

**INFLUENCE OF SCIENTIFIC LITERACY ON DISASTER MANAGEMENT SKILLS OF
SECONDARY SCHOOL STUDENTS**

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Abstract

We have been facing disasters of various types, natural as well as manmade, since ancient times. Landslide, flood, earthquake and storm occur frequently every year worldwide. As we cannot prevent disasters, we can at least plan for them through disaster management involving preparedness, mitigation relief and rehabilitation. Generally, the goal of learning science is to gain a better understanding of universe and the things in it. Science is the process of seeking and applying knowledge about universe. So enhancing scientific literacy through science education is also important. The present study focuses on the influence of scientific literacy on disaster management skills of secondary school students. Survey method is adopted for the present study. The sample consists of 100 secondary school students studying in IXth standard following Kerala state syllabus. Necessary data were gathered using a Scientific Literacy Test and a Disaster Management Skills Test. According to the findings, scientific literacy has a positive influence on disaster management skills of students at secondary school level

Key Words: Scientific Literacy, Disaster Management Skills

Introduction

Disaster is a very common phenomenon for humanity. We have no control over when and where disasters will happen. Human beings have experienced disasters in different forms since time immemorial. The latest world disaster report suggests that disasters have increased both in frequency and intensity. People are becoming more and more vulnerable to disasters of all types, which include earthquakes, floods, cyclones, landslides, droughts, accidents, forest fires etc. This is quite true in the case of both developed and developing countries. Disaster management has assumed greater importance in recent times. The whole purpose of disaster management is not to prevent these natural or man-made disasters. We may not be able to avert many of these disasters, but we can definitely mitigate their impact.

Scientific literacy is very crucial for effective living in the modern age of science and technology. Scientific literacy is the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help to make decisions about natural world and the changes made to it through human activity. [The Organization for Economic Co-operation and Development (OECD)(1999)].

The purpose of education is both to give information to the individual and at the same time to teach the individual, how problems are solved. Those who are scientifically literate should be able to overcome difficulties in daily life, be sensitive to the environment and take appropriate measures. For this reason, science education should be started at an early age. So students gain problem-solving skills and different perceptions and these work towards creating a scientifically literate society.

Disaster Management is defined as an applied science which seeks, by the systematic observation and analysis of disasters, to improve measures relating to prevention, mitigation, preparedness, emergency responses and recovery (Carter, 1991). Disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster and achieve rapid and effective recovery.

The major aim of teaching science is to make the student a responsible person in the society, to understand the world around him and to enrich the life of the people he is associated with. Science learning helps students in thinking and to satisfy the basic urge of curiosity, creativity and the insight obtained from scientific process and these in turn develop intellectual honesty, positive attitudes and social skills. A student of science should be able to observe carefully, think logically and draw conclusions and then to arrive at the right decision. In daily life he will be facing new situations, circumstances and problems. With adequate scientific knowledge he can overcome the hurdles and challenges of day today life. He can analyse each problem critically, scientifically and discuss with experts and can finally take the right decision.

Need and Significance of the study

Scientific literacy is the knowledge and understanding of the scientific concepts and processes required for personal decision making, participation in civic and cultural affairs and economic productivity (National Academy of Sciences 1995). The term 'Scientific Literacy' refers to a comprehensive understanding of scientific terms, processes, concepts and ability to apply these in appropriate contexts. Such literacy enables sound judgement, informed decision making and a greater appreciation of the world around us.

WHO defines disaster as any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area. Mainly, disaster is divided into two types: natural disaster and man-made disaster. Natural disaster is caused by natural factors such as earthquake, landslides, floods, river erosion, cyclones, forest fires, Tsunami etc. On the other hand, man-made disasters are occurred due to human action toward surface of the earth, such as nuclear disaster, mine disaster, chemical disaster, biological disaster etc.

The 1990 UNESCO World Conference on Education for All argued that science education should promote "a world community of scientifically and technologically literate citizens" (Millar, 2006). So it is seen that many countries give priority to dimensions of scientific literacy in science reforms and development of science curriculum (AAAS, 1990; Driver, Leach, Millar& Scott, 1996; Koballa, Kemp, & Evans, 1997; Millar& Osborne, 1998).

Disaster also called 'Calamity' and 'Catastrophe' is a sudden, devastating event that causes serious disruption of the functioning of a community or a society with widespread human, material, economic and/or environmental losses which exceed the ability of the affected community or society to cope with using its own level of resources. Disaster management can be defined as taking immediate and proper measures to cope with disasters and their components and consequences under time pressure and threat due to looming danger and lack of adequate and accurate information and other resources. Such actions need to be planned. Lack of proper attention and failure to draft strategic plans for managing disasters in a scientific way might lead to a crisis that can lead to the destruction of the institutions and systems. Disaster management and prevention differ according to the type and size of the disaster as well as degree of it's intensity.

