts to make them Scientifically Literate.

School Management:

School management can play a vital role in making learners aware of Science and Technology. They can conduct orientation programme for parents about the importance of Science education which will be helpful for learners to behave rationally and objectively. The management can arrange some programmes for teachers to guide them for developing scientific literacy among the learners.

Individual guidance and counselling can be given to student, parents and teachers for the welfare of learners.

Curriculum Designer:

It is required to develop an innovative curriculum to guide learners in the era of science and technology. Curriculum developer should provide different activities which will help learners to construct knowledge, understand and apply knowledge of concept in science to interpret, integrate and expand their knowledge.

Curriculum developer should design textbook with lively writings and extra ordinary visuals to develop greater perception of concept in science.

Recommendations of the study

1. Principal should organize expert lectures and seminars to make the learners aware of recent discoveries in science so as they develop their interest in science.
2. Textbook functions as major learning resource. It should develop with lively writing and extraordinary visuals as well as updated from time to time. Some modern inventions, current science researches and its outputs should be included which will help learners to develop greater perception of concepts in science subject.

3. Teacher should encourage learners to ask science related questions and encourage scientific inquiry among learners.
4. Teacher should make use of methods like group discussion, problem solving, discovery in learning, brain storming, experimentation, project based learning while teaching science.
5. During teaching learning process, teacher should emphasize the goal of every topic and its connection and significance in daily life of the learners.
6. Science teacher should always promote rational thinking knowing why and how all time agenda of science classes should be. Interschool and intra-school competitions on science quizzes, debates, essay, elocution and projects should be organized.
7. School should organize regular visits to science related institutions like HomiBhabhacentre for Science Education, Indian Institutes of Geomagnetism, Marathi VidnyanParishad, etc.
8. School principal can create forum where learners and teachers can interact, discuss about science. Senior teachers' talk, Workshop can be organized so as to help new teachers.
9. Mobile science laboratory which is promoted by NCERT must be implemented practically. It will provide opportunities to learners to perform experiments. close relevance of science should be created by discussing topics related daily life.
10. Projects like Vidyavahini run by Government of Maharashtra should be popularized and maximum schools should be motivated to take part in it.
11. Teachers need to include discussion, debate, quizzes etc. constructive learning, learning by doing should be promoted. Cautious efforts to be done to improve scientific literacy and habit of science reading and discussing should be nurtured.

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