

ANALYSING WATER-RELATED TOPICS IN SCIENCE TEXTBOOKS FROM SUSTAINABILITY AND SOCIAL JUSTICE PERSPECTIVES

Meenakshi Kaushik

Homi Bhabha Centre for Science Education, TIFR, Mumbai
meenakshit@hbcse.tifr.res.in

This article explores how the Indian school science curriculum deals with social justice and sustainability with reference to water-related topics. The three pillars of sustainable development as put forth in Rio Earth Summit (1992) were used as the framework to explore sustainability and social justice perspectives in NCERT EVS (grade 3-5) and science (grade 6-10) textbooks. As the terms ‘social justice’, ‘sustainability’ and ‘sustainable’ are not mentioned frequently in the curriculum so the water-related topics were examined carefully to investigate signs of content related to sustainability and social justice using the key developed by Jóhannesson et al (2011). The analysis revealed that sustainability and social justice perspectives are discussed more in textbooks for primary and secondary level as compared to the upper primary level.

INTRODUCTION AND REVIEW OF LITERATURE

‘Water is for one and all’, this phrase implies equal access to water to everyone irrespective of one’s class, caste, race or gender and, also for sustainable use of water to ensure the availability of potable water for future generations. The challenge to make potable water accessible to all is more pressing than ever due to lack of formal water provision, unequal distribution and water pollution.

The unjust exploitation of natural resources for economic development has given rise to many concerns. The relationship between development and environment led to the conceptualization of sustainable development (Adekunle, 2017). According to Langhelle (2000), the term ‘sustainable’ was first used in a report made by the working group within the World Council of Churches in 1976. He cited the following excerpt of the report from Birch et al. (1979)

The twin issues around which the world’s future revolves are justice and ecology. ‘Justice’ points to the necessity of correcting maldistribution of the products of the Earth and of bridging the gap between rich and poor countries. ‘Ecology’ points to humanity’s dependence upon the Earth. Society must be so organised as to sustain the Earth so that a sufficient quality of material and cultural life for humanity may itself be sustained indefinitely. A sustainable society which is unjust can hardly be worth sustaining. A just society that is unsustainable is self-defeating. Humanity now has the responsibility to make a deliberate transition to a just and sustainable global society. (p.296)

This conceptualization of sustainable society clearly has a social justice mandate which got lost or subsumed within the discourse that conflated ‘development’ and ‘economic growth’. In Brundtland report (1987), sustainable development is defined as the development that meets the needs of the present without compromising the ability of the future generation to meet their own needs (Langhelle, 2000). Such conceptualization of sustainable development does not consider the existing social inequalities. The most widely conceived notion of sustainable development is highly anthropocentric though alternative ecocentric views are also put forth.

Agyeman, Bullard and Evans, (2002) argued that the concept of sustainability is not limited to environmental aspects only, it must consider the aspects of social justice where *questions of social needs and welfare, and economic opportunities are integrally related to environmental limits imposed by supporting ecosystems*. What role does class, race, caste, justice and equity play in sustainability? According to Agyeman (2008), inequity and injustice resulting from racism and classism [and casteism] is bad for the environment as well as for sustainability as broadly conceived. Langhelle (2000) also viewed social justice as an integral part of sustainable development. He opined that development and environmental policies, as well as the strategies and priorities, are greatly influenced by the way the relationship between social justice and sustainability is perceived.

In Rio Earth Summit, 1992, three pillars of sustainable development were put forth, which are: Environmental Protection (Environmental sustainability); Social welfare and cultural integrity (Social sustainability); and Economic development/prosperity (Economic sustainability) (Nightingale, 2019). The main objective of development is to maintain the balance between these three pillars to attain sustainability. According to Nightingale (2019), environmental sustainability is assumed to be the most important and the views vary from highly anthropocentric to ecocentric. Social sustainability mainly focuses on social justice dimension. Social justice supports the idea that everyone deserves equality in economic, political, and social rights, as well as equal access to important human rights (Adams & Bell, 2016). It aims for the total transformation of society to bring social justice by addressing social inequalities. Economic sustainability is argued to be the main pathway to sustainability (Rio Earth Summit, 1992). Many argue that economic growth is necessary for achieving sustainability. According to these people, poverty causes overexploitation of resources and therefore leads to environmental degradation. Whereas another group of people consider global capitalism as fundamentally unsustainable causing inequalities among societies and *overexploitation of ecosystems*. They advocate for alternative economic relations (Nightingale, 2019). Economic sustainability is given the most consideration while making policies on sustainable development.