Practically, natural phenomenon can be explained by science. Science may elaborate the cause of natural disaster phenomenon clearly. A major goal of science education is to develop student competency in solving real- life problems using the concepts and theories of science. Now a days the students are expected to be the individuals who are questioning, wondering the reasons and researching, recognizing the conflicts and contradictions making good observations and making right inferences from these observations, thinking scientifically, criticizing, producing, aware of the ways to reach knowledge, creative, decision- makers, responsible, expressing himself/herself, not memorizing the information, but to be aware of the ways to reach, use, share and produce the knowledge.

Objectives

1. To find out the extent of scientific literacy among secondary school students.
2. To find out the extent of disaster management skills among secondary school students
3. To find out the relationship between scientific literacy and disaster management skills of secondary school students.
4. To find out the influence of scientific literacy on disaster management skills of secondary school students.

Hypotheses

1. There is significant positive relationship between scientific literacy and disaster management skills of secondary school students.
2. Scientific literacy has a positive influence on disaster management skills of secondary school students.

Methodology

Descriptive survey method was adopted for carrying out the study. The sample consists of 100 secondary school students studying in IX th Standard following Kerala state syllabus.

Tools used

For the present study, investigators prepared and employed

- Scientific literacy test
- Disaster management skills test

Analysis and Discussion

Data were analysed using mean, median, standard deviation, Karl Pearson's Product moment correlation coefficient 'r' testing the significance of 'r', Analysis of Variance (ANOVA) and Post-Anova Test of Differences by Use of 't'. The details of Analysis done is described below.

Table 1

Extent of scientific literacy among secondary school students

GROUPS	NUMBER	MEAN	MEDIAN	SD	SKEWNESS	KURTOSIS
TOTAL	100	13.26	14	2.75	-0.741	0.593
BOYS	54	13.33	14	2.52	-0.673	1.293
GIRLS	46	13.17	14	3.03	-0.766	0.107

The table shows the arithmetic mean for the total sample as 13.26 and standard deviation as 2.75. The maximum possible score in scientific literacy test is 20 and the least is 0. This shows that the mean score of the scientific literacy of secondary school students is found as about 50 percent of the total score. The value of median obtained is 14.

Table 2

Extent of disaster management skills among secondary school students

GROUPS	NUMBER	MEAN	MEDIAN	S.D	SKEWNESS	KURTOSIS
TOTAL	100	13.21	14	3.13	-1.677	2.392
BOYS	54	13.29	14	3.12	-2.229	4.705
GIRLS	46	13.11	14.5	3.18	-1.116	0.369

The table shows the arithmetic mean for the total sample as 13.21 and standard deviation as 3.13. The maximum possible score in disaster management skills test is 20 and the least is 0. This shows that the mean score of disaster management skills of secondary school students is found as about 50 percent of the total score. The value of median obtained is 14 .

Table 3

Extent of disaster management skills of secondary school students based on different sub domains

SUBDOMAINS	NUMBER	MEAN	MEDIAN	SD	SKEWNESS	KURTOSIS
EARTHQUAKE	100	3.19	3	0.91	-0.637	0.246
TSUNAMI	100	3.24	3	1.04	-0.555	0.042
FLOOD	100	3.73	4	1.25	-0.851	-0.011
LANDSLIDE	100	3.02	3	0.99	-0.355	-0.545

The table shows the arithmetic mean and standard deviation for the disaster management skills of secondary school students based on different sub domains. The maximum possible score in sub domains of disaster management skills is 5 and the least is 0. From the table the mean scores of sub domains of disaster management skills of secondary school students are found at an average level and the mean score is higher in the sub domain Flood..

Table 4

Data and result of test of significance of ‘r’ between scientific literacy and disaster management skills of secondary school students.

VARIABLES	N	‘ r’	t
Scientific Literacy	100		
Disaster management skills	100	0.762	11.65**

**P<0.01

The co-efficient of correlation between the scores of scientific literacy and disaster management skills among secondary school students is 0.762 and the t-value is 11.65 which is significant at 0.01 level. This reveals that there is significant positive relationship between scientific literacy and disaster management skills of secondary school students. This means that the students having high scientific literacy are also have high level disaster management skills. Hence the Hypothesis 1 is sustained.

• Influence of scientific literacy on Disaster Management Skills

In order to find out the influence of scientific literacy on disaster management skills, the total sample was categorized into three groups namely students having high scientific literacy, students having average scientific literacy and students having low scientific literacy. Students who scored more than Mean+ 1/2 standard deviation (14.64) were included in the high group. Students who scored less than Mean - 1/2 standard deviation (11.89) were included in the low group and the students who scored between 11.89 and 14.64 were included in the average group. The mean and standard deviation of the disaster management skills of the three groups were calculated. The details about the three groups are given in table 5.

