An empirical inquiry in to association of Scientific Literacy and Sense of Responsibility among Higher secondary students

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Abstract

More responsive scientifically literate students can promote broader participation in knowledge-based innovation to meet the highest ethical standards and they can help to ensure sustainable societies in the future. Scientific Literacy and Sense of Responsibility are two important traits in school students that need to be nurtured. In such premise the present investigation was undertaken in order to study the relationship between Scientific Literacy and Sense of Responsibility among higher secondary students of the science and arts stream. 120 students of class 11^{th} and 12^{th} of Varanasi city were selected by cluster random sampling technique. The Findings of the study revealed that stream of study influences the scientific literacy and sense of responsibility of higher secondary students and there is a positive relationship between scientific literacy and sense of responsibility. Scientific literacy of higher secondary science stream students was better than arts stream and sense of responsibility of higher secondary science stream students are better than arts stream students. This means students who show the feeling of responsibility towards and about science, necessarily have better scientific literacy.

Keywords: Scientific Literacy, Sense of Responsibility, Higher Secondary Students.

Introduction

Education in democratic societies is meant for the benefit of all people and it must be ensured that they become aware of the advantages the education can bring to their lives. The education needed to make democracy work effectively is not just any kind of education which not only comprised of 3 R's i.e. Reading, Writing, and Arithmetic but a new system of literacy based on scientific knowledge. This rapidly growing scientific knowledge has changed the world from contemporary civilization to scientific civilization. The growing importance of scientific issues in our daily lives on global, national, and local level demands an insight into science. The means or processes by which scientific knowledge is obtained and understand are important in addition to the ability to acquire and using scientific knowledge. "Scientific Literacy is the term that describes the ability of an individual to understand scientific laws, theories, phenomena, and things. This means the responsibility of each citizen to have the necessary scientific knowledge base to make practically and informed decision of his/her life" (Dragos and Mih,2015).

Scientific Literacy can't put emphasize theoretical educational endeavors that are unrelated to the learner's daily life, but rather it put emphasized the application of knowledge to the

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improvement of living conditions. Scientific literacy relates to “an ability of functionality as a citizen within society (at home, at work, in the community), not purely at the knowledge level, but in making decisions and acting as a responsible citizen” (Holbrook & Rannikmae, 2009).

“According to NSTA (1991), a scientifically literate person engages in responsible personal and civic actions after weighing the possible consequences of alternative options” (Holbrook & Rannikmae, 2009).

According to the United States National Centre for education statistics "Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and central affairs and economic productivity. A scientifically iterate person is defined as one who has the capacity to:

1. Understand experiment and reason as well as interpret scientific facts and their meaning
2. Ask to find or determine the answer to questions derived from curiosity about everyday experiences.
3. Describe, explain and predict a natural phenomenon
4. Read articles with an understanding of science in the popular press and engage in social conversation about the validity of the conclusions.
5. Identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed.
6. Evaluate the quality of scientific information based on its source and the methods used to generate it.
7. Pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.

Learning has a positive influence on student’s awareness of and empathy towards individuals in the community and their needs: their sense of personal responsibility, their interest in taking action, and their understanding of the political & social issues that affect the community (Denby, 2008). **A Sense of responsibility** means being considerate for their own well-being as well as of the feelings and needs of others. sense of responsibility can be explained as “a sense of internal obligation and commitment to produce or prevent designated outcomes or that these outcomes should have been produced or prevented” (Lauermann & Karabenick, 2011). A sense of responsibility is the consciousness of one's obligations. To be responsible is to be answerable or accountable for something; it is to be able to make sense of and respond within one's sphere of association, it is to take action based on one's sense of connection and answerability to the self and others. Being a part of family and community children need to learn their responsibilities. Children should develop a sense of responsibility to be prepared for adult living. In this respect, the academic approach can not only help to improve the student's sense of responsibility but also tap their discernment of responsibility. The academic approach is the most basic and important

way to cultivate a student's sense of responsibility. Practice like classroom learning, scientific research, and participating in academic conferences are efficient in improving student's sense of responsibility.