Education for Sustainable development (ESD)

The central focus of ESD is to prepare students to become responsible citizens by enabling them to participate meaningfully in community-related issues and adopt a sustainable lifestyle by taking the responsibility for both themselves and future generations (de Haan, 2006). According to Wheeler (2000), ESD should aim at developing a deep understanding of complex environmental, economic and social systems and recognition of the importance of interconnectedness between these systems. According to McKeown and Hopkins (2007), most of the ESD models advocate an issue-based and interdisciplinary approach to bring together different

perspectives towards a socially relevant contemporary issue. Science and technology plays an important role in the social and economic development of any society and many issues/concerns regarding sustainability have their links with science and technology either in their genesis or in solutions. Therefore, science education is at the core of the ESD.

Water-related issues like water pollution, the disappearance of water from lakes and rivers, depletion of groundwater etc. are in news since last two-three decades and now the situation has become severe. Now, many areas including major cities around the world, are facing water shortage and water contamination issues. There is a need to take immediate actions to sensitize people, students and common people alike towards such serious water crisis. The present paper aims to explore what water-related topics are covered and how sustainability and social justice perspectives are incorporated in NCERT EVS and science textbooks.

SAMPLE AND METHOD

For this study, NCERT EVS (Environmental Studies) textbooks for grade 3-5 and science textbooks for grade 6-10 were analysed from sustainability and social justice perspectives using the three pillars of sustainable development as put forth in Rio Earth Summit (1992) as the framework. NCERT textbooks are the most widely used textbooks in India. As recommended by NCF-2005, NCERT textbooks for primary level (EVS, grade 3-5) are based on an integrated approach, therefore science and social science are integrated as Environmental Studies. Although NCF-2005 advocates for integrated curricula, the syllabus represents collection curricula where themes are not connected but are isolated. Water-related topics are part of the syllabus at all grades, however, the topics are fragmented.

The descriptive content analysis method was used for textbook analysis. First, the chapters which included water-related topics were selected. Then, these chapters were analysed using the key developed by Johannesson et al. (2010) to study the signs of sustainable development. This key has seven characteristics: values, opinions and emotions about nature and environment; knowledge contributing to the sensible use of nature; welfare and public health; democracy, participation, and action competence; equality and multicultural issues; global awareness; and finally, economic development and future prospect. The selected chapters were read carefully and the content manifesting any of these characteristics was selected. The selected content was then categorised into social, environmental and economical aspects of sustainable development and analysed from the social justice perspective.

ANALYSIS AND DISCUSSION

The textbook analysis discussed in the following section will reveal what water-related topics are covered and, where and how sustainability and social justice perspectives are incorporated in NCERT EVS and science textbooks.

Water-related topics covered in the NCERT EVS (grade 3-5) and Science (6-10) textbooks

Water-related topics are covered in at all levels, primary (grade 3-5), upper primary (grade 6-8) and secondary

level (grade 9-10). There is at least one chapter or one section at each grade level which is devoted to ‘water’; however, the content covered in these chapters is repetitive, focusing mainly on water sources, their use, water shortage, water pollution and rainwater harvesting. For example, surface water pollution is discussed through an example of river Ganga in grade 8 (Ch-18) and, also in grade 10 (Ch-16). Table 1.1 represents the water-related topics covered in science textbooks (grade 3-10).

Water related topics	NCERT textbook (numbers indicate the grade level)
Fundamental concepts: forms of water, properties, water cycle	3,5,6,7,9
Water availability	7
Sources: Fresh and salt water sources	3,6,7
Uses: domestic; Agricultural and Industrial	3,4,6,9
Water shortage	3,4,6,7
Initiatives to deal with water shortage: rain water harvesting, revival of lakes and ponds, sustainable use of water	3,5,6,10
Water pollution	4,7,8,9,10
Cultural references	3,5

Table 1: Water-related topics covered in the textbooks

The major emphasis in lower grades is on water shortage issues whereas in higher grades emphasis is shifted to water pollution. While discussing the uses of water, domestic and agricultural uses of water are discussed repeatedly in textbooks across the grades whereas industrial use of water is not discussed significantly. Also, in the case of water pollution, as contributing factors, domestic waste is discussed the most, followed by agricultural waste whereas, pollution caused by industrial waste is not discussed much in the textbooks. Moreover, throughout the grades, a major focus is on surface water and pollution of groundwater is discussed briefly only in the science textbook of grade 7. The extent and the severity of the impact of surface water and groundwater pollution on human and environment are not discussed appropriately.