Table 5

Mean and standard deviation of the levels of disaster management skills of the three groups of secondary school students based on their scientific literacy.

Groups based on scientific literacy	N	Disaster Management Skills	
		M	SD
HIGH	41	15.44	0.709
AVERAGE	42	13.38	0.854
LOW	17	6.88	2.233

The table shows that 41 students scored high marks in the disaster management skills test. The number of students who scored average marks in the test was 42. The students scored low marks in the disaster management test is 17. The mean score of the disaster management skills test of the high group is 15.44. The mean scores of the average and low groups are 13.38 and 6.88 respectively.

The obtained data were further subjected to the treatment of ANOVA. The summary of the data and the result obtained for the one way ANOVA for the different groups of scores of disaster management skills of secondary school students who were grouped into High, Average and Low based on their scientific literacy test scores is given in table: 6.

Table 6

Summary of one way ANOVA for scores of Disaster management skills of the different groups of secondary school students based on their scientific literacy scores.

Variable	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares (Variance)	F value
Disaster management skills	Between Groups	884.79	2	442.39	330.689**
	Within Groups	129.767	97	1.338	

**P<0.01

The F value is 330.689 which is greater than the table value for F with df (2, 97) at 0.01 level. This shows that the secondary school students belonging to different levels of scientific literacy differ significantly in their disaster management skills.

A significant F is obtained here. For to find significant pairs of means Post-Anova Test of Differences by Use of 't' is used here. The details are shown in table: 7

Table: 7
Post-Anova Test of Differences by use of ‘ t’

	Mean Differences		
Sets	High (1)	Average (2)	Low (3)
Means	15.44	13.38	6.88
High (1) 15.44	–	2.06**	8.56**
Average (2) 13.38	–	–	6.5**
Low (3) 6.88	–	–	–

**P<0.01

All the mean differences are larger than the critical mean differences at 0.01 level. Hence, all the mean differences are significant at 0.01 level. Here the three pairs of means are significant at 0.01 level. From this it is very clear that scientific literacy has positive influence on disaster management skills of secondary school students. Hence the hypothesis 2 is sustained.

Conclusions and Educational Implications

From the analysis and findings it is clear that the scientific literacy of secondary school students is found at an average level. The disaster management skills of secondary school students is found at an average level. The disaster management skills in sub domains such as Earthquake, Tsunami, Flood and Landslide of secondary school students are found at an average level and the mean score is higher in the sub domain flood. From the findings, it is very clear that there is significant positive relationship between the scores of scientific literacy and the scores of disaster management skills of secondary school students. From the findings this indicates that scientific literacy has a positive influence on disaster management skills of secondary school students.

The importance of scientific literacy is increasing daily. Scientific literacy is the ability to understand and apply scientific concepts, scientific process and scientific situation. Today disaster mitigation can be applied in teaching and learning in the classroom. Disaster mitigation education should be given to students. Science as a subject that explains natural phenomenon may take a role to do disaster mitigation for students. Students should be able to relate the concepts of science logically, critically and creatively into phenomenon in the real life. It will build student’s scientific literacy and awareness about the occurrence and mitigation of natural as well as manmade disasters.

References

1. Abruscato, J. (1992). *Teaching Children Science* .London: Library of congress cataloguing in Publication data.
2. Erdogan, M.N. &Koseoglu, F. (2012). *Analysis of High School Physics, Chemistry, and Biology curriculum in terms of Scientific Literacy Themes. Educational Sciences: Theory and practice* Vol.12, No.4 p. 2899-2904.
3. Gregario, L. (2010). *Scientific literacy and Natural Disaster Preparedness. Thailand: Published by UNESCO Bangkok.*
4. Harlen, W. & Qualter, A. (2006). *The Teaching of Science in Primary Schools.* London: David Fulton Publishers.
5. Hassard, J. (2005). *The Art of Teaching Science.* New York: Oxford University Press.
6. Holbrook, J. &Rannikmae, M. (2009). *The meaning of Scientific Literacy. International journal of Environmental and Science Education, Vol.4, No.3, P.275-288.*
7. Levinson, R. &Thomas, J. (1997). *Science Today.* London and New York: Routledge.
8. Manesh, A.K. (2017). *Handbook of Disaster and Emergency Management.* Sweden: Gothenburg.
9. Nuraini, L., Jefiza, A. &Wijaya, A.D. (2013). *An Innovation of Disaster Mitigation based on Physics Learning Using Earthquake Media Model in Improving Students' Scientific Literacy and Disaster Awareness. CISAk 2013. Conference Paper available: <https://www.researchgate.net/publication/281775154>.*