Scientific literacy may involve particular attitudes towards learning and using science. A scientifically literate student feels concerned about environmental and social issues, and in turn responsible to act on these issues, and empowered to use science as a tool in addressing these issues. So, there is a need to study the relationship between scientific literacy & the sense of responsibility of students. For the better improvement of our society, we need an education system that focuses on fostering a sense of responsibility in our children. "Children need to develop a sense of responsibility to be prepared for adult living. Teaching children responsibility can begin when they are young and is one of the best values for children to possess" (Whyte, 2017). Children can develop a sense of responsibility by learning a cooperative attitude. Children develop this attitude through their learning experiences. Family and school play an important role in providing learning experiences. Through family members, children learn cooperation, decision making, problem-solving, etc. In school activities that include discussions, problem-solving, learning by doing, experimentation, discovering, assignments, projects, cooperative learning, peer group learning, etc. can help students to develop a sense of responsibility. All these methods are based on scientific inquiry that may help students to cultivate their understanding of the consequences of their own actions and develop a sense of responsibility for their own deeds.

Keeping the above points in mind there is a need to study whether a responsive attitude toward science may also improve peoples' sense of responsibility towards themselves, family, friends, community, and the whole society.

Objectives

The Main objectives of the study were:

1. To study the status of scientific literacy and sense of responsibility among higher secondary students of science and arts stream.

2. To study the relationship between scientific literacy and sense of responsibility of higher secondary school students of science and arts stream.

3. To compare the scientific literacy and sense of responsibility of higher secondary students of science stream and arts stream on the basis of

Gender and Parental Occupation (service/business/farmer)

Research Design

Methodology

Descriptive survey method of co-relation type has been used in the present study. The relationship between scientific literacy and sense of responsibility of higher secondary school students of science and arts stream were also explored.

Population, Sample and Tools of the study

All the students studying in the class XI and XII belonging to science and arts disciplines of higher secondary schools in Varanasi city constituted the population of the study. Sample of the study consisted of 120 students of class XI and XII of Varanasi city in which arts and science stream were taken. The members of the sample were selected by cluster random sampling technique. Two standardized tools were used for data collection Scientific Literacy questionnaire developed by Jaiswal (2010) and sense of Responsibility questionnaire developed by Shandilya & Gardia (2009).

Procedure

As per their manual, the above tools were administered on the selected sample. Scoring of response sheets was also done as per guidelines in the manual. Then, skewness of scientific literacy, and sense of responsibility scores were calculated and the skewness value for scientific literacy score was .167, and for sense of responsibility was –.544. The value of the skewness shows that distribution of scores in scientific literacy and sense of responsibility of total sample follows normal distribution, which indicates that the selected sample is approximately symmetrical hence, the collected data can be treated through parametric tests, namely 't' test, which was applied to find out the significance of difference with respect to the variables under study among science and arts stream at higher secondary school level and Karl Pearson's Product Moment Coefficient of Correlation (r) was computed to check statistical significance of correlation between two variables under study for secondary school students.

