Conceptualizing Justice-centred Science and Environment Education in the context of the M(East) ward in Mumbai

A Thesis

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Declaration

This thesis is a presentation of my original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature, and acknowledgement of collaborative research and discussions.

The work was done under the guidance of Professor K. Subramaniam, at the Tata Institute of Fundamental Research, Mumbai.

Himanshu Srivastava

In my capacity as supervisor of the candidate's thesis, I certify that the above statements are true to the best of my knowledge.

Prof. K. Subramaniam

Date: 9th May, 2023

For my parents

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When I embarked upon this journey, I had not anticipated that it would take me this long to complete it. But that's life – unpredictable and non-linear. When you think things are going as per your plan, it will throw a surprise at you, and you are left with no choice but to accommodate the new variables. Likewise, my PhD journey wasn't a straightforward one with so much happening on the personal front. I lost both my parents and my beloved grandmother, my pillars of strength, during my PhD. I am sure they will be watching over me from wherever they are and would be proud of the shape that this PhD thesis has finally taken. I miss them today more than ever. Now that I have reached the final milestone, it's time to look back and thank all the people who made this possible, bearable and worthwhile.

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Srivastava, H., Gupta, A. & Raveendran, A. (2021). Examining the discourse on waste in school education from the standpoint of marginalized communities in Mumbai. *Cultural Studies of Science Education,* 1-30. https://doi.org/10.1007/s11422-021-10049-5 **(Informs Chapter 3 and 4 of the thesis)**

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3 R   Reduce, Reuse and Recycle

AQI   Air Quality Index

BMC   Bombay Municipal Corporation

CDA   Critical Discourse Analysis

CEE   Centre for Environment Education

CPP   Critical Pedagogy of Place

CSL   Critical Scientific, Technological and Environmental Literacy

EE   Environment Education

EEFS   Environment Education for Sustainability

ESD   Education for Sustainable Development

FOK   Funds of Knowledge

GDP   Gross Domestic Product

HBCSE   Homi Bhabha Centre for Science Education

HDI   Human Development Index

HEAL   Health and Environment: Action-based Learning

HSTP   Hoshangabad Science Teaching Programme

KSSP   Keralā Shāstra Sāhitya Parishath

KVSS   Kachrā Vāhatuk Shramik Sangh

MCGM   Municipal Corporation of Greater Mumbai

MH   State of Maharashtra

MHADA   Maharashtra Housing and Area Development Authority

NCERT   National Council of Educational Research and Training

NCF	National Curriculum Framework
NGO	Non-Government Organization
PSM	People's Science Movements
RQDA	R package for Qualitative Data Analysis
SD	Sustainable Development
SDG	Sustainable Development Goals
STS	Science-Technology-Society
STSE	Science-Technology-Society-Environment
SWM	Solid Waste Management
TFI	Teach for India
TISS	Tata Institute of Social Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCED	World Commission on Environment and Development

Abstract

This thesis is premised on two major assumptions that education can play a significant role in social transformation, and that critical scientific, technological and environmental literacy is a must to change the social order that is oppressive to people and the natural environment. Building on critical strands within the fields of science and environment education, the thesis aims to develop a systematic critique of the formal educational discourse from the perspective of marginalized communities such as the M(East) ward in Mumbai city and explore the possibilities of a justice-centered science and environment education. In the context of the M(East) ward - the most neglected municipal ward in the city - waste seemed to be the most promising theme to initiate discussions on social and environmental justice as one of the largest dumping sites in Asia, the Deonar dumping ground, is the central identity of the geographical region. Waste as a curricular theme is closely linked with various science and social science topics, such as health, materials, development, and environment which were the focal themes in the study. The study had a threefold agenda: 1) Critically examining the educational discourse on focal themes, 2) Exploring students' life worlds, and 3) Conceptualizing a model of justice-centered science and environment education in that context.

The work is broadly situated within the realm of critical qualitative inquiry as it adopts two overtly political methodologies - Critical Ethnography and Critical Discourse Analysis – to address the research objectives. The participants in the study comprised of Grade 9 students, science and social science teachers from local schools, and an array of people working in the domain of waste (rag pickers, scrap dealers, professionals working in the waste management sector, trade union leaders), and field associates and officials of organizations such as Apnalaya, SWaCH, and the Tata Institute of Social Sciences' Transforming M-ward project. The analysis of the educational discourse involved a critical examination of the science and social science textbooks, classroom teaching of relevant topics, and formal and informal interactions with teachers and students of the M(East) ward.

The findings indicate that the educational discourse on selected themes is largely decontextualized and depoliticized. By not providing any space for their voices and concerns

on an issue so central to their lives, the curriculum exerts 'symbolic violence' on the students (Bourdieu & Passeron, 1977). The explorations into students' life worlds brought to the fore not only their rich experiences, values, knowledge, concerns, cultural beliefs, political views, but also a medley of emotions such as shame, agitation, and more importantly, undaunted hope that the situation can be changed. Further, based on my interactions with students and other participants, I try to delineate a justice-centered model with regard to the theme of waste in terms of conceptual ideas, discussion points, activities, and resources that can be employed.

1. Introduction

There is no such thing as a neutral educational process. Education either functions as an instrument that is used to facilitate the integration of the younger generation into the logic of the present system and bring about conformity to it, or it becomes the practice of freedom, the means by which men and women deal critically and creatively with reality and discover how to participate in the transformation of their world.

(Freire, 1972, p. 34)

1.1 Education for social transformation

The lines quoted above from Paulo Freire's *Pedagogy of the Oppressed* suggest that education is a political practice that serves to maintain the *status quo* or conscientize people to bring changes in the prevailing oppressive conditions in society. Freire (1972) argues that a transformative education advances the liberation of the oppressed as well as the oppressor. The vital role of education in empowering people and breaking the shackles that restrain people from exercising freedom has been emphasized by Indian visionaries and social reformers such as Jotirao Phule (1827-1890) and B R Ambedkar (1891-1956) as well. Owing to their lived experiences as members of downtrodden castes, both Phule and Ambedkar were concerned about the plight of the oppressed castes and saw its roots in the prevailing Brahminical worldview of the casteist Indian society. Along with Savitribai Phule, Jotirao opened schools especially for girls of lower caste groups and wrote a letter in 1882 to the Education Commission emphasizing the need for immediate attention to primary education as well as girls' education. In the letter, he also advocated the necessity for government involvement in higher education to employ non-Brahmin teachers to dismantle the Brahminical hegemony in education. Having been a student of science himself, Phule embraced a modern view of education and *"evidently saw a modern education with an*

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emphasis on science as an important and crucial force in demolishing the Brahminical view of the world and in ensuring that the shudraatishudras[1] would be ready to embrace the coming industrial change and to claim their rightful place in the world" (Venkatesh, 2016, p. 129).

Ambedkar, a champion of social justice, strongly believed in the transformative role of education. In 1942, he inspired his followers with a powerful slogan: *Educate, Agitate, Organize,* emphasizing the importance of education in the struggle for liberation. He questioned caste and gender heirarchies that are deeply ingrained in Hinduism, and was concerned about class inequities as well. "Equity was at the core of Ambedkar's ideology, and his writings delineated its varied forms and dimensions: equality of respect, equal human dignity and worth, equality before law, equal rights, equality of condition, consideration, and also of opportunity" (Velaskar, 2012, p. 251). Rege (2010) argues that both Phule and Ambedkar "underline the preference for truth enhancing values and methods through an integration of critical rationality of modern science and the scepticism and self-reflection of ancient non-Vedic materialists and the Buddha" (p. 93). Both perceived science in a liberating role and envisaged teachers and students as "modern truth seekers and agents of social transformation" (ibid, p. 93).

This thesis focuses on conceptualizing a transformative science and environment education. While it shares the vision of Phule and Ambedkar of a more equal and just society and the role of education in addressing historical injustices, it does not locate itself within the modernist, rationalist framework espoused by these visionaries of the late colonial period. Rather, the position advanced by this thesis is informed by various criticisms of science, technology and development mounted by post-colonial scholarship of the late 20th century (discussed further in Section 1.5). In the next section, I elaborate further on what I mean by a transformative science and environment education.

1.2 Need for a transformative science and environment education

The world is on the verge of an environmental crisis evident in the way global climate is changing, natural resources are dwindling, species are becoming extinct, ecosystems are degrading, biodiversity is getting lost, pollution levels are rising, agriculture sector is

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[1]   Phule used the word 'sudraatishudra' to refer to lower castes which include dalits as well as Other Backward Communities (OBCs) (Venkatesh, 2016).

disrupted, and mountains of garbage are piling in metropolitan cities across the world. These human-induced environmental problems have left a permanent dent on the natural environment. The crisis has affected everyone but most adversely the people from marginalized sections who have faced detrimental effects on their health, safety, and livelihoods. On the socioeconomic front, one notes the rising concentration of wealth in the hands of the top one percent. The World Inequality Report (2018) shows that the income inequality is steadily deepening day by day (Alvaredo et al., 2018). In the name of development, indigenous people in rural areas and slum dwellers in cities are frequently uprooted. People are bound to live and work in dehumanizing conditions. Foster et al. (2011) argue that the divide between human beings and nature is widening and it has led to a situation, best represented as "the crisis of the earth". Further, they claim that this unprecedented crisis is a direct outcome of capitalist modes of production.

To bring any radical change to the socioeconomic or environmental conditions, ecologies and economies need to be reconceptualized. This thesis is premised on the assumption that education too can play a significant role in social transformation. Since the current times are marked by the immense presence of science and technology in almost all facets of life, I believe that science and environment education also carry the responsibility of pursuing transformative goals. In the 21st century, it is not easy to even imagine a life without science and technology. Moreover, technoscientific advancement forms the backbone of economic development and scientific rationality is often invoked to justify policies related to environment protection or development.

Since the industrial revolution in Europe, science and technology have pervaded several spheres of human life. Though these played a liberating role in its initial phase, offered new ways of thinking about the world, and challenged the religious orthodoxy in the West, as time progressed the profit-oriented economy successfully capitalized on technological innovations. The governments too used scientific rationality to justify their policies and development projects. As a result, the scientific enterprise received enormous support from the transnational agencies like the World Trade Organization as well as state governments that supported market economies and emerged as a highly powerful discipline. Ironically, its reductionist methods have turned out to be 'violent' on nature and to common people (Nandy, 1988). Kumar (1996) points outs that modern science is based on problematic value-premises. It objectifies nature and sees it as something that needs to be 'controlled' and 'subjugated'. It

holds no moral responsibility towards the object of inquiry and presents itself as a highly specialized, and therefore, compartmentalized, pursuit of knowledge absolving scientists of taking any serious interest in related fields. Kumar (1996) argues that such premises need to be questioned at a fundamental level in order to address emerging deeper problems such as ecological crisis. Kyle (1999) argues that science and technology have unfolded in and strengthened a political economy that nurtures consumerism and individualism of an order that has "brought the world to the brink of global destruction" (p. 260).

1.3 Scientific literacy: A contested goal of science education

As science and technology increasingly mediate all sorts of human interactions, having basic knowledge of science and technology has become vital to survive in the system. "It is a striking feature of education systems the world over that science is invariably accorded high status, and allocated considerable resources, throughout the years of compulsory schooling. In low-income countries, where difficult choices about resourcing are inevitable, science is a priority subject" (Driver et al., 1996, p. 8). Science is unquestioningly considered a 'core' subject in all the policy documents and all students are made to learn science as part of their general education.

However, only a miniscule of a large number of students who undergo school education get an opportunity to advance their careers in science and become a part of the scientific workforce. For the majority, science learning means, at best, gaining basic scientific literacy that prepares them to survive in the system and deal with specific situations that might arise in the future. Science education, therefore, has this dual responsibility: to lay a foundation in the discipline for a minority of students, and to improve public understanding of science by inculcating scientific literacy for the majority of students.

Thomas & Durant (1987) provide five main arguments to promote public understanding of science: the *economic* argument, the *utilitarian* argument, the *democratic* argument, the *cultural* argument and the *moral* argument. The *economic* argument concerns the supply of scientists who would develop industrial processes and contribute to the economy. The *utilitarian* argument refers to fulfilling specific needs of the consumers, e.g. enabling them to manage technological objects and processes on a day-to-day basis. The *democratic* argument corresponds to the aim of preparing students as responsible citizens who can make informed

choices in future and participate in discussion, debate and decision-making at various levels. The *cultural* argument is about presenting science as a major cultural achievement of our times. The *moral* argument claims that there are certain values and norms inherent in scientific practice which are of wider value. Taking a closer look at the democratic citizenship argument, one finds that most of the arguments in favour of developing democratic citizenship or presenting science as a cultural achievement do not take a critical perspective toward science and technology (Hodson, 2003). Moreover, all the arguments except the economic one fall under the broad umbrella of 'functional' scientific literacy (Ryder, 2001). In this framework, science is projected in a positive sense and all the criticism is directed to the misuse of science by the state, by public, or by big corporations.

Even though inculcating scientific literacy among students has been on the prime agenda of policy makers especially in the international policy discourse, what constitutes scientific literacy has always been a matter of serious contention among science educators (Deboer, 2000). For instance, Hodson (2003) points out that "if it is correct that most people obtain their knowledge of contemporary science and technology from television and newspapers..., then the capacity for active critical engagement with text is not only a crucial element of scientific literacy, it is perhaps the fundamental element" (p. 646). Fensham differs with him on this as he says, "it is a highly unrealistic hope that - even through the best of schooling - a level of science knowledge can be achieved that enables citizens to critically evaluate the scientific claims of the various expert groups" (Fensham, 2002, p. 16). Some other scholars like Shamos debunk the idea of pursuing universal scientific literacy as a goal as "its elements are so wide ranging that they cannot be achieved – and certainly not for everyone… Moreover,...most people can get along perfectly well without scientific knowledge and can easily access it when the need arises" (Hodson, 2003, p. 650). Roth & Lee (2004) point out that whether science could be or should be for all, is still a matter of debate in the science education community. Extending the debate on scientific literacy beyond school boundaries, they argue in favour of science education as/for participation in the community.

Roberts (2007) identifies two broad positions (Vision I and Vision II) that represent different goals of science education on a continuum. While Vision I has the conventional focus on teaching and learning the 'products' and 'processes' of science, Vision II is about understanding the usefulness of scientific knowledge in life and preparing students to deal with situations that they are likely to encounter in the future as citizens. Sjöström & Eilks

(2018) conceptualize another notion of scientific literacy i.e. Vision III, which is more politicized in nature and aims at "emancipation and socio-ecojustice" (p. 67). This vision is similar to what Hodson (2003, 2011) calls 'Critical scientific, technological and environmental literacy' (CSL). This idea is elaborated further in Chapter 2 of the thesis. With the objective of conceptualizing a justice-centred science and environment education, this thesis is guided by Vision III and aims to contribute to the growing body of literature under the ambit of the new paradigm.

1.4 Neoliberal pressures on science and environment education

One of the major hurdles operating against social transformation is neoliberalism which has been the "central guiding principle of economic thought and management" since the 1970s (Harvey, 2007, p. 2). Individualism, competition, deregulation, privatization, commodification, and increasing withdrawal of the state from the matters of social welfare, are some defining characteristics of the neoliberal imagination. Harvey (2007) argues that "Neoliberalism is in the first instance a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong property rights, free markets, and free trade (p. 2)… It holds that the social good will be maximized by maximizing the reach and frequency of market transactions, and it seeks to bring all human action into the domain of the market" (p. 3). The role of the state is limited to providing the necessary support for smooth functioning of markets and allowing for transnational entities to influence the economy. Beyond that, state interference is not welcomed.

Bencze & Carter (2011) note that the mainstream science education often works as an agent of neoliberalism, producing either the scientific force serving the interests of the global economic elite, or mere consumers of goods and services. Underlining the thick connections between science education, global capitalism, and the neoliberal agenda, they point out that -

> ...under influences from apparently hegemonic forces of neoconservatism and neoliberalism, school science often functions to generate *knowledge producers*, including engineers, scientists and other theoretical workers - who, in turn, may develop and manage mechanisms of production of goods and services on behalf of global economic elite. At the same time, it also is apparent that school science generates a large class of

citizens who are prepared, essentially, to serve as *consumers* - both in terms of faithfully following labor instructions from the aforementioned knowledge producers (who may be accountable mainly to their financiers) and also enthusiastically engaging in repeating cycles of consumption of goods and services.

(Bencze & Carter, 2011, p. 648, emphasis in original)

Carter (2008) illustrates how deeply globalization has impacted the agenda of scientific enterprise and science education. She argues that the focus of science education has shifted to mastery over scientific facts and competencies decided by the global market and expresses her concern that there is an overemphasis on learning canonical science. She urges for a science education that would "help students understand and make critical judgments about science in ways that can enhance their engagement to work for a more socially just, equitable, and ecologically sustainable world" (p. 628).

Similar critiques of the close alliance between neoliberalism and science education have been made by other scholars as well, who suggest that in order to get a better sense of how the neoliberal ideology plays out in the context of scientific activity or in science education, one should unravel assumptions made at different levels, explicate subjectivities, explore educational discourse in STEM education policies (Hoeg & Bencze, 2017a, 2017b), textbooks and teachers' narratives (Bazzul, 2012) and examine how sensibilities associated with neoliberalism structure teaching and learning in schools (Tobin, 2011).

Globalizing ideologies have also significantly influenced the landscape of environment education (Jickling & Wals, 2008). Hursh, Henderson, & Greenwood (2015) claim that "neoliberal ideals promoting economic growth and using markets to solve environmental and economic problems constrain how we conceptualize and implement environmental education" (p. 299). A transformative science and environment education must address these concerns and help students develop systemic understanding of issues, a critical consciousness, a commitment to social and environmental justice, and competencies to take collective action.

It is not surprising that as the market pressures are increasing on scientific practice as well as the education system across the globe, voices of dissent are also rising from multiple quarters. In the 1970s, various people's movements around the globe, including environmental movements, campaigns against the unethical drug trials in developing countries, protests

against the nuclear power plants, movements around animals' rights, called into question the rapid pace and the nature of technological advancement, the profit-oriented technocratic development model, and the state's complicity in the big science projects. These movements pointed out the need for a radically different education focusing on developing a critical perspective towards the nexus between scientific enterprise, global capitalism, and the state, among many other things. To address these rising concerns, the STS (Science, Technology and Society) education paradigm emerged within the field of science education. In Chapter 2 of the thesis, I discuss various positions, approaches and strategies that scholars have adopted in the area of STS education. In the subsequent sections, I turn my attention to the Indian context and discuss the state of STS and environment education in the country.

1.5 Contesting imaginations of science and technology in modern India

Situating science and environment education in India in a historical context demands critically looking at various imaginations of science and technology in the country, and what role of science and technology was envisaged in those imaginations. Chadha (2005) identifies three major discourses on science and technology in post-independence India: liberal progressivist discourse, leftist discourse, and radical post-colonial discourse.

She argues that the liberal progressivist discourse is "characterised by a sense of uncritical optimism on the role of science and technology in building modern India" (p. 251) and dominates the public opinion of science and technology in the country. Post independence, the Indian state had several daunting problems in front of it which included national security, national integration, food security, industrial development, as well as overcoming traditional orthodoxy. While M. K. Gandhi[2], the prominent face of the Indian freedom struggle, was against modernity, mechanization and industrialization, the Indian state, under the leadership

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2   An offshoot of the Gandhian position is the Appropriate Technology stance. Appropriate technologists advocate small scale, low cost technology which is labor-intensive, easy to maintain and has low environmental impact – technology which is an intermediate between the traditional variety and those that have been developed to fulfill the needs and desires of the rich (Schumacher, 1973). While critics view the appropriate technology stance as suggesting different solutions for different strata of society which might reinforce social inequality (Zelenika & Pearce, 2011), proponents defend their stance as being a reconciliation between tradition and modernity with a potential of liberating the poor (Reddy, 1975).

of Jawaharlal Nehru, the first Prime Minister of independent India, showed immense faith in scientific and technological advancement. It was hoped that modern western science and technology would lead the way for growth and development, and bring back the country on the world map at par with the other 'superpowers'. Initiatives such as setting up big dams, atomic energy plants, technology institutes, and green revolution were at the core of this imagination.

The leftist view is primarily held by those who were/are associated with various People's Science Movements (PSMs). The PSMs focus on diverse issues such as "the development of science and technology for people, protection of natural environment and forests, opposition to mega projects of global corporations and the World Bank, improvement in the conditions of life and health, building cultural identity, promotion of scientific knowledge among the common people, research related to people's health, innovation in scientific communication, and rediscovering Indian heritage" (Varma, 2001, p. 4796). In this imagination, science and technology is perceived as "appropriated, controlled and abused by the elite, leading to economic and intellectual exploitation of the masses" (Chadha, 2005, p. 251) but which has the potential of working as a tool for social transformation and therefore, must be reclaimed by people.

The third discourse concerns various criticisms of science and technology that have emerged in the past fifty years in the country. This includes sociological, environmental, feminist, post-colonial and post-modern critiques of science and technology. The critics problematize the nexus between scientific enterprise, capitalism and the state, and argue that the methods of modern science are intrinsically violent to nature and to the masses (Shiva, 1988). This view is often equated with a relativist position on knowledge as the critics challenge the hegemony of scientific knowledge over local knowledge systems. In this regard, Nanda (2003) cautions that disparaging scientific rationality might invite conservationist forces to justify orthodox and unjust cultural practices.

With the publication of "*A Statement on Scientific Temper*" in 1981 by a group of scientists and leftist scholars, and "*A Counter Statement on Humanistic Temper*" in the same year by a few critics of science, the debate has significantly polarized into pro- and anti- science camps. This polarization of the debate between the leftists and the critiques of science is worrisome as both these stances seem concerned about masses. It is striking that while liberal-

progressivist and leftist discourses express immense faith in the methods of science and technology and see scientific methods and scientific temper as panacea for all kinds of problems in the country, the critics question the 'scientism' that surrounds the two discourses. I find myself more aligned with the third kind of discourse that takes an informed view of various criticisms and urges for adopting a critical perspective towards scientific enterprise as it unfolds in the broader political economy.

1.6 STS Education in India

Despite parallel and contesting discourses on the role of science and technology in the country, the policy documents in post independence India have always portrayed science in a positive light. A recent policy document - NCERT's focus group paper on teaching of science - acknowledges the emancipatory potential of science and presents science as a tool for social change and addressing problems associated with socioeconomic inequality.

> Science learning should be used as an instrument of social change to reduce the socio-economic divide. It should help to fight prejudice related to, among others, gender, caste, religion and region. Science education ought to empower students to question the social beliefs, notions and practices that perpetuate social inequality. (NCERT, 2006b, p. 28)

It is striking that the document does not hesitate from valorising science, and presents a glorified image of science.

> In a progressive forward-looking society, science can play a truly liberating role, helping people out of the vicious circle of poverty, ignorance and superstition. In a democratic political framework, the possible aberrations and misuse of science can be checked by the people themselves. *Science, tempered with wisdom, is the surest and the only way to human welfare*. This conviction provides the basic rationale for science education.
>
> (NCERT, 2006b, p. 2, emphasis added)

Clearly, the curricular discourse is caught up in the logic of scientism and any criticism of science and technology is yet to find space in policy documents. This is despite the concerns raised by various PSMs about the role of science and technology in furthering state's modernization and development agenda, and propagating these ideas through various grassroots initiatives since 1960s. Sahoo & Pattnaik (2012) argue that developing a critical understanding of science and technology in lay public has always been at the heart of PSMs.

There were two historic initiatives – the KSSP and the HSTP program, which operated at a reasonably large scale and adopted STS-informed perspectives in their conceptualization of science education. The *Keralā Shāstra Sāhitya Parishath* (KSSP) was the largest PSM organization in India that was formed in 1962 with the goal of taking science to common people. As a mass movement, KSSP sought to "popularise science and the scientific attitude among the people, to arm them and their organisations with science, to mobilise people against the abuses of science, to campaign for alternatives that are more in conformity with interests of the people and to agitate for the development of self-reliant science and technology for the nation" (Ekbal & Issac, 1988, p. 9). *Science for Social Revolution* was the slogan that captured the essence of KSSP's ideology.

The *Hoshangabad Science Teaching Program* (HSTP), that was initiated in 1972 as an educational experiment, aimed at improving the quality of science education in the state of Madhya Pradesh by providing authentic but low-cost experiences of learning science to village students. As part of the program, students got ample opportunities for field visits, asking questions, conducting investigations, analyzing data, and drawing inferences based on their own observations. Science was seen in a liberating role and inculcating scientific temper among students was emphasized in the program. HSTP also envisioned science learning to be closely connected with students' immediate natural and social environments. Students were encouraged to bring examples from their contexts, critically reflect on their experiences as part of classroom activities as well as outside the classroom. Though the program was shut down in 2002 because of certain political reasons, HSTP showed possibilities of working effectively with the government system and transforming the culture of science teaching by introducing some meaningful changes in the system (Balagopalan, 2003).

Among other notable efforts in STS education, is the activity-based foundation course on STS that was developed by Homi Bhabha Centre for Science Education (HBCSE) in the 1990s (Natarajan, 1999). Through booklets on eight broad STS themes: a) The population problem, b) Education, c) Health – diseases, drugs, and new challenges, d) Resources: energy, e) Resources: land and air, f) Global climate change, g) Ecological balances, and h) Conflicts, the course aimed at introducing higher secondary students to real-world problems, sensitizing them to local issues, and enhancing their understanding of the complex linkages between science, technology and society.

Another program titled "The Health and Environment: Action-based Learning" (HEAL) program was initiated by HBCSE in 2003 with the objective of spreading awareness about the strong connections between health and environment (Mahajan, Bellara & Nair, 2005). Nearly one thousand college students participated in conducting a survey on air and water quality and the health conditions of residents at designated project sites. More recently, studies involving socioscientific issues have been conducted at HBCSE with an imperative of inculcating critical science education among students (Raveendran & Chunawala, 2013, 2015a, 2015b; Raveendran, 2018, 2021). This work is still in a nascent stage and more research is needed to explore how students negotiate various socioscientific issues embedded in local context (Raveendran, 2018).

1.7 Environment Education in India

Though respect for 'mother nature' and protection of environment have always been an integral part of the cultural ethos of the Indian society, any serious effort to introduce environment education (EE) into the Indian education system can be easily traced back to Gandhi's *Basic Education* project that was initiated in 1937 (NCERT, 2006a). Aimed at social transformation through strengthening local governance structures, the project sought to foster skills for productive activity and inculcate values among learners by engaging them deeply in their local environments and community life. Post-independence, the National Education Commission (also known as "Kothari Commission", 1964-1966) recommended making environment education a core part of formal education.

This was also a time when environmentalists had started pointing out problems with various technoscientific development projects set up after independence in the name of nation building and economic growth. The environment movements that began in early 1970s also advocated common people's rights over water, forests and land. In 1976, the Indian Constitution declared protection of natural environment as a fundamental duty of all Indian citizens. The Centre for Environment Education (CEE) was set up in 1984 which spearheaded numerous programs for integrating environment education at all levels. The National Policy on Education 1986 (modified in 1992) stated 'protection of the environment' as an element of common core for developing a curriculum framework. The subsequent National Curriculum Frameworks (1988, 2000) reiterated the need for integrating EE into the curriculum (NCERT,

2006a). Further, in a landmark judgment of the Supreme Court of India (M C Mehta vs. Union of India and others, 2003), EE was made mandatory at all levels of education in the country and the states were advised to integrate it within existing disciplines in the curriculum. Following this ruling, EE received due attention in the formulation of the National Curriculum Framework in 2005, and EE was finally infused with other subjects across levels in the textbooks that were developed subsequently.

It is striking that several non-formal educational initiatives have also been instrumental in developing learning materials and implementing programs in schools. For instance, various people's science movements which were also concerned about diverse local and global environmental issues, initiated programs in environment education as well. Some of the most prominent among these are efforts by the *Keralā Shāstra Sāhitya Parishath* (KSSP), the *Chipko* movement, the *Narmadā Bachāo Aandolan*, and the Save Silent Valley Campaign. These movements adhered to the ideals of critical environmental education to varying degrees and questioned the "dominant development paradigm that accelerates economic disparity and environmental destruction" (Sahoo & Pattnaik, 2012, p. 16). Mainstream environment education in India, however, is yet to embrace the critical ideas espoused by these movements as evident in its rhetoric of sustainable development (Haydock & Srivastava, 2019), and the technocentric approach to discuss environmental issues (Almeida & Cutter-Mackenzie, 2011).

A quick review of policy documents reveals that sustainable development is the new *mantra in the* post-liberalization phase in India. For instance, while discussing the objectives of environment education, the position paper on Habitat and Learning – an auxiliary document to the National Curriculum Framework drafted as part of the curriculum reforms in the Indian education system in 2005, states:

> The main focus of EE should be to expose students to the real-life world, natural and social, in which they live; to enable them to analyse, evaluate, and draw inferences about problems and concerns related to the environment; to add, where possible, to our understanding of environmental issues; and to promote positive environmental actions in order to facilitate the move towards *sustainable development*.

> (NCERT, 2006a, p. 4, emphasis added)

Further, it says, "Truly meaningful EE is... a crucial activity that must lead the way for a paradigm shift in education to promote the pursuit of *sustainable development*" (NCERT, 2006a, p. 5, emphasis added).

While a systematic analysis of various educational programs, textbooks, supplementary material developed by government or private agencies is a must to examine the effectiveness of diverse approaches and strategies and design new learning experiences, very little documentation is available in any form. It will not be exaggeration to say that research in environment education in India is just beginning (Almeida & Cutter-Mackenzie, 2011), and it is not unexpected if the results are contradictory at times given the diversity of contexts. For instance, in their analysis of EE curricula in Madhya Pradesh, Iyenger & Bajaj (2011) note the dominance of the natural science approach to deal with environmental content. They take issues with the stark disconnect of the content with the local and immediate context of students. To illustrate their point, the authors point to the example of a major environmental disaster, i.e., Bhopal gas tragedy that does not get prominent space in the textbooks or the teaching of environmental issues in classrooms in Bhopal. On the contrary, D'Souza, Brahme & Babu (2020) note "adequate and informed social contextualisation" of environmental studies textbooks developed by the NCERT (p. 187). The difference in the observations of the two studies is not unexpected as the two sets of textbooks have been developed by two different agencies. Some other notable empirical studies are by Dutta & Chandrasekharan (2018, 2019) and Haydock & Srivastava (2019).