The concept of sustainable development is explicitly introduced in science textbook for grade 10 in chapter-16 (Management of Natural Resources). Definition of sustainable development from the Brundtland Report (1987) is given.

The concept of sustainable development encourages forms of growth that meet current basic human needs while preserving the resources for the needs of future generations. (NCERT, 2006, grade-10, p268)

Though no concrete example is provided in the textbooks to help students to understand the meaning of sustainable development, students have been encouraged to adopt environment-friendly habits and make changes in their lifestyle. Attempts have been made to sensitize students towards sensible use of water through activities like calculating how much water is needed per person per day, how much water is available for our use and by mentioning difficulties faced by people in water-scarce areas.

Sustainability perspective was found to be significantly incorporated in textbooks, however, social justice aspect was marginalized except few instances (discussed in the next section). Unlike sustainable development, the importance of social justice is not discussed explicitly anywhere in the textbooks. The interconnectedness of sustainable development and social justice is not brought forth in the textbooks.

In the upcoming sections, the water-related content covered in the textbooks is analysed from a social, environmental and economic perspective. Social justice perspective is discussed within each foresaid section.

SOCIAL AND CULTURAL ASPECTS RELATED TO WATER

Analysis revealed that the textbooks have mainly incorporated the perspective of rural and poor sub-urban societies of India. Of the three levels, primary level textbooks were found to be incorporating social and cultural aspects of water-related topics significantly, like discussions on different practices like reuse of water, using 'tanka method' for rainwater harvesting etc. EVS textbook for grade 5 included discussion on how people in the past used to tackle the issue of water shortage sustainably by constructing stepwells and interconnected lake system to store rainwater for yearlong use and how the change in lifestyle of people and neglect of such sustainable water management systems led to water shortage issues at these places.

The EVS textbooks also included discussion on the water-related customs and cultural practices to depict the significance of water to people's lives, for instance, in EVS grade 5 textbook, there is a section on 'customs related to water' with pictures of a bride worshipping a spring and stone carvings near the place of drinking water (p54). Apart from familiarizing and sensitizing students about water-related issues, textbooks at both primary and upper primary level were also found to include many real-life success stories of reviving water bodies by common people including children, in different areas of country, to cite a few examples, Bhima Sangh's successful efforts of reviving water bodies in grade 4 EVS textbook and Bhujpur story of groundwater recharge through rainwater harvesting (p201) and transformation of Alwar district into a green place (p202) in grade 7 science textbook etc.

Social Justice perspective

Textbooks at the primary level were found to incorporate social justice issues like gender and social (caste-based) discrimination, as compared to middle and secondary level. EVS textbooks have incorporated discussions around gender and social discrimination, for instance, in EVS textbook for grade 3, there is discussion on how water shortage in a village of Rajasthan, 'Bajju', impacts lives of women through a picture showing women walking long distances to fetch water for daily use (p134), and students have been asked one word questions like 'Do your neighbors bring water from the same place?; Are there certain people who are not allowed to take water from there?; Who fetches and stores water in your house?' with the purpose to sensitize children towards issues like caste and gender discrimination (p 21); in EVS textbook for grade-4, issue of unequal access to water is presented through an example of water park in an area (Bazaar Gaon, Maharashtra) where villagers are facing water shortage issues (p147-148). These textbooks have also mentioned other implications of water shortage and pollution like migration, health issues and extra financial burden on people etc. There are also footnotes in EVS textbooks which appeals to facilitators to discuss such issues with

children to sensitize them towards gender and caste-based discrimination and sensible use of water. Though uneven distribution and differential access to water across the country have been discussed in the textbooks, human-induced causes and consequences of unequal access to safe water in terms of health effects and opportunity cost is not discussed sufficiently.

In grade 7 textbook, there is discussion on water pollution due to poor sanitation and sewage and how students can contribute in maintaining the water sources in healthy state, for example, by approaching municipality or gram panchayat to compliant about open drains and sewers (p220). However, there is no space for discussion around the people (manual scavengers) involved in the cleaning of these drains and sewers and what impact does such work has on their lives.

In grade 10 textbook, social justice issues like displacement of people and inequitable distribution of water, etc. caused by mega projects like construction of dams, are incorporated significantly; however, instead of enabling students to think critically about various aspects of these issues and explore connections between these aspects, textbook describes relatively few dimensions of such issues.