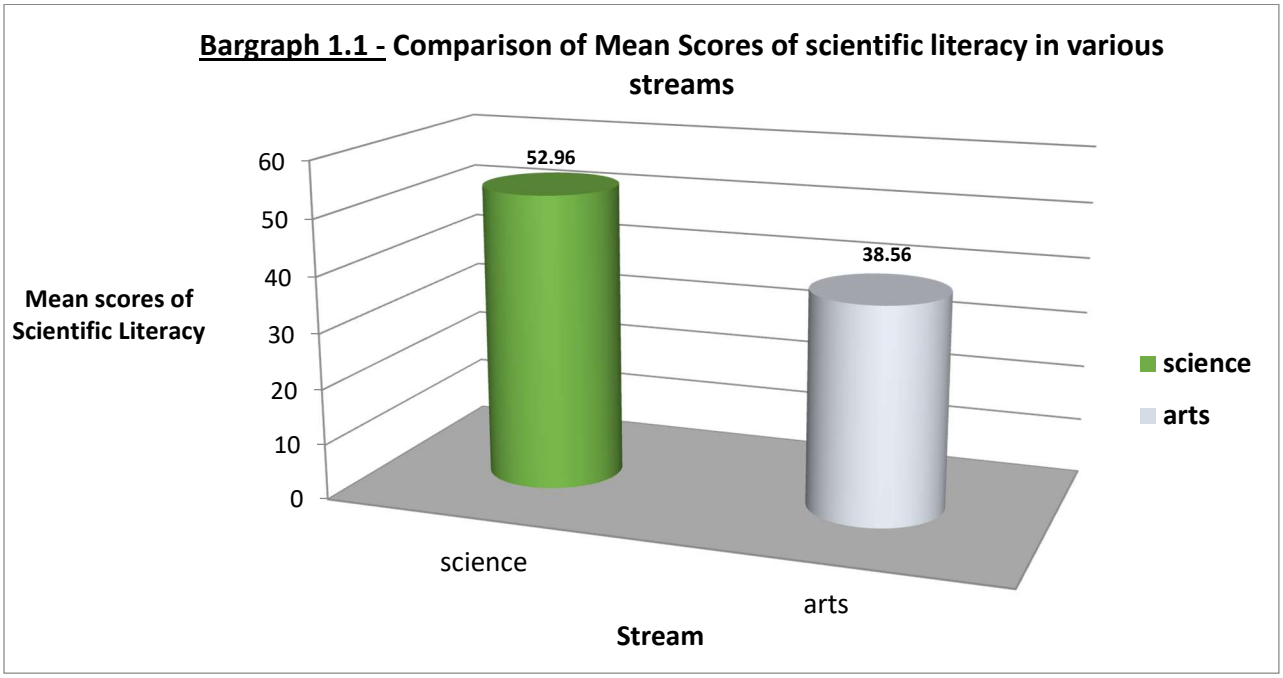
Data Analysis:

Table 1.1 Scientific literacy of higher secondary students of science and arts stream

Stream	Size	Mean	Standard Deviation	t-value
Science	60	52.96	10.95	9.2435*

Arts	60	38.57	7.52	

***significant at 0.05 level**

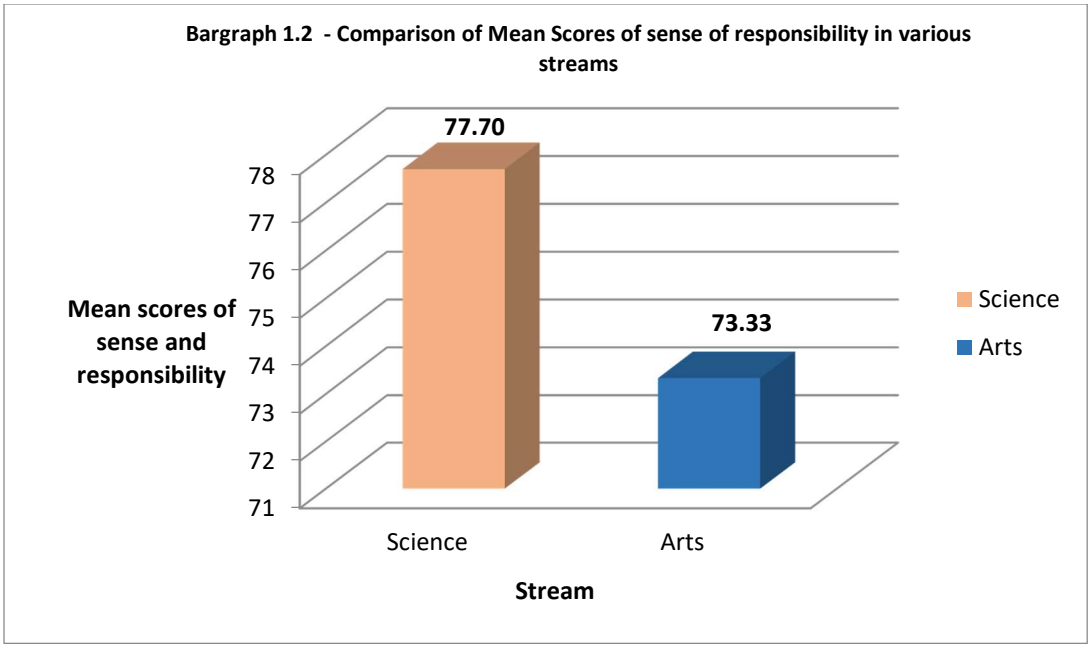


Above table shows that science stream and arts stream students differ from one another in scientific literacy.