In a case study of an urban farm in Mumbai, Dutta & Chandrasekharan (2018) demonstrate how concrete engagement in environmental activities, such as urban farming, further motivates participants to take environmental actions in other contexts and contributes to developing pro-environmental values. Another study conducted by these researchers in the school context shows how participating in pro-environmental community practices such as setting up and running a terrace farm could lead to transformative changes in students' action competence and perspectives on environmental matters and seed environmental sensibilities (Dutta & Chandrasekharan, 2019).

Haydock & Srivastava (2019) review various environmental philosophies prevalent in the Indian environmental discourse for their primary focus, their positions on the root cause of the environmental crisis, and the kind of solutions proposed to address the crisis. They then employ this framework to analyze the teaching of environment-related topics of three science

teachers in Central India and examine the ideologies underpinning their teaching, their views, and the textbooks they followed. They point out that though certain glimpses of Gandhian philosophy, appropriate technology and eco-marxist philosophy were present in teachers' narratives and the textbook chapters analyzed, the discourse on environmental issues largely follows an eco-capitalist or ecological modernization philosophy.

1.8 Placing textbooks and teachers in the school education system

Textbooks hold a central place in the Indian school education system (Kumar, 1988). As teaching and assessment in schools are closely tied to the prescribed textbooks, the term "textbook culture" best represents the character of school pedagogy in India (p. 452). Tracing the roots of this heavy reliance on textbooks to the colonial imagination, Kumar (1988) sees textbooks as the "symbolic hub of the power structure that governs the teacher's daily routine" (p. 453). He also argues that a centralised system of curriculum, syllabus and textbooks is a way of exercising bureaucratic control over teachers and classroom teaching. In such an education system, teachers get a narrow space in selecting the content, ordering or deciding the pace of their teaching.

Moreover, the teachers have an imperative to implement the prescribed syllabus within a given time frame which puts severe constraints on their instructional styles and methods. Yet, they do not merely relay the content of the textbooks but mediate between the textbooks and the students and do exert a degree of autonomy over pedagogic discourse and its practices wherever they can (Vijayasimha, 2013). Pointing out the systemic nature of teaching-learning practices, Vasavi (2015) argues,

> Identifying the strategies by which teachers relate to and engage with the school and the larger system enables us to move beyond personalising the limitations of teachers… Situating them within the culture of the system as it marks them will enable us to understand why such a large proportion of teachers becomes indifferent to the challenges of being competent and responsible teachers. For one, the system constantly and in multiple ways erodes their agency, disables their own growth, stunts their voice, and erases any presence that they can have as key members of the education system. In addition, teacher training itself tends to be 'cosmetic' and is largely unprofessional (Batra, 2009), thereby leaving little imprint on the teaching-learning practices that teachers enact in their classes. (p. 44)

Sarangapani (2003) draws our attention to the learners themselves in shaping the pedagogical space. As she argues, "Contrary to the image of children being oppressed by authority and discipline, we find… that they also actively participate in creating the reality of the school. They cooperate in instituting and interpreting the power-knowledge regime." (p. 118). They possess "a wealth of experience and knowledge about the world that most Indian schools fail to harness" (Sharma, 2007, p. 29), showing immense possibilities of designing a meaningful learning experience for students. Therefore, one of the aims was to examine the textbook and classroom discourse (in teachers' and students' articulations) to explore possibilities to connect school curriculum with their lifeworlds.

Though the wider culture of schools, dynamics of classrooms, and educational discourses on core science topics in the Indian context, have been well documented by ethnographic studies such as Sarangapani (2003), Sharma (2007) and Vijayasimha (2013), interdisciplinary themes such as waste, which is intrinsically linked to various other curricular themes (health, development and environment), have remained unexplored. This study attempts to critically analyse the educational discourses on these interlinked themes as contained in the textbooks, enacted in classrooms, or expressed by teachers and students with a focus on analysing what teachers select for discussion and the examples, activities and questions they use to discuss that content.

1.9 Research objectives

As discussed before, research in critical science and environment education in India is in the nascent stage and there is a dire need to explore multiple cultural and socioeconomic contexts.

This thesis makes an attempt in this direction by focusing on a particular geographical region, the M(East) ward in Mumbai, and exploring students' understanding and experiences of select themes (waste, environment and development) in the region. Through this thesis, I aim to develop a systematic critique of the educational discourse on the aforementioned themes in science and environment education from the perspective of marginalized communities. Students' everyday discourses on these themes are also explored and an attempt is made to offer an alternative discourse that is aligned with the principles of social and environmental justice. Thus, the study has a three-fold agenda:

1) Critically examining the educational discourse on waste, environment and development (*Problematize the dominant discourse*)

2) Exploring students' lived experiences and out-of-school knowledge with regard to waste, environment and development (*Identify pedagogical resources in students' life worlds*)

3) Conceptualizing a justice-centred science and environment education model for the M(East) ward community (*Offer an alternative*)

1.10 Organization of the thesis

The thesis is divided into six chapters.

In the introduction chapter, I dwell upon the need for a transformative science and environment education, examine the relevant curricular documents, and present a historical context of STS and environment education in India. The research objectives and the broad structure of the thesis are also spelled out.

The second chapter provides an overview of the theoretical and empirical work that has shaped this research. The chapter begins with a discussion on a range of perspectives, approaches, aims and strategies that scholars have adopted in the field of STS and environment education. Special attention is paid to critical currents in both the fields. The merger of place-based education and critical pedagogy has been appealing to me and I discuss that idea at length. It provides a justification for focusing on a particular 'place' for the study.

In the third chapter, I describe the methodological orientation, the ontological and epistemological framework employed in the study, and various aspects of the research design. This is followed by a brief description of the study context, and the rationale of the study. Research questions are also outlined.

The fourth and fifth chapters of the thesis broadly encompass the findings of the study. In the fourth chapter, I have engaged in an 'oppositional' reading of the educational discourse on waste from the standpoint of the M(East) ward students under three broad themes. First, I explore how waste is defined in the educational discourse and what reasons are provided for the large scale generation of waste, its accumulation and improper management. This is

followed by the analysis of what effects of waste on the natural environment and human life are emphasized. Finally, I discuss what measures are suggested to overcome the problem. For each theme, I primarily draw upon the Grade 9 science textbook that is followed by the schools affiliated with the state board and the teachers' discussion of waste and its management in their classrooms. Further, to problematize the educational discourse, I also bring in data from out-of-school interactions with teachers and students in the community, and my interactions with two groups of rag pickers, one scrap dealer, and an engineer associated with a private firm that deals with renewable fuels.

The fifth chapter is dedicated to a critical examination of the educational discourse on environment and development under four broad themes. I begin with a discussion on how nature is presented in the educational discourse i.e. what language is used to talk about nature, and how the relationship between humans and nature is portrayed. This is followed by a discussion on the understanding of development where I examine how development is defined in the textbook chapters, what markers of development are discussed, and how the difference between various development indicators is explained. The other important theme is the regional variation in development. Here, I explore what variations are highlighted in the discourse and what variations are ignored, and what kinds of explanations are offered for the regional imbalance in development. The last theme is the conflicts around development projects. A critical engagement with various aspects of development projects reveals the complexity of the topic to the learners. For each theme, I rely on my analysis of the relevant textbook chapters in science and social science textbooks, classroom observations, teacher interviews, and my interactions with the students of the M(East) ward in out-of-school settings.

In the final chapter, I propose an alternative model of justice-centred science and environment education for the students of the M(East) ward. I conclude the thesis with my reflections on the significance and the possible implications of the study.

2. Literature review

The focus of this chapter is to locate the study in the vast body of literature that exists in the field of Science-Technology-Society (STS) studies and environment education. This thesis draws upon the critical scholarship in both these fields. First, I engage with the key ideas and practices that have shaped the two fields. Two striking ideas that also form the basis for this thesis are: Critical Scientific, Technological and Environmental Literacy (CSL) (Hodson, 2011, p. 27) and Critical Pedagogy of Place (CPP) (Gruenewald, 2003, p. 8). I discuss both these ideas at length in this chapter.

2.1 Various currents in STSE[3] education

The field of STS education emerged in response to the criticism that the scientific enterprise faced in the 1970s from various quarters. STS education "places science squarely within social, technological, cultural, ethical and political contexts" (Pedretti & Nazir, 2011). A quick analysis of the work that has happened under the STS banner since then indicates the way these concerns have been implemented by various science educators. Aikenhead (2003), in his review of the STS courses and several key STS programs all around the world, identified a diverse range of STS perspectives reflected in curricula, which vary in the proportion of the STS content viz-a-viz canonical science content necessary for student engagement, the way the two were integrated, and the relative emphasis on STS content in student assessment. This categorization highlights the persistent tension between two visions for science education: a) the pragmatic vision (learning how to learn and being able to use what one has learned for social reconstruction or some other aim), and b) the vision privileging academic knowledge. It

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3   STSE stands for Science, Technology, Society and Environment. In the beginning of the STS movement, environmental issues did not receive much attention. However, as the field evolved over time, the need was felt to include environment as well. That is how the STSE education came into being. The acronym STSE was used for the first time by Jim Gallagher in 1971.

also provides a framework to make sense of the ways in which STS might be integrated into science curriculum.

Pedretti & Nazir (2011) present a more updated and useful characterization of the field as they claim to go beyond "*how* STSE might be integrated into science curriculum" to "*why* and *what* of STSE education" (p. 605). Based on the focus, the aims of science education that informed the work, the dominant approaches and the pedagogical strategies employed, they identify six major currents in STSE education (see Table 2.1) that "coexist, overlap, inform one another and can be used in harmony" (Bencze et al., 2020, p. 832). By detailing various assumptions made under these strands, the nature of practice under each strand, the strengths, the limitations and the challenges before each strand, they portray a very comprehensive picture of the field.

Table 2.1 Six major currents in STSE education

(Reproduced from Pedretti & Nazir, 2011)

Current	Focus	Aims of science education	Dominant approaches	Examples of strategies
Application/ design	Solving problems through designing new technology or modifying existing with an emphasis on inquiry and skills	Utilitarian Practical Problem solving Transmission of disciplinary knowledge and technical skills	Cognitive Experiential Pragmatic Creative	Problem-based learning Designing and building artifacts
Historical	Understanding the historical and socio-cultural embeddedness of scientific ideas and scientists' work	Cultural and intellectual achievement Intrinsic value (interesting, exciting, necessary)	Creative Reflexive Affective	Historical case studies Role play Drama Simulations
Logical reasoning	Understanding issues Decision making about	Citizenship Civic responsibility	Reflexive Cognitive	Use of socioscientific issues

	socioscientific issues through consideration of empirical evidence	Decision making (personal and societal) Transaction of ideas		Risk/benefit analysis Stakeholder analysis Use of argumentation models Decision making models Debates
Value centered	Understanding issues Decision making about socioscientific issues through consideration of ethics and moral reasoning	Citizenship Civic responsibility Decision making (personal and societal) Transaction of ideas	Affective Moral Logical Critical	Case studies Socioscientific issue analysis Use of moral philosophical frameworks Values clarification Moral decision making
Socio-cultural	Understanding science and technology as existing within a broader socio-cultural context	Cultural and intellectual achievement Transaction of ideas	Holistic Reflexive Experiential Affective	Case studies Use of socioscientific issues Inclusion of alternative knowledge systems e.g. traditional and spiritual Storytelling Integrated curricula
Socio-ecojustice	Critiquing/solving social and ecological problems through human agency or action	Citizenship Civic responsibility Problem solving Transformation/ agency/ emancipation	Creative Affective Reflexive Critical Experiential Place based	Use of socioscientific issues Case studies Community projects Debates Developing action plans Use of local and global contexts

In Table 2.1, the first current listed, the application / design current focuses on problem-solving through technological design projects (e.g. Cajas, 2001; Roth, 2001; Savery & Duffy, 1996). There is a range of design-based activities that are commonly used by STSE teachers.

Students are often asked to design artifacts to demonstrate their expertise in disciplinary knowledge, carry out specific design tasks while working within specific constraints such as efficient use of materials, cost effectiveness, durability, aesthetic appeal, and environmental friendliness, or design/modify a technology to address a particular social or environmental problem. The assumption here is that technology is an essential part of society and technological solutions can fix societal problems. A related concern some STSE scholars have raised is that the students do not get enough opportunities to consider the role of political and economic factors in designing artifacts. They also lose sight of the impact of technology on society and the environment as their sole focus remains on creating new artifacts. The major challenge before STSE educators who believe in problem-solving through technology, is to design "activities that foster both the development of technological design skills and critical thinking about the in-depth relationships between technology, science, societies and environments" (Pedretti & Nazir, 2011, p. 610).

The historical current emphasizes the historical embeddedness of the scientific practice. The focus of the STSE scholars working within this paradigm is on developing students' understanding of the historical embeddedness through the use of historical narratives in the teaching of science (e.g. Abd-El-Khalick & Lederman, 2000; Duschl, 2004; Irwin, 2000; Lawson, 2002; Matthews, 1994). Science is often presented as decontextualized and dehumanized and this current turns this understanding upside down. Educators have adopted three distinct approaches to introduce historical matter – 1) Engaging with incidents from scientists' lives showing scientists as fallible people living and working in a socio-cultural context, 2) Interrogating the scientific method, demonstrating the role of bias in scientific discoveries, 3) Examining historical case studies of socioscientific incidents, "reflecting on their development, resolution, and long-term outcomes or legacies" (Pedretti & Nazir, 2011, p. 611). Finding resources to prepare authentic historical matter for classrooms is a big challenge before educators (Allchin, 2004). Raveendran & Srivastava (2019) caution that teachers using historical narratives in their classrooms should also be conscious of the metanarratives regarding science that get conveyed through those narratives.

The logical reasoning current is one of the dominant currents within STSE education. It is premised on a positivist assumption that socioscientific issues, irrespective of their complexity, can be best addressed through a scientific approach and logical reasoning.

Developing students' competence in argumentation (e.g. Driver, Newton, & Osborne, 2000; Duschl & Osborne, 2002; Simon, Erduran & Osborne, 2006; Zohar & Nemet, 2002), decision-making (e.g. Bell & Lederman, 2003; Ratcliffe, 1997; Sadler & Zeidler, 2005), logical reasoning, risk-benefit analysis, stakeholder analysis are some of the common strategies adopted in this current. It is striking that the role of non-logical factors such as emotions, values, cultural norms, and politics is completely disregarded while considering socioscientific issues within the scope of this current.

The value-centred current endorses the view that values are an integral part of people's consideration of socioscientific issues. The STSE scholars in this paradigm consider science to be a value-laden enterprise. Students are encouraged to critically analyze various value positions with regard to socioscientific issues and develop their own value position. A group of scholars in this tradition emphasizes the consideration of moral reasoning in students' negotiation of socioscientific issues (e.g. Zeidler & Keefer, 2003; Zeidler & Schafer, 1984; Zeidler, Sadler, Applebaum & Callahan, 2009).

The proponents of the socio-cultural current mostly working in multicultural and non-Western contexts believe in cultural pluralism. Science is seen as one among many ways of knowing the world and not as a superior form of knowledge. In this tradition, science is presented to students as an important cultural and intellectual achievement embedded in a socio-cultural context (Aikenhead, 2001; Jegede & Aikenhead, 1999; Ogawa, 1995).

The socio-ecojustice current focuses on "understanding the impacts of science and technology on society and environments" as well as "critiquing or solving these problems through human agency and action" (Pedretti & Nazir, 2011, p. 617). Citing some prominent scholarly work in the area (Bencze, 2008; Barton, 2003; Roth & Barton, 2004; Roth & Désautels, 2002), Pedretti & Nazir (2011) claim that "...traditional science education and other STSE currents do not go far enough in educating students about the political and economic factors influencing science and science education, nor does it provide them with the tools necessary to actively transform society" (p. 617). The advocates of justice-centred science education believe that "the aim of science education should be the promotion of a certain type of citizenship and civic responsibility of which transformation, agency and emancipation are key features" (p. 617). The work presented in this thesis can be placed within this current.

In terms of practice, Pedretti & Nazir (2011) identify two main approaches within this current: a) place-based education in which the boundaries between schools and students' environments are permeable and students engage with *local* issues and explore relevant economic, political, social and cultural aspects of the issues, b) engagement in active inquiry, debates and discussions around *general* social and environmental problems that originate from science and technology. Further, they caution that "science teachers are often uncomfortable with such an explicit agenda, worrying about ethical implications, their own competence, and the long-term consequences involved in overtly teaching in such a manner" (p. 618). A major challenge before science teachers following this line of work lies in selecting pedagogies that help them navigate the fine line between indoctrination and empowerment. In the next section, I present an overview of the theoretical and empirical work in STSE education that keeps the ideals of social and environmental justice at the center.

2.2 Critical voices in STSE education

In line with the focus and objectives outlined above for the socio-ecojustice current, scholars such as Hodson (2003, 2011), Dos Santos (2009), Roth & Barton (2004) and Weinstein (2009) advocate inculcating Critical Scientific, Technological and Environmental Literacy (CSL) as the primary aim of science education. The word 'critical' in critical scientific literacy points to "an indebtedness to a certain scholarly and activist tradition rooted in dialogues between Marxism, Antiracism, Feminism, Queer Politics, Liberation Theology, and anti-colonialism— for starters—but also to a prior tradition both within science communities as well as 'lay' spheres challenging science's embeddedness within the militarism and capitalism" (Weinstein, 2009, p. 1). For Hodson (2011), the word 'critical' in CSL signifies " a commitment to a much more rigorous, analytical, logical, thorough, open-minded, skeptical and reflective approach to school science education than is usual" (Hodson, 2011, p. 28). Elaborating further on the role of CSL, Hodson (2011) argues that -

> …the most important function of (critical) scientific literacy is to confer a measure of intellectual independence and personal autonomy: first, an independence from authority, second, a disposition to test the plausibility and applicability of principles and ideas for oneself, whether by experience or by a critical evaluation of the testimony of others; third, an inclination to look beyond the superficial and to address the ideological underpinnings of science and technology, the economic and political structures that

sustain them, and the norms and practices that accommodate some views and some participants but marginalize or exclude others; fourth, sensitivity to the complex interactions of class, race, gender, language, knowledge and power; fifth, an ability to form intentions and choose a course of action in accordance with a scale of values that is self-formulated; sixth, a commitment to criticism and constant re-evaluation of one's own knowledge, beliefs, attitudes and values. (p. 27-28)

In a seminal paper, Hodson (2003) argues that it is not enough to prepare students to cope with the demands of the changing world. Students need to learn to question the logic of the existing system and work towards transforming the world into a more equal and just space. The justification he offers, is as follows -

A succession of human and environmental tragedies have sometimes cast science in the role of villain; disturbing social changes and deep ethical concerns arising from scientific and technological innovations have caused science to be viewed by many as a potential threat to familiar and comfortable ways of life; the increasing commercialization, industrialization and militarization of science have shown once and for all that science is not value-free and disinterested. The merger of science and technology into technoscience, the appropriation of the knowledge-making capacity of science to promote the interests of the rich and powerful, and the usurping of the scientific and technological endeavour for the goal of ever-increasing levels of material consumption, have profoundly changed the sociopolitical and moral-ethical contexts of scientific and technological practice.

(Hodson, 2003, p. 649)

Illustrating the idea of critical scientific literacy in the environmental context, he explains -

... it is not enough to view environmental problems merely as matters of careless industrialization and inexpert management of natural resources, because this ignores the underlying causes of the problems – the values underpinning industrialization and the exploitation of natural resources – and sees their solution as a *technical* problem, for which we need a quick 'technological fix'. In that sense, the approach *depoliticizes* the issues, thereby removing them from the 'realm of possibility' within which ordinary people perceive themselves as capable of intervention. As a consequence, dealing with environmental problems is left to the 'experts' and the holders of office, and ordinary citizens are *disempowered*.

(Hodson, 1992, p. 554, emphasis in original)

Thus, the idea of a critical scientific, technological and environmental literacy is "inextricably linked with education for political literacy and with the ideology of education as social reconstruction" (Hodson, 2003, p. 660), and can be achieved only through a politicized curriculum organized around real world issues that have a technoscientific or environmental dimension.

In the past two decades, scholarship in the field has bloomed rapidly. At a fundamental level, most scholars working within this paradigm agree on politicizing the curriculum around contextually relevant socioscientific issues. There is also an agreement over the need for perspective building through engaging students in dialogue and reflective exercises with a view to inculcating values of social and environmental justice, and enhancing their "action competence" (Jensen & Schnack, 1997) through engaging them in concrete sociopolitical actions. However, the relative emphasis on various aspects and the constructs chosen to describe the goals are different.

For instance, Rodriguez (1998) offers a framework of sociotransformative constructivism as "an alternative orientation to teaching and learning that takes into account how social, historical, and institutional contexts influence learning and access to learning in schools" (p. 590). In his framework, he identifies four key elements of justice-centred science education – *dialogicality,* engagement in *authentic* activities*,* participation in *metacognitive* exercises*,* and *reflexivity*. Similarly, building on the Freirean humanistic perspective, Dos Santos (2009) puts forth a radical view of scientific literacy characterized by organizing curriculum on socially relevant themes and socioscientific issues, establishing a dialogical process in classrooms, and engaging students in sociopolitical actions. Basu, Barton, Clairmont & Locke (2009) advocate developing *critical science agency* as the primary goal of science education which corresponds to inculcation of critical awareness and engagement in acts of social transformation along with developing expertise in the subject matter. For Dimick (2012), the key question is whether as an outcome of school science education, students are getting empowered at various levels and she identifies three important arenas – *academic*, *social* and *political* – where empowerment needs to happen.

> Academic empowerment within social justice education requires that students be taught competitive academic knowledge and skills so they can succeed in today's educational, social, and economic structures, while also being taught to think critically about the ways these structures affect their lives .… Social empowerment refers to classroom social

relationships and interactions between teachers and students and among students that are safe, supportive, nondiscriminatory, and antioppressive …. Political empowerment is defined as students' recognition and intentional, critical examination of the structures and forces that establish and maintain power inequities within the sphere of political participation.

(Dimick, 2012, p. 5-7)

Morales-Doyle (2017) sees justice-centred science education as a *catalyst* for social transformation and advocates blending critical pedagogy with culturally-relevant pedagogy. Tolbert & Schindel (2018) emphasize the need for confronting the ideology of consumerism and engaging students with the ethics of care.

Common to the scholarship is a key suggestion that the science curriculum needs to be organized around issues that are interdisciplinary in nature and issues that matter to people, and that "(s)cience education must be situated within social, technological, cultural, ethical and political contexts and realities" (Bencze et al., 2020, p. 829). This thesis draws upon the STSE education scholarship that advocates a justice-centred science education. In particular, the thesis attempts to envision critical scientific, technological and environmental literacy in the context of the M(East) ward by incorporating elements of socio-transformative constructivism (Rodriguez, 1998) and critical and culturally relevant pedagogy (Morales-Doyle, 2017) described above. To be specific, it employs the contextually relevant themes of waste, environment and development in out-of-school interactions with the students of M(East) Ward. Through the use of reflective exercises, students deliberated on their living conditions and in the process, raised questions (in our minds) on the textbook discourses regarding these themes. The out-of-school interactions, in contrast to their classroom discussions, were dialogic in nature. While these interactions and deliberations did not immediately lead to concrete sociopolitical actions (as envisaged by CSL advocates), they were a step towards conceptualising what sociopolitical actions *could be* possible in this context.

2.3 The complex and evolving field of environment education

2.3.1 Environmental crisis, sustainable development and neoliberalism

Environment education worldwide has a very long history though its form and focus have been changing from time to time. Increasingly, scientists, activist groups as well as government and non-government bodies are acknowledging that the world is facing the situation of a global environmental crisis, and that urgent action is needed at multiple levels in order to address the impending environmental catastrophe. The environment movements of the 1960s and 1970s focused on redressing various global as well as local environmental problems. In 1972, the United Nations took cognizance of the pressing situation and an environment program was conceptualized highlighting the need for education related to environmental problems (Sarabhai, Pandya, & Namagiri, 2007). In 1975, the International Environmental Education Programme was launched by UNESCO, producing the Belgrade Charter which stated educational goals of not only learning about environmental problems, but also acquiring "skills, attitudes, motivations and commitment to work individually and collectively toward solutions" (UNESCO-UNEP International Environmental Workshop, 1975). Following this, a major Intergovernmental Conference on Environmental Education was organized in 1977 at Tbilisi USSR, in which there was an attempt to further define the nature, objectives and pedagogical principles of environment education and to establish broad guidelines for local as well as global action. In the past few decades, the idea of Sustainable Development (SD) and Education for Sustainable Development (ESD) has received lot of emphasis globally, including developing countries. This is indicated for example in the 1987 report of the World Commission on Environment and Development (WCED), the 1992 United Nations 'Earth Summit', the declaration of the decade 2005-2014 as the UN Decade for ESD, and the United Nations Sustainable Development Goals (SDGs) announced in 2015.

One of the UNESCO documents defines the goal of ESD as -

> … to build a sustainable future based on the fragile balance between competing needs. This balance should not be based on the principles of a universal moral, but rather on negotiated compromises between an active, informed public and decision-makers from both political spheres and the business world.

> (Sauvé, 1996, p. 21)

While sustainable development is a much celebrated term in contemporary economic and environmental policies across the globe, the idea has received criticism from various quarters as well. For instance, Sauvé (1996) maintains that sustainable development "sanctions the status quo (business as usual), sustainable profit, and it therefore cannot allow for a radical reform of relationships between people, and between humans and Earth-Nature" (p. 23). Bonnett (1999) points out some intrinsic problems associated with the concept. He argues that sustainable development reinforces an anthropocentric stance and has a "subtle addiction to management" (p. 317) which is prone to become "a term of political convenience used to mask and/or legitimate vested interests" (p. 318). Sustainable development in practice serves to sustain the conditions for continuous economic growth. Kopnina (2020a) argues that -

> The concept of sustainable development is mostly centered on simultaneously addressing triple social, economic and environmental objectives (colloquially known as People, Profit, Planet). The triple objectives of sustainable development are supposed to be achieved through economic growth and development. By contrast, the concept of environmental sustainability takes the integrity of the ecosystem as a starting point of discussion about any social or economic sustainability, as People and Profit are highly dependent on the Planet.

> (Kopnina, 2020a, p. 2)

Jickling & Wals (2008) contend that globalizing ideologies and neoliberal forces have significantly altered the agenda of environment education which is reflected in the increased emphasis on ESD. Læss⊘e (2010) points out that ecological modernization is the dominant framework of understanding sustainable development. He urges developing "participatory ESD that goes beyond its current limitations, by working with dilemmas, dissensus and deliberative communication" (p. 54). Kopnina (2012) argues that "the discourse on SD is dominated by the perspectives of the political and corporate elites" (p. 707). She maintains that "While promoting environmental justice that concerns the distribution of environmental benefits and burdens among humans, ESD undermines ecological justice between humans and the rest of the natural world" (p. 712). In a recent article, she reiterates that "the ESD falls short of recognizing ecological justice, or recognition that nonhumans also have a right to exist and flourish" (Kopnina, 2020b). She also argues that sustainable development discourse fails to address the ideology of prioritizing economic growth, continuing industrial production, and anthropocentrism.

Suggesting an alternative, Bonnett (1999) argues that sustainability should be seen as a frame of mind. Environment education with a focus on sustainability should be relevant to students. "It must encourage pupils to explore links between their personal lives and wider environmental and development concerns, by dealing with issues like consumerism and how the practices of business and industry influence their lives" (Tilbury, 1995, p. 199). Tilbury (1995) further urges adopting a holistic approach and advocates 'Environment Education for Sustainability' (EEFS) which is -

> based on the premise that environmental and development problems are not solely caused by physical and biological factors, but that an understanding of the parts played by aesthetic, social, economic, political, historical and cultural elements is required. It acknowledges that the investigation of any environmental issue must involve the study of the intersection and interaction of these elements.

<div align="right">(Tilbury, 1995, p. 199)</div>

Another key component of EEFS is *value-orientedness*. Students must develop an environmental ethic as part of their education – a concern for all life forms, a commitment towards a sustainable living and sustainability, in general. This will not be possible unless students go beyond a 'value clarification' approach, and engage with questions such as how their socio-economic, political and cultural contexts shape their values, and analyze things from standpoints of various marginalized groups. Thus, EEFS is an issue-based, action-oriented model of EE and might work as a way forward.

A critical analysis of the field of environment education, however, reveals a diversity of approaches in practice and a wide range of underpinning ideologies (Barraza, Duque-Aristiza' Bal & Rebolledo, 2003; Carter, 2012; Cole, 2007; Hart & Nolan, 1999; Læss∅e, 2010; Palmer, 2002; Sauvé, 2005), ranging from those that serve the interests of the dominant capitalist economic system to those that are deeply critical of the same. Some claim that the prevalent rhetoric on sustainable development (Tilbury, 1995) masks the actual aims (Winter, 2007), with school practices favouring the maintenance of a system "marked by high environmental impact and deeply stratified class relations" (Stahelin, Accioly & Sánchez, 2015) – i.e. capitalist economic control by the elite and powerful at the expense of social justice and environmental concerns (McLaren & Farahmandpur, 2005). The influence of neoliberal forces on environment education is evident in the way the idea of environment and

sustainability is reduced to management of natural resources, the environmental crisis is explained as a problem of mismanagement, and technomanagerial solutions are suggested to address environmental problems (Sauvé, 1996).

2.3.2 Pro-environmental behavior and Pro-environmental action

One of the primary concerns of environment education has been to positively change students' environmental behavior, and therefore, a major thrust area in environment education research concerns exploring students' knowledge, values, attitudes, interests, concerns and behavior related to environment, their interconnections, and the factors that affect these aspects (e.g. Chawla, 1998; Connell, Fien, Lee, Sykes, & Yencken, 1999; Robelia & Murphy, 2012; Makki, Abd-El-Khalick, & Boujaoude, 2003; Bamberg & Möser, 2007; Onur, Sahin, & Tekkaya, 2012; Uitto, Juuti, Lavonen, Byman, & Meisalo, 2011; Kopnina, 2013).

In a seminal paper, Kollmuss & Agyeman (2002) review several theoretical frameworks that have been proposed to explain the gap between possession of environmental knowledge and displaying pro-environmental behavior[4]. They analyze various factors that have been found to have some influence on pro-environmental behavior such as demographic factors (e.g. gender and year of education), external factors (e.g. institutional support, necessary infrastructure, economic incentives, social norms, family customs and cultural traditions) and internal factors (e.g. motivation, environmental knowledge, values, attitudes, environmental awareness, emotional involvement, locus of control[5], responsibilities and priorities. In line with several other studies, Kollmus and Agyeman (2002) do not attribute a direct relationship between environmental knowledge and pro-environmental behavior. Further, they synthesize factors like environmental knowledge, values, attitudes and emotional involvement to propose a complex construct named "pro-environmental consciousness" which is "embedded in broader personal values and shaped by personality traits and other internal and external factors" (p. 256).

