

TRANSCENDING DISASTER EDUCATION: A DEVELOPMENTAL APPROACH ENSURING SUSTAINABILITY

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Our earth, with the present population estimate of 7.5 billion humans, has been a cradle to the evolution, transformation and manifestations of many civilizations that ever existed on its surface. The time elapsed and the human society proliferated with the development of science and technology through the modern thoughts brought about by three gigantic revolutions made in agriculture, industrial and information technology sectors of income and human sustainability. The continuance of human life on earth is intricately intertwined with the sustainability of the earth on micro to macro scale. The sustainability of earth bears the imprints of all those catastrophes that affect its ability to guard human life on it. The world with vast continental landmasses and having diversified topographic structures is bound to face multiplicity of natural hazards on local to regional scale. Natural events of such adverse effects on human property and life have led us to conceptualise these as disasters. The trend analysis of last 100 years over the earth reveal the fact that much have been changed by natural disasters with an average occurrence of 7 in 1914 to 341 disasters in 2014 per continent on a global scale. The present study focuses on how frequent the disasters have continued to harm our environment and up to what extent threatened existence of mankind in the last ten decades. The available data on past natural calamities have been studied to gauge the intensity and effects of these hazards and realising a better way to mitigate them by educating all for disasters and disaster management as this will ensure timely disaster preparedness in general. Each disaster occurs at the backdrop of some science in it. This necessitates natural disasters as a probable area of concern which awaits intrinsic study and investigations with enough scientific aptitude and enquiry in science education of our country. Natural disasters though a comprehensive theme to work upon is still a phenomenon least understood in our education system. The origins of such events of unforeseen calamities are originating and set in one country but its effects howsoever mild or severe it may be are widespread across national boundaries. To understand, mitigate and finally to manage them lies with the scientific community at our disposal. Without realising scientific spirit and integrating science behind disasters by each one of us, the goal to manage our earth resource and to prove a nature worthy of being called as sustainable, and hence notion of all round sustainable development remains devoid of reality.

Key words: *Natural hazards, disasters, sustainable development, science education*

Introduction

The sustainability approach over the earth's surface is taken in various forms each having different meanings within a window of some contextual human undertaking. In all its forms it measures a continuing supportive platform where the outputs of the support are always yielding. If the earth is taken as a plain where the human life dwells, evolves and develops then, its ability to provide such a support in a continued state within a time

range will give us how sustainable our earth is for the continuance of human life and its development. Over the years, the earth's surface has kept on changing under the varied impacts of natural events occurring on it. These natural events with the passage of time grew in pace and in their impacts which had the ability to completely ruin human society in terms of loss of life and property. They rose from few in number to their frequent occurrences witnessed by different parts of the world in a year.

Initially, considered to be events of divinity occurring under supremacy of the almighty creator the God, they are now found to be embedded in the fabric of science and within the framework of earth's physical phenomenon. Some incipient study would thus, perhaps reveal that their definitions changed as the science progressed and man started to turn to investigations of enquiry into them. They would have been substantially referred to as an event, a chance phenomenon, a physical disturbance, an imbalance in the state of earth's equilibrium, a calamity, a hazard and so on or the most accepted vocabulary of modern times as natural disasters.

Equation of Risk Governs the Concept of Sustainability

The disasters in their scientific constitution follow a worldwide accepted equation of risk, which is given as — Risk = f_n (Hazard * Vulnerability * Exposure)Equation (I)

The equation implies that disasters as a natural phenomenon have the dynamics of risk or the danger for the human sustainability which is always dependent on variables of hazards, vulnerability attached with that hazard and the time for which a part of land is exposed to the hazards. A hazard shall mean the potential to disrupt human society and its environment with a magnitude beyond the coping capacity of the affected community. Vulnerability states the extent of getting damaged which can take place in the affected area in terms of social or economical loss or both. However, the severity of such a disaster would be realistically related by the ultimate factor of exposure time in its occurrence period. The aforesaid discussion

makes it clear that disasters have an inherent component of risk in the form of danger for human society. The question is how it relates to the concept of sustainability.

How does Sustainability Change with Disasters?

The promise of sustainability finds its root in the fact that earth should provide us our all basic needs in the coming times at the same pace and to the similar extent of requirements existing currently. A disaster is such a huge impact factor of sustainability assessment that it can slow down the pace as well as extent of this proposed sustainability. Human society dwells with a constant equilibrium which he maintains with the environment within a framework of prerequisite ecological inter-relationships. Since the disasters are known to greatly disrupt this steady state of natural equilibrium by their impacting magnitude, exposure time and arrival frequency, the land's carrying capacity is attenuated, and hence forming a limiting factor in sustainable human development.

Studies with Aggregate Data

Any naturally occurring adverse event will be qualified to be called a disaster only if it crosses over a threshold value set by the government of the affected country. Under this definition, we broadly classify three categories of natural disasters namely as geological, hydrological and meteorological disasters. However, the definition also extends to some less discussed disasters of wildfires, health disasters in the case of an epidemic and those rarely seen space disasters created by impact events and airbursts. Many of the disasters in the earth's history are traced through their global evidences

collected by avenues of discoveries where the findings are inappropriate for any quantified assessment. From an available database,

the quantifications are met out in the form of aggregate data from the beginning of the last century.