1.2 Sense of responsibility of higher secondary students of science and arts stream

Stream	Size	Mean	Standard Deviation	t-value
Science	60	77.70	10.40	2.428*
Arts	60	73.33	12.32	

***significant at 0.05 level**

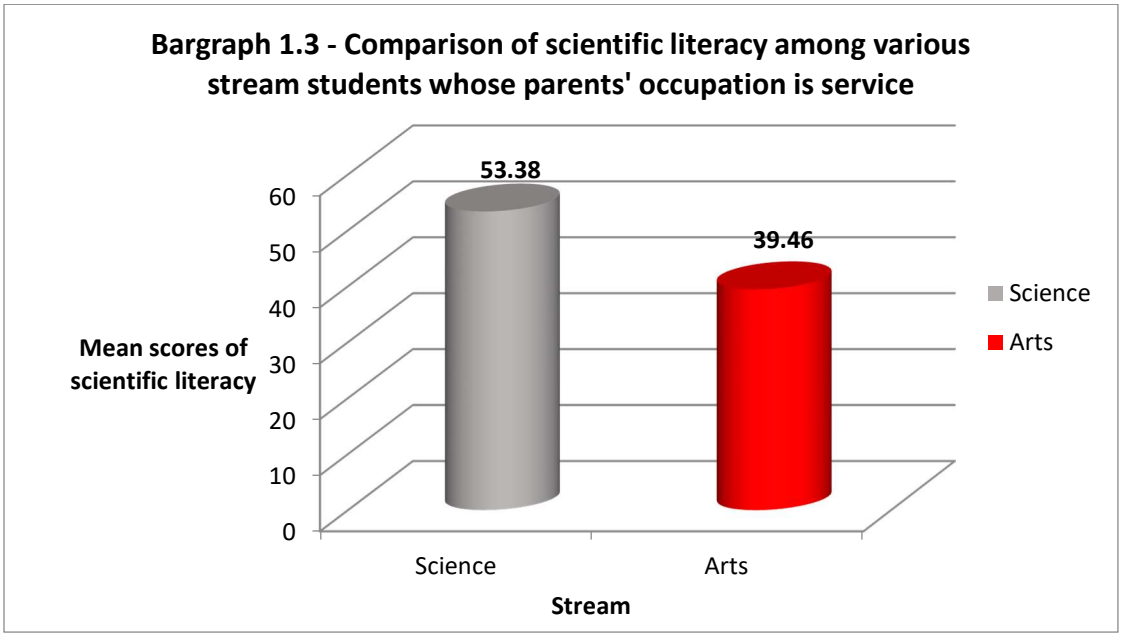


It is clear from the table that science stream and arts stream students differ from one another in sense of responsibility.

1.3 Scientific literacy of higher secondary students of science and arts stream whose parents' occupation is service.

Stream	Size	Mean	Standard Deviation	t-value
Science	21	53.38	10.66	4.78*
Arts	18	39.46	7.42	

***significant at 0.05 level**



It was found that the score of scientific literacy of higher secondary students of science stream whose parents' occupation was service differ significantly from arts stream students whose parents' occupation is service.

1.4 Scientific literacy of higher secondary students of science and arts stream whose parents' occupation is farmer.

Stream	Size	Mean	Standard Deviation	t-value
Science	19	53.52	12.05	5.93*
Arts	20	34.66	7.32	