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4   Pro-environment behavior refers to "the behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world (e.g. minimize resource and energy consumption, use of non-toxic substances, reduce waste production)" (Kollmus & Agyeman, 2002, p. 240).

5   Locus of control refers to "an individual perception of whether he or she has the ability to bring about change through his or her own behaviour" (Kollmuss & Agyeman, 2002, p. 243).

Stern (2000) proposes a similar conceptual framework to explain the interrelationship between values, beliefs, norms and "environmentally significant behavior". He identifies four kinds of causal variables influencing individual environmentally significant behavior: attitudinal, personal capabilities, contextual factors, and habit and routine. Both these frameworks provide an elaborate account of the interplay of values, beliefs, norms and other contextual factors in slightly different ways. While Kollmus & Agyeman's model is an outcome of a review of various theoretical frameworks, Stern's framework is developed based on prior empirical work. Similar findings have been reported by Bamberg & Möser (2007) as well who identify attitudes, behavior control and personal moral norms as primary determinants of pro-environmental behavior.

It is striking that the role of knowledge in enabling pro-environmental behavior or pro-environmental action still remains contested in the literature. While Robelia & Murphy (2012) emphasize the necessary role of awareness and knowledge about environmental problems in taking informed action, Dutta & Chandrasekharan (2018) argue that environment-related information "does not enable people to form an empowered community, and participate in environmentally sustainable behavior, based on tangible outcomes" (p. 1194). Chawla (1998) points out the crucial role of significant life experiences in the formation of environmental sensitivity of environmentalists and environment educators. Moreover, in their study of students' environmental perceptions and attitudes, Connell et al. (1999) note that young students hold a strong sense of ambivalence, i.e., even though they are "strongly concerned" about environmental problems of their communities, they "feel frustrated, pessimistic and even angry because not enough practical action is being taken and they see little likelihood of this changing" (p. 108).

Levy & Zint (2013) point out that "as the scale of environmental problems has worsened, there has been a growing recognition of the need for individuals to address these issues through not only personal behavior change, but also through collective civic action" (p. 554). Their review of the research related to environmental political participation and the factors that influence political participation highlights the crucial role of a number of issues including "political conflicts over curricula, methods of fostering environmentally responsible behaviors, individual attitudes towards environmental political action, optimal environmental activism strategies, and factors that influence the development of pro-environment attitudes"

(p. 556). Further, they outline a framework for environment education research which stresses fostering environmental political participation.

2.4 Socially critical current in environment education

Since the themes like waste, environment and development that are the focus of this thesis are also of interest to environment educators, I situate – albeit briefly – this work in specific traditions in Environment Education (EE) research. Mapping the vast landscape of environment education, Sauvé (2005) discerns 15 distinct but overlapping currents depending on various parameters such as conceptions of environment, implicit or explicit aims of environment education, main approaches and strategies, and illustrative pedagogical models. All the currents that Sauvé points out have different histories, motivations, and justifications that define the approaches and strategies followed by their proponents. Of all the currents, the socially critically current in environment education is worth paying attention as it draws its inspiration from critical theory and seeks radical transformation of social and environmental reality.

Sauvé (2005) argues that the socially critical current "promotes analysis of the social dynamics underpinning environmental realities and problems: analysis of intents, positions, arguments, explicit and implicit values, and the decisions and actions of the various protagonists in a given situation" (p. 23). Emphasizing the political nature of the current and its primary aim to transform realities, Sauvé asserts, "Action plans emerge from or during investigation, in a perspective of emancipation, of freedom from alienation. It is a courageous stance, in that it begins by confronting oneself (one's own beliefs, attitudes and values, the relevance and coherence of one's own actions) and implies the questioning of commonplace ideas, received wisdom, and dominant trends" (p. 24).

The pedagogy that is argued under this current stresses on:

> ...the interdisciplinary and community-oriented projects that aim to develop critical action-knowledge for resolving local problems and furthering local development. It stresses the importance of addressing issues that are contextually relevant and significant to people, and highlights the fecundity of knowledge dialogues: formal scientific knowledge, experiential knowledge, traditional knowledge, local everyday knowledge, etc. These diverse types of knowledge must be compared and contrasted, nothing must be taken for granted; diverse discourses must be appraised within a critical approach in order

to better inform action. It is also necessary to clarify the rational or theoretical foundation (most often implicit or unconscious) that supports action, and to create the conditions for progressively refining a theory of action. Theory and action are tightly interwoven from a critical perspective. (p. 24)

Thus, the socially critical current in environment education seems to be well aligned with the principles of socio-ecojustice current identified in STSE education as both emphasize on finding ways to address contextually relevant issues, community-oriented projects, encouraging a dialogue between different kinds of knowledge and diverse discourses, and adopt a critical approach to better inform action.

2.5 From 'Place-based education' to 'Critical pedagogy of place'

Layrargues (2000) argues that while global environmental problems such as climate change seem remote and offer little motivation for action, local environmental problems provide a meaningful context closer to the lived experiences of the community and render possibilities of action. The importance of the local context in making learning meaningful to students can be traced back to as early as the 1950s and can be discerned in John Dewey's writings. In the mid-1990s educators from different parts of the world (but primarily from the United States) began expressing concerns regarding students' alienation from their communities and the natural environment. They advocated place-based education which would provide young students with the opportunities to engage with the human and natural environments that they actually inhabit (Smith, 2013).

Gruenewald (2003) maintains that 'place' is a critical construct as it "foregrounds a narrative of local and regional politics that is attuned to particularities of where people actually live, and that is connected to global development trends that impact local places" (p. 3). He further argues that place-based education is a radical idea because "current educational discourses seek to standardize the experience of students from diverse geographical and cultural places so that they may compete in the global economy" (p. 7). However, place-based pedagogies as practiced by various educational programs across the globe pay little attention to the larger structures and processes that shape the human and natural world. "In its focus on local, ecological experience, place-based approaches are sometimes hesitant to link ecological

themes with critical themes such as urbanization and the homogenization of culture under global capitalism" (p. 4).

To bring back cultural and ecological politics at the center of place-based education discourse, Gruenewald (2003) advocates a 'critical pedagogy of place' (CPP) that synthesizes the tradition of critical pedagogy and place-based education by utilizing the strengths of both the fields, and seeks "to contribute to the production of educational discourse and practices that explicitly examine the place-specific nexus between environment, culture and education" (p. 10). Informed by the ethic of eco-justice (Bowers, 2001), CPP has two broad and interrelated goals: 1) *Reinhabitation* which corresponds to identifying, recovering, and creating material spaces and places that teach us how to live well in our total environments, and 2) *Decolonization* which calls for identifying and changing ways of thinking that injure and exploit other people and places (Gruenewald, 2003).

Ironically, Bowers (2008) calls this blending of critical pedagogy and place-based approach an "oxymoron" and urges educators to "avoid embracing a critical pedagogy of place" (p. 325). His main concern is CPP's lack of emphasis on cultural specificities such as "intergenerational traditions of habitation" (p. 333), and "local cultural commons" (p. 334). He suggests to engage students in creating thick descriptions of the cultural traditions and practices associated with how local people inhabit place. "A thick description of the relationship between people and place may reveal patterns of environmental abuse as well as the ideology and techno-science developments that are major contributors to degrading the environment. But it may also lead to an awareness of many aspects of local cultural commons that have been carried on for generations, and that represent alternatives to the consumer/industrial culture that is being globalized" (Bowers, 2008, p. 331).

Clearing the air, Stevenson (2008) points out that while CPP underlines the possibility of convergences of the two traditions, Bowers (2008) is more concerned about the inherent contradictions of blending the two. However, "the two traditions can be juxtaposed with their tensions and contradictions treated as pedagogical space for engaging in critical analysis and authentic learning, drawing on rich or thick descriptions of the places students inhabit… and a critical pedagogy of place (broadly defined) can be commensurate with the disjunctures or divergences with which we must live and from which we must learn" (p. 358).

Dimick (2016) points out that Gruenewald's notion of decolonization "combines critical consciousness with disrupting settler colonialism" (p. 816). In the Indian context, that idea has limited applicability as the form of colonialism in India was "exploitation colonialism". The British and other colonizers never settled on the Indian land in majority during or after colonial period. Therefore, like Dimick, I have focused on reinhabitation and developing critical consciousness as the two intended outcomes of CPP. Dimick also notes that despite CPP offering a powerful conceptual and pedagogical framework, there is a scarcity of empirical studies that utilize the framework in formal or informal science education, particularly in urban contexts. Through a case study conducted at an urban high school in the United States, she demonstrates how CPP can be employed in formal science classrooms and what kind of challenges and tensions might arise in the process.

I conclude this section with the reminder given by Stevenson (2008) that the time has come to shift the vision of 'Think globally, act locally' to 'Think and act locally and globally'. Since India is a land of diversity – diverse cultures and faiths, spectrum of socioeconomic problems, and a whole range of educational practices, I believe there cannot be one formula for all contexts. Any discussion on critical science and environment education needs to be situated in a specific context. From a critical pedagogy of place perspective, I felt important to situate these conversations on social and environmental justice in my immediate neighborhood and I have tried to explore possibilities lying within school education of engaging students in 'reinhabiting' their place (i.e. whether they act towards improving the social and ecological life of places at present as well as in the future) and exhibiting signs of critical consciousness (i.e. whether they question the injustices and oppression and take actions that could transform their realities).

In the next chapter, I provide contextual details of this neighborhood i.e. the M(East) ward in Mumbai where HBCSE is located and where I was staying during the course of the study. The study design and analytical framework adopted for the study are also described in Chapter 3 of the thesis.

3. Study design

Just as there is no neutral education, there is no neutral research.

Lather (1986b, p. 257)

As discussed in Chapter 1, the study has three research objectives. Firstly, it aims to develop a systematic critique of the educational discourse on waste, development and environment from the standpoint of the M(East) ward students. Secondly, it seeks to explore affordances the participants offer in terms of knowledge, value commitments, dispositions, and wider sociopolitical understanding which prepares a ground for conceptualizing a transformative science and environment education, which is the third objective of the study. All the objectives were pursued using qualitative methods.

This chapter begins with a description of the geographical context of the study which is followed by a discussion on the research questions, the methodological approach employed for the study, and the research paradigm in which the study is located. The study design is delineated at length. Next, I provide the contextual details of the participants and various data sources and methods that were used to explore the research questions. I conclude the chapter with a detailed description of how the data was analyzed and how the trustworthiness and credibility of the study was established.

3.1 Situating the study: Case of the M(East) ward, Mumbai

Mumbai, the financial capital of India, is known as the city of dreams *"Mayanagri"* where millions of people from different parts of the country migrate every year to fulfill their dreams. The M(East) ward in Mumbai is one of the poorest areas in the city. For many poor migrants to the city, the slums of the M(East) ward happen to be the first choice to settle at affordable costs. The M(East) ward hosts India's largest open landfill site, Deonar dumping

ground, which is spread over 1.32 sq-km area. The area close to the dumping ground is densely populated with thousands of families directly or indirectly dependent on city's waste for their livelihoods. Mostly inhabited by Muslims and Dalit Bahujans (a political term encompassing various subcastes that are considered to be at the bottom of the caste hierarchy and rank lowest in most socioeconomic indices), it does not seem to be just a coincidence that the M(East) ward happens to be the most neglected municipal ward in the city with a Human Development Index (HDI) of a mere 0.05 while the average HDI for Mumbai is 0.56 (MCGM, 2009).

Fig. 3.1 Representative image of the alleys in the M(East) ward

(Photo credit: Apnalaya: An NGO working with urban poor)

Life in the slums of the M(East) ward, as elsewhere, is full of hopes, and yet constrained by the everyday struggle for survival – a story similar to the Annawadi slum near the Mumbai International airport which has been beautifully documented by Katherine Boo in her book 'Behind the beautiful forevers: Life, death and hope in a Mumbai undercity' (Boo, 2014). During my visits to the dumping site and its neighborhood, I have often observed children playing on the streets or rushing to school, toddlers defecating on the road-side, cattle walking freely on the street, adults standing in queues for water, dropping and picking up kids from schools, chatting with neighbors, and running their shops (Field notes).

Gendered division of activities, both in the public and private spaces, is discernible. For instance, household chores, such as cooking or washing clothes, are performed mostly by the women in the community. Similarly, reading newspapers at a street corner, or sitting around in tea shops is the privilege of men.

What makes the people of the M(East) ward different from the other wards in the city is probably the nature of their struggle which is not just about securing livelihoods but also getting access to basic resources such as water, air, and sanitation facilities. The municipal corporation supplies water twice a day. Those who have water connections sell their water to others. As soon as the water arrives, people line up with their buckets and cans and pay 30 to 40 Indian rupees everyday for every 20 liters of water (Field notes).

The M(East) ward is also a hub of hazardous industries such as oil refineries, fertilizer plants, an incineration plant, and an atomic energy research centre. As one approaches the slums near the dumping site, a severe decline in the air quality is palpable, making it difficult to pass through the area without covering one's face. It is striking that thousands of people breathe that air day and night.

As per the census data of the year 2011, about 0.8 million people live in this ward, of whom over 72.5% live in slums (TISS, 2015). Very few people living in the area have concrete or brick houses. Some families live in rental rooms of sizes as small as 10 feet x 10 feet. Those who cannot afford even a small room, have made temporary shelters right above the open drains in the area. Some live in small shanties in shifts where they share the space with another family as they cannot solely afford the rent of a shack. The residential areas are congested, the lanes narrow, and the houses poorly ventilated. With the burgeoning population

in the city, it is not surprising that the government has no plans to resettle the residents of the M(East) ward to a safer and more comfortable place.

Since most houses do not have toilets, people either defecate in the open or use public toilets run by the private contractors and pay two Indian rupees for every single visit to the toilet. The quality of water and the condition of hygiene in these toilets are poor, making people, particularly women, suffer the most.

Because of the poor quality of air, water, and sanitation, the residents of the M(East) ward face considerable health problems. The life expectancy at the time of birth in this ward is a mere 39.4 years while the national average is 69.25 years (MCGM, 2009). Tuberculosis, diabetes, blood pressure, respiratory ailments, typhoid, diarrhea, reproductive health problems are some of the commonly reported diseases in the area. In comparison to other wards, the maternal mortality and child mortality rates are high (TISS, 2015). The crime rates are also high in the area. Substance abuse, sexual harassment, theft, and physical violence are common.

A survey report published by a reputed social science institute in Mumbai claims that the M(East) ward is "an extreme example of skewed development in the metropolis, with virtually all indicators showing an urgent need for action that is multi-dimensional, comprehensive and strategic to serve its burgeoning population" (TISS, 2015, p. viii).

3.2 Research questions

In the context of the M(East) ward of Mumbai, waste seems to be the most promising theme to initiate discussions on social and environmental justice as one of the largest dumping sites in Asia, the Deonar dumping ground, is the main identity of the geographical region. For marginalised communities like the one living in the M(East) ward, the experience of waste is unique as it is a part of their lived reality as opposed to that of the middle class people whose engagement with waste begins and ends with dropping trash in designated bins.

Waste is an integral part of any production chain, and therefore, intrinsically linked to the nature of economy. In a capitalist economy, where maximizing profits is the only motive, production and consumption of commodities is promoted without any scruitny. Waste is bound to be generated in large quantities in a consumerist society for which environmental

burden is not a matter of concern. In the 21ˢᵗ century, the problem of waste is one of the major environmental threats. Mounds of rotting garbage in metropolitan cities adversely affect the surrounding environment. The leachate from landfills, which consists of heavy metals and toxic substances, contaminates surface and groundwater. The methane gas gets trapped in the piles of unsorted garbage. At high temperatures, the gas gets ignited and the garbage catches fire. Local burning of waste is also commonly practiced which pollutes the air. Inadequate waste management causes serious impact on the health of those who are dependent on waste for their livelihoods, or live near landfill sites. Life forms such as plants, birds and aquatic animals are also severely affected because of the pollution caused by improper management of waste.

Waste as a curricular theme is closely linked with several topics that are discussed in the secondary science and social science curriculum such as health, materials, development, and environment. This study aims to critically analyze the educational discourse on three themes[6] – waste, environment and development (focal themes in the study), to examine how empowering (or, disempowering) the educational discourse is for the students of the M(East) ward, and what possibilities lie in their everyday experiences to develop an alternative learning experience that is relevant, meaningful and transformative for them.

In particular, I seek to explore –

1) How is the educational discourse on waste, environment and development positioned vis-à-vis the lived experiences and out-of-school knowledge of the students in the M(East) ward?

    a) How are the focal themes presented in the secondary science and social science textbooks that are followed in the region?

    b) How are the focal themes dealt with in regular classrooms? Which aspects are emphasized, and which get left out?

    c) What views do teachers and other stakeholders hold about the focal themes?

2) What knowledge do students invoke from their everyday experiences while discussing the focal themes in out-of-school settings?

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6   Health was also explored as a theme but it is not reported in the thesis.

While the first research question and the three sub-questions are steered at developing a systematic critique of the educational discourse from the standpoint of the people of the M(East) ward, the second research question is aimed at eliciting cognitive and cultural resources owned by the students in the community. By systematically documenting these resources, the study seeks to contribute to designing a relevant, meaningful and transformative learning experience for the students of the M(East) ward and thereby, conceptualizing a model of justice-centered science and environment education in the particular context.

3.3 Research paradigm

The study is situated within the realm of *critical* qualitative inquiry as opposed to a *positivist* or an *interpretive* paradigm which work with a very different set of ontological and epistemological assumptions (Guba & Lincoln, 1994). While positivism seeks objective truth about reality using reductionist and deterministic methods to avoid values and biases of researchers creeping into their research, interpretivist tradition of research gives utmost importance to the researcher's subjectivity. In interpretivism, knowledge is considered to be value-laden as it is generated as the outcome of the interaction between the researcher and the researched, the interplay of their values and subjectivities.

Critical qualitative inquiry shares most of these attributes with interpretivism; what marks it out is its overt commitment to social transformation. Kincheloe et al. (2018) argue that a research can be qualified as 'critical' only if it seeks to "create conditions for empowerment and social justice... and confront structures of oppression" (p. 421). In critical research, "a reality is assumed to be apprehendable that was once plastic, but that was, over time, shaped by a congeries of social, political, cultural, economic, ethnic, and gender factors, and then crystallized (reified) into a series of structures that are now (inappropriately) taken as 'real', that is natural and immutable" (Guba & Lincoln, 1994, p. 110). Thus, the ontological position underpinning critical research is historical realism.

3.4 Methodological bricolage

Unpacking an ideological problem often demands fundamentally questioning disciplinary blinders. The idea of 'bricolage' appealed to me as it seems to capture the essence of how a

qualitative researcher brings together multiple methods, strategies, theoretical frameworks, perspectives and analytical approaches to make sense of the data. According to Kincheloe et al. (2018), bricoleurs are critical and reflective of their academic practices, conscious of the power of academic knowledge, question their own assumptions and their knowledge of the particular communities they study, and are watchful of the political implications their research might have. Denzin & Lincoln (2018) unpack the idea of *bricoleur* at multiple levels.

> The methodological *bricoleur* is adept at performing a large number of diverse tasks, ranging from interviewing to intensive self-reflection and introspection… The researcher as *bricoleur*-theorist works between and within competing and overlapping perspectives and paradigms… The interpretive *bricoleur* understands that research is an interactive process shaped by his or her own personal history, biography, gender, social class, race, and ethnicity, and by those of the people in the setting… The political *bricoleur* knows that science is power, for all research findings have political implications. There is no value-free science. This researcher seeks a civic social science based on a politics of hope… The product of the interpretive *bricoleur*'s labor is a complex, quiltlike bricolage, a reflexive collage or montage – a set of fluid, interconnected images and representations. This interpretive structure is like a quilt, a performance text, a sequence of representations connecting the parts to the whole.

> (Denzin & Lincoln, 2018, p. 6, emphases in original)

As a *bricoleur,* I bring in diverse theoretical perspectives and methods for data collection and analysis (discussed later in the chapter). In terms of methodology, I draw upon two explicitly ideological research methodologies – Critical Ethnography (Anderson, 1989; Kincheloe & McLaren, 1994; Carspecken, 1996; Trueba, 1999; Madison, 2005) and Critical Discourse Analysis (Fairclough, 1989; Fairclough & Wodak, 1997; Wodak & Meyer, 2009). In the subsequent section, I describe the key premises of both these methodologies, the ontological and epistemological frameworks, and the methods followed for data collection and interpretation.

3.4.1 Critical Ethnography

Critical ethnography is an overtly political research methodology which is centered around the idea of "praxis" (Lather, 1986a). It is an outcome of the convergence of two major traditions of research – conventional ethnography within interpretivist paradigm and critical

theory, as the researchers felt a "theoretical and methodological dissatisfaction" from both these traditions (Anderson, 1989).

Critical ethnographers bear an "ethical responsibility to address processes of unfairness or injustice within a particular lived domain" (Madison, 2005, p. 5). A critical ethnographer "takes us beneath surface appearances, disrupts the *status quo*, and unsettles both neutrality and taken-for-granted assumptions by bringing to light underlying and obscure operations of power and control" (p. 5). Thus, interrogating power structures and laying bare inequities endured by marginalized communities with the goal of transforming the unjust conditions is at the heart of critical ethnography.

A critical ethnographer "use(s) the resources, skills, and privileges available to her to make accessible – to penetrate the borders and break through the confines in defense of – the voices and experiences of subjects whose stories are otherwise restrained and out of reach" (p. 5). Barton (2001) points out that "Politicizing ethnography is a defining characteristic of critical ethnography because it is rooted in the belief that exposing, critiquing, and transforming inequalities associated with social structures and labeling devices (i.e., gender, race, and class) are consequential and fundamental dimensions of research and analysis" (p. 906). Highlighting the political nature of critical ethnography, Treuba (1999) argues that:

> (C)ritical ethnography as a research methodology stresses the notion that all education is intrinsically political, and consequently critical ethnography must advocate for the oppressed by: (a) documenting the nature of oppression; (b) documenting the process of empowerment – a journey away from oppression; (c) accelerating the conscientization of the oppressed and the oppressors – without this reflective awareness of the rights and obligations of humans, there is no way to conceptualize empowerment, equity, and a struggle for liberation; (d) sensitizing the research community to the implications of research for the quality of life – clearly linking intellectual work to real-life conditions; and (e) reaching a higher level of understanding of the historical, political, sociological, and economic factors supporting the abuse of power and oppression, of neglect and disregard for human rights, and of the mechanisms for learning and internalizing rights and obligations.

> (Trueba, 1999, p. 593)

The epistemological framework of critical ethnography is of social constructivism as knowledge is understood to be produced as an outcome of "an active, context-based process

influenced by the values, histories, and practices of the researcher and of the community in which the research is done" (Barton, 2001, p. 905). Kincheloe & McLaren (1994) delineate the value orientation of critical researchers and the principles of critical epistemology.

> We are defining a criticalist as a researcher or theorist who attempts to use her or his work as a form of social or cultural criticism and who accepts certain basic assumptions: that all thought is fundamentally mediated by power relations which are socially and historically constituted; that facts can never be isolated from the domain of values or removed from some form of ideological inscription; that the relationship between concept and object and signifier and signified is never stable or fixed and is often mediated by the social relations of capitalist production and consumption; that language is central to the formation of subjectivity (conscious and unconscious awareness); that certain groups in any society are privileged over others and, although the reasons for this privileging may vary widely, the oppression which characterizes contemporary societies is most forcefully reproduced when subordinates accept their social status as natural, necessary or inevitable; that oppression has many faces and that focusing on only one at the expense of others (e.g. class oppression versus racism) often elides the interconnections among them; and finally that mainstream research practices are generally, although most often unwittingly, implicated in the reproduction of systems of class, race and gender oppression.

> (Kincheloe & McLaren, 1994 as cited in Carspecken, 1996, p. 4)

Given that this study intends to develop a systematic critique of the educational discourse on certain topics from a justice perspective, and outline an alternative educational experience which is transformative and aims to conscientize students of the M(East) ward, critical ethnography was deemed to be the most apt methodology to unpack the two research problems. It provides an overarching ontological and epistemological framework in terms of values and assumptions that are consistent with those that informed the logic of the research problems and the study design. However, as Anderson (1989) argues, "... there has been little evidence in practice of a recognition by critical ethnographers in education that language is a social phenomenon that is enmeshed in relations of power and processes of social change" (p. 262), I turn my focus to issues of language, and discuss critical discourse analysis as a methodology complementing my explorations in critical ethnography.

3.4.2 Critical Discourse Analysis

Similar to critical ethnography, Critical Discourse Analysis (CDA) is a methodological approach that adopts an explicit socio-political stance, and is premised on an interest in understanding, uncovering, and transforming conditions of inequality (Rogers, Malancharuvil-Berkes, Mosley, Hui & Joseph, 2005). One of the fundamental principles of CDA is that it understands language as a social practice (Fairclough & Wodak, 1997), which is not only determined by social structures but also "contributes to stabilizing and changing that structure simultaneously" (Wodak & Meyer, 2009, p. 7).

A commonly used CDA framework proposed by Fairclough (1989) prescribes three stages of critical discourse analysis: *description*, *interpretation*, and *explanation*. At the *description* stage, the text is at the focus of analysis and is examined for lexical features and grammatical choices. At the *interpretation* stage, one is concerned with the process of producing and interpreting the text by discourse participants. The *explanation* stage is concerned with the broader social determinants of production and interpretation of a text. "The relationship of discourses to processes of struggle and power relations is the concern of the third stage of the procedure, *explanation"* (p. 141).

However, since CDA draws its strength from three overlapping intellectual traditions – discourse studies, feminist post-structuralism, and critical linguistics, studies involving CDA vary in their approaches and the methods they employ. There is no one particular way to conduct CDA. Wodak & Meyer (2009) argue that CDA is "characterized by the common interests in de-mystifying ideologies and power through the systematic and retroductable investigation of semiotic data (written, spoken, or visual)" (p. 3). The key focus is on laying bare structural interrelationships of discrimination, power, and control in language.

In the context of science education, scholars have used CDA to investigate classroom contexts and textbooks. For instance, Moje (1997) used critical discourse analysis to explore the question of what counts as knowledge in science within the oral and written discourses of a high school chemistry classroom. Other notable studies include that of Bazzul (2013, 2014) which examined how biology textbooks work to constitute subjectivities related to ethics, gender, neocolonialisms, and neoliberalism, and that of Sharma & Buxton (2015) which explored the textual representation of the relationship between natural and social systems in a middle-grade science textbook.

In the context of this study, CDA seemed an appropriate methodological framework to analyze the educational and students' everyday discourses on waste, development and environment from the standpoint of the M(East) ward people. In my analysis, I have primarily looked at what is foregrounded and what is omitted, whose voices, experiences and concerns get represented and who gets pushed to the margins, which words and metaphors (if any) are used to describe an idea, how synonymity is established between words, whether there is any particular order in the way ideas are discussed, whether the tone of the text is definitive or tentative, what assumptions have been made about the readers, and what ideologies might be underpinning the text.

3.5 Participants

The participants in the study comprised of students, science and social science teachers of the selected schools, rag pickers, scrap dealers, professionals working in the waste management sector, leaders of sanitation workers' trade union in Mumbai, field associates and officials of non-government organizations such as Apnalaya, SWaCH, and the Tata Institute of Social Sciences' Transforming M-ward project. However, the predominant focus of analysis is on students, teachers and textbooks.

3.5.1 Teachers

To understand the teaching practices for the selected topics and examine teachers' perspectives on the related subject matter and pedagogical issues, I approached various public and private secondary schools in the M(East) ward. Six science teachers and three social science teachers volunteered to participate in the study. Table 3.1 contains the details of participant teachers' profiles and some details of their classroom teaching. For the sake of confidentiality of participants, participant teachers' names have been replaced with pseudonyms.

Seven out of nine participant teachers were Muslims, except for Mr. Jignesh who was a Hindu, and Ms. Reema who was a follower of Jainism. At the time of observations, Mr. Jignesh was on a two-year-long internship with an organization called *Teach for India* (TFI). He had taken a break from his engineering job and was teaching in a reputed private unaided

Table 3.1 Summary of teachers' profiles and some details of their classroom teaching

S. No.	Teacher (Pseudonyms)	Age and Teaching Experience	Professional qualification	School profile	Chapter observed	Duration for which s/he taught the chapter
1	Mr. Jignesh	34 years (2 years)	B.E. (Electrical Engineering)	English medium, Private unaided (running since 1978)	Solid waste management; Bonding with ecosystems	7 periods of 35 minutes
2	Ms. Abida	29 years (3 years)	M.Sc. (Genetics), B.Ed., M.Ed.	Urdu medium, Private aided (running since 1995)	Solid waste management	4 periods of 30 minutes
3	Mr. Sahil	26 years (2 years)	B.Sc. (Chemistry), B.Ed.	English medium, Private unaided (running since 1985)	Solid waste management; Bonding with ecosystems; Highway to Health	2 periods of 30 minutes
4	Ms. Reema	52 years (23 years)	B.Sc. (Chemistry), M.A. (Economics), B.Ed.	English medium, Private unaided (running since 1985)	Solid waste management; Highway to Health	2 periods of 30 minutes
5	Ms. Rubina	29 years (3 years)	B.Sc., B.Ed.	Urdu medium, State government school (running since 2008)	Solid waste management	2 periods of 30 minutes
6	Ms. Zaara	~45 years (17 years)	B.A., B.Ed.	Urdu medium, Private unaided (running since 1983)	Regional development	3 periods of 30 minutes
7	Mr. Sudhakar	~ 35 years (3 years)	B.E. (Computer Science)	English medium, Private unaided (running since 1985)	Regional development	3 periods of 30 minutes
8	Ms. Zoya	~ 25 years (1 year)	B.A., B.Ed.	Urdu medium, State government school (running since 2008)	Regional development	3 periods of 30 minutes
9	Ms. Maheen	~ 30 years (6 years)	B.Sc., B.Ed.	Urdu medium, State government school (running since 2008)	Highway to Health	4 periods of 30 minutes

school run by a Hindu trust active in the community. The school was assigned to him by the TFI administration. He had no education degree but before he set out on the internship, he underwent an intensive workshop organized by TFI for its interns to learn the skills of classroom management.