Environmental aspects related to water

The main approach in EVS textbooks is anthropocentric, the facts related to water scarcity and water pollution are discussed concerning its impact on human health, whereas, the impact on plants, different animals, and aquatic life, is only briefly mentioned at different levels., The concern for the environment seems to be arising from concern for human welfare, for instance, any attempt that has been discussed in the textbooks to deal with the water shortage or water pollution is made when human health and everyday life is adversely affected; none of the story or incidence is mentioned in the textbooks where any effort is made to save the environment for the sake of environment and well-being of other species. However, the importance of water for different species and its relation to biodiversity is discussed at primary as well as secondary level.

Whereas at the primary level, the focus is more on the water shortage, as we move from primary to secondary level, the focus shifts to water pollution. While discussing water pollution, the textbooks were found to emphasize more on the surface water pollution as compared to groundwater pollution Although textbooks have included brief discussions about the impact of pollution on aquatic life at all levels, the long-term consequences of water depletion and contaminations on the environment are not discussed. The interrelationship between humans and the environment also does not seem to be adequately addressed in the textbooks. The way water shortage is projected in the textbooks, it is attributed more to natural causes and only human-induced cause discussed is an increase in population which has exaggerated the situation; there is not much discussion around water mismanagement issues at local as well as at the national level except in the textbook for grade 10.

Social Justice perspective

Environmental sustainability is an important aspect of sustainable development. Throughout the grades, especially at primary level, textbooks have emphasized sensitizing students towards sensible and just use of

water resources. However, textbooks does not provide much opportunity for students to critically think how does unjust exploitation of water resources by a particular section of the society (for example water-intensive industries like mining industry) affect the majority of people, other species and ecosystems in various ways and create sustainability issues. The issue of water management is essentially an issue of environmental justice (Vanderwarker, 2012) and everyone including the non-human species have right to environmental resources like water. This sentiment is found to be missing from the textbooks.

Economical aspects related to water

Economic development is at the heart of sustainable development. According to Adekunle (2017), a society which is economically more developed is more sustainable. The economical aspect of water is briefly discussed in EVS textbooks. In grade 5 EVS textbook, students are asked to examine the water bill printed in the textbook and find out how much do they pay for water. A few instances, these textbooks also mention that some of the people have to buy drinking water from the market as there is no provision for safe water supply. As the focus at the primary level is mostly on the use of water for domestic purposes, the economical aspect of water concerning agricultural and industrial use is not discussed. As we move to the secondary level, there is a discussion related to cost involved in mega projects like the revival of river Ganga.

You must have heard about the Ganga Action Plan. This multi-crore project came about in 1985 because the quality of the water in the Ganga was very poor (NCERT, 2006, grade-10, p266)

The economic value of water in producing hydroelectric power is also discussed in science textbooks for grade 9 and 10. These instances help make students realize that the water that is supplied to their houses and communities is not free as contrary to popular belief, but it is paid, as there is processing cost involved. However, it is not mentioned in the textbooks that this cost differs from domestic to agricultural and industrial use. There is also no discussion around 'subsidy' provision, what it is, and how it varies for water consumption for different purposes.

Social Justice Perspective

The textbooks of secondary level have incorporated social justice issues that are related to economical aspect of sustainable development, for example, while discussing the mega projects, textbooks at the secondary level address the issues like inequitable distribution of water from the dam, woes of people who are displaced from the site etc. The textbooks for primary and upper primary level were also found to address social justice-related issues like the struggle of people from marginalized section to arrange water for daily use and helplessness in using dirty water for various purposes including drinking, whereas people from a privileged section of society have easy access to water and water purification systems.

CONCLUSION

The analysis revealed that sustainability and social justice perspectives are incorporated significantly in EVS textbooks for primary level and to some extent in science textbooks for secondary level. Whereas science textbooks for upper primary level seem to adopt factual approach and marginalize the sustainability and social

justice perspectives. Additionally, at all levels, the contentious issues that arise because of the complex interaction between human and environment are not adequately addressed. The discourse on misuse and mismanagement of water resources for industrial as well as agricultural purposes is side-lined in the textbooks. For example, cultivation of water-intensive crops in areas with low water table, constructing industries which require a large quantity of water in areas facing water shortage issues, violation of rules and regulations related to waste discharge are not adequately covered in the textbooks.

There are very few instances where students are provided space to think critically about issues related to sustainability and social justice; they are asked closed questions with limited scope for critical and interdisciplinary thinking. There is a need to create space for students within the textbooks to understand and appreciate the complexity of human-environment interaction and reflect on their experiences as a member of the society from a sustainability and social justice perspectives.

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