***significant at 0.05 level**

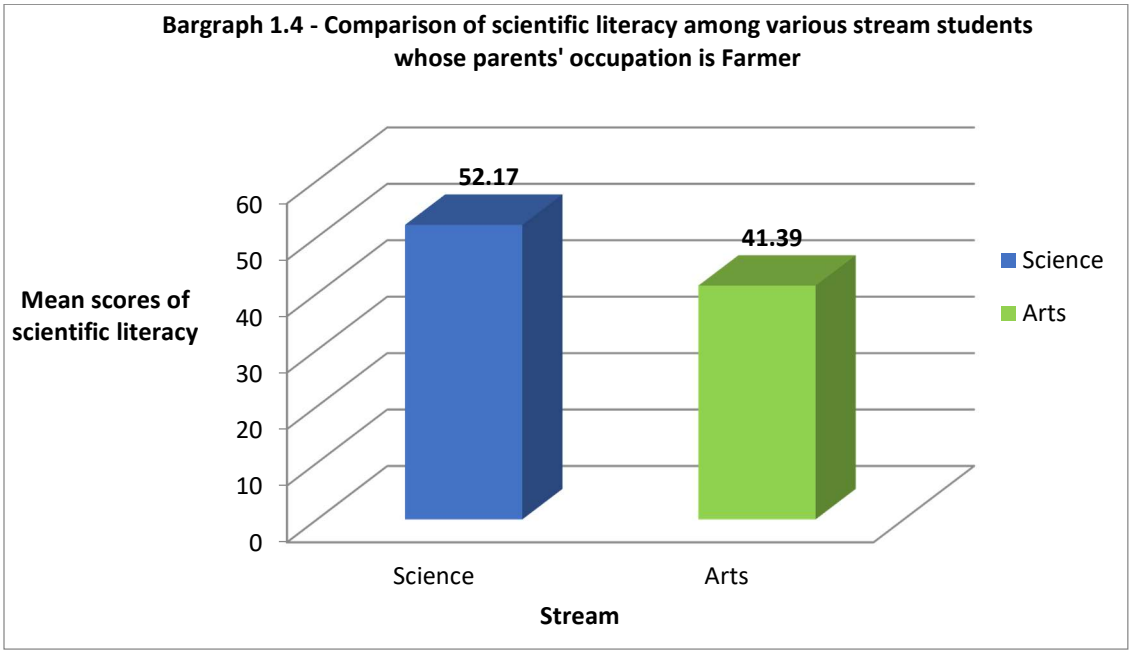


Table 1.4 shows that science stream and arts stream students differ from one another in scientific literacy whose parents' occupation is farmer.

1.5 Scientific literacy of higher secondary students of science and arts stream whose parents' occupation is business.

Stream	Size	Mean	Standard Deviation	t-value
Science	23	52.17	10.68	3.85*
Arts	19	41.39	6.42	

***significant at 0.05 level**

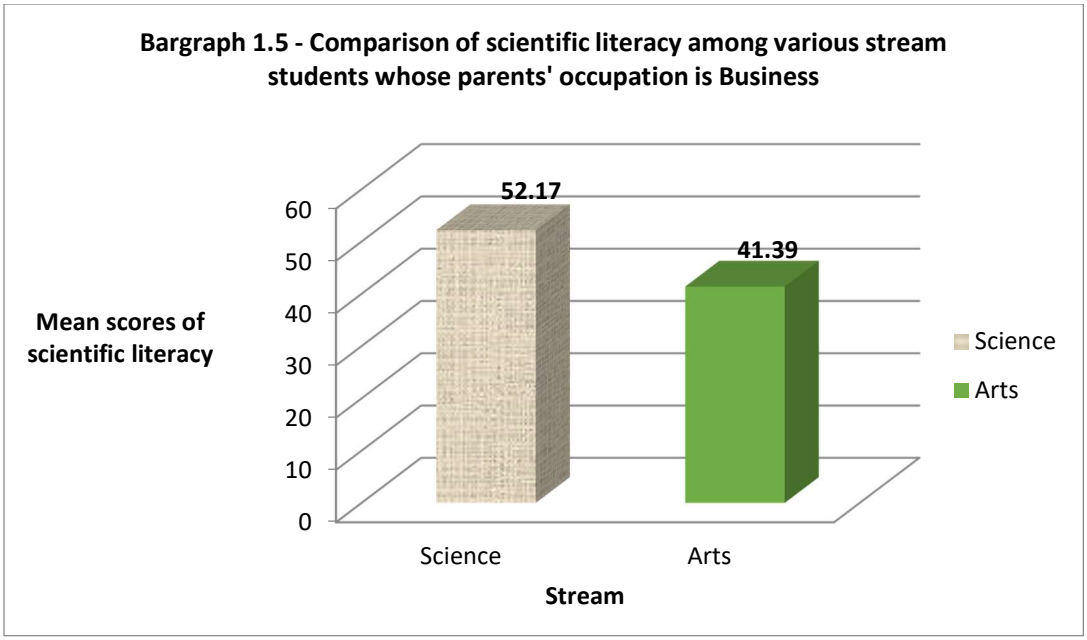


Table 1.5 indicates that science stream and arts stream students differ from one another in scientific literacy whose parents' occupation is business.