In contrast, Ms. Reema had 23 years of teaching experience at the time observations were conducted. She had a degree in science and education and had been teaching in a private unaided school funded by a Shia Muslim trust. Another young teacher from her school, Mr. Sahil, also volunteered for the study. He had begun his teaching career by tutoring students residing in the nearby areas. At the time of observations, he had entered his second year of formal teaching. Ms. Abida was teaching in a low-fee private Urdu medium school which is partly funded by the state government. Ms. Abida had only three years of teaching experience, but she had degrees in science and education. Ms. Rubina, Ms. Zoya and Ms. Maheen worked in a Municipal Corporation-run school and met all the standards set by the government to qualify as teachers. All three had a bachelor degree in education as well as a college level degree in their respective discipline. Ms. Rubina had a background in science, and it was her third year of teaching when we interacted with her. Ms. Zoya was relatively new in the school and she had just began teaching social sciences. Ms. Maheen was an experienced science teacher but she went on maternity leave while the study was ongoing. She could not be contacted later for one-to-one interaction.

3.5.2 Students

The students were a vital part of the study. As part of the study, I interacted with three different groups of students between the age range of 14 to 18 years. All student participants[7] came from low-income families in the M(East) ward. Their parental occupations (as reported in their personal information forms) ranged from tailoring, mason work, bag making, construction work, zari work, security, driving, working in a garage, working as a mechanic, running a salon, selling vegetables, running a meet shop, repairing airconditioners, working in

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7   While conceptualizing the study, I had anticipated some of my student participants to be Dalits because of the proximity of the schools to the Deonar dumping ground. I managed to make contacts in at least ten private and public high schools in the region but I never met a single Dalit student in those schools. This could mean that either Dalit students in the community hardly reach high school, or they go to far away places for schooling. Most of my student participants (31 out of 34) were Muslims. Only three students belonged to Hindu families.

malls, stitching suits, selling antique items, to working with plaster of paris. Most students who participated in the workshops reported that they worked somewhere, used to support their family businesses or help with household chores but they hesitated in sharing if they themselves or their parents were involved in ragpicking from the dumping ground. Therefore, it cannot be said with confidence whether they were directly involved in handling waste. However, the detailed anecdotes they narrated while talking about the dumping ground show that they may have had a direct experience of waste picking from the dumping ground. Even if they were not involved in rag picking themselves, they knew about how small-scale recycling works and they connected the crimes and their poor education and health conditions in the community to their proximity to the dump. At the time of fieldwork, most students were in Grade 9, except a few who had entered Grade 10.

The first group of students I interacted with was part of a private 'tuition' center which one of my colleagues used to run in the area. The group consisted of 9 boys. At the time of interaction (April 2015), five of them had entered Grade 9, and the rest had just entered Grade 10. I first observed my colleague's interactions with them during a summer camp. On my request, the students in the tuition center once took me around including the top of a dry patch in the middle of the dumping ground for better view, and familiarized me with the geography and politics of the area (see Fig. 3.2). During our interactions, they narrated several instances from their lives. What struck me the most about those narratives was the overwhelming reference to sexual harassment, substance abuse, physical violence, and other kinds of crime. Over the weekends, I would accompany them to nearby parks and play cricket with them.

The second set of students were from a high school run by the city municipal corporation. Three teachers from the same school had volunteered to participate in the study and have their teaching observed. After we completed classroom observations, I had an informal meeting with Grade 9 students and invited them to participate in an out-of-school workshop with me. During our initial interactions, we realized that there was a mixture of both vocal and reserved students in the class. We shortlisted about 15 students who were comfortable in expressing themselves verbally or in writing. Finally, in consultation with the principal, we narrowed down our list to 11 students (5 girls and 6 boys) who participated in a 10-day long workshop.

Fig. 3.2 Students from Workshop 1 showing the spread of dumping ground

The third set of students (all from Grade 9) came from a municipal corporation-run night school in the area. All the students the night school caters to work during the day time. This is also the only government run high school in the locality and hence it was of special interest to me. Since there were only two teachers appointed in the school at the time of data collection and both did not have any background in science, the principal of the school advised me to have direct interactions with the students instead of observing classroom teaching. The third student workshop was conducted with the students of the night school. In the first few interactions, we played mathematical games and built rapport with them. We asked them to write an incident related to the rains, and had conversations around the fire that broke out in the dumping ground a few months back. Some students actively participated in these discussions. We selected about 20 such students from the class for further interactions of which 14 students (9 girls and 5 boys) regularly participated in the after-school interactions spread over a month.

3.5.3 Other participants

In order to characterize the educational discourse on waste, development and environment, it was important to situate the debate in the larger context. Also, to explore the possibilities of transformation, it was vital to understand the visions, imaginations and current work of the

organizations who have spent considerable time in working in the region for the empowerment of people in the community. Keeping that in mind, I interacted with two groups of rag pickers (one in *Cheetah Camp* area, and another in *Mankhurd* area), one scrap dealer in *Mankhurd* area, an engineer associated with a private firm that deals with renewable fuels, the leaders and members of *Kachra Vahatuk Shramik Sangh* <https://kvssmumbai.weebly.com/> (the only trade union of sanitation workers in Mumbai), officials of SWaCH <https://swachcoop.com/> (sanitation workers' cooperative operating in Pune), people associated with *Apnalaya* <https://apnalaya.org/> (an NGO working in the M(East) ward with a mission of empowering urban poor) as well as members of the Transforming M-ward project of the *Tata Institute of Social Sciences* <https://www.tiss.edu/view/11/projects/transforming-m-ward/>.

3.6 Data collection

Most of the fieldwork for this study was done in 2015-2016. Jeffrey & Troman (2004) classify ethnographies on the criterion of the time spent in field work in those studies. The three time modes they discuss are – *compressed* time mode, *selective intermittent* time mode, and *recurrent* time mode. The fieldwork for this study followed a *selective intermittent* time mode as I was selective about the sites and contexts. Field visits were flexible - some were short, some were intense. There were times when I would visit the field on a frequent basis and spend hours in interacting with people, participate in meetings, or roam around the area. At some other times, I would just focus on revising data collection tools, transcribing and interpreting data. "The main interest of the researcher, in this mode, is being open to the events of the research process and being able to pursue particular interests with gusto and to discard those avenues that seem less relevant and interesting" (Jeffrey & Troman, 2004, p. 542). In total, there were about 75 days of actual visits to the field exploring possibilities of interactions with various people, meeting them in person and paying close attention to the ongoing activities, as well as visits to schools and classrooms. Since a major chunk of the fieldwork involved interacting with teachers and students, the classroom observation activity and my interactions with study participants were largely dictated by the academic calendar and their convenience. Interactions with other participants were spread over a few months. The time between field visits allowed me space for reflections, analysis and further planning.

As mentioned earlier, I gained preliminary access to the field site through one of my colleagues who used to run a tuition center in that area and teach students of various age groups. Keeping that center as a base, I gradually began exploring the neighborhood on my own, approaching schools for classroom observations, seeking permissions, attending public meetings, spending time at various tea stalls, observing people busy with their routine activities, people struggling for water, people going in and coming out of the landfill site either to collect waste, to play cards with friends, or just to defecate in open. Throughout this phase, I continued to take field notes.

After a few rounds of follow-up, five secondary schools agreed to let me observe teaching practices in their schools and interact with students. The students enrolled in these schools were from various localities in the M(East) ward. Four of these schools were low-fee private schools, and one was a Municipal Corporation school. I observed classes of six science teachers and three social science teachers (see Table 3.1). These classes were audio/video recorded depending on the teachers' preference and comfort. First, we obtained verbal consent from the management of the concerned schools. Written consent was obtained from all the participant teachers for recording their classroom practices (see Appendix I and II for consent forms). Besides, two observers (myself and another researcher trained in conducting qualitative research) attended all the classes and took down detailed notes. After every class, both the observers would confer and discuss their impressions about the class, exchange their notes on what they found striking in the class, and discuss any differences of opinion on their interpretation of classroom proceedings. For every teacher, the arrangement was such that the teachers used to inform me of their schedule and other related events such as school's annual function, celebration of science day, or science exhibition, and I would try my best to accommodate all these events along with classroom observations. Attending these extra-curricular events not only gave me an additional opportunity to interact with the participant teachers and students, it also helped me understand the larger culture of teaching and learning of school science. Later I conducted interviews with the participant teachers, two groups of rag pickers, one scrap dealer, one professional who works in the waste management sector, and some activists.

Classroom observations were supplemented with a critical discourse analysis of the relevant textbook chapters (Chapter on waste and environment in the science textbook, and the chapter on development in the social science textbook). Wherever possible, I collected artifacts such

as students' school project reports, photographs of their science projects, and wall posters in the schools. Some of these reports and projects were related to the themes explored in this study and therefore, complemented my explorations on their perspectives on various matters.

Interactions with students were in form of workshops with three distinct groups of students in out-of-school settings. All these workshops were spread over a week or two, and about 10-15 students participated in each of these workshops. Table 3.2 summarizes various sites of data collection (mainly classroom observations, student workshops and teachers).

Table 3.2 Sites of data collection

Site	Classroom observations conducted	Average attendance during classroom observations	Participant teachers (pseudonym)	Workshops with students in out-of-school settings
Private tuition Centre in Shivaji Nagar	-	-	-	Workshop 1 (No girls, 9 boys)
School 1: English medium, private unaided, co-ed school (since 1978)	Grade IX A	31	Mr. Jignesh	-
School 2: English medium, private unaided, co-ed school (since 1985)	Grade IX A	43	Mr. Sudhakar	-
	Grade IX A	43	Mr. Sahil	
	Grade IX B	34	Ms. Reema	
School 3: Urdu medium, private aided, co-ed school (since 1995)	Grade IX B	40	Ms. Abida	-
School 4: Urdu medium, municipal corporation, co-ed school (since 2008)	Grade IX A	30	Ms. Maheen	Workshop 2 (5 boys, 6 girls)
	Grade IX A	35	Ms. Zoya	
	Grade IX B	36	Ms. Rubina	
School 5: Urdu medium, private, unaided, girls school (since 1983)	Grade IX A	32	Ms. Zaara	-
School 6: Urdu medium, municipal corporation, co-ed night school (since 2008)	-	-	-	Workshop 3 (9 boys, 5 girls)

The first workshop was with the students of the tuition centre run by one of my colleagues in Shivaji Nagar. The participants of this workshop were enrolled in various private schools in the neighbourhood. They came from relatively privileged background as they were paying a tuition fees of 500/- every month. The second workshop was conducted at a municipal corporation school in Cheetah Camp area with the students identified from the class that I had observed earlier in that school. All the participants in the workshop lived in Cheetah Camp area - an area that was set up in 1976 to rehabiliate about 70,000 slumdwellers displaced from Janta Colony in Chembur to make space for the expansion of the Bhabha Atomic Research Centre. Cheetah Camp site is about 6 to 7 km from the dumping ground by walk, but much closer as the crow flies. Some people in Cheetah Camp community go to the dumping ground for ragpicking. Some children in Cheetah Camp have also relatives in Shivaji Nagar and visit them. The third workshop was conducted in the night school in Shivaji Nagar. All the participants in this workshop were enrolled at the night school (see Table 3.3).

Table 3.3 Brief overview of the workshops

	Duration	**Participants**	**Session length**	**Topics covered**
Workshop I	April 2015	No girls, 9 Boys	7 sessions of 90 minutes approx.	Waste, materials, political economy
Workshop II	April 2016	5 Girls, 6 Boys	10 sessions of 90 minutes approx.	Waste, health, development, nature, aspirations, political literacy
Workshop III	July-Aug 2016	9 Girls, 5 Boys	16 sessions of 90 minutes approx.	Waste, health, development, nature, aspirations, political literacy

The basic format of all these workshops was focus group discussion and we discussed various topics ranging from waste, health, development and environment, to their views on government, the problems in the community, the possibilities of change, and their aspirations. The workshop data was video recorded with prior consent of students and their parents (see Appendix III and IV for consent forms). The relative locations of the three workshops and classroom observations conducted in five different schools are marked in Fig. 3.3.
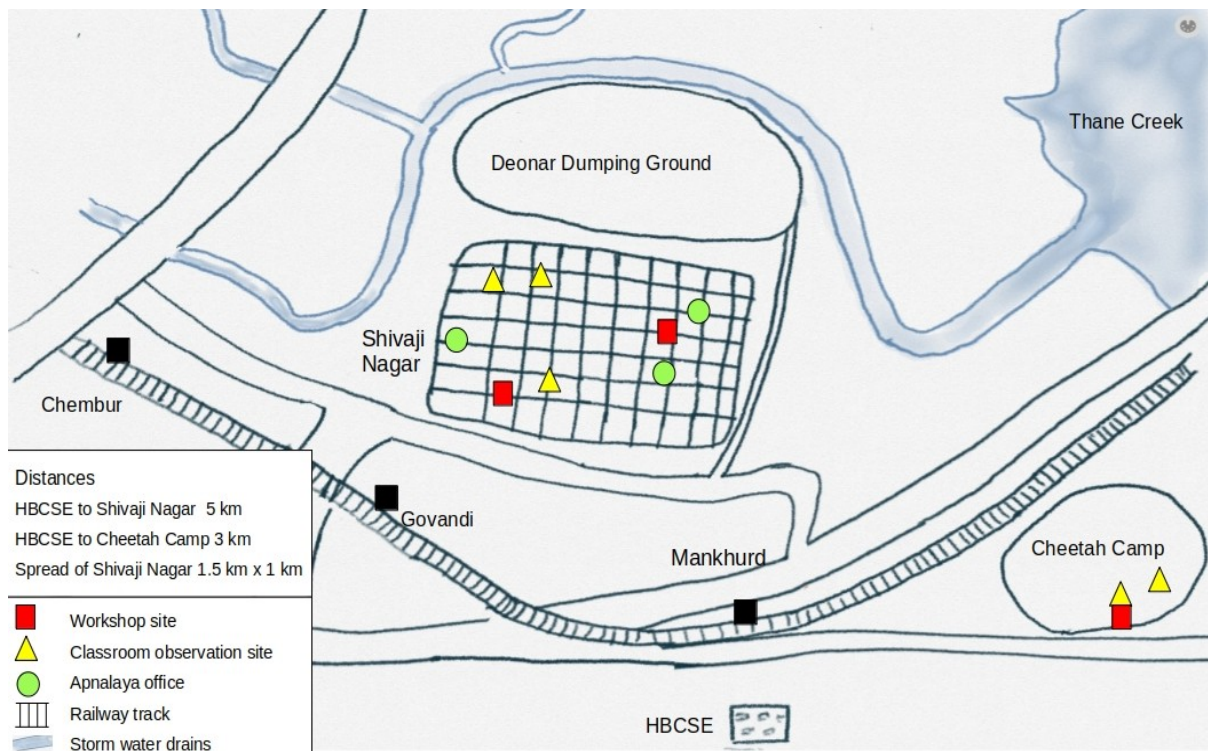
Fig. 3.3 Relative locations of workshops and classroom observation sites

For these workshops, I developed activities based on my reading of the literature and prior experience of working with students. I used various triggers to initiate discussion with students. For example, I used a short film called 'story of stuff' <https://www.storyofstuff.org/> to elicit their views on political economy of materials (Fox & Leonard, 2007). I wrote a poem to help them reflect on their lived reality, identify some of the major problems in their locality and think of ways to address those problems (see Appendix XVIII). The title of the poem was '*Ek chuze ka khwaab*' (Translation: The dream of a fledgling). I wrote a fictional story called '*Jungle me chunaav*' (Translation: Elections in a jungle) to explore their ideas about the role of government, elections, and to map their political literacy (see Appendix XVII). Another fictional account of a steel plant was developed and used to elicit students' understanding of aspects of development (see Appendix XIV). I designed a game to dig deeper into their understanding of waste categorization methods. I used the stories written by some other children of the rag picking community in Bhopal to make them talk about their experiences of housing, sanitation, water supply, healthcare, and encounter with the police. I developed a few contextualized narratives to

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understand how students make connections between health, poverty, nutrition, hygiene and the health infrastructure (see Appendix XIII). I also used Sudharak Olwe's poignant photographs of sanitation workers in various contexts to trigger discussions on the living and working conditions of sanitation workers (see Appendix XIX). In addition to this, students made concept maps on themes such as waste, health, nature and development, and gave written responses to related worksheets eliciting their views on selected issues. Fig. 3.4, 3.5, 3.6 and 3.7 show representative photographs from the three workshops.

Fig. 3.4 Representative photograph of the discussions in Workshop I

Fig. 3.5 Representative photograph of the settings in Workshop II
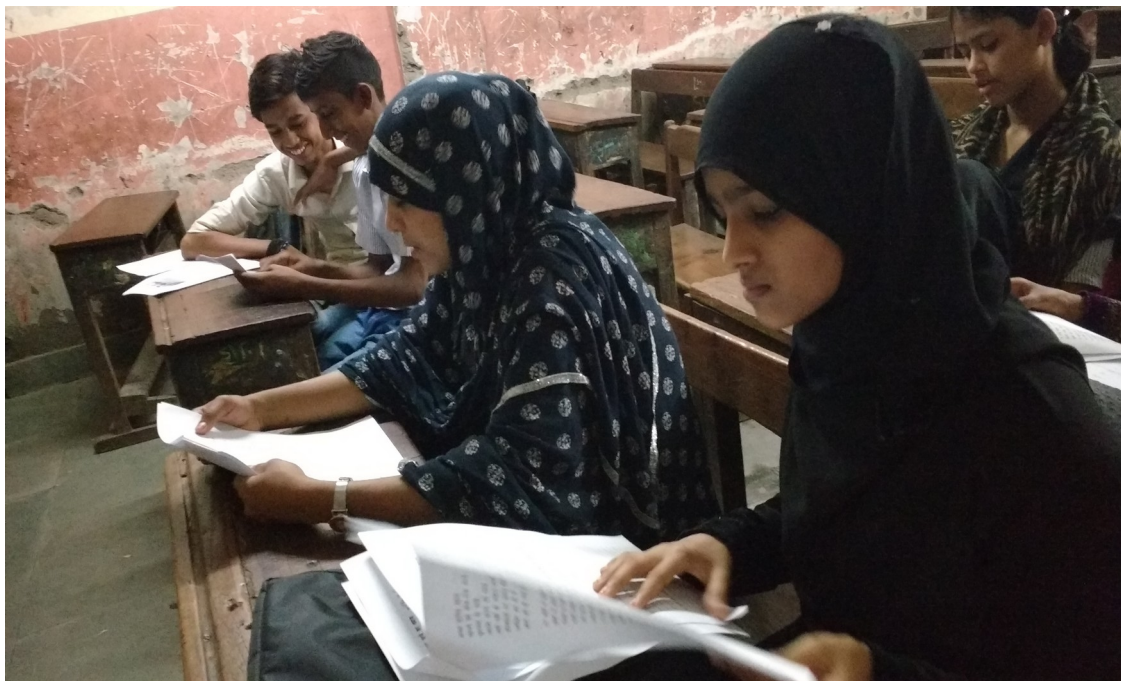
Fig. 3.6 Workshop III: Students reading the poem *'Ek Chuze ka Khwaab'*

Fig. 3.7 Students responding to a worksheet during Workshop III

Part of the fieldwork happened beyond the school walls as well. I participated in a few public gatherings that were called by the civil society to seek solutions of the frequent fire problem at the Deonar dumping ground site. On invitation by one of the leaders of *Kachra Vahatuk Shramik Sangh* (KVSS)*,* I attended a huge gathering of workers at the famous *Azad Maidan* in Mumbai, called by the trade union to put pressure on the government to ensure sanitation workers' wages and other rights. Several workers spoke of their miseries at that public forum. Later I interviewed two sanitation workers and one of the leaders of KVSS. Interactions with *Apnalaya* team members and the TISS M-ward project team members were spread over a few months and informal in nature. I was part of their everyday activities, and also facilitated sessions for students and teachers associated with these organizations. A short trip to Pune resulted in one-time interaction with an engineer who works in the waste management area, and the head of the cooperative of sanitation workers – SWaCH. All the interviews with participants were audio taped.

3.7 Analytical approach

As discussed earlier, I have used CDA to analyze the data, which comprised of the relevant chapters from the science and social science textbooks of Grade 9, classroom observation notes, interview transcripts of participant teachers and other respondents, as well as my interactions with students in three out-of-school settings. Three out of the five schools where I observed classroom practices were Urdu medium schools. The other two schools were English medium schools. However, since I have limited understanding of Urdu, I have analyzed the English versions of the science and social science textbooks using CDA. The textbooks are produced by a statutory state agency and are close translations of the original, presumably in Marathi or in English.

Further, to guide the interpretation of the text, the interpretative stance needs to be clarified. For this purpose, I have drawn on Apple (1992), who asserts that a text can be read in three distinct ways: *dominated*, *negotiated*, and *oppositional* (p. 10). A *dominated* reading of a text means accepting it at its face value. When a reader tries to mediate and transform the meaning of a text but still accepts the overall meaning, it is said to be a *negotiated* interpretation. An *oppositional* reading entails the reader 'repositioning' himself/herself in a marginalized position vis-à-vis the text. My analysis of the educational discourse in this study reflects an *oppositional* reading of the text. This will become evident in the presentation of the results, where I juxtapose the textbook and classroom discourse on waste, development and environment against the living and working conditions of sanitation workers, rag pickers, and people living in the vicinity of the Deonar dumping ground.

Though CDA is more commonly used to critique written texts, I find that it is a relevant tool for analysing texts from the classroom and other face-to-face interactions, as used in science education studies like Moje (1997). In my analysis, while the textbook discourse is treated as the "authoritative text", it is examined, not in isolation but in juxtaposition to the classroom discourses and the students' everyday discourses. So, the "text" of the textbook is analysed in relation to participant students' understanding and experiences and problematised through their lens. Thus, the analysis of different data sets is intertwined. The analysis moves between the vocabulary and structure of the text and the ideologies conveyed by the text. However, this is not to say that the classroom discourse or the students' everyday discourses are free of power relations because the actors who engaged in these discourses (teachers, students, other

respondents and myself as a researcher) are placed in relations of power vis-a-vis one another. In my analysis, I flesh out these aspects, for example, by pointing out how teachers attempted contextualisation of the textbook discourse in sensitive ways but at the same time also reinforced specific hierarchies. In addition to exploring how subjectivities are molded and constrained by social structures, CDA also brings forth how participants can lay bare and challenge taken-for-granted hegemonic power. In my analyses. I have tried to interweave such positions voiced by the participants.

Further, as a researcher, while I invited students' experiences during our interactions with them, I realised that I had primary control over the discussions since I planned and conducted those workshops. Therefore, while analysing students' responses in the workshop context, I paid close attention to how they negotiated these interactions and tried to understand their responses in terms of both their socioeconomic realities and agency. Throughout the analysis, I have tried to reflect on my own power position and the research instruments employed to elicit students' views.

Moreover, the knowledge and the experiences of the students of the M(East) ward, sanitation workers and rag pickers regarding various aspects of the sanitation work is accorded value in the study, thereby questioning the power equations between, on the one hand, the educational and everyday discourses, and on the other hand, between the researcher and the researched.

The data collected was mostly in the form of audio or video recording except my field notes (about 156 pages including classroom observation notes), the textbooks that I analyzed, and the responses to writing tasks. I went through all the workshop data (40 hours in total) and selected clips that had relevant discussion. Informal conversations on unrelated matters were not selected for transcription. The selected workshop data and all the interviews were then outsourced to a professional for transcription. I verified all the transcripts (326 pages of workshop data and 198 pages of interview data) which were then uploaded on an open source Qualitative Data Analysis software package called RQDA <https://rqda.r-forge.r-project.org/> in .txt format. RQDA allows researchers to generate coding schemes, organize codes into code categories, write memos for codes, code categories and text files, retrieve and edit codes at any stage, and search across multiple files for a particular code or coding category. These features helped me develop a sophisticated coding scheme in digital format, and do preliminary coding of all the text files. The codes were assigned into various code categories. However, as I began comparing codes across transcripts, several codes were redefined,

reassigned, or merged in other codes. Appendix XXV presents the final list of codes. In the final iteration, I took printouts of the coded data and worked manually on it to verify the coding scheme. The broad themes that emerged from the data were then superimposed on the textbook chapters to see how aligned those were to the overall organization of textbook chapters. Some of the themes were also redefined in the process. At various stages of analysis, I involved my experienced colleagues as well as those who had themselves conducted qualitative studies. They helped me decide the subsequent steps of analysis. The coding scheme also greatly benefited from their inputs. Fig. 3.8 summarizes the overall study design.

3.8 Validity concerns

Establishing trustworthiness and credibility of data is a major challenge in any qualitative research. "The combination of multiple methodological practices, empirical materials, perspectives, and observers in a single study is best understood… as a strategy that adds rigor, breadth, complexity, richness, and depth to any inquiry" (Denzin & Lincoln, 2018).

Lather (1986a) argues that validity in the context of openly ideological research needs to be reconceptualized to ensure rigor while creating space for subjectivity and reflexivity. She suggests four criteria to "guard against researcher biases distorting the logic of evidence" (p. 67). The first criterion, she discusses, is the triangulation of methods, data sources and theoretical schemes which, she argues, is an essential part of establishing trustworthiness of data in a study. To ascertain data credibility, it is imperative that researchers look for not just convergences in data but also for negative cases and counter-patterns. As discussed in Section 3.6, data for this study was collected through multiple sources (students, teachers, textbooks, activists, sanitation workers and rag pickers) and by employing diverse methods (field notes, interviews, classroom observations, focus group discussions, as well as writing tasks). The theoretical framework is also multi-layered as it would become evident in Chapters 4 and 5 of the thesis.

Participants | 34 high school students, 6 science and 3 social science teachers, Officials of KVSS, *Apnalaya*, *Swach*, and TISS M-ward project, rag pickers, scrap dealers, 1 engineer

Data sources

| Field notes | Textbook chapters | Classrooms | Interactions with teachers | Interactions with other participants | Workshops with students |

Workshop I → Workshop II → Workshop III

Methods employed

Participant observations
Interviews of teachers and other participants
Student artifacts
Focus group discussions with students
Written responses

Analytical approach

Transcription of selected audio-visual data; Verification of transcripts → Developing codes and categories; Coding on RQDA → Refining coding scheme by redefining, reassigning and merging some codes → Emergence of themes and sub-themes

Validity

Peer debriefing ⊹ Triangulation ⊹ Subjective reflexivity ⊹ Member checks ⊹ Catalytic validity

Fig. 3.8 Study design in a nutshell

However, in a theoretically guided, unabashedly ideological research, there is always a risk of 'conceptual overdeterminism'. A 'systematized reflexivity' on the researchers' part could help in overcoming any theoretical imposition. The role of empirical data is crucial in making a claim and I have extensively relied on the data collected through various sources and methods to make my argument. In the next section (Section 3.9), I describe my positionality i.e. what my ethical and political sensibilities are and how they have shaped over time, and discuss how I negotiated issues of power, privileges, and values with the study participants.

Another criterion to enhance data credibility is through 'member checks' which brings in 'face validity' to the research design. Member checks are vital to ascertain that the respondents are not misrepresented. In the context of this study, I kept rewording what my respondents uttered during my interactions with them, and crosschecked with them if I have understood them right. Even in the workshops with the students, I used to rephrase students' responses in my words and seek their confirmation. If they disagreed with my interpretation, I

would ask them to clarify their position. However, since the analysis of data took significant time to complete, I had lost touch with most of my respondents by then and the results could not be shared with them.

One of the key validity criteria in a critical ethnography is 'catalytic validity' i.e. to what extent the research facilitates participants' *conscientization*, helps them reflect on their lived realities, and leads to activism (individual / collective action). A critical ethnographer not only documents the reality but also aims to 'educate' the research participants and facilitate the process of gaining self-understanding and enhancing self-determination in the struggle towards social justice. In this study, the primary objective was to problematize the educational discourse from the standpoint of a marginalized community, and explore possibilities of a transformative science and environment education. The methodological lens of critical ethnography and critical discourse analysis was apt to investigate the same but educating respondents in the sense of *conscientization* did not happen in significant ways as that was not the primary objective of this research. In my interactions with students, I had used a few worksheets which did make my participants reflect on their living conditions (housing, health, sanitation, and so on). There were a few glimpses of *conscientization* with student participants, mostly as a by-product of the research, which I report in Chapters 4 and 5 of this thesis.

3.9 Positionality of researcher

In qualitative research, a researcher is acknowledged as being "biographically situated" (Denzin & Lincoln, 2018, p. 52). Qualitative researchers inevitably bring their life histories, social position, formative experiences, political and professional beliefs and values to the study which are likely to affect the interaction between the researcher and the researched. Madison (2005) argues that reflecting on one's "positionality is vital because it forces us to acknowledge our own power, privilege, and biases just as we are denouncing the power structures that surround our subjects" (p. 7). In this section, I reflect on my ethico-political sensibilities, and discuss how I negotiated issues of power and identity in the course of the study.

3.9.1 Ethico-political sensibilities

I hail from Kanpur - a crowded city in North India, known to be the industrial hub of the state of Uttar Pradesh, and declared as the most polluted city in the world by the World Health Organization in 2018. Kanpur is home to millions of working class people who migrate from various parts of the country searching for a livelihood, and so was my family. Caste and religion-based politics have a long history in that region, and conflicts between upper caste Hindus, Muslims and Dalits used to be common when I was growing up there. Born in a working class family, I spent my childhood in a neighborhood watching unemployed youth whiling away their time playing street cricket, gambling and fighting. The 1992 riots post Babri Masjid demolition was an eye-opening experience for me which made me question the right-wing alliance of my extended and immediate upper-caste, Hindu family. My empathies for Muslims go long back. I was in Grade 6 when I eye-witnessed people in my neighborhood setting a house, rented by the only Muslim family in that locality, on fire. I could never appreciate the hate against Muslims and the propaganda of right wing parties across the globe. I am not entirely sure when I developed my caste sensibilities. My grandmother used to take me to a temple which had a slogan on one of the walls - "*Nar aur naari ek samaan. Jaati, dharm sab ek samaan*" (Translation: Men and women are equal. All castes and religions are equal.) which people used to chant at every other occasion in the temple. Those were my early lessons in equality (not equity or justice).