Table 1
Aggregate data of affected persons from disaster

Years	Total number of disasters per continent		Total affected (Number of persons in thousands per continent)	Total deaths (Number of persons in thousands per continent)	Trend in number of disasters (Percentage factor increase or decrease)	
	Global	Asian	Global	Global	Global	Asian
1912	7	4	99.09	52.09	–	–
1922	7	2	11.00	101.24	0.00	-50.00
1932	9	4	36.88	73.29	+28.00	+100.00
1942	9	6	183.10	1608.23	0.00	+50.00
1952	24	9	1001.73	8.95	+1.66	+50.00
1962	28	12	143.26	17.35	+8.33	+33.33
1972	64	30	219154.82	20.03	+128.57	+150.00
1982	160	68	151118.61	13.95	+150.00	+126.67
1992	233	101	68609.27	18.89	+45.63	+48.53
2002	505	175	659261.17	21.32	+116.74	+73.27
2012	369	143	111425.29	11.60	-26.93	-18.29
2015	394	177	104395.00	23.88	+1.36	+23.78

Compiled from EM-DAT international disaster database

The various kinds of disasters of varying magnitudes and each sub-type having distinctive scales of destruction was taken in aggregate form and the data was put under study at an interval of ten years period starting from the year 1912. To yield projected results data pertaining to 2015 was also taken to gauge current state of disasters. With the

beginning of twentieth century, we faced 7–9 hazards per continent in a year with no significant rise of world population. However, the reported number of affected people and the resulting deaths were more at the end of 1942 or World War II period. Time scale study revealed that the numbers recorded maxima from 1972–1982 with a gain of 150

percentage points. This period marks the age of sudden population rise and change with more technological upbringings in India and in the world and, therefore, seemed most accountable to more number of people affected and the resulting deaths.

Impact Studies of Natural Disasters

The compiled data on natural hazards provide us the numerical facet of damages with regard to their increase in numbers and frequency with advancement of time. We study through these numbers, their impact over the land in general and on human life in particular. Their impact studies require a deeper approach of assessment and evaluation. From 1912–1915 there was negligible increase in the number of disasters per year per continent up to 1942 and after it, they rose in bigger numbers till 2002 by almost doubling every ten years. The trend was most visible in Asia where our country holds a key position. After 2002, we account for an abrupt drop of 26.93 and 18.29 percentage points in the number of these disasters globally and in Asia, respectively, in the last ten years. The reasons of such timely variations are manifold but culminating at one focal point of study. After 1972, the global population grew enormously with more and more exploitation of resources and the sustainability of the earth has been tested from this time onwards. Better technologies came, more industrial clusters and agglomerations sprawled, industries dominated with persistent agriculture to feed huge population of 7.5 billion humans today. The earth provided the same land earlier with similar dimensions as it is offered today but man as the sole judge of using resources has

ultimately disrupted the state of equilibrium of nature seen in more intense and frequent natural hazards.

Measures to Mitigate Natural Disasters: A Governance Issue

It is evident from the fact that with further rising population and greater ecological imbalances, our lands will lie more prone to disasters. For a country like India having sub-continental dimensions feeding 18 per cent of the world's population, India is projected to be the world's most populous country by 2022, surpassing China and is bound to face disasters in the form of catastrophes. This was already felt by us and our government planned to enact Disaster Management Act in 2005, which provided us institutional, legal, financial and coordination mechanisms at the national, state, district and local levels. The Indian government places its vision to build a safe and disaster resilient India by adopting a holistic and integrated approach towards disaster management where community participation, capacity building and cooperation with agencies at national and international levels are sought out. In the formulation of the objectives of such a national policy on disaster management, we have proposed a culture of prevention, preparedness and resilience at all levels through knowledge and education by encouraging prevention from disasters based on technology, traditional wisdom and environmental sustainability.

Science in Disasters: An Essential Feature of Science Curriculum

One major cause of the greatest disasters in the last 30–40 years has been the climate

change phenomenon not by nature itself but by the triggering effect of man's rising population. Therefore, human-induced climate change draws a parallel to the number of natural disasters if human population grows uncontrollably at the present rate with further degradation of environment. Further, any disaster is an event in outcome but its development, progression and dissipation is governed by physical laws just like in other natural and applied sciences. A disaster can never be explained and estimated in its chance probability with a scientific commitment to its study by way of usage of empirical, observational and analytical research methods in it. The scientific community has made several strides to locate the cause of them and have successfully given both quantified and qualitative assessment of disasters. If at one end, lies are the causes of natural hazards, then their assessment, risk evaluation, monitoring, control and preventions are the other major objectives of science at the other end. This sufficiently justifies that disasters have science in them and this science forms a bridge of human response to natural disasters between their causes and measures of mitigation and management.

Disseminating Education of Disaster Science: A Way to a Better Living

A disaster mitigation and management effort aims to achieve its objectives through six levels of imparting education and training namely, prevention, mitigation, preparedness, response, rehabilitation, reconstruction and recovery. What is provided by the earth is destroyed by the disasters affecting sustainable development.

Without understanding the essentials of science in disasters we shall not meet effective community participation and their cooperation at all levels in the time of crisis. Just like an elementary knowledge of computer application is essential for every countryman for digital India, a preliminary sound knowledge of disaster science shall render each one of us to act in a timely way in mitigating a disaster by a self-preparatory response. To make our earth a better place to live peacefully on the lines of sustainability goal and development approach, a strategy to educate each one of us in disaster sciences shall yield fruitful results at national level.

Conclusion

Any country runs from a risk of disasters and these disasters are inevitable because they are naturally arriving with great spatial-temporal variability without giving an early warning and range in magnitude from feeble to devastating. Their effects may be completely catastrophic to ruin crores of human property and multitude of life. The progress and the national development of the country will inter-relate to its capability to cope up with the situation when a disaster strikes its land and people. To fight back from any economic pitfalls and environment degradation impacting national sustainable development, disaster education offers us an indispensable scientific tool to mitigate them and standard procedures to manage critical situations. Growth and spread of disaster science as a mandatory part of science curriculum is the need of the hour and an aspiration of the country at the moment.

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