1.6 Sense of responsibility of higher secondary students of science and arts stream whose parents' occupation is service.

Stream	Size	Mean	Standard Deviation	t-value
Science	21	76.19	9.78	0.35
Arts	18	75.00	10.88	

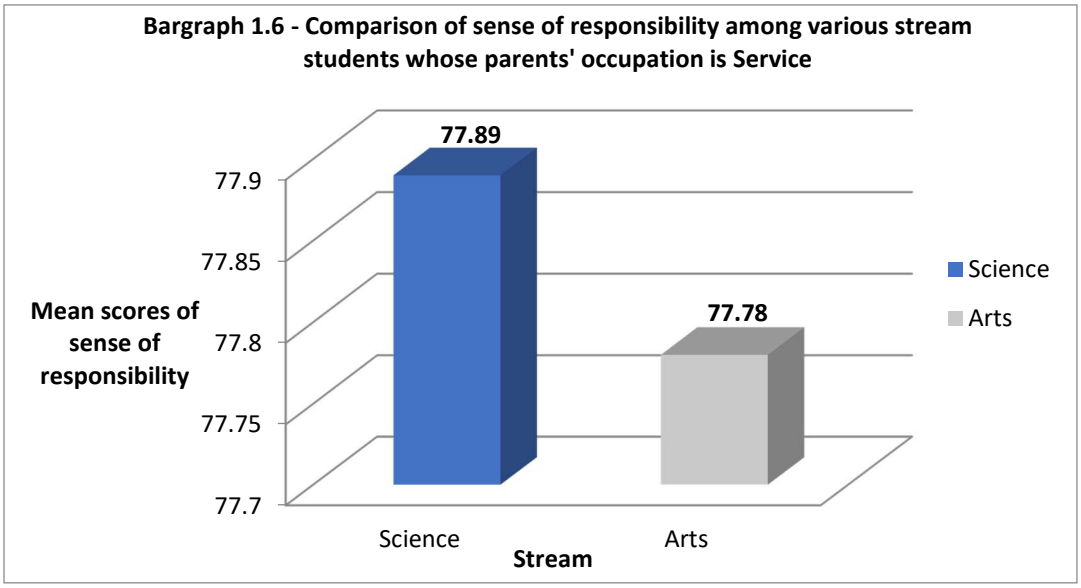


Table 1.6 shows that science stream and arts stream students does not differ from one another in sense of responsibility whose parents' occupation is service.

1.7 Sense of responsibility of higher secondary students of science and arts stream whose parents' occupation is farmer

Stream	Size	Mean	Standard Deviation	t-value
Science	19	80.04	9.47	3.13*
Arts	20	68.95	12.35	