After completing my school education, I got admitted to a prestigious and highly competitive engineering college in Kanpur. However, as a student, I soon began to feel a sense of disengagement with the engineering curriculum which was depoliticized and disconnected from real life. As part of a voluntary student organization *Prayās*, I spent a significant amount of time of my engineering days with the underprivileged children of the neighborhood, helping them with their school education. I was also part of a community health initiative which provided heath care services at a nominal price to those who could not afford costly treatment. Among the many activities of the organization, I watched documentaries on social and political issues, visited organizations working in the field of education and played an active role in campus- and city-wide protests. Inter-communal riots broke in *Godhra* in 2002, Iraq was invaded by USA in 2003, Indian ocean tsunami occurred in 2004, *Khairlanji* massacre happened in 2006. Discussions and debates on all these natural or man-made calamities had a significant influence on my ethico-political sensibilities. As part of *Prayās*, I

visited the nearby villages, visited families of migrant workers, and tried to engage with their issues. This is when I became aware of workers' struggles for their rights and got an exposure to Marxist theory. As I was getting interested in school education, one of my comrade friends, who also happened to be a faculty at IIT, gifted me a copy of Paulo Freire's *Pedagogy of the Oppressed*. The book has always been a big inspiration for me.

My engagement with education deepened further when I got an opportunity to work with a non-profit organization *Eklavya,* and pursued educational research for five years before I joined the PhD program at HBCSE. As part of *Eklavya*, I got a chance to closely observe the abject conditions of government schools, teachers' struggles, and developed a critical outlook towards textbooks. The Masters in Elementary Education course at *Tata Institute of Social Sciences*, Mumbai introduced me to critical perspectives in education.

My doctoral work, therefore, both draws upon and has a bearing on my lived experiences, my political commitments, as well as the training I have received as a practitioner of education and a researcher in the field of science education. As part of my commitment to equity and justice, I seek to explore possibilities of a transformative science and environment education through this study. I have tried to remain reflexive of my positionality throughout this research starting from conceptualization of this work to formulation of research questions, selecting methodologies and methods, data collection, data analysis, as well as reporting.

3.9.2 Negotiating issues of power and identity

For the participants of the study, I was an 'insider' as well as an 'outsider'. Most teachers and students were able to connect with me after knowing that I had migrated to the city from the same geographical region as most of them had. Also, in everyday conversations, I used to speak the same language as them. Often I used to get the sense that they see me as one of them and talk freely with me. However, there were some occasions when they would perceive me as an 'outsider' for I did not share the religious identity with them and had no experience of writing in Urdu which was their mother tongue. It is difficult to imagine how I would have managed data collection and data analysis without Tuba's help. Tuba, a friend who assisted me during data collection phase with video recording, also worked as on-site translator throughout the study. Most students, especially girl students, immediately connected with her. Tuba's presence as a co-facilitator in the workshops also balanced out the gender dimension.

Some women teachers were also more open to Tuba than me as she always came across as an 'insider'.

I had assumed that being in Mumbai for so many years, the student participants will be well versed in Marathi (the state language) and Hindi (the lingua franca in big cities like Mumbai) but to our utter surprise, most students did not seem to have adequate writing skills either in Marathi or in Hindi. They were more comfortable in Urdu. To make things easier for them, we translated all the writing tasks in Urdu as well and encouraged them to respond to the writing tasks in whatever language they felt comfortable. Most responses used to be in Hindi or Urdu. Urdu responses were translated back in Hindi and English for the purpose of analysis. In verbal communication, students were able to manage with Hindi mixed with Urdu words, so we decided to have our conversations in Hindustani (a mix of Hindi and Urdu) and ensured that all technical words were spoken in Urdu as well. I also learned several Urdu words in the process. Sanitation workers, on the other hand, preferred to speak in Marathi and I got assistance from two other colleagues from HBCSE to facilitate those interactions. Teachers were comfortable with both Hindi and English. However, since the medium of instruction was Urdu in three out of five participant schools, most teaching happened in Urdu which I used to find difficult to follow. Here also, Tuba helped me understand the classroom data of Urdu-medium schools.

Building good rapport with respondents is vital for smooth and successful data collection. I spent significant time with my student respondents to gain their trust and mitigate possibilities of any contrived interaction. I used to listen to them patiently, and tried my best to not pass a judgment on their views that they expressed during interactions. I also tried to avoid dismissing a student's response even if it was against my position, and sharing my opinion on matters. However, it was difficult to resist at times when the students or teachers insisted that I share my views on a specific topic. In those cases, I shared my opinion at the end of the conversation so that their views do not get influenced by my views. However, it is neither easy nor desirable to conceal your commitments in a teaching-learning scenario. Students constantly try to read their teachers' minds and respond accordingly. On the role and functioning of the present right-wing government, they were perceptive of our political position and were excited to express their views. They were also careful about it and asked us in advance if their views can be misused against them. When we assured them that their views were confidential and will remain anonymous if used in academic forums, they

enthusiastically criticized the government and shared how biased it is against their community. An open discussion on political matters in which their opinions were valued also benefited our relationship with them. As they found us on the same coast of the river with regard to political leanings (in the sense, that both researchers and the student participants were critical of conservative practices of the ruling government), they felt further assured and connected with us.

Students seemed to perceive my relationship with them to be largely democratic and non-threatening. They were free to walk out, not engage in the discussion if they didn't want to, and suggest what should be discussed in the next session. Sometimes these negotiations were not easy and required convincing from both ends. With time, the students developed a trust in us as they realized that we valued their views as well as their religious and cultural beliefs. Occasionally, students would invoke religious scriptures to make their argument and I would not dismiss it even if it contradicted the modern scientific worldview (Examples discussed in Chapter 5). In Workshop III, the sessions used to happen in the evening and often coincide with evening *Azaan* (prayer) timing. As per request from some students, we used to take a break for a couple of minutes when *Azaan* would start and resume the session once it got over. In the same workshop, a group of girls decided to tie 'rakhi' (a band that sisters tie to their brothers on a particular festival in North India) to me and as a return gift, I got chocolates for everyone and we made plans for a picnic as well. After every session in a workshop, we used to play some games and that too helped in breaking the barriers between the researcher and the researched.

Teacher respondents, however, were more formal with us. Perhaps we did not spend sufficient time with them before we got into observing their teaching. With other participants, the experience varied from person to person. While interactions with officials of KVSS, Apnalaya and SWaCH were bound to be formal, interactions with sanitation workers and other members of these organizations were relaxed. I was briefly involved with some field activities of *Apnalaya* as well. I attended sessions at their informal learning centers when children used to prepare street plays on contemporary social and political issues. Students associated with Apnalaya also belonged to the M(East) ward slums and had similar experiences as other student participants. On one occasion, I was invited to be a part of a children's rally to promote breast feeding and make community mothers aware of the importance of nutrition and vaccination. Another time, it was about gender equality. I also attended a public meeting

organized by *Apnalaya* to discuss people's issues with the government officials. Students associated with *Apnalaya* had prepared their demands which they read out in front of the officials. Later, I was invited to be a part of a residential camp of students by *Apnalaya,* where children took part in various cultural activities and I got a chance to informally interact and mingle with the students of various age groups. In 2017, a young high school girl who was part of *Apnalaya,* got burnt while she was setting up a kerosene stove at her house. She faced severe burn injuries. Her mother was a rag picker and was unable to support her daughter's treatment. When *Apnalaya* reached out to people in its circle to raise funds for her treatment, I played an active role in that campaign. The running around for her treatment – visiting her family, meeting doctors, arranging donors, and coordinating things – deeply impacted me, and greatly enhanced my feelings for the community. These informal interactions with *Apnalaya* team members and the students associated with the organization helped me understand the community issues better.

I also made friends with a group of rag pickers in *Mankhurd* area with whom I used to chat on a frequent basis. Often I used to give them plastic waste and glass bottles for recycling which they used to appreciate. Occasionally they would ask me what I do, whether I am married, who is that person with whom I had come yesterday to the tea shop, and so on. They had noticed that a huge pit was dug inside my institute which they could see from outside and they were curious to know the purpose of it. When I told them that it was a compost pit, they wanted to know what waste is dumped inside it. These little conversations, in spite of our class, caste, gender and linguistic differences, had disrupted the power relationship between us, and helped me develop a more-equal relationship with them because of which they were very comfortable when they talked to me about their work and their lives, in general. In this section, I have discussed a few instances of how we negotiated power and identity issues with various study participants. More examples would follow in Chapters 4 and 5 of the thesis where I discuss the findings of the study.

4. Discourse on Waste

The landmark judgment of the Supreme Court of India (M C Mehta vs. Union of India and others, 2003) mandated environmental education at all levels of education in the country and advised the state to integrate it within existing disciplines in the curriculum. Following the judgment, various environmental issues, including waste management, were accommodated in the school curriculum. It is interesting, however, that the topic of waste has largely been introduced through the science curriculum with a focus on 'scientific' management of waste through appropriate technologies. In the state of Maharashtra, the topic is introduced in the secondary science curriculum and primarily deals with solid waste management. The focus of this chapter is to critically analyze the educational discourse on waste in science classrooms, and to problematize it against the lived experiences and everyday knowledge of the students of the M(East) ward.

4.1 Frequent fires at Deonar dumping ground

January 28, 2016: People residing in the eastern suburbs of Mumbai woke up to a sky filled with thick white smoke from a major blaze that had erupted at the Deonar dumping ground the previous night. Newspaper reports and television channels immediately reported the issue with some of them featuring a satellite picture of the dense smog captured by the NASA earth observatory (Fig. 4.1). The fire went on for several days before it could be brought under control resulting in a sharp increase in respiratory problems among people residing in the neighborhood.

On January 29, the Air Quality Index (AQI) – a composite indicator to measure air quality which takes into account levels of particulate matter apart from concentration of five gaseous pollutants – was recorded as 325 in the morning, which further shot up to 341 by the evening (any value above 300 is considered to be 'very poor' and 'hazardous' by the Ministry of Environment, Forest and Climate Change, Government of India). The local air quality

monitoring station at Chembur, set up by the Ministry of Earth Sciences, Government of India recorded the presence of pollutant particles to be eight times the permissible limit between 8 am and 9 am on the same day (Chatterjee, 2016).

Fig. 4.1 Representative photograph of the fire that broke out at Deonar landfill

(Image source: https://commons.wikimedia.org/wiki/File:Mumbai_oli_2016028.jpg)

Responding to this alarming situation, elite citizen forums in the neighboring areas of the dumping ground protested vociferously against the worsening quality of air and demanded that the dump be shut down permanently or shifted elsewhere. They organized meetings with

state officials and submitted a petition to the municipal corporation, invoking solid waste management rules to make their case. The livelihoods of thousands of rag pickers were affected too as their entry to the dump was stopped immediately after the fire incident. The municipal corporation ran a major evacuation drive in the name of 'security measures' and displaced hundreds of poor people who lived in small shanties near the dumping ground. Clearly, the fire had affected different groups of people differently.

The main controversy around the incident was who should be held responsible for the fire. Fires are not uncommon in landfills. One technical explanation behind the breakout of fires in the landfill is the spontaneous combustion of methane gas that gets generated and trapped in the piles of garbage. However, this explanation seemed unlikely because the fire broke out in the middle of the night in January when the temperature is moderate. Some attributed the cause of the fire to sabotage by a private contractor whose waste processing contract was likely to expire soon. Another hypothesis was that the rag pickers set fire to the garbage to extract metallic waste. Some Non-Government Organizations blamed the centralized system of waste disposal for frequent fires. Eventually though, the police held two kingpins of the garbage 'mafia' responsible for the massive fire and filed a complaint against them (Sinha, 2018).

Nowhere in the discourse around the fire and whether to shut down the landfill, was any attempt made to raise broader questions on why waste gets generated at such a large scale in cities like Mumbai, why waste has piled up at landfill sites, why the municipal corporation of Mumbai continues to dump waste at a site which completed its lifetime a long time back, or what alternatives the government is willing to provide to the thousands of rag pickers who are dependent on the dumping site for their livelihoods. These unasked questions as well as the aforementioned conflicting discussions around the fire incident in the public sphere reveal the complexity of the issue, where arguments of diverse nature (scientific, socio-economic, political, legal, philosophical) interplay with one another. It also indicates that the discourse on waste in the public sphere is techno-managerial (considers the issue as a case of improper management of waste and focuses on finding technological fixes rather systemic solutions), classist (only urban middle class concerns matter), and insensitive to both the conditions of the poor whose lives are connected to waste and to the impact on the environment.

In this chapter, I seek to understand whether the educational discourse on waste coincides with the dominant discourse on waste that emerged around the fire, or whether counter-

hegemonic tendencies and possibilities exist in the enacted curriculum. More specifically, I explore how the discourse on waste in school education is positioned vis-à-vis the concerns, experiences, and out-of-school knowledge of the students from the community that lives close to the Deonar dumping ground through a critical examination of their science textbook, teaching practices, teachers' interviews, and out-of-school interactions with students. The students of this community were of particular interest since they occupy the bottom-most rung of a deeply hierarchical, consumerist society. An understanding of their life worlds would shed light on how to contextualize the curriculum and reimagine transformative science education for the community.

4.2 Waste: a complex terrain

Waste is one of the distinguishing features of human society. Across the globe, it is acknowledged as a serious environmental problem. What makes the problem of waste in India unique is its enormous volume and the nature of waste piling up at various landfill sites in the country (Doron & Jeffrey, 2018). Under pressures of accelerated growth, post-colonial India witnessed a massive migration from rural to urban areas. Most cities in India have expanded in an unplanned manner and waste management in urban spaces has become a major challenge for the country. An online report published by 'Down To Earth' claims that "Over 377 million urban people live in 7935 towns and cities and generate 62 million tonnes of municipal solid waste per annum. Only 43 million tonnes (MT) of the waste is collected, of which 11.9 MT is treated and 31 MT is dumped in landfill sites" (Lahiry, 2019). Mumbai alone produces about 8000 metric tonnes of solid waste every day (~3 MT per year). In the absence of an efficient waste management system, mounds of garbage stand tall in the middle of all the big cities.

Moreover, most of the unattended waste at the landfill sites is mixed and therefore, its processing or material recovery is next to impossible. Further, since none of the landfill sites in India have an underlying layer of plastic, the contamination of groundwater and soil in nearby areas through the process of leaching is inevitable. The landfills also lack a provision for the controlled release of methane gas and therefore, they are prone to combustion fires. The Deonar dumping ground is an illuminating example of what could happen if a landfill crosses its lifetime. The massive fire that broke out in Deonar dumping ground made the

entire city choke. However, waste continues to be dumped at this site and the chances of such fires will only increase as time passes.

A pressing question, therefore, is how a city's waste ends up accumulating at landfills. The story of waste undoubtedly begins with the production of commodities. The commodities produced are sold in the market, used by the consumers and eventually discarded by their users. If a waste management system is in place, these discarded items should be collected by the authorities and transported for further processing. In a well-managed system, biodegradable waste is composted, biomedical waste transported to incinerators and the recyclable waste recycled. The energy recovered from burning biomedical waste at a high temperature is supplied to manufacturing industries, and the materials recovered from recycling are sent back to the manufacturing industries. But often that is not the case.

Based on the interviews of various people associated with KVSS, I gather that the municipal corporation of Mumbai works in close alliance with the private lobby for waste management in the city. Though contracts are awarded for waste collection as well as waste processing for each landfill site, the private contractors focus only on waste collection and blatantly ignore the processing part of the contract. The corruption in the government system enables the private lobby to operate smoothly. The government pays the contractors based on the amount of waste collected. Their lorries ply through the city day and night and dump the collected waste at their assigned landfill sites. The more waste they dump, the more they are paid by the government. The contractors, therefore, use all possible means to maximize the collected waste. As a result, waste continues to accumulate at the three landfill sites in Mumbai. Since most waste collected by the municipal corporation in collaboration with private contractors is left unsegregated, unprocessed and unattended at the landfills, a local mafia monopolizes and closely regulates access to the landfill. The rotting waste at the landfills not only affects the health of the people who live in the close vicinity, but also poses severe health risks to those who are dependent on waste for their livelihoods. Waste has different impacts on different groups of people. In the next section, I discuss how waste affects different groups of people, and who should be held responsible for the aggravating waste problem.

4.2.1 The interlinkages between waste and caste

In India, the notions of waste, dirt and filth are closely tied up with the ideas of purity and pollution. The cultural anthropologist, Mary Douglas argues that the rules of purity and pollution vary from culture to culture with what is considered pure and impure being a matter of customs and beliefs. In the Indian context, this notion manifests itself in the context of 'caste pollution', which is a "symbolic system, based on the image of the body, whose primary concern is the ordering of a social hierarchy" (Douglas, 2003, p. 126). Doron & Jeffrey (2018) note that in India "attitudes about ritual purity and pollution often collide with scientific understanding of waste and dirt and of sanitation and hygiene" (p. 2).

Primarily associated with the Hindu religion, the caste system in India operates on the principles of purity and pollution, which is in turn predicated on the hierarchical division of labor. While the upper castes engage in intellectual labor and ritual tasks, the lower castes are bound to do manual labor with the lowest, "untouchable" castes engaging in menial jobs which include handling dirt, waste, carcasses and excreta. The upper castes also distance themselves from the lower castes whom they consider unclean and polluted. This may not necessarily be related to the actual facts of being clean or unclean. Rather, the upper castes maintain a symbolic distance from the lower castes. Even the touch or shadow of a Dalit is enough to pollute a Brahmin (the uppermost caste in the hierarchy). Ambedkar (2013), therefore, argues that the caste system is not merely the division of labor, but also the division of laborers.

Over time, casteism has penetrated other religious groups in India as well (well depicted in a 2007 documentary titled 'India untouched: Stories of a people apart') (Stalin, 2007). The socio-economic status of lower-caste Muslims is not much different from Dalit Bahujans. Post-independence, provisions in the constitution, as well as government policies have sought to remedy the situation. Despite these provisions and policies, a large majority of Dalit Bahujans remain disenfranchised and continue to have access to only menial jobs. It is also striking though not surprising that when it comes to working with waste and sanitation work, a disproportionately large number of Dalit Bahujans are involved. Some go through a severely dehumanizing experience as they are, by birth, bound to carry human excreta from dry toilets and roadsides on their heads, and throw it at a far place for the convenience of the larger village community (mostly upper-castes). Some Dalit sanitation workers are involved in other

forms of manual scavenging. They get down to clear choked sewers without any protective gear, sometimes never to return alive.

Besides this, the rag pickers who are at the forefront of the informal economy around recycling belong to poor communities (mostly Dalit Bahujans and lower-caste Muslims). Millions of them earn a livelihood by collecting waste from streets or dumping sites, sorting it and selling it to the recycling industry. Their socio-economic conditions are such that they are willing to brave the risks involved in handling waste, if it would bring them an income (Doron & Jeffrey, 2018).

The waste workers as well as those who live near the dumping sites live in conditions that pose a high degree of risk to their health and yet are discriminated against by the other sections of society. Rag pickers and sanitation workers are also prone to accidents and injuries during work. They suffer a much greater impact than those who detach themselves from the waste chain after disposing of their waste in designated bins. The sociologist David Pellow notes,

> Although all human beings contribute to the waste stream, we rarely share the burden of managing garbage and pollution equally. Moreover, in most parts of the world, those social groups that consume the most natural resources (environmental "goods") and create most of the waste and pollution are the least likely to have to live or work near the facilities that manage those environmental "bads" (2004, p. 1).

The unequal exposure to pollution, toxics, health risks and occupational hazards that the Dalit Bahujans and lower-caste Muslims of the M(East) ward confront everyday as part of their job is similar to the experiences of people of color in the Global North who bear the brunt of the treadmill of production or what has been recognized by scholars as a manifestation of 'environmental racism' (Pellow, 2004, p. 8).

4.2.2 The elephant in the room: the political economy of consumption

There is no dearth of explanations for who is responsible for aggravating the waste problem. While Marxist scholars such as John Bellamy Foster and Stefan Engel locate the roots of the growing problem of waste management in the technoscientific model of development, profit-oriented capitalist economy, and the resultant consumerist tendencies prevailing in society, many others like Paul Ehrlich and Arne Naess argue that overpopulation and people's attitude

toward the environment is the root cause of the problem (Haydock & Srivastava, 2019). Describing overpopulation as the primary reason for the waste problem is to ignore the disproportionate, excessive consumption patterns of the elite class. In a country where most people barely have a livelihood, it is important to stop blaming individuals for their changing lifestyles and their attitudes towards the environment and consumption. Although consumption practices need to be questioned, there is also a limit to how much individuals are to be blamed for their actions when consumer goods are designed by companies to have a short shelf-life (planned obsolescence), and consumers are made to believe that their goods are no longer in vogue (perceived obsolescence) (Fox & Leonard, 2007). Repair and reuse have also ceased to become attractive practices in the fast-paced economy.

4.3 Prior studies on waste education

With consumerism and wastefulness being a major part of today's lifestyle, waste management has become a pressing problem for most countries. However, it is surprising that waste remains an under-explored area in educational research. The reason for the paucity of research on waste education, I speculate, is possibly because it is still perceived as a problem of the developing countries.

A review of the empirical work done in this field reveals that a large proportion of studies have employed quantitative methods to explore primary school children's understanding of municipal waste processing (Glažar, Vrtačnik & Bačnik 1998), middle graders' understanding of hazardous waste (Malandrakis, 2008), 15-year-old students' preconceptions about urban environmental problems and solid waste (Membiela, Nogueiras and Suárez 1993), high school students' attitudes toward recycling (Ugulu, 2015), and secondary students' understanding and practices related to waste management (Ifegbesan, 2010).

Very few studies have employed qualitative methods in this field of research. Some notable studies include Palmer (1995), who used semi-structured interviews and discussion methodology to explore young children's understanding of the management of waste materials. Sedawi, Assaraf & Cwikel (2014) used semi-structured interviews and observations to explore how 9-10 years old children from indigenous communities in Israel perceive waste and its impact on environment. Koos Kortland conducted a case study in Netherlands to investigate middle graders' decision making abilities regarding household packaging waste

(Kortland, 1996) and their perception of waste (Kortland, 1997). The findings of the latter study point out that "the students' perception of the environmental effects of dumping and burning waste is limited to pollution of air, water and soil", while the "depletion of raw materials is never or rarely mentioned" (Kortland, 1997, p. 68). He also reports some conceptual areas where students face problems. For instance,

- The distinction between renewable and non-renewable raw materials, where students might see recyclability as a criterion for renewability

- The distinction between recyclable and non-recyclable materials, where students might see separate waste collection or biodegradability as a criterion for recyclability

- The distinction between reusing and recycling (for which there is only one word in Dutch), where students might base their idea about the possibility for reuse of a package on the recyclability of the material

- The recognition of the limitations of reusing/recycling: the difficulty of recycling laminated materials and waste separation after dumping, and the impossibility of a fully closed cycle of packages and/or packing materials. (p. 68)

Most of the empirical work available in the area focuses on the interplay of knowledge, values and attitudes. Social, political and economic contexts of waste remain largely unexplored in educational research. As an exception, Cinquetti & Carvalho (2007) analyzed images, didactic resources, discussions, participative lectures and simulations to explore Brazilian elementary teachers' content knowledge regarding solid waste, their values and their political participation in environmental matters. Their findings indicate that challenging the prevalence of anthropocentric and utilitarian approaches remains one of the major concerns in environmental education especially in the context of teaching and learning about solid waste. To encourage political participation, they argue that the "negative connotation attributed to utopia" regarding environment must be challenged (p. 575) and that alternative content and didactic procedures should be developed which can "help people to reflect on consumerism, particularly from the perspective of environmental sustainability and social equity" (p. 576).

From a social and environmental justice perspective, it is important to understand the ideological underpinnings of the discourse on waste in order to develop a critique and design an intervention. However, the review of literature in waste education suggests that such an analysis of the discourse still remains an unexplored area in science / environment education

literature. This study aims to fill this gap by critically examining the discourse on waste in the context of science and environment education from a justice framework. In order to understand the nature of discourse and the underlying ideological commitment, I analyzed the textbook chapter on waste, observed classroom practices of a few teachers when they taught this topic in their respective classes, and interviewed those teachers when they were done with their teaching. Focus group discussions were conducted with the students in three out-of-school settings to elicit their lived experiences and everyday knowledge.

4.4 Educational discourse on waste

The topic of waste management is discussed in the Grade 9 science textbook of the Maharashtra state board (henceforth referred to as MH science textbook) that was published in 2010, and reprinted in 2014. The textbook declares that it is aligned with the principles and themes suggested in the NCF (2005), and aims to inculcate analytical skills, creative thinking and problem solving skills among students (Foreword, MH science textbook). Out of the 17 chapters in the textbook, two chapters are related to the environment, of which the chapter on waste management is the last. The chapter is ten pages long (p. 216-225) in a book of size 225 pages. Titled 'Solid waste: ecofriendly management', the chapter is divided into six sections: (1) Solid waste management, (2) Classification of solid waste, (3) Effects of improper management of solid waste, (4) E-waste, (5) Stages of proper solid waste management, and (6) Role of an individual in the management of solid waste. While the objectives of the chapters are not explicitly mentioned in the textbook, they can be inferred from the sections around which the chapters are organized.

There are seven activities in total that expect students to – a) name materials that they put in garbage bins on an everyday basis, b) talk to a mobile shop owner and inquire about disposal of irrepairable mobiles, c) ask their mothers about segregation practices in their respective households and how that waste is disposed off, d) observe and classify the waste collected in their schools, e) question their own consumption of rough papers and plastic bags, think of ways to mitigate their consumption, f) talk to a waste collector about the precautions needed to be taken while collecting waste from door to door, and g) make a compost of their own. A critical analysis of the chapter is essential as the textbook is the only material available to most school-going students in India and, to a large extent, delimits what gets discussed in a class.

I have analyzed the educational discourse on waste from the standpoint of the M(East) ward students and the analysis is presented below under three broad themes. First, I explore how waste is defined in the educational discourse and what reasons are provided for the large scale generation of waste, its accumulation and improper management (henceforth, referred to as the 'waste problem'). This is followed by the analysis of what effects of waste on the natural environment and human life are emphasized. Finally, I discuss what measures are suggested to overcome the problem.

For each theme, I primarily draw upon the Grade 9 science textbook that is followed by the schools affiliated with the state board and the teachers' discussion of waste and its management in their classrooms. Further, to problematize the educational discourse, I also bring in data from my out-of-school interactions with teachers and students in the community, and my interactions with two groups of rag pickers, one scrap dealer, and an engineer associated with a private firm that deals with renewable fuels. Interactions with teachers were semistructured in nature in which we asked them to deliberate on the chapter on waste and clarify their pedagogical approach. They were further probed on their views regarding the nature of waste, the risks associated with waste handling, the political economy of waste, the reasons behind the accumulation of waste at the Deonar dumping site, and various techniques of waste management, policies, and government schemes regarding waste management.

The "text" analyzed as part of the study constitutes the textbook chapter on waste and the transcripts of the classroom recordings, interviews of teachers and other participants, as well as interactions with students. My attempt of an 'oppositional' reading of the text would become evident in my presentation of the results where I juxtapose the discourse on waste in the textbook and classroom against the living and working conditions of sanitation workers, rag pickers, and people living in the vicinity of the Deonar dumping ground. In the sections that follow, I present my analysis of the educational discourse on waste, and while doing so, I point out gaps between the school science discourse and students' life worlds and indicate possibilities for transformative science and environment education. In other words, my analysis blends "what is" with "what could be."

4.4.1 Understanding waste

'Unwanted discarded material' or 'valuable resource'

Mary Douglas defines waste or dirt as 'matter out of place'. She maintains that "there is no such thing as absolute dirt: it exists in the eye of the beholder" (Douglas, 2003, p. 2). In a Marxist framework, a commodity becomes waste when it loses its use-value (Horton, 1997). O'Brien (1999) contends that waste is often treated as "a depletion, dissipation or loss of value – generally as a by-product of greed, inefficiency or distorted economic relations" (p. 269). He argues that the process of commodities turning into waste is not about the loss of value of a commodity rather a "regulated exchange of value between objects" (p. 271).

In the MH science textbook, waste is defined as "any unwanted discarded material created by human beings" (p. 216). While the textbook rightly acknowledges that waste of any kind is a creation of human societies, its reading of it being 'unwanted discarded material' seems limited, as an unwanted item for an individual could be of possible use to someone else, the idea implicit in the notion of 'value-conversion' put forth by Martin O'Brien. In a community like the M(East) ward, where thousands of rag pickers collect waste from the dumping ground day and night, and sell it to the local scrap dealers where it is sorted, cleaned and transported to recycling industries, value-conversion is an idea that students in the community are familiar with at an early age. For instance, even though the students, in an out-of-school conversation, did not manifest much understanding of materials in terms of scientific categories (i.e., metals, non-metals, and alloys), or the physical and chemical properties of various materials, they demonstrated a sound understanding of materials economy by proactively sharing information on the recycling process as well as the recycle value of different materials.

Discussion on recycling process

> Himanshu: What happens to the items that are sold to the local scrap dealers?
>
> Tahir: That is melted and its shape is changed.
>
> Gulshan: Local scrap dealers sell it to bigger scrap dealers who do one more round of sorting.
>
> Zeena: From small shops, the material goes to big shops and from there, it goes to companies where it is melted and comes back to us in the form of new items.

Discussion on recycle value

Tahir: Different kinds of iron are sold at different rates. 20 rupees (per kg) is also the rate and 26 rupees (per kg) is also the rate.

Gulshan: Books are sold at 8-10 rupees (per kg).

Sadaf: Book covers (made of cardboard) are sold at the rate of 1 rupee (per kg).

Himanshu: So, which is the most costly material (in terms of recycle value)?

Zeena: Copper. It's sold at (the rate of) 300-400 rupees (per kg). Zinc is also close to copper but at a little less price.

Tahir: Just 100-150 rupees less than copper.

Himanshu: And, at what price is German (Silver) sold?

Gulshan: 120 rupees (per kg). Brass will be 200 rupees (per kg).

Tahir (corrects Gulshan): Brass is 260 rupees (per kg).

Himanshu: And, steel?

Karim: 180 rupees (per kg).

Saahir: No, it's just 30 rupees (per kg).

Gulshan: It's definitely not 180 rupees. It will be 60 rupees or so. If you are talking about copper, then I can understand but steel's price is not that much.

Himanshu: What about plastic?

Zeena: Different plastics are sold at different prices. 12 rupees (per kg), 8 rupees (per kg).

Gulshan: 5 rupees (per kg). The plastic used in chairs is sold at a higher price.

Sadaf: Women selling garlic purchase the low-grade plastic and give some garlic in return.

Gulshan: Those women purchase anything ranging from plastic and iron to german.

Sadaf: But low-grade plastic goes to them only. Scrap dealers don't buy that plastic.

These values are close to the recycle values provided by the two groups of rag pickers. In an informal conversation, a rag picker in the Mankhurd area shared that different kinds of plastic have different rates. On average, it is sold at the rate of 12/- kg, of which black plastic (already recycled) is the cheapest and is sold only at the rate of 7/- kg. Other recycle values were as follows - Copper 350/- kg, Brass 250/- kg, German Silver 100/- per kg, bottle caps 50/- kg, iron items 15/- kg, steel items 30/- kg, glass bottles 2.50/- kg, and card boards 7/- kg.

Moreover, as discussed earlier, the city's waste dumped at the Deonar dumping ground is a source of livelihood for thousands of people who are part of the formal or informal recycling chain. As the rag pickers collect recyclable waste, they also retain items which they find useful for themselves, thus begging the question of whether things can ever become 'unwanted discarded material' in absolute terms. In the classrooms, however, all the participant teachers reiterated the textbook definition.

Elsewhere in the chapter, the textbook also espouses the idea of waste as a valuable resource if managed properly. The value of waste, according to this definition lies in the materials and energy that can be recovered from waste by making use of "appropriate processing technology" (MH science textbook, p. 221). It is mentioned that industrial waste can be used to recover materials, biomedical waste can be incinerated to produce energy and biodegradable waste can be processed in an anaerobic environment to form biogas. Here again, a limited notion of value is invoked, that would have less relevance to the context of the M(East) ward.

Among all the teachers, only Ms. Abida and Mr. Jignesh spent a significant amount of time discussing material and energy recovery in their respective classes. In order to explain the intrinsic value of waste, both discussed the role of biogas plants in producing electricity and generating biogas as well as the process of incineration to produce ash and energy. It is striking that neither of them made any reference to an incinerator located in the immediate vicinity of their schools which spews white smoke day and night. Thus, even though both the teachers seemed invested in the topic of material and energy recovery, they did not engage critically with the content. For instance, the risks associated with the incinerators were not part of the discussion.

In another instance, Mr. Jignesh explained how industries were handling their waste responsibly because of government stipulations which forbade industries from throwing their waste anywhere. While he seemed to emphasize the environmental responsibility of the waste processing companies, a student in his class got curious about whether the government would pay the companies to process their waste. We could situate the question in the context of the students' lived experiences. Most of the students come from communities engaged in waste processing, where waste is seen as an economically valuable resource. So, in this context, the student appears to be evaluating the question of responsible waste processing from the point of view of economics, not ethics.

Mr. Jignesh responded to the student by saying that there are specific industries which earn money by processing waste and making new products. While the point he made about specific industries making waste processing a lucrative business is valid, this could also have been an appropriate juncture to discuss why the government is outsourcing waste processing to the private sector and how privatization would affect the livelihoods of rag pickers, small recyclers and scrap dealers. Private companies collecting and processing waste have threatened the livelihoods of millions of people (Demaria & Schindler, 2016). Since the private lobby's sole interest in this business is to make profits, they would require the large-scale generation of waste. This small episode from Mr. Jignesh's class also shows that opportunities to have a dialogue with students on political economy questions such as why government is withdrawing from providing essential services and pushing privatization, do arise even in science classsrooms and critical science educators committed to the cause of social and environmental justice must not let these opportunities slip away.   .

Dry and wet waste

The taxonomic categories used to describe an entity also structure the way we think about it. In the scientific literature, waste is usually classified based on two distinct criteria – a) biodegradability, and b) source. Both these criteria are discussed in the MH science textbook chapter with examples. Using the biodegradability criterion, waste is categorized as biodegradable waste and non-biodegradable waste. Even though this is a scientific categorization, the categories popular in public discourse are 'dry' and 'wet' waste. The government programs also use the latter categories to encourage citizens to segregate household waste. It is important for people to learn more about it so that they could segregate

their waste and indirectly contribute to the reduction of waste at landfill sites. Probably that is why the textbook too has a mention of these categories. The irony, however, for the students of the M(East) ward is that the city's waste that is dumped at the Deonar dumping ground is mixed in nature. Mounds of garbage have been rotting there for years while in school the students are taught lessons on waste segregation. One can only imagine how distant a textbook activity that encourages them to observe and categorize the waste deposited in the garbage bin of their classroom must be.

My experience of working with the M(East) ward students suggests that the dry and wet waste categorization causes confusion among students as the two categories are colloquially used to distinguish things that soak water or absorb moisture, and things that do not soak water. In my out-of-school interactions with the students from the community, I noted that the students tend to categorize things differently.

> Himanshu: What do you understand by dry waste and wet waste?
>
> Rizwana: Wet waste becomes wet when it comes in contact with water.
>
> Zeena: If wet waste is mixed with dry waste, everything would become wet.
>
> Himanshu: If I have a pen with me and if I dip it in a water mug, which bin would you then put it in – dry waste or wet waste?
>
> Many students speak simultaneously: Wet waste
>
> ……
>
> Himanshu: Where would you put a dry piece of soap?
>
> Many students speak simultaneously: Wet waste
>
> Himanshu (repeats): Dry piece of soap!
>
> Students also repeat their answer (with equal conviction): Wet waste
>
> Sadaf: Dry waste
>
> Sameer: Dry piece of soap will go in dry waste only, na !
>
> Karim: Soap will go to the dry bin only.
>
> [Day 5, Workshop III transcript]

Even though the classification of waste in terms of 'dry' and 'wet' waste categories is useful for segregation purposes, I find that the everyday meaning of the terms is so deep rooted that it causes confusion not only among students but also among teachers. For instance, Mr. Sahil once told his class, "When the dry waste gets mixed with wet waste, it becomes wet waste too" [Classroom observation notes]. He also confidently reiterated the point in his interview. Another teacher, Mr. Jignesh, confused dry waste with recyclable waste and categorized paper as dry waste. The teachers also seemed to hold alternative conceptions of solid waste. Ms. Rubina, for instance, seemed to believe that solid waste is the waste that is rigid in nature which has been recognized as a known 'misconception' among people of various age groups (Stavy & Stachel, 1985).

Locating the roots of the 'waste problem'

Waste is generated at a large scale in all the big Indian cities. In order to communicate the scale of waste generation in the country, the textbook refers to the situation in three major cities in the state of Maharashtra: Mumbai - 5000 tonnes/day, Pune - 1700 tonnes/day and Nagpur - 900 tonnes/day (MH science textbook, p. 216). All the participant teachers used the same examples to establish in their class that waste is getting generated at a vast scale. But where do the textbook and the teachers locate the roots of the problem?

In the science textbook, I note that the only reference to the roots of the problem appears in the beginning of the chapter on waste management where the text reads,

> In human society, solid waste is a serious issue and has a linkage with economic growth, environmental degradation and health hazards; polluting air, water and land result in diseases and destruction of human habitat.

(MH science textbook, p. 216)

In the above statement, solid waste is linked with environmental degradation, health hazards, pollution, diseases and destruction of human habitat along with economic growth. However, except for economic growth, all the other issues mentioned are the effects of improper waste management. It is unlikely that students perceive the nature of the economy as a systemic cause for the waste problem. Rather, they may conclude that hampered economic growth is also an effect of improper waste management.

Since the textbook does not explicitly engage with the question of why waste gets generated at such a high scale, it is not surprising that the participant teachers did not raise the issue in their classrooms. In their interviews, they were invited to share their views on excessive waste generation and improper management of waste.

Mr. Sahil seemed to believe that people's attitudes are at fault. He also believed that overpopulation is a cause for large scale waste generation.

> Himanshu: I think everybody knows that waste needs to be reduced but that doesn't seem happening. Waste is multiplying day by day. Do you agree with me on this?
>
> Mr. Sahil: Yes, I agree. And you know why this is happening because people don't think about it. Suppose somebody thinks about it, then the question comes why should only I be concerned. What will change if I am alone trying to do this? That is why people do not take any step. This is the situation and the amount of waste is aggravating. As the population increases, the amount of waste generated will automatically increase.
>
> [Interview transcript, Mr. Sahil]

The Malthusian notion that links overpopulation and demographic behavior with excessive consumption and environmental degradation is widely entrenched in Indian textbooks (Sama, 2015) and seemed to be held by teachers as well. Ms. Abida also opined that people's behavioral practices and the lack of political will play a major role in the accumulation of waste. For instance, see the excerpt below:

> Himanshu: Everybody talks about Reduce, Reuse and Recycle but the amount of waste is not getting reduced. It's increasing day by day.
>
> Ms. Abida: That is because people don't care.
>
> Himanshu: But why? People know about these things but still they are not following them. What do you think?
>
> Ms. Abida: Because there is *no pressure on people for anything*. If the government puts a ban on polythene, then it will not be in use. If there is some pressure on people, then they will follow these practices. We get encouraged if shops offer carry bags. It helps to sort out things!
>
> [Interview transcript, Ms. Abida, emphasis added]

Mr. Jignesh explained the improper waste management situation in terms of inadequate government regulations and lack of awareness among people. However, unlike Ms. Abida, he seemed to believe that the government has a responsibility in educating and providing the means for people to manage waste.

> Mr. Jignesh: It's a mindset problem across the country… It has to be a mix of strong policy implemented with like... *how you are able to ensure compliance versus increasing awareness and then providing the means for people to solve it*. So as a government if we are unable to do all three, it is [inaudible]. If you raise awareness but if you don't provide them the means to dump or process waste, then it is not going to happen.
>
> [Interview transcript, Mr. Jignesh, emphasis added]

Thus, neither the textbook nor the teachers located the problems of waste in the political economy. Mostly, they attributed the cause of the waste problem to individual carelessness or lack of political will and mismanagement. In the out-of-school conversations, students were also engaged in a conversation around the causes behind the aggravating problem of waste:

> Himanshu: Do you think people don't know where they should dispose of their waste?
>
> Many students speak simultaneously: Everyone knows.
>
> Tahir: But people are lazy, they don't want to step out and throw their waste responsibly.
>
> Karim: In Rafiq Nagar, people throw their waste in the gutter. The dustbins are there, but still...
>
> Himanshu: Why do they do that?
>
> Karim: *Kaahiliyat* (Laziness), what else? The gutter is right behind their homes. So they open their doors and throw their waste into the gutter.
>
> Gulshan: The government is also responsible for maintaining cleanliness. If garbage is not removed, diseases will spread.
>
> Karim: Garbage removal happens everyday. What else do you want? Whatever be the case, Govandi cannot become Bandra. [Govandi is an area within the M(East) ward which includes the neighbourhood near the dumping ground and hosts numerous slums, while Bandra is a posh locality in Mumbai]
>
> Gulbano: Govandi is very filthy, sir. Bandra is clean.

Gulshan: There is no comparison between Govandi and Bandra.

Himanshu: Can Govandi be made as clean as Bandra?

Zeena: If the government wants it that way, it can be done.

Gulbano: People here (Govandi) do not care for cleanliness. They spit and litter anywhere they want to.

Zareena: The dumping site is also located here.

Himanshu: So why do you think the dumping is done here, and not anywhere else?

Zeena: Lots of poor people live here, that's why!… Where there are buildings, there will be cleanliness. And, where there are slums, there will be filth.

[Day 4, Workshop III transcript]

From the conversation with the students, it is evident that students made associations between the cleanliness of the neighborhoods and the class of the people inhabiting them. Students notice that localities such as Bandra, which is home to posh, multi-storeyed apartment complexes, are much cleaner than the shabby neighborhoods in the M(East) Ward. It is also interesting that most students, contrary to some of the teachers, did not seem to think that this is due to lack of awareness on the part of the people living in these localities. While some students attribute the reason to laziness and specific habits of people, others attributed it to the absence of political will. This conversation highlights the necessity of discussing the root causes underlying the waste crisis with the students. The students need to be provided alternative perspectives that would help them make the linkages between the political economy, waste and governance. Otherwise, they would continue to harbor the belief that their community is at fault and is responsible for the crisis.

4.4.2 Impacts of waste on human life and natural environment

The second theme that I discuss in the chapter is what effects of waste are emphasized in the educational discourse. As discussed earlier, improper waste management adversely affects human life as well as the natural environment. Here, I engage in a critical reading of the educational discourse on the impacts of waste.

In a section titled 'Effects of improper management of solid waste' in the textbook chapter, six adverse effects of improper waste management are mentioned, in the following order - the loss of beauty, highly odorous / bad smell, release of toxic gases, spread of diseases, environmental pollution and the adverse effect on bird diversity. It is striking that the aesthetic effects (loss of beauty and foul smell) are prioritized over other effects on living beings and the natural environment. In the discussion that follows, the chapter mentions that an obnoxious smell emanates from decomposing waste. For people dwelling close to the Deonar dumping ground, the stench emanating from open drains which exacerbates in the rainy season is an everyday reality. However, there is no discussion of what the implication of this foul odour is in terms of its impact on long term health and well being and quality of life. Similarly, in the discussion on release of toxic gases, the chemical formulae of the gases that are produced (Hydrogen Sulphide, Methane and Carbon dioxide) are provided, probably to make the discussion look scientific. However, questions such as what kind of waste is more likely to produce a particular gas, under what conditions these gases are produced, why these gases are harmful to human health, and how to detect the presence of these gases, which may also be considered as 'scientific' information, were absent in the textbook and classroom discourse. Such information, in my opinion, may help the survival of those who are involved in rag picking at landfill sites, and those who get down to clean choked sewers and septic tanks.

The textbook also discusses the effect of improper waste management on human health-

> Dumping of solid waste invites various diseases. The common diseases observed around solid waste disposal areas are typhoid, bacillary dysentry, amoebic dysentry, diarrhoea, cholera, etc. Open dumping of solid waste creates unhygienic environmental conditions, and directly affects public health. Along with mosquitoes, flies and rodents are very common in and around the dump yards.

> (MH science textbook, p. 218)

As discussed before, common ailments in the M(East) ward include diseases such as tuberculosis, diabetes, respiratory problems, and reproductive health issues. The life expectancy in the M(East) ward is a mere 39.4 years and the child and maternal mortality rates are much higher than the other wards (TISS, 2015). Can these abysmal health indicators and the proximity to the landfill be a mere coincidence? The dependency on the city's waste

for livelihood has ensnared the people of the M(East) ward in a vicious cycle of poverty leading to the lack of nutrition, access to clean air and water, and unhygienic conditions. Inadequate public health infrastructure also exacerbates the poor health conditions of the community.

The health problems of people who handle the filthiest forms of waste (handling carcasses, human excreta, or cleaning sewers) would be of a different order. Sanitation workers are known to engage in excessive consumption of alcohol as it helps to block out the stench of sewers. This leads to the gradual deterioration of their health. Deaths due to asphyxiation while cleaning the oxygen-starved blocked gutters are also frequent (Wilson & Singh, 2016). Other common afflictions that plague rag pickers are wounds caused by broken glass pieces or sharp metallic objects and skin infections caused by the handling of used sanitary napkins and medical waste with bare hands. While it may not be practically possible for a textbook chapter catering to the entire state of Maharashtra to address the specific problems and issues of people living close to a landfill in Mumbai, there could be ways in which the textbook could invite a discussion of the local context through questions or activities. Such references to the local context do not exist in the textbook.

The threats posed by the rising mountains of garbage to non-human species are also neglected by the textbook. The effect of improper waste management on bird diversity, for instance, is just given a passing reference without any discussion of the importance of bird diversity and ways by which improper waste management threatens birds' existence.

The classroom discussions on the effects of improper waste management followed the same order in which various effects have been discussed in the textbook chapter. While four out of five teachers discussed the effects in brief, Ms. Abida spent a considerable amount of time discussing the effects and connecting it with the students' everyday experience.

To begin the discussion, Ms. Abida posed a question to her students, "What could be the effects of improper waste management?" but as is often the case with teachers engaging in traditional science teaching, did not wait for their responses. The six effects were discussed one after the other. The following is an excerpt from her classroom that illustrates the nature of discussion that happened on the loss of beauty and foul smell:

> Ms. Abida: Number 1 - Loss of beauty. What if a lot of waste is dumped in your class, would you like it?

Class (in chorus): No

Ms. Abida: Would you be able to sit here?

Class (in chorus): No

Ms. Abida: Instead if some fragrance is spread here, would you like it?

Class (in chorus): Yes

[Referred to the dumping ground right next to the school and asked students]

Ms. Abida: How would it look if there would be green grass everywhere on this hill?

Class (in chorus): Very nice

Ms. Abida: But if there is dirt everywhere, will you like it?

Class (in chorus): No

Ms. Abida: Will we be able to go there?

Class (in chorus): No

Ms. Abida: If it becomes clean and green, then we may also go there. It will feel pleasant. So the first point is the loss of beauty.

….

Ms. Abida: Second point is the foul smell. There is no need to tell you that foul smell comes from waste. Do we like it?

Class (in chorus): No

Ms. Abida: Can we live there?

Class (in chorus): No

[Classroom transcript, Ms. Abida's class]

The landfill, with all its 'loss of beauty' and 'foul odour' is also a site of recreation for children and adults in the community. The aesthetic that appears to be communicated by the textbook and the teacher is a middle class one, where the landfill is othered as a site of degradation, uninhabitable and bereft of any beauty. This probably has to do with the fact that

the teacher does not belong to the same community as the students. In her interview, she mentioned how it took her awhile to get used to the foul smell from the landfill:

> Himanshu: Since the dumping ground is so close to your school, do you see any problem with that?
>
> Ms. Abida: Yes. Whenever it is hot outside, a foul smell starts coming from the drain that flows there. This smell is... [facial expression suggesting disgust]. Now we are sort of used to it but in the beginning, I used to get headache and nausea…
>
> [Interview transcript, Ms. Abida]

In contrast to Ms. Abida, who tried to contextualize the content but tightly regulated the discussion, Mr. Jignesh began the discussion by asking students to reflect on their everyday reality. He asked the class, "What problems do you observe in Shivaji Nagar (the locality in which the school is situated and where most students belong) because of the waste that comes to the dumping ground?" to which one girl student responded by saying that diseases like malaria and dengue are common in their locality. Some other responses that came from students included cancer and tuberculosis as well. While Mr. Jignesh clarified that cancer is not related to waste, he did not explain how other diseases are related to waste, or probe the students further.

There were also gaps in the teachers' conceptual knowledge of some of the infectious diseases prevalent in the area. For instance, Mr. Sahil mentioned in his interview, "If they (students) are taught in the chapter that littering leads to birth of mosquitoes, these mosquitoes go to your food and can cause malaria to you, they (students) would be able to appreciate the connection". Diseases like malaria and dengue are prevalent in places where there are still water bodies where mosquitoes breed. Ms. Rubina too mentioned malaria and dengue in her class while discussing the effects of improper SWM on health but did not explain the connection between these diseases and the rotting of waste. These gaps in the teachers' knowledge are a matter of concern because these are diseases that seriously affect the health of the community of the M(East) ward.

In addition to mentioning the various health issues people in the community faced because of the fire, Mr. Jignesh, in his interview, expressed his concerns regarding the dumping of chemical and biomedical waste at the Deonar dumping ground which results in soil pollution. He mentioned air and water pollution as two inevitable outcomes of landfilling. He also

seemed concerned about the social health of the community that lives close to the dumping ground. For instance, he discussed substance abuse among the adolescents in the community, the easy access to and rampant consumption of pornography among boys, and sexual harassment of girls in public spaces. This shows that he held a broader perspective which exceeded what is presented in the textbook.

The out-of-school interactions with students on aspects of health and its connection with waste reveal that the M(East) ward students have an implicit understanding of various dimensions of health (personal, mental, and social). However, they lacked adequate technical knowledge of various diseases in terms of their causes and remedies. Students' written responses on a worksheet that explored their understanding of common diseases, their symptoms, and practices of cure in the community unveil that students' understandings are not bound by the rigid scientific framework (Srivastava, Khan & Raveendran, 2018). For instance, Tahir identified alcohol consumption, drug abuse, and tobacco consumption as the "diseases" common in the community. While talking about genetic diseases (diseases that might get transferred from parents to their children), he expressed that "an uncivilized family environment where verbal abuses are common" is also transmitted from parents to children. Several participants mentioned home remedies for common cold, vomiting, body ache, and watery eyes when discussing cures and remedies. However, for some other symptoms like blood in sputum or loose motions, they were sure about consulting a doctor immediately. The students also brought into their discussions references to alternative medical practices in the community, including prayer, black magic, and home remedies. Most students shared that they do not rely solely on medicines and believed that prayer (duā) plays a vital role in treatment.

When presented with contextually-relevant vignettes (see Appendix XI), students demonstrated a sound understanding of the obvious as well as subtle connections between health and poverty. While on the one hand, they recognized that one's economic condition constrains one's access to health care facilities, they also pointed out during the discussion how their economic class limits their access to quality food, clean water, proper sunlight, proper sleep and causes stress at various levels. In the follow-up discussion, they manifested clarity in understanding how nutrition, hygiene, and adequate health care facilities are essential for health. Access to clean water, sunlight, proper sleep, sufficient and nutritious

food, and a stress-free work environment were, therefore, some other factors that the students mentioned as determinants of health.

The students were further asked to estimate the average life expectancy of the people in the M(East) ward and compare that with that of the more privileged areas in the city. It was striking to observe that all the students initially thought that the people of the M(East) ward would have a larger average life expectancy. They believed that since people in the M(East) ward live in unhygienic conditions, they develop greater immunity and are generally more sturdy. Once the government data on the average life expectancy was revealed to them, they immediately made connections between the lower life expectancy in the ward with the incinerator's presence in the middle of the community and low hygiene standards in the locality. On the question of who is responsible for one's health, several students pointed out the role of self, parents, extended family members, and doctors in ensuring health. Mohsin mentioned the government's role in maintaining public hygiene and argued that the government is also accountable for public health.

4.4.3 Overcoming the waste problem

Measures needed to address the waste problem is another theme that I discuss in the chapter. There are three stages of waste management that are discussed in the textbook chapter: waste segregation, its handling and transportation, and waste processing. In the section below, I present my analysis of how each of these stages are discussed in the educational discourse from the standpoint of the students of the M(East) ward.

Segregation, handling and transportation

For effective management, it is important that waste is segregated at its source. The municipal corporation of Mumbai encourages citizens to keep separate bins at their homes and segregate dry and wet waste. The corporation has placed plastic containers in street corners in the city and made arrangements to empty the containers on a regular basis. It has also instructed citizens to take care of their wet waste themselves at the local level while corporation-owned waste collection vehicles collect the dry waste. However, the door-to-door waste collection mechanism serves only the middle and the elite class of the society. In crowded localities like the slums of the M(East) ward, the people dispose of the unsegregated waste in the government-owned bins because they cannot afford to have bins in their homes to segregate

waste. Therefore, they merely collect their unsegregated waste in easily available recycled low-grade plastic bags and discard them near the corporation containers. Since the waste lies around unattended in slum areas, it invites stray dogs, cows and other animals which tear them apart when foraging for food. People living close to open drains throw their waste directly into the drains causing them to clog.

In addition to the waste collection system of municipal corporations, thousands of self-employed rag pickers and scrap dealers are an integral part of the waste chain. In Mumbai, the rag pickers begin their day early in the morning collecting recyclable waste from roadsides or directly from waste containers. Eventually, they find a place to sort the day's collection and sell it to local scrap dealers at a nominal price, from where it is transported to big recycling companies after another round of cleaning and sorting.

In my interactions with various waste workers, I figured that there is also a hierarchy between rag pickers who collect waste from the streets, from the dumping ground and the scrap dealers who collect waste from the rag pickers or directly from households. Scrap dealers, who collect waste items such as papers, plastic, glass bottles, and e-waste items directly from households and do not 'dirty' their hands, are in a better off socioeconomic situation. They also do not associate themselves with the rest of the waste workers, as was clarified by one of the scrap dealers (Mrs. Jain) whom I interviewed as part of the study. Mrs. Jain believed that she was doing 'business' and not handling 'dirty stuff'.

The conversations with rag pickers revealed that most of them had been in the business for one or two generations, and yet they continued to face similar problems as their elders faced. For instance, the rag pickers do not have a proper place to sort the waste they collect during the day. Their work is not 'valued' in society even if it involves hard work. Local people often mistreat them, and municipal corporations do not recognize them as sanitation workers. A rag picker who starts her/his day early morning earns 800-900/- rupees on an average day. On better days, a young rag picker earns about 1000-1100/- rupees, while old rag pickers can earn only 500-600/- rupees per day. The two rag picker groups I interacted with over a few days seemed to have adequate knowledge of the recycling process and recycling values of different materials but did not know how these values are decided and what technologies are involved in processing materials.

The textbook chapter emphasizes that segregation is the key to waste management and that dry and wet waste should not be mixed together. Students are encouraged to 'talk to their mothers' and inquire if the waste is segregated in their homes before disposal. However, as argued earlier, the categories of dry and wet waste are confusing. Furthermore, the gender stereotype of mothers being accountable for waste management in the home is reinforced. There is an exercise in the textbook which encourages students to find out from rag pickers how much waste they collect every day and reflect on the precautions that they need to take while collecting the waste but this activity was not taken up for discussion by any participant teacher. In fact, although several activities were suggested in the textbook (see p. 100), none of these were actually taken up in the classroom.

While teaching, Ms. Rubina invited her students to recall that the municipal corporation had distributed two buckets to each house in their locality, Ms. Abida showed her students pictures of various color-coded bins downloaded from the Internet which had no connection with students' everyday experiences of waste collection. Mr. Jignesh, on the other hand, made an important point in his class that segregation of waste is a joint responsibility of citizens and the government. He asked his students, "What if the government or municipality doesn't collect waste separately? Will it help if you segregate at home but the government doesn't do it?" This is consistent with his view that both the government and people are responsible for waste management. Thus, the textbook and classroom discussion on waste segregation, handling and transportation is highly simplified and limited, thereby misrepresenting the complexity involved in the reality of waste management in the city.

Waste processing

About half the MH science textbook chapter on waste is dedicated to the techniques involved in processing solid waste. The chapter foregrounds the problem of waste as a case of mismanagement and focuses only on scientific methods of waste management rather looking for systemic roots of the problem and exploring systemic solutions. Such an approach can be characterized as a techno-managerial approach towards the problem of waste. Two kinds of processing methods are discussed in the textbook – 'common' methods and 'scientific' methods. While disposal in landfills and the sea are identified as the two common methods of waste management, the textbook chapter discusses composting, vermicomposting, secured landfilling and pyrolysis as 'scientific or eco-friendly' methods of solid waste management. It

is striking how synonymity is established between two different words which have little to do with each other. 'Scientific' methods are not necessarily 'eco-friendly'. History has revealed how 'scientific' approaches in areas such as agriculture and forestry have turned out to be harmful to the environment (Carson, 2002). In the Indian context, the green revolution would be one among numerous examples of scientific interventions that have caused widespread ecological destruction (Shiva, 2016).

Disposal in landfills and sea

The two 'common' methods of waste management that are discussed in the textbook are disposal in landfills and the sea. These methods are briefly described and the risks associated with them are mentioned in a cursory manner. For instance, the only paragraph on landfills in the chapter reads,

> Collected solid waste is dumped in an outside area. It is a traditional technique for municipal solid waste disposal and is a very common practice found in many cities of India. A landfill is a system designed and constructed to dispose discarded waste. In this, traditional methods of solid waste disposal are carried out by open dumping and land filling method. However, this method can cause leaching and ground water contamination, if the landfills are not constructed properly.

(MH science textbook, p. 220)

The description above treats the landfill site as an endpoint – a site where waste is dumped. However, for most people of the M(East) ward, it is a vibrant site of social and economic activity, a space where their livelihoods and lives are entangled.

Another problem with open landfills is that the anaerobic decomposition of waste causes methane gas formation, which gets trapped in the pile of garbage. While the uncontrolled methane emission contributes to greenhouse gases in the environment, the trapped methane is also responsible for fire incidents at landfills. Through leachate, toxic substances find their way to the food chain and cause severe diseases like cancer in human beings.

Composting

Composting is the most common technique to deal with organic waste. It can be done at the household level as well as at the community level. Mr. Ramesh, a senior engineer associated

with a private firm that deals with renewable fuels, shared in an informal conversation that "wet organic waste" contains 80-85% water and that this water needs to be evaporated before it could be put to any use. This evaporation of water requires enormous energy and cost, and as a result, only 10% of a city's wet waste is composted, and the rest is dumped in the dumping ground. Also, there is a limit to how much compost can be utilized locally. The alternative that his firm offers involves crushing the "wet organic waste" and processing it in a bio-digestor, which helps extract Carbon Dioxide, Methane, Hydrogen Sulfide, and other gases. Since methane gas's combustion efficiency is higher than biogas, the methane produced in the process is collected separately, bottled, and sold to industries as a renewable fuel. The methane gas is also compressed to make CNG, which can run vehicles and reduce fossil fuels' consumption. Mr. Ramesh also mentioned that lignocellulosic biomass such as leaf litter and tree cuttings are difficult to decompose. The industrial solution their firm offers for this kind of "dry organic waste" involves compressing plant dry matter to form briquettes, which works like "green coal" and can be easily fed to boilers and furnaces in industries.

Composting and vermi-composting as techniques of waste management are described in detail in the science textbook and the students are encouraged to set up a compost in their "backyard, garden, terrace or in a small pit" (MH science textbook, p. 222). While making a compost or vermicompost is an important environment-friendly practice, the description of the activity assumes that everyone has a terrace, a backyard, a garden or some sort of open space in their houses. In another instance, avoiding the use of tissue papers is mentioned as a 'good habit' to aid solid waste management. Assuming that every household has a 'backyard', a 'terrace', or 'open space', or access to tissue papers is completely at odds with the lived realities of many students. Such references point to specific assumptions regarding the class of readers the textbook is addressed to.

The discussion on composting and vermi-composting in classrooms, primarily revolved around the teacher providing a detailed description of the textbook procedure of making compost. It is noteworthy that two out of five teachers probably realized that the composting procedure described in the textbook might not make sense to the students coming from that community and took efforts to contextualize it for their students. While Ms. Abida provided the example of her farm and explained how compost is made in villages, Ms. Rubina told her class, "If we have to do it, we can even do it in a carry bag" (Classroom observation notes). Ms. Abida also opined in her interview that the local corporator should make provisions for

every household to have a compost pit inside the house so that the wet waste is processed locally.

In my interactions with students, however, most students seemed unfamiliar with the idea of composting or vermi-composting. For instance, in one of the workshops, a student said that composting is done in rural areas where villagers dig a pit and dump left over food, vegetable peels, cow dung and leaves (Day 8, Workshop III). In urban spaces, not many examples are available for students to gain first hand experience of composting. As composting is gradually catching the attention of the urban middle class and the municipal corporations are encouraging citizens to do composting at local level, it is still a far-fetched reality for slum dwellers. Perhaps the discourse should focus on how to compost at the community level and the official curriculum should suggest practical ways to go about it keeping in mind the lived reality of the urban poor. If composting is done at the community level, it will set a concrete ground for discussing the idea of biodegradability with students and they will be able to appreciate the difference between dry and wet waste.