***significant at 0.05 level**

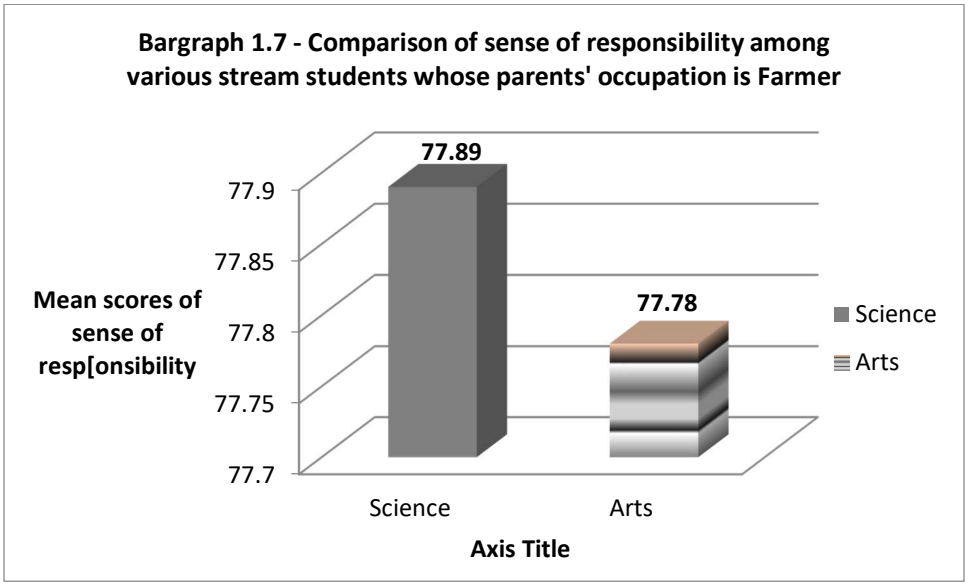


Table 1.7 shows that science stream and arts stream students differ from one another in sense of responsibility whose parents' occupation is farmer.

1.8 Sense of responsibility of higher secondary students of science and arts stream whose parents' occupation is business.

Stream	Size	Mean	Standard Deviation	t-value
Science	**23**	**77.89**	**10.68**	**0.81**
Arts	**19**	**77.78**	**14.09**	

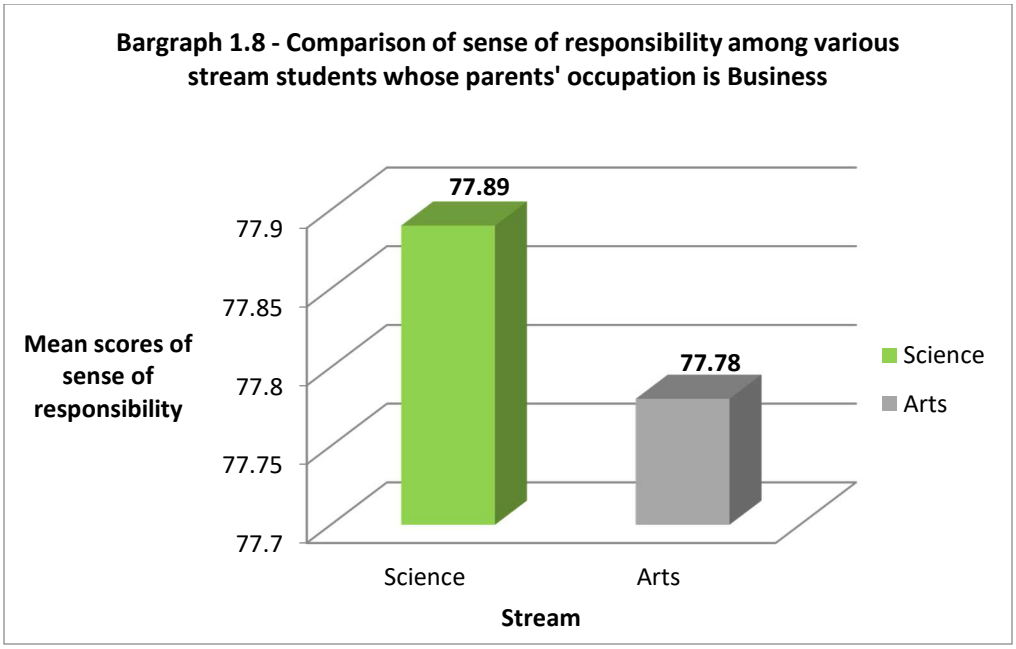


Table 1.8 shows science stream and arts stream students does not differ from one another in sense of responsibility whose parents' occupation is business.

2.1 Scientific literacy and sense of responsibility of higher secondary students of science stream.

Table 2.1 Pearson's correlation coefficient (r-value) was calculated between the scores of scientific literacy and sense of responsibility of science stream students.

Science Stream	Scientific literacy	sense of responsibility
Scientific literacy	1	0.14*
sense of responsibility	0.14*	1

*r-value significant at 0.05 level

It was observed from the table the correlation coefficient between the scores of scientific literacy and sense of responsibility of higher secondary science stream student is significant, this shows that scientific literacy of science stream students is positively correlated with their sense of responsibility.

2.2 Scientific literacy and sense of responsibility of higher secondary students of arts stream.

Table 2.2 Pearson's correlation coefficient (r-value) was calculated between the scores of scientific literacy and sense of responsibility of arts stream students.