Secured landfilling

While composting and vermi-composting are presented as the 'scientific' methods of management of wet waste, secured landfilling is presented as the 'best' method of dry waste management. In this regard, the text reads -

> Site selection and suitable location should be 2 kilometers away from water bodies. Site should also be away from human settlements and highways. Site should not come under forest zone or ecological sensitive zones.

(MH science textbook, p. 222)

While making these recommendations, the chapter seems to have completely overlooked the expanding tendencies of Indian cities. Even if a landfill is made in the outskirts of a city, the city would eventually reach there. For instance, the Deonar dumping ground, even though it was not a secured landfill, was set up in 1927. It is now more than 90 years old. In these many years, the city has expanded vertically as well as horizontally. At present, the Deonar landfill is at the edge of a crowded part of the city but the municipal corporation continues to dump waste even after the landfill has completed its lifetime. For the students of the M(East) ward who live in the close vicinity of the landfill, statements such as a landfill "should be" far from

human settlements, highways and water bodies would make no sense as they do not have a choice but to live next to one. In the classrooms, none of the teachers referred to the landfill in the vicinity when reading out the paragraph quoted above. Moreover, nowhere in the discourse, there was a mention of scientific capping of landfills (secured or otherwise) when they cross their lifetime.

Pyrolysis and incineration

The textbook discusses waste-processing industries in a positive light. For instance, while discussing industrial solid waste management, the text reads, "Nowadays industrialists are sending their waste to authorized dealers for scientific handling and disposal. Mostly industrial solid waste is recycled. Dumping is done in a scientific way" (MH science textbook, p. 223). The word 'scientific' is again used here to connote something essentially positive.

In the same vein, heating semi-combustible waste to a high temperature (pyrolysis) is said to be beneficial for obtaining gas and electricity and incineration is discussed as "an industrial combustion process designed to reduce unwanted material to simple solid and gaseous residues" (MH science textbook, p. 223). However, research also shows that several toxic compounds such as dioxins and furans are released in the air when waste is burnt at a high temperature (Central Pollution Control Board, 2004). When discussing the reasons for lower life expectancy in the M(East) ward with students in my out-of-school interactions, students promptly referred to the incinerator located on a highway passing through the residential area, and pointed out that (biomedical) waste from various hospitals is brought there and burnt in high temperature furnaces. They also believed that the incinerator was one of the reasons for lower life expectancy of the ward. This indicates the necessity to discuss the risks associated with such procedures with the students.

The analysis of classroom practices reveals that most participant teachers, except Mr. Jignesh, restricted their teaching to the chapter content. To introduce various SWM techniques, he made his students work in groups and design a SWM plan (a rule book) for a hypothetical city. To further motivate his students, he also announced that the best plan will be presented to the local corporator for consideration. The question he posed in the class, was -

You are part of a team which is designing a solution for solid waste management of a new city. Create the solution with below points: Guidelines (rules) for waste management at home, Solution of waste management by government for the city - How collection of waste will happen, How transportation will be done, Which ideas for processing of waste?

(Classroom observation notes, Text copied from the blackboard)

As soon as the problem was posed, students began sharing their suggestions such as avoiding littering, segregating waste in three different bins (wet waste, plastic and glass) and burning waste. Mr. Jignesh clarified that burning waste would result in toxic gases and therefore, it is not an advisable idea. He, then, asked his students to first read the section on the scientific methods of waste management and discuss the problem in small groups. He attended to all the small group discussions and helped students understand the problem and come up with a solution. Once the students were done with initial brainstorming and had made their points for presentation, Mr. Jignesh discussed the methods given in the textbook one after the other and helped them refine their proposal. However, as time was running out, he could only collect the proposals from students and did not discuss either of them in the class. During an informal post-class conversation, he said that he could not complete the activity to his satisfaction because of the lack of time. Though none of the proposals were presented to the local corporator, such kinds of open-ended activities have enormous generative potential. They promote dialogue among students and help students make connections with their everyday experiences and contexts.

3 R: Reduce, Reuse and Recycle

The final section of the chapter is dedicated to the role of an individual in solid waste management. Reduce, Reuse and Recycle (3 R's) are mentioned in the chapter in a cursory manner as the *mantras* for waste management to be followed at the individual level. Students are asked how often they carry plastic bags for necessities and they are encouraged to reflect on their consumption of plastic bags. It is noteworthy that the textbook talks about 'Reduce' only in the context of paper and plastic carry bag consumption, while consumerism in general is not questioned. Consumerism is important to discuss when teaching waste management because this concept has intimate connections with the manner in which the capitalist economy functions. The notion of 'Reuse' could also be connected to the issue of

consumerism - why do we choose to buy new things when we may repair and reuse? There are also possibilities to engage in creative exercises where students think of innovative ways to reuse items which may seem worn-out. This is also a context to invite rich out-of-school knowledge, since the students come from socio-economic groups that lack purchasing power, whose communities engage in *jugaad* (thrifty innovations using limited resources). In the out-of-school discussions, the students seemed unfamiliar with the textbook definitions of the 3 R's though they had rich knowledge of recycling, as discussed in the previous section.

While discussing 3 R's in the classroom, Mr. Jignesh encouraged students to think of examples from their context. Other teachers used the same examples which are given in the textbook chapter. The teachers also seemed to lack clarity on these ideas. For instance, Ms. Rubina confused 'Reuse' with 'Recycle'. When explaining recycling to her students, she provided the example of old rubber tyres spread on the floor for children to play and old plastic bottles used to make children's toys. In the interviews, the teachers seemed confused about the concept of 'Reduce' - whether it refers to reducing consumption in general, or reducing the waste generated, or reducing consumption of things that produce more waste. There is no elaboration on what materials are recycled and what can not be recycled, what various recycling techniques are, and how one could contribute to efficient recycling. Had there been any discussion on these questions in the classroom, students will perhaps start appreciating the justification for segregating waste and see the logic in practicing in a pro-environmental way.

'Good' habits of waste management

The textbook also provides a list of some good habits of solid waste management. Students are encouraged to avoid littering, look for eco-friendly options to carry things, avoid the use of disposables, and run awareness programs in their schools. Such prescriptive statements without a justification or an analysis of how these practices would make things better, do not empower students in any way. While all the teachers in their classrooms mentioned these habits in passing without any problem, Mr. Sahil's classroom teaching shows how insensitive and alienating these habits and other prescriptive measures could be for the students of the M(East) ward. When Mr. Sahil talked about avoiding littering and asked his students to throw their waste only in the dustbin at their homes, one of the students spontaneously responded, "I don't have a dustbin at my home". Mr. Sahil seemed taken aback and sarcastically remarked,

"You don't have a dustbin at home!" His remark led to a burst of laughter in the class and the discussion ended at that point (Classroom observation notes).

4.5 Discussion

In this chapter, I have attempted an oppositional reading of the educational discourse around waste from the standpoint of the adolescents of the M(East) Ward. This translated to a critical reading of the textbook chapter on waste management and teachers' discussion of this chapter in the classrooms. Wherever appropriate, I have introduced students' voices from the out-of-school interactions as a way to problematize the classroom discourse.

The findings indicate that the textbook and the classroom practices deal with the problem of waste in a techno-managerial manner with a focus on teaching how to *manage* waste through scientific methods. Moreover, overpopulation, mismanagement, lack of political will and people's attitudes are offered as explanations for the aggravating waste problem, while the connections between the generation of waste, consumerism and the nature of economic growth are sidelined by the textbook as well as the teachers in their classroom discourse. These observations resonate with the findings of another study in which the researchers analyzed the presence of underlying environmental philosophies in selected Indian science textbooks and classroom practices, and explored their perspectives on the global environmental crisis (Haydock & Srivastava, 2019). The findings of the present study indicate that discussing the political economy of waste generation with the M(East) ward students may be of significant importance so that students could go beyond explanations that implicate their communities and their behavioral practices for the burgeoning waste problem.

This brings us to another important insight that emerged in my analysis - the class and caste character of the educational discourse around waste. A middle class, upper caste audience is assumed in many of the examples and activities of the textbook. For instance, aesthetic effects of improper waste management are privileged over the impact of waste on people's health and the natural environment, which is consistent with a 'bourgeois environmentalist' standpoint that reflects a "... concern with an ordered environment, that is safe, hygienic, unpolluted, green and uncongested, (which) is in some ways an extension of the concern about bodily well-being" (Baviskar, 2002). As I argue, the pro-environmental behaviors that are promoted by the textbook ranging from waste segregation to composting and reducing specific

consumption practices also assume a middle class audience since it takes for granted the readers' access to resources like a backyard or dustbins to segregate waste or money to spend on consumer goods. When I critically examine the prescribed pro-environmental practices from the standpoint of the students of the M(East) ward, it is striking that their community's immense contribution to easing the environmental burden through their livelihood, not merely personal actions and behaviors, remains unacknowledged. In other words, the people who deal with waste on an everyday basis or live close to landfill sites do not become subjects in or subjects of the textbook, let alone a discussion of their social locations or the caste character of sanitation work. The textbook's approach to waste is, ironically, sanitized.

It is partly the placement of the topic of waste in the science textbook that makes its sanitized and reductive/ techno-managerial treatment possible. The hegemonic discourse that maintains the dichotomy of facts and values makes it possible for powerful interest groups driving the institutions of science and science education to construct boundaries around acceptable political ideologies in the science curriculum (Raveendran & Chunawala, 2015b). Even the choice of science content around waste reveals these tendencies. For instance, the discussion of the highly controversial waste processing industries downplays risks and threats that they pose to local livelihoods and unveils propensities within the discourse to protect corporate interests. That said, discussion of 'risks' incurred by highly polluting industries and health effects does raise ethical dilemmas for educators working with the urban poor in developing countries. For instance, Baviskar (2002) writes-

> The quarry workers, metal workers, glass manufacturers, small-scale dyers and printers and others who make possible the myriad steps of industrial processing are trapped in low wage, hazardous work. Yet cleaning up these industries in many cases requires a move to more capital intensive technologies that would render the poor jobless. How does one reconcile these conflicting concerns? Environmentalists in India need to examine more closely the complicated, and often contradictory, connections between ecology and equity.

In other words, how does the environmental risk discourse serve a student whose community is dependent on 'risky' work? How does one engage in a responsible and productive discussion around risk with students from marginalised communities? It is important for educators to be conscious of what 'science content' is meaningful for the students and what ideological positions drive the selection of the science content.

What then would be relevant 'science content' for children of the community? Let us begin with the scientific categorization of waste into 'dry' and 'wet' categories. As demonstrated in the results, the terminology is itself counter-intuitive to both teachers and students and these categories do not have any relevance unless students understand what biodegradability means. The waste accumulating in the landfill site is also of an unsegregated nature. Educational interventions could focus on initiating community-level composting and engage students with the science of biodegradation. They can explore topics such as the rate at which different materials degrade in nature, the conditions that favour composting, the role played by microbes in decomposition of matter, what gases are produced if waste is left to rot, and how to detect the presence of these gases. Other possible lines of inquiry are why there is a high prevalence of diseases like tuberculosis, typhoid or malaria in the M(East) ward, how to safely extract materials from garbage piles, and how are various materials recycled. My analysis reveals that teachers were also ill-equipped to deal with concerns that affect the community.

Beyond the disciplinary politics of science education, in India, the centralized system of textbook production and dissemination militates against meaningful and contextualized learning. Therefore, as long as the teachers are not free to choose their own teaching material, the teachers are confronted with the daunting task of contextualising the textbook matter. Moreover, transacting the chapter on waste would require an *oppositional* reading of the textbook by teachers, as the textbook chapter, as pointed out, is nowhere close to acknowledging, let alone engaging with the lived realities of the people as in the M(East) ward. However, my classroom observations reveal that the textbook largely structured the classroom practices of the teachers, reflecting a *dominant* or *negotiated* reading of the textbook (Apple, 1992) on the part of the teachers.

As discussed earlier, the teachers did make efforts in their pedagogical spaces to contextualize the subject matter and connect to students' life worlds. They were familiar with students' everyday struggles and lived experiences to some extent. In their interviews as well, they demonstrated familiarity with the problems in the M(East) ward and students' struggles for water, sanitation, and healthcare. They also used that knowledge to connect with their respective students but these efforts were limited in scope. For instance, none of the teachers referred to the local incinerator or the informal recycling industry flourishing in the neighborhood. I speculate that since most of the teachers did not hail from communities that

live close to the landfill, they lacked empathy for the concerns faced by the community and did not have much expectations of the students they taught. When asked to respond to the civil society's suggestion of permanently shutting the Deonar dumping site, the teachers forthrightly endorsed the proposal. In their defense, they repeated the textbook argument that a landfill should at least be two kilometers away from human settlements! They did not pay heed to the livelihoods of thousands of rag pickers and scrap dealers whose survival is entirely dependent on the landfill. Teacher professional development programs must take cognizance of such avenues and help teachers develop a critical understanding of these complex issues.

The out-of-school interactions with the students from the community reveal that the students had a rich understanding of the recycling economy, and that their concerns and questions were way different from a typical middle class student. In the informal interactions, the students also offered their *dark* funds of knowledge (Zipin, 2009), when they shared stories of crime, violence, substance abuse, sexual harassment at public places and the discriminatory behaviour of police towards their community. However, the educational discourse around waste does not allow any space for students to share their experiences, concerns, questions or knowledge, and seems to be working merely as an instrument of *symbolic violence* (Bourdieu & Passeron, 1977).

To help develop a systemic perspective on waste, curricular experiences that engage students with the socio-material aspects and trajectories of waste practices and waste materials might be helpful (Jørgensen, Madsen & Læssøe, 2018). Levinson (2009) highlights the importance of bringing out *interlocking* narratives that would facilitate students in understanding science in its social context, appreciate the systemic nature of science and connect the local to the global. To demonstrate the possibility of developing such narratives, he takes up the story of aluminium and demonstrates how the extraction and purification of aluminium is linked with the lives of the waste collectors at Rio de Janeiro in Brazil (Levinson, 2014). Such narratives need to be developed in the context of the M(East) ward as well.

5. Discourse on Environment and Development

Leaving behind their homes,

their soil, their bales of straw,

Fleeing the roof over their heads, they often ask,

O, city !

Are you ever wrenched by the very roots

In the name of so-called progress?

(A poem by Jacinta Kerketta, a young tribal activist from India)

People are suffering. People are dying. Entire ecosystems are collapsing. We are in the beginning of a mass extinction, and all you can talk about is money and fairy tales of eternal economic growth. How dare you!

(Greta Thunberg at United Nations' Climate Action Summit, 2019)

Conceptualizing a transformative science and environment education in the context of the Global South cannot sidestep an interrogation of the concept of 'development'. Discourses on development are integral to the way post-colonial nations have come to understand themselves. The dominant model of development imagined and implemented in India post-independence advocates innovations and investment in science and technology. However, technoscientific interventions in the name of development have occurred at the cost of sacrifices on the part of the majority in service of the interests of a privileged minority, and inevitably by incurring huge ecological costs. Thus, notions of development need to be critically examined in relation to the ideals of social and environmental justice.

In the Indian context, topics such as ecosystems, environmental degradation and waste management are discussed in science textbooks, while topics related to development are part of the social science curriculum. It is interesting that textbooks, while discussing these topics, often try to invoke a separation between the natural and the social world of human beings. The social organization of human beings and its impact on the environment are rarely acknowledged in the discussion on environmental problems. Similarly, technical aspects of development or the impact of development schemes on the natural environment is not included in the social science curriculum. The inclusion of environmental issues in the science curriculum probably rests on the assumption that environmental problems are best addressed through a technoscientific approach. I argue that the roots of this assumption reveal an uncritical acceptance of a capitalist model of development which fails to account for social and ecological justice.

In this chapter, I examine the educational discourse on environment and development in the textbooks used in the schools of the M(East) ward. This constitutes an interesting problematic: while for privileged researchers like myself, the landfill symbolizes the sordid underbelly of 'development', a reminder of our consumerist and excessive lifestyles; for the people of the M(East) ward, it probably represents a source of livelihood, recreation and the means to a better future. Being immigrants of little means, survival in the M(East) ward is necessary for them to secure a better future. However, as reported in Section 3.1 of Chapter 3 of the thesis, the M(East) ward holds the last rank among all the wards in Mumbai in terms of Human Development Index. Access to clean water, adequate health care, quality education, sanitation facilities, and women's safety are some of the major concerns for community members (Field notes[8], 2016). Thus, the main question that I aim to address in this chapter is – *How is the educational discourse on development and environment positioned vis-à-vis the concerns, experiences, and out-of-school knowledge of the students of the M(East) ward?*

I begin with examining the dominant discourse on development and environment in the Indian sub-continent which sets the context for analyzing the educational discourse on these topics. The analysis of the educational discourse involved a critical examination of both science and social science textbooks that are followed in the schools of the M(East) ward, classroom

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8   These issues were also raised by some young students associated with *Apnalaya* Foundation during a *Bal Panchayat (a forum of local youth)* meeting in front of the officials of the M-ward office and the police department on October 29, 2016.

teaching of topics related to environment and development, and formal and informal interactions with teachers and students of the M(East) ward.

5.1 Dominant discourses on environment in the Indian context

The idea of nature and the human-nature relationship are at the core of any discourse on environment and environmental problems. Different environmental philosophies hold different positions on these matters (Haydock & Srivastava, 2019) resulting in a whole range of discourses on nature existing simultaneously. For instance, a scientific reading of nature assumes uniformity in nature that "allows experiments to be repeated... (and) make(s) scientists search for universal structures and universal laws" (Sarukkai, 2012, p. 23). Another assumption that science makes about nature is that it is mute and inanimate, and it does not reveal its secrets on its own. The truth needs to be discovered through the scientific method. In their description of scientific method, earlier philosophers of science have often invoked metaphors of violence. For instance, Francis Bacon, a major proponent of the scientific method during the times of the scientific revolution in Europe, held that man is superior to nature, and man must "conquer", "subjugate", and "tame" nature in order to study it and build his empire. This kind of androcentrism has dominated the discourse on nature in the sciences for a long period of time. Nevertheless, the environment and feminist movements of the previous century have radically questioned and challenged these views on nature.

In popular imagination as well as in the discourse of conservationists, nature is often associated with the notion of "wilderness" that needs to be preserved for its own sake. Environmental philosophies such as Gandhian ideology, deep ecology, certain forms of ecofeminism, and ecospiritualism assign divinity to nature, make references to the idea of balance of nature, and explain the global environmental crisis in terms of the rupture of the balance for diverse reasons (Haydock & Srivastava, 2019). These philosophies have also been critiqued for their caste character since they seem to justify the hierarchical caste structure and employ the purity-pollution discourse (Sharma, 2017). Another view on nature that dominates recent policy documents across the globe is driven by the logic of market and conceptualizes nature in terms of a pool of 'resources' needed to be used 'efficiently' and 'managed' properly.

5.2 Dominant discourses on development in the Indian context

In the developed countries, the alarm over dwindling natural resources and the necessity to restrain economic growth first appeared in the 1970s with the publication of the report "Limits to Growth" in 1972. The same year, the United Nations Conference on the Human Environment in Stockholm discussed environment and development as interlinked concepts. This conference was pivotal in launching the Anthropocene[9] discourse which argues that the economic growth need not necessarily lead to environmental destruction (D'Souza, 2012). The 1970s also witnessed the emergence of modern environmentalism in the western world with the publication of Rachel Carson's *Silent Spring*. The term "sustainable development" was eventually introduced in 1987, in the report, *Our Common Future*, also known as the Brundtland report (D'Souza, 2012; Kothari, 2014).

The Indian government policy responded to these developments in the West, evident in the discursive shifts in the understanding of nature and economic growth from the first to the fifth five-year plan document. While the first five-year plan document of independent India discusses both nature and human beings in terms of untapped potential, the notion of resource scarcity and the necessity to acknowledge environmental degradation and pollution are discernible in the fifth plan document (D'Souza, 2012). The shift in the discourse on nature and economic growth parallels a broader global discursive shift in the understanding of development, conceptualized only in terms of economic growth in the 1800s to an understanding of development as growth that is inclusive of social and environmental indicators in the mid-1990s (Achuthan, 2011).

In post-colonial India, one finds multiple discourses on development competing with each other. These discourses can be understood in relation to the visions of three nationalist leaders - Jawaharlal Nehru, M K Gandhi, and B R Ambedkar. The development model adopted by the

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9   The word 'Anthropocene' is commonly used to denote a geological epoch wherein humans are the central agents driving large scale and long lasting environmental changes as manifested in climate change. The term 'Anthropocene discourse' is used to refer to the dominant discourse on the environment and the global environmental crisis and the associated moral and political responsibilities that it places on humankind (Raveendran & Srivastava, 2022). The Anthropocene discourse upholds the notion of sustainable development, according to which economic growth is a non-negotiable for our societies but must not occur at the cost of depletion of natural resources. Sustainable development advocates are optimistic about striking a balance between economic growth and resource utilization through technoscientific innovations.

Indian state post-independence was inspired by Nehru's scientific socialism. According to this model, controlled economic growth under a socialist state, bolstered by technoscience based development projects, would be the way to save a country struggling to overcome poverty, ill-health, and overpopulation. On the other hand, Gandhi had an entirely different vision of development that sought to sustain rural livelihoods, opposed big deskilling technology and industrialization, and emphasized decentralized economic activity of the village panchayats (local self-governance system set up at the village level) that are unregulated by the state. Ambedkar, a scholar, anti-caste leader, and the architect of the Indian constitution, emphasized the necessity of state-protected industrialization (Robinson, 2014). His concerns were primarily to protect people of marginalized castes. He staunchly believed that industrialization, through the provision of employment opportunities, would put an end to caste-based economic feudal relations prevalent in the primarily agrarian Indian society (Shivaprasad, 2016).

However, despite these diverse visions, the Nehruvian idea of scientific socialism won out when Jawaharlal Nehru took over as the first prime minister of independent India. Big technoscientific development projects such as atomic energy ventures of the 1950s, the green revolution of the 60s and 70s, and the white revolution of dairy technologies of the 70s and 80s were instituted. In these decades, however, people's movements also began to raise critical questions on these technoscientific development projects such as who they benefit and who they leave behind. For instance, the *Narmada Bachao Aandolan* (Save Narmada Movement) of the 1980s was a social movement against the Sardar Sarovar Dam, a product of the Nehruvian imagination of technoscientific development, raising concerns about widespread ecological destruction as well as displacement of the marginalized people who lived near the project site[10]. Thus, the people's movements directly raised critical questions on development – development for whom and at what cost. In other words, while international and national policy documents celebrated the dominant discourse of sustainable development, popular movements in India through the 70s and 80s stressed the political nature of environmental issues, seeking to politicize the notion of development, raising questions on conventional models of economic growth.

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10   It also has to be pointed out that some scholarly works (reviewed in Sharma, 2017) have critiqued the *Narmada Bachao Andolan* for being exclusive of concerns related to landless, marginalised groups, especially dalits.

Since the 1990s, with liberalization, the Indian economy opened up to foreign investment, heralding the integration of the Indian economy with the global economy. Concomitantly, the state has also receded from investing in essential welfare services such as health and education, resulting in the increased privatization of these sectors. At present, the Indian government has implemented a series of revisions in the environmental laws that safeguard business interests at the cost of displacing the indigenous communities that depend on the forests for survival and livelihood (Aggarwal, 2019).

In academia, the 1990s also witnessed the emergence of the post-development (PD) discourses (Escobar, 2011). Drawing on post-structuralist theorists such as Foucault, proponents of PD discourses argue that development and its associated terminology need to be understood as a dominant discourse. This discourse which has emerged in the Global North, defines, limits, exploits, and dispossesses the people of the Global South. However, critics of the post-development discourse argue that it is important not to view development as a monolithic, all-powerful entity. There have been ways in which human agency in the Global South has resisted the development discourse through "local re-imaginations, alternative voices, and different worldviews" (D'Souza, 2012).

The dominant, state-backed model of sustainable development holds different implications for different people. While for the privileged, it may signify progress and prosperity; for the marginalized, development projects have led to displacement and loss of livelihoods and ways of being. In other words, development, in the sense of unfettered economic growth, comes at a huge cost to be paid by people whose livelihoods and lives are linked to their local environments.

5.3 Examining the educational and everyday discourses on environment and development

The focus of this chapter is to characterize the educational discourse on environment and development. In order to identify potential pedagogical resources in students' lifeworlds, I juxtaposed this discourse against the students' everyday discourses on these matters. This part of the study involved a critical discourse analysis of two relevant textbook chapters (*Bonding with ecosystems* in the science textbook, and *Regional development* in the social science textbook), classroom practices of three science teachers (Mr. Jignesh, Ms. Abida, and Mr.

Sahil) and three social science teachers (Mr. Sudhakar, Ms. Zoya, and Ms. Zaara) when they taught those chapters, their views expressed in their interviews, and the participant students' understanding of development and environment which they shared in our interactions with them in out-of-school settings.

In my analysis, I have tried to cover all major ideas discussed in the two chapters. Section 5.4 begins with a discussion on how nature is portrayed in the educational discourse, i.e., what language is used to talk about nature, and how the relationship between humans and nature is portrayed. This is followed by a discussion on the understanding of development in Section 5.5 where I examine how development is defined in the textbook chapters, what markers of development are discussed, and how the difference between GDP and HDI is explained. A subsection deals with the regional variation in development – what variations are highlighted in the discourse and what variations are ignored, and what kinds of explanations are offered for the regional imbalance in development. Finally, I discuss the conflicts around development projects because an engagement with various aspects of real development projects reveals the complexity of the topic to the learners. The issues related to social and environmental justice are brought into sharp relief when controversial projects are debated in the public domain.

For each theme, I rely on my analysis of the textbook chapter on 'Regional development' and 'Bonding with ecosystems', classroom observations, teacher interviews, and my interactions with the students of the M(East) ward in out-of-school settings.

5.4 Discourses on environment

Curriculum documents such as the position paper on teaching of science advocate that science "should be placed in the wider context of the learner's environment, local and global, enabling him/her to appreciate the issues at the interface of science, technology and society" (NCERT, 2006b, p. 3) and students should develop concern for environment as part of science education. In Maharashtra (MH), where the syllabus of science and technology for secondary classes is based on the principles and themes suggested in the position papers of NCERT, this commitment is reiterated in the 'Foreword' of the Grade 9 science textbook albeit in a slightly modified form.

In this revised edition two new chapters relating to environmental issues has [sic] been added. The preservation of the delicate ecosystem is of vital importance today and students need to be active participants in the process of preserving the environment. Waste management is also a burning issue today and the chapters discuss these aspects in depth.

(Foreword, MH science textbook)

This commitment is reflected in the two environment related chapters that are part of the MH science textbook though ironically both the chapters appear at the end of the textbook. The chapter titled 'Bonding with ecosystems' is the penultimate chapter[11] of the science textbook of Grade 9. It is a nine pages long chapter (p. 207-215) and is primarily divided into three sections: 1) Types of ecosystems, 2) Interaction between biotic and abiotic factors in an ecosystem, and 3) Energy flow and its importance. The chapter deals with important ideas in ecology such as ecological niche, interdependence in nature, energy pyramid, cycle of nutrients and nature's mechanism of maintaining a balance. There are total four activities in the chapter that expect students to - a) classify various components into living and non-living categories, b) prepare a list of useful and harmful insects, birds depending upon these insects, find the significance of the nests of various birds, and name the animals that eat these insects, c) prepare a list of shade loving plants, plants that require less or more water, and plants which belong to Sahyadri shrubs, and d) make a list of things that crows, eagles, smal fish, deer and fox eat.

This chapter was selected for analysis as this is the only chapter in the science textbook in which references have been made to nature, environment and the interdependence of living and non-living beings. A critical analysis of the chapter would shed light on the underlying assumptions about the nature and human-nature interactions in the curricular discourse on environmental issues. Therefore, in my analysis of this chapter, I have primarily focused on how nature is presented in the chapter, and how the chapter deals with the human-nature interaction.

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11 The last chapter of the Grade 9 MH science textbook is titled "Solid waste: Ecofriendly management". The analysis of that chapter is presented in Chapter 4 of the thesis.

5.4.1 Understanding of nature and the balance of nature

A central idea that often remains implicit in any environmental discourse concerns the understanding of nature, i.e., how nature is perceived and portrayed in the discourse, what is seen as natural and what is not. As discussed earlier, the MH science textbook chapter 'Bonding with ecosystems' is the only chapter in the textbook that deals with ideas related to nature. Various ecological concepts such as biome, ecological niche, food chain, food web, energy pyramid, biogeochemical cycles and the flow of energy and nutrients in nature are introduced to the learners in that chapter in a concise manner. While the textbook explicitly refers to nature merely in the context of the balance of nature, I have tried to examine other parts of the chapter as well to unravel the underpinning assumptions about nature. The textbook largely adopts a technical approach to deal with the topic in which every other statement introduces a new technical term and no attempt is made to develop a systematic understanding of the concepts. At times, the textbook employs a utilitarian language to refer to nature. For instance, on page 207, students are asked to identify "useful" and "harmful" insects in the chapter. In the social science textbook, nature is presented as merely a pool of "resources" waiting to be utilized by humans. This textbook has a separate chapter where the distribution and utilization of "natural resources" in different parts of Maharashtra is discussed at length.

Another idea that the MH science textbook endorses about nature is the presence of biogeochemical cycles in nature and nature's mechanism in maintaining a balance. It is mentioned that though the flow of energy is unidirectional in an ecosystem, the flow of nutrients is cyclic. The subsequent text reads, "The more the ecosystem diversity, more will be its capacity to keep energy and nutrients flowing. So it is our prime duty to maintain the balance and preserve the biodiversity to enrich the biosphere (Life)" (MH science textbook, p. 214). However, if nature has its own mechanism of maintaining a balance, why do we (humans) need to make efforts to maintain the balance, is not explained. Instead, vague questions such as "What measures will you take to maintain a balance in nature" are posed to students (MH science textbook, p. 215).

The textbook's emphasis on the balance of nature needs to be seen in the larger context of environmental debates. The environmental crisis is often explained in terms of the disturbance in the balance of nature which appears to assume that "undisturbed nature is ordered and

harmonious, and that ecological systems return to a previous equilibrium after disturbances"
(Wu & Loucks, 1995). However, the belief that nature has a mechanism to maintain balance
and that environmental problems are caused by humans upsetting the balance of nature is a
contested idea among ecologists. The idea that nature maintains a balance has a long history,
and is prevalent in various cultures throughout the world (Egerton, 1973). Numerous
interpretations exist of the idea, the closest to a scientific understanding being that of a
mathematical equilibrium. However, a belief in the balance of nature does not explain
observations such as randomness in nature, extinction of species, and large oscillations in
population density (Cuddington, 2001). Moreover, accumulating evidence indicates that if
reasonably long time periods are taken into consideration, we do not observe steady state
equilibrium in nature. Things are interconnected and keep changing. In addition, no evidence
exists to suggest any possible physical mechanism whereby such a balance might be
maintained. Inclusion of such ideas in the science textbook might distract students from
exploring the sociopolitical roots of environmental crisis and the associated problems.