Arts Stream	Scientific literacy	sense of responsibility
Scientific literacy	1	0.257*
sense of responsibility	0.257*	1

*r-value significant at 0.05 level

Thus, it is concluded that the relationship between scientific literacy and sense of responsibility of arts stream students is positive. The scores of scientific literacy and sense of responsibility of higher secondary arts stream students is significant.

2.3 Scientific literacy of higher secondary male students of science and arts stream.

Table 2.3 Pearson's correlation coefficient (r-value) was calculated between the scores of scientific literacy of higher secondary male students of science and arts stream.

Scientific literacy	Scores of male science students	Scores of male arts students
Scores of male science students	1	0.12*
Scores of male arts students	0.12*	1

*r-value significant at 0.05 level

The results indicated that scientific literacy scores of male science students are positively correlated with scientific literacy scores of male arts students. The correlation obtained in the above table reveals a significant relationship.

2.4 Scientific literacy of higher secondary female students of science and arts stream.

Table 2.4 Pearson's correlation coefficient (r-value) was calculated between the scores of scientific literacy of higher secondary female students of science and arts stream.

Scientific literacy	Scores of female science students	Scores of female arts students
Scores of female science students	1	0.16*
Scores of female arts students	0.16	1

*r-value significant at 0.05 level

The correlation obtained in the above table depicts the existence of significant relationship between scientific literacy scores of female science and arts students. Positive correlation entails that if scientific literacy scores of female science students increases, the scores of female arts students also increases.

2.5 Sense of responsibility of higher secondary male students of science and arts stream.

Table 2.5 Pearson's correlation coefficient (r-value) was calculated between the scores of Sense of responsibility of higher secondary male students of science and arts stream.

sense of responsibility	Scores of male science students	Scores of male arts students
Scores of male science students	1	0.10*
Scores of male arts students	0.10	1

*r-value significant at 0.05 level

Table depicts the relationship between sense of responsibility scores of female science students and female arts stream students. It is revealed that there exists association at 0.05 level, thus the relati*onship* between sense of responsibility scores of female science stream students and arts stream students is positive and significant.

2.6 Sense of responsibility of higher secondary female students of science and arts stream.

Table 2.6 Pearson's correlation coefficient (r-value) was calculated between the scores of sense of responsibility of higher secondary female students of science and arts stream.

sense of responsibility	Scores of female science students	Scores of female arts students
Scores of female science students	1	0.34*
Scores of female arts students	0.34	1

*r-value significant at 0.05 level

The above table reveals that there exists a significant relationship between sense of responsibility scores of male science students and male arts students. It means that scores of male science students are positively and significantly related to male arts students.

Conclusion and Discussion

Finding of the study shows that the two variable i.e. scientific literacy and sense of responsibility were influenced by the stream of study. The study clearly indicates that the scores of scientific literacy of arts stream students are lower than the science stream students, hence for acquiring necessary knowledge of and about science, it is necessary for all students to participate actively and responsibly. Lebhand (1992) conceded that stream of study influenced the scientific literacy at graduate level. Chikara (1985) investigated that stream of study influences the achievement of science and scientific attitude. Results shows that the science stream students have greater sense of responsibility than that of arts stream students. Thus, these findings are in congruence with the findings of Lebhand and Chikara and it was also said that "a scientifically literate person feels concerned about the environment and social issues and in turn responsible to act" (Pella,1966). In this study variables like gender and parents' occupation were also found to influence the scientific literacy. The results have shown that male science students show greater scientific literacy than male arts students and female science students were better in scientific literacy than female arts students. This means students who show the feeling of responsibility towards and about science, necessarily have better scientific literacy. Jenkins (1993) describes that socio–economic condition

of parents influences the student's scientific knowledge, Bendyopadyanm (1984) found that parental education, income and socio-economic status influences the scientific literacy and numerical ability. The present study throws light upon the contribution of parents' occupation in making sense of responsibility of their children towards scientific literacy. It was found that sense of responsibility of male science students were related to male arts students and sense of responsibility of female science students were related to female arts students. No study had been describing influence of sense of responsibility particularly in students with respect to gender and parents' occupation, although future results could reproduce similar findings.

The current study contributes to our understanding of the relationship between scientific literacy and sense of responsibility among science and arts stream students, the conclusion implies strengthening of scientific literacy among students so that a responsive citizenry for the country may be produced by our schools.

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