5.4.2 Human-nature interdependence

The idea of balance of nature is also closely linked to the interdependence of living beings
and non-living beings, and humans and nature, in particular. One finds that even though there
is no explicit discussion on the human-nature interdependence in the science textbook, the
two-way dependence of living beings and non-living beings is highlighted in the chapter
analyzed.

> Every abiotic factor in a given ecosystem like, type of soil, quality of light, temperature,
> humidity and so on affect the biotic factors in that ecosystem. Ultimately, these abiotic
> factors even decide which organisms will survive in an ecosystem and how many of them
> will be able to continue to live there. On the other hand, living organisms constantly take
> in or given out various abiotic factors. Thus, biotic factors are constantly depleting or
> adding to the abiotic factors in the ecosystem. Each biotic factor affects the quality of the
> abiotic factors around itself and thus affects the lives of the other biotic factors with
> which it shares the ecosystem.

(MH science textbook, p. 209)

When the participant teachers were posed a question on the human-nature interdependence, Mr. Sahil first talked about it in terms of Oxygen and Carbon-dioxide exchange between humans and plants. Later he offered a more sophisticated explanation.

> If we interfere with the nature too much, we will have to bear the consequences as well… Suppose we cut forests at a large scale, then the nature will definitely show us its colors. Global warming will happen. Rains will suffer. A lot of problems will arise and that is why I feel that the nature is also dependent on humans… Pollution causes acid rains. Global warming has resulted into melting of ice (at glaciers) and catastrophes like Tsunami. At some level, humans are responsible for all this. Nature definitely depends on us.

> (Interview transcript, Mr. Sahil).

The workshop discussions revealed that most students were generally aware of humans' dependence on nature but they failed to note how nature was dependent on humans. When this discussion happened in Workshop II, only 3 out of 11 students could think of how nature was dependent on humans and provided examples to support their position on the matter.

> Saadat: If humans do not cut trees, the balance of nature will be retained. The smoke that the vehicles release pollutes the air. If people control the use of vehicles, if they travel by cycles, it will help keep air clean. If water is not consumed in a limit, then...

> Kasim: Nature is made for humans and humans are made for nature. For instance, trees release oxygen and take carbon dioxide. We take that oxygen and release carbon dioxide. This is how both are dependent on each other. We are alive because of them and they are alive because of us.

> Farhana: Sir, we get oxygen from trees and they take our carbon dioxide. We also get fruits, wood, vegetables, etc. from trees. So if a person cuts a green tree, he should get lifetime imprisonment because cutting a tree is equivalent to killing a person… Even if we leave science aside, even then things are connected with each other. Earth has water. Trees take that water for growth. We take fruits of those trees. Like that, everything is interconnected.

In retrospect, I speculate why most participant students could not think of ways the natural environment is dependent on humans could be to do with students' socioeconomic realities. For students from privileged contexts, thinking critically of their contributions to the environmental crisis is reasonable. They must question their consumerist practices

individually and as a class phenomenon and interrogate their impact on the natural environment. The contribution of marginalized communities living next to a dump yard to the environmental burden is minimal compared to an average middle-class person. Therefore, it is not surprising that the learners from these communities are more concerned about how they are affected by their surroundings rather than how they affect their environment.

5.4.3 The question of rights over natural resources

While discussing human-nature interdependence, some students in the second workshop also cited their religious scriptures (*Quran*) to claim that nature is subservient to humans as humans are superior in the hierarchy. They are the noblest of all creations (an idea that is best captured in the phrase *Ashraf-ul-Makhluqat*) and air, water and all other natural things have been created to serve humans.

> Nikhat (with very strong conviction): In our *Quran Shareef*, it is mentioned that everything has been created for humans.
>
> Himanshu: Ok, let us assume that that is the case.
>
> Nikhat: It is not about assuming. It is indeed like that.
>
> Saadat: Humans are superior to all.
>
> Farhana: Animals and plants come below humans in the hierarchy.
>
> Himanshu: Why do you say air and water were created for humans?
>
> Farhana: First, rivers, mountains, ocean etc. were created. Only then humans were created, so it is obvious that these things were created for humans.

While the anthropocentric[12] notion of superiority of humans over other creatures recurred in the students' discourse, students' position on the question of the rights over natural resources revealed a more egalitarian viewpoint. All the students in Workshop II, except Imran and Saadat, argued that everybody has equal rights over mountains, forests, and ocean.

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12 "An anthropocentric presupposition views nature as a servant to humankind. Anthropocentrism is sanctioned by some religious and philosophical doctrines, in general... This anthropocentric tradition places humans just below the heavenly angels but above animals, plants, and the rest of nature" (Aikenhead & Ogawa, 2007, p. 549).

Farhana: Sir, no one has built these mountains and ocean. They are given to us. They are natural. So everyone has equal rights over them. No one can claim that these things are made by them and they belong to them. Anyone can use them – humans, animals, trees, anyone.

Imran: As we discussed, humans have brains and animals don't. So it is clear that humans should get more privileges. They have more rights.

Nikhat: Humans and animals should have equal rights because humans can use their brains and make best out of what they get. Animals are only concerned about feeding themselves. But rights are equal.

Later in the discussion, however, she contradicted herself and completely changed her position.

Nikhat: Humans are superior in the hierarchy because they have brains. They can do anything but animals only feed themselves. That is why humans have more rights over natural resources.

Interestingly, even by the end of the session, the opinion remained divided on who has more rights over natural resources. When a similar discussion happened in Workshop III, some participants argued that no one has rights over water.

Sameer: No one has rights over rivers because they are formed when rain brings water. No one has rights over water – neither the government, nor people, nor animals.

Gulshan: Everyone has equal rights.

While for Sameer, the question of rights over water was an absurd one, most participants opined that everyone has equal rights. Gradually the discussion on rights turned to the issue of whether all humans have equal rights over water and if yes, why some people get 24 hours water supply while some others have to struggle for water everyday.

Himanshu: Everyone has a right, not anyone in particular. And, does everyone have equal rights? Or, some have less and some more?

Many students (simultaneously): Yes, everybody has equal rights.

Himanshu: If everyone has equal rights, then everyone should get it equally. No?

Sadaf: Sir, if everyone gets it equally, then it will get over fast as people will start over-consuming. That's why a limit is set. Suppose someone gets lot of food, then that person ends up overeating and food gets wasted also. So it is important to distribute it in a limit so that everyone is able to function.

Himanshu: Who sets this limit?

Sameena: Government

Himanshu: How does government decide whom to give more and whom to give less?

Zareena: People who are responsible for distribution, they know that.

Sadaf: Sir, we didn't get water from the last two days.

Himanshu: But others got it, right? Some get it and some don't. How is that decided?

Sadaf: Everyone has equal rights but the land from where water is fetched is owned by the government. When they release water from there, then only we get it.

Zareena: Water that comes out of pipe is equal.

Gulbano: Sir, selling water is criminal.

Sadaf: Yes

Sameena: Sir, if water is not sold, how will anyone use it?

Rizwana: Sir, people's livelihoods are dependent on water.

Tamanna: Yeah

Himanshu: That's right. Everyone knows that selling water is criminal and Zareena also mentioned that people who are responsible for water supply, who open the taps from there, they decide whom to give and how much.

Sadaf: Bandra gets 24 hours water supply. Why so?

Rizwana: We usually get dirty water in our house.

[Parallel discussions among students – everyone trying to share his/her experience with water – mostly inaudible]

Himanshu (repeats the question): Everyone has different experience with water supply. Some areas get 24 hours water supply and some get water for very little time. So how is it decided? If everyone has equal rights over water, then how do you explain this variation?

Karim: So much population is there, everyone can't get it simultaneously.

Sameena: Sometimes more water is released and sometimes very less.

Rizwana: Sometimes in the morning and sometimes in the evening.

Sadaf: And, sometimes not at all !

Sameena: Days when there is electricity for longer, less water is supplied.

Himanshu: Ok, please listen to me once more. There are places which get water for only one or two hours and water supply is erratic. Some areas do not get water at all and people have to stand in queues to purchase water but some other places get water 24 hours a day.

Zareena: Yes, In villages.

Himanshu: Yes in villages but also in cities. Big buildings get 24 hours water supply.

Sameena; Sir, where pipelines have not been laid, those areas do not get water and those people have to stand in queues for water.

Zareena: Places which are closer to ocean or ponds get more water.

Sadaf: No, it has nothing to do with ocean. We get water through pipelines after filtration at the source.

Himanshu: Ok but where does water come from in those pipelines?

Sadaf: Those pipes are huge.

Zareena: Water comes from underground.

Zeena: Water comes from rivers.

Sameena: Sir, we all have equal rights but the government does not supply water equally. Some get more and some get less.

Himanshu: Why?

Rizwana: Their wish… his relatives might be getting more.

Himanshu: If that is the case, then everyone in their lanes will also get more water.

Sadaf: No sir, we have a separate connection. We don't give water to anyone else.

Himanshu: What kind of connection is there in your house?

Sadaf: Direct from underground (borewell)

Sameena: We pump up water using a motor. Drinking water is purchased from outside… There is a big lake, water is collected there only. Rain water is also collected there. If rains are good, we get more water and if rains are less, we get less water. Collected water is filtered and supplied to all households.

In the excerpt mentioned above, the discussion organically moved from the question of who owns natural resources to why some people have more and some have less. When the problem was posed as a philosophical problem, the students pointed out that no one has exclusive rights over these resources but when it comes to why they were unable to access it and were being treated differentially, they tried to explain their inadequate access to clean water in terms of government officers' will, overpopulation, the amount of rains, their physical distance from a water source, or a logistical problem of distribution. While one student talked about the lack of water pipelines in the community, it did not seem to occur to them that this might have to do with structural reasons.

5.5 Discourses on development

Development, which is the other theme that I discuss in this chapter, falls within the realm of the social sciences curriculum. A relevant curriculum document – The position paper on teaching of social sciences (NCERT, 2006c) – that has informed development of textbooks in the state of Maharashtra in the absence of a state curriculum framework, strongly advocates for adopting an interdisciplinary (pluralistic) approach to understand the subject matter. It asserts that there is an urgent need to "restore self-esteem to the social sciences by having them address social and political issues in such a way as to awaken in the students a real concern for social justice" (p. 3-4), and advocates engaging students in critically reflecting on "social issues that have a bearing on the creative coexistence between individual good and collective good" (p. V).

To examine the educational discourse on development, I analyzed the chapter titled 'Regional Development' in the social science textbook of Grade 9 of the Maharashtra state board. The textbook was publised in 2012 and reprinted in 2015. It is divided into two parts: a Geography section and an Economics section. The other chapters in the geography section are – Concept of region; Natural resources in Maharashtra; Occupation; Agriculture; Industries; Transportation, communication and tourism; and Population. The chapter 'Regional development' was chosen for analysis as it makes explicit references to economic growth and development, and explains the regional variation in development. No other textbook chapter deals with the idea of development at length. It is an eight pages long chapter (p. 59-66) in the textbook of size 93 pages, and appears at the end of the geography section of the textbook. The chapter aims to build students' understanding of regional development, the concept of Human Development Index (HDI), factors determining HDI, a comparative picture of HDI in various parts of the state of Maharashtra, the regional imbalance in development indicators and its causes. These aims are listed on the first page of the textbook chapter as "learning outcomes".

The chapter is divided into four sections: 1) *Concept of development* – In this section, the difference between the concept of change, growth and development is discussed; 2) *Regional development* – The focus here is on identifying various levels of regional development and explaining the reasons for regional imbalance in development; 3) *Human development index* – the difference between Gross Domestic Product (GDP) and Human Development Index (HDI) is explained here; and lastly, 4) *Regional development in Maharashtra* – In this section, the status of regional development is discussed using various maps.

5.5.1 Markers of development

In the chapter on regional development in the MH social science textbook, 'development' is shown to be distinct from two other conceptually similar terms: 'change' and 'growth'. The textbook claims that "development means moving from simple or lower level condition to higher and progressing condition." (p. 60). Highlighting the distinction between development, change and growth, it is argued that not every change indicates development. "Only if the change is progressive it leads to development" (p. 60). Similarly, not any kind of growth (for instance, growth of waste, diseases or poverty) would amount to development of a region. The emphasis is given on "all round" development. "If development is all round then only it will

be called development otherwise it may just amount to growth of some dimensions" (p. 60). Another striking feature of development that is discussed in the textbook is its dynamic nature. The textbook asserts that development is an ongoing process which "does not have a full stop" (p. 60). In the classroom teaching, I observed that all the social science teachers (Mr. Sudhakar, Ms. Zoya and Ms. Zaara) discussed these ideas at length and provided several examples to make a clear distinction between development, change and growth.

Furthermore, industrial growth is projected as a key marker of development in the textbook. While discussing that in their classes, I observed an interesting contrast in the participant teachers' positions on the matter. While Mr. Sudhakar told his students, "if more and more industries are coming, that can be called development" (Observation notes, Mr. Sudhakar's class, Day 1), Ms. Zaara told her class that "even if industries are there, if they are causing problems to people, then it is not development" (Observation notes, Ms. Zaara's class, Day 2). Ms. Zaara also asked her students to speak their minds when they think of development. The students mentioned economic development and related it with the increase in the number of industries and businesses. Ms. Zaara clarified that development is not just about economic development. It is also about social and cultural development which broadly means ensuring basic amenities such as access to clean water, clean environment, education and safety for everyone, and creating basic infrastructure like roads, schools and hospitals. She also referred to developing a culture of tolerance and peace as part of the cultural development of a region. This is consistent with the textbook's position on development which asserts that development has to be holistic and all round in nature. According to the textbook,

> In order to achieve proper, all round and all inclusive development of any region, it is necessary to do following three things:
>
> 1. To provide facilities like shelter, health and education, which makes people's life comfortable in the region. For this make the distribution system of these facilities more strong and expand them and through this raise the standard of living of the people.
>
> 2. To establish political, social and economic systems and institutions, which will promote the dignity and respect of the people in the region.
>
> 3. To generate situations so that people in the region can live fearless life.
>
> (MH social science textbook, p. 62)

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Ms. Zaara (unlike Mr. Sudhakar and Ms. Zoya) also stressed in her class that development in its true sense means development of each and everyone independent of one's class and gender identity indicating a sensitivity to social inequalities at the least and perhaps a commitment to social justice as well. "What kind of development should be there? All round. It should be inclusive, only then it is development in its true sense – whether rich or poor, illiterate or educated, a child or an old person, man or woman" (Observation notes, Ms. Zaara, Day 1). In her interview as well, Ms. Zaara indicated concern about the widening gap between the rich and the poor and stressed that everyone should get equal opportunities for development. She mentioned that *Roti* (food), *Kapda* (clothes) and *Makaan* (shelter) are the three things which the government must procure for everyone. Later, she added that other philanthropic initiatives and the corporate sector should also contribute towards the cause through their social responsibility schemes. She also mentioned environment in relation to development. Commenting on the possible conflict between development and the environment, she said that it is important to adopt a model for development that doesn't disturb nature (Interview transcript, Ms. Zaara) – a view that is aligned with the ideology of sustainable development.

Ms. Abida, Mr. Sahil and Mr. Jignesh also echoed these views in their interviews while talking about the tension between environment and development. Ms. Abida, in her interview, mentioned that "Development is must. Maintaining environment is also important. Both these things need to go simultaneously. If you are setting up an industry, you should also plant trees at some place so that a balance is maintained. If you are doing something that is causing harm to the environment, then you must do something about maintaining the balance." (Interview transcript, Ms. Abida). A concern for sustainability was also reflected in Mr. Sudhakar's interview when he expressed that "we should not spoil the environment for the next generation" (Interview transcript, Mr. Sudhakar). He also argued that agricultural land should not be dispensed for constructing buildings or setting up factories.

When I asked students in the out-of-school setting of Workshop II about their ideas of development, they talked about ensuring basic infrastructure such as roads (Farukh), buildings (Mohsin), factories (Haroon), schools (Saadat and Imran), hospitals (Nikhat and Saadat), gardens (Mohsin), playgrounds (Haroon), parking facilities (Aalia), metros (multiple students), luxuries such as branded cars - BMW, Mercedes, Ferrari, Tata Motors and Maruti Suzuki (several boys), smart phones (Mohsin) as well as basic amenities like water connection (Farhana) and sanitation facilities (Aalia and Haroon) for every household. They

also talked about establishing a friendly, non-violent (Haroon) and peaceful environment (Mohsin), technological progress (Saadat), economic growth (Aalia and Farha), maintaining cleanliness (Farha, Nikhat and Imran) and greenery (Aalia), providing access to healthy food (Farhana), laws to protect people (Haroon), and even the end of slavery (Farhana) as signs of development.

Similarly, in Workshop III, there was a discussion on whether Mumbai is a good city. Students were asked to provide justification for their positions on this matter and also to suggest ways to improve the city. While Sameena and Gulshan said that Mumbai is a good city because no one sleeps hungry there, Zeena raised women's safety as a criterion to argue why Mumbai is better than cities like Delhi. She also talked about the affordable prices of various commodities and reasonably good access to adequate healthcare in Mumbai. There seemed to be a general consensus on Mumbai being a good city because the city accommodates everyone and even the poor can survive there (Karim and Sameena). However, there were some dissenting voices as well. For instance, Gulbano argued that crimes are rampant in the city. Gulshan, Kareem and Zeena gave several examples of the kind of crimes that are regular in the neighborhood – drugs (which includes use of injections, whitener, brown sugar, Iodex, MDMA, coco etc.), murder, rape and eve-teasing. While Sadaf felt that the sale of alcohol should be completely banned, Zareena and Zeena stressed that the laws need to be stricter on these crimes if things have to change for the better. When probed further on why the government does not put a ban on alcohol sale, Gulshan pointed out that the government makes money from the sale. Zeena also endorsed the argument and said that the government gets tax from alcohol shops and that is why they do not put any ban on the sale. Comparing the case of India with a 'developed' country like USA, Zeena said:

> We can't leave everything to the government. People in USA are united - they all follow
> the same religion. So everyone is on board when something comes up. Here, Hindus and
> Muslims keep fighting with each other. They are scared of each other and no one is able
> to progress.

> [Workshop III, Day 11]

In response to the questions followed by a fictional story 'Elections in a jungle' that was used to elicit students' political views, many students talked about the discriminatory behaviour of the ruling government against the Muslim community. In particular, they mentioned the ban

imposed by the government on using loudspeakers for *Azaan* and selling beef. They were agitated by this kind of growing intolerance in the society and did not see it as a marker of progress or development.

Clearly, students held a wide range of ideas about development (for instance, water connection at household level, adequate sanitation facilities, a non-violent and peaceful environment, ban on alcohol, stricter laws to protect people from crimes, and end of slavery) that were rooted in their lived experiences, and their views were not constrained by the ideas that are discussed in the 'official' or 'enacted' curriculum. Conversations on questions such as what development is and what makes a city a good city with the students of the M(East) ward also revealed their rich but 'dark' funds of knowledge (Zipin, 2009) about various crimes including substance abuse and physical violence.

5.5.2 Levels of development

After establishing basic understanding of what development is, the textbook describes various levels of development. The World Bank has provided a list of 300 different indices that are used to determine the level of development of a region. This includes fields like agriculture, industry, mining, power sector, economic policies, education, health, science and technology, social policies and poverty. The textbook explicitly acknowledges that development does not just mean economic prosperity i.e. Gross Domestic Product (GDP) or per capita income. The need for Human Development Index (HDI) is then introduced as the criterion for determining levels of development of a region. Three factors are taken into consideration to figure out HDI of a region. These are mean standard of living (economic factor), life expectancy at the time of birth (health factor), and the duration of education (social factor). The HDI values range between zero and one. "For highly developed region this value will be closer to one.. (and) for the regions where the development level is quite low the value will be closer to zero" (MH social science textbook, p. 62).

The textbook then provides comparative HDI data for Mumbai, Pune and other big cities to show how well Mumbai is doing in comparison to other districts. Interestingly, while the average HDI for Mumbai is 0.56 (MCGM, 2009), there is huge variation among various wards in the city – M(East) ward's HDI being as low as 0.05. While this piece of information is important for the students of the M(East) ward and can help in building critical

consciousness about their lived realities, the possibility of bringing the local variation for analysis and discussion is completely missing from the textbook.

While discussing this topic in his class, Mr. Sudhakar first told his students that the HDI of Shivaji Nagar is the "lowest in the whole country" though later he asked them to find out whether that is indeed the case and if yes, what could be the reasons for it. The students were encouraged to think about the problem based on the three factors that they had discussed in the class (economic factor, health factor and social factor). The students, however, did not seem to be paying attention to this question and seemed indifferent[13] to the fact that the HDI of the area that they live in is the lowest in Mumbai (if not, in the whole country).

Ms. Zoya too tried to connect the discussion on HDI to students' everyday experiences in a different way. While discussing poverty as a factor in determining HDI of a region, she referred to the poverty line and discussed the levels of poverty defined by the Indian government. As part of the public distribution system, different kinds of ration cards are issued in India to people based on their annual income. People living below the poverty line are issued 'Yellow' cards. 'Orange' cards are issued to those whose annual income is between INR 15,000 and 1 Lakh, and if the annual income is more than 1 Lakh, 'White' cards are issued. The students found this discussion closer to their lived experiences and enthusiastically provided information about the current ration card scheme.

In the out-of-school interactions with students, the topic of HDI did come up, but in a different context. For instance, I engaged students in a significant amount of discussion on average life expectancy (one of the factors used to determine HDI). When asked to estimate the life expectancy of various wards in Mumbai, they initially thought that the life expectancy will be more in the M(East) ward as people live in unhygienic conditions in the region and would have developed better immunity than those residing in the posh areas of the city. However, when the data was presented to them, they were able to make connections of the lower life expectancy with their vicinity to the dumping ground and the toxic substances released in the air by the incinerator situated in the middle of the locality.

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13   Several possibilities arise here: perhaps, they did not understand the importance of HDI value as an indicator of socioeconomic development of a region, even if they understood the meaning of HDI, they might not have thought of it as truly representing the essence of their living conditions.

5.5.3 Understanding variation in development

Another idea that is discussed in the MH social science textbook concerns the variation in regional development. The textbook discourse on development justifies any variation in terms of the difference in natural conditions, lack of natural resources in a region, poor utilization of the available resources, and absence of necessary skills and machinery. "The availability of resources, their qualitative status, preparedness of people for using the resources, methods of resource utilization, the infrastructure that is available in the region etc. are some of the factors on which the development depends" (MH social science textbook, p. 60). Since the availability or the quality of resources is not in anyone's hands, the burden of development squarely falls on people's shoulders with their 'willingness' and 'ability' being the major determining factor in 'utilization' of resources as evident in the following statement given in the textbook,

> People have to achieve development using the resources available in the region… In any society there exist a number of groups of individuals. There is considerable diversity among such groups in terms of economic, educational, health aspects. Similarly their customs/way of life, traditions, belief, faith etc. also differ considerably. All these affect the willingness and ability of people in utilization of resources.

> (MH Social Science Textbook, p. 60-61)

This concern about the maximum utilization of resources reflects a development model that is predicated on a capitalist economy. Moreover, the discourse does not problematize how diversity among groups may in fact be about inequitable distribution of resources. In a more egalitarian system, development would mean providing access and ensuring equitable distribution of resources to everyone. However, the official discourse does not acknowledge the harsh reality that certain groups may never avail of these resources due to the inherent power dynamics of the society. Moreover, while the textbook recognizes that regional development depends on geographical conditions and various social and cultural factors, the textbook chapter is solely focused on understanding geographical reasons. It is striking that questions related to the uneven development of the cities are not raised. Some other questions that remain unaddressed in the textbook chapter, are: why regions like Gadchiroli that are rich in natural resources are still economically backward, why cities like Mumbai and Pune are highly developed, why there is less urbanization and development in other parts of

Maharashtra, and why funds are not being mobilized towards the development of backward regions in the state. I argue that by emphasizing the geographical factors alone, the textbook depoliticizes the discourse on development and violates its commitment to adopting an interdisciplinary approach to deal with social and political issues.

To discuss the topic of regional development in his class, Mr. Sudhakar relied on a powerpoint presentation and projected a 'Word Web' on a screen (Fig. 5.1) while Ms. Zaara verbally explained all the points mentioned in the textbook chapter.
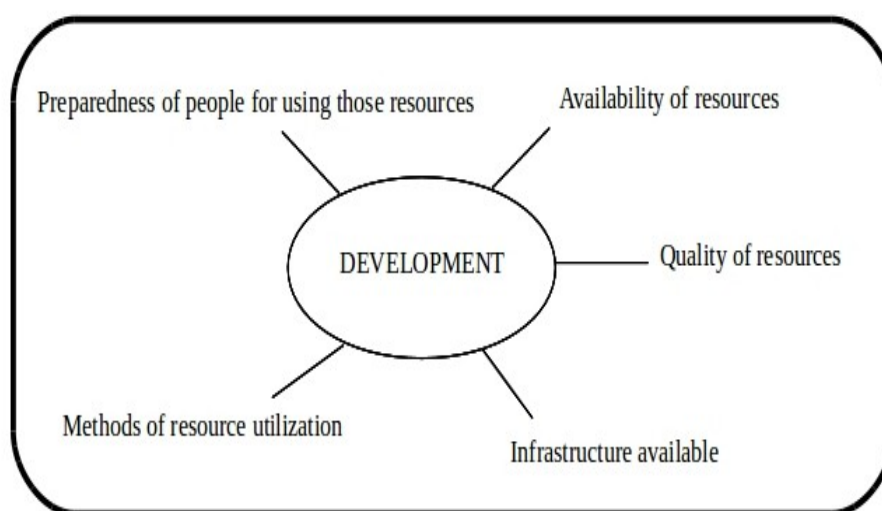
Fig. 5.1 Word web used by Mr. Sudhakar to introduce factors affecting development

Both the teachers seemed to wish to contextualize the discussion by providing examples other than those that are provided in the textbook. However, their difficulties with connecting the issue to the students' immediate contexts was apparent in the way the discussion proceeded in their respective classes. For instance, Mr. Sudhakar brought up examples such as the installation of automatic ticket vending machines at local railway stations in Mumbai, extraction of oil from Mumbai oil fields, the shifting of the Tata Nano project, and the import of Australian coal for use in the steel industry in India. The students, however, did not seem to relate to most of these examples as they remained silent for most of the discussion in the class (Observation notes, Mr. Sudhakar's class).

Moreover, in an attempt to compare rural and urban contexts in terms of the use of electrical appliances, Mr. Sudhakar, who had received only a short-term course as a TFI fellow before

he set out to teach in the school, made some general remarks about rural and urban populations. Some of those remarks did not seem sensitive to the socio-economic class of students he was teaching as would become evident in the following excerpt from his classroom.

> Do you find more electrical appliances in villages or in cities? Electrical appliances like fridge, TV, AC, geyser – where do you find them? Nobody in villages uses geysers to heat water. People use stoves/ chimneys for hot water and bathing. In cities, we use geysers to heat water, We use ACs during the summer months. Correct? We also use plenty of appliances like microwave, washing machine. No one in villages uses washing machines.

> (Observation notes, Mr. Sudhakar's class, Day 2)

Furthermore, in his interview, Mr. Sudhakar explained the huge difference in the HDI values of the M(East) ward and that of areas in South Mumbai in terms of inhabitants' religious affinity, their immigration status and educational levels.

> Mr. Sudhakar: These two areas are 25-26 kilometers away and one is low on HDI and one is high on HDI.

> Himanshu: So why is there a difference?

> Mr. Sudhakar: Yeah, so the difference they pointed out was… First of all, the religion plays a very important part. They have a very conservative religion. Then the lack of education. And, mostly people living here are all immigrants from UP and Bihar...

> Himanshu: How does that affect the development of this area?

> Mr. Sudhakar: So the thing is that when they come from villages, they don't have much money. They only come here to make money. And, the people on the other hand those who are living in South Bombay or somewhere, they would have houses of their own. Even if it is a MHADA (Maharashtra Housing and Area Development Authority) house, they will have a proper house where there will be proper water connection, electricity, proper sewage disposal, waste disposal and everything. On the other hand, when they come here, they have to live in an unplanned sort of slum where there is no water connection – irregular water connection and electricity. So the basic amenities are not there. If you go there (South Bombay), you will find good schools – schools having playgrounds, community centers, libraries, swimming pools, sports facilities. Here we don't have anything of that sort.

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Himanshu: So it seems to be the most neglected ward !

Mr. Sudhakar: Right, like I was hearing …. I went for a community presentation and they were telling like till few years back, they used to carry water from long...like there were no water pipelines till Shivaji Nagar. Also, there was no electricity. They had to put electricity. BMC didn't want them to give water connection and electricity connection because once you give them, you are sort of implying that I recognize you as residents of Mumbai. And, that time the government didn't want to recognize them as residents of Mumbai. If you recognize them, then you have to include them in social welfare schemes also. That was not… But I think for the last 7-8 years, lot of things changed after lot of hue and cry was made about the dump yard. Also, if you see here... no one in Mumbai... there is a councilor or MLA or MP from other parties like Shiv Sena, MNS, BJP or Congress. Here we have Samajwadi Party. I think this is the only seat Samajwadi Party has got in Maharashtra. Again they have brought their own leaders also here. People from UP, Bihar, they have got BSP and SP here as against their votes.

[Interview transcript, Mr. Sudhakar]

In the excerpt above, Mr. Sudhakar first tried to explain the stark variation in development indicators between different wards in terms of the religious affinity and the poor status of education among Muslims. As the conversation proceeded, he realized that it is basically the local government's fear of immigrants that has resulted in the denial of basic amenities to the people of the M(East) ward. Ms. Zaara too pointed out the vested interests of the government as reasons for inadequate infrastructure in the M(East) ward. Business is handled mainly in South Mumbai, so those areas get maximum benefits from the government. Ms. Zaara said that the government should stop playing politics and invest in backward areas for "social" reasons without expecting quick returns. Thus, both the teachers explained the ward-wise variation more as a political problem than a geographical issue.

5.5.4 Conflicts around development projects

As discussed before, in accordance with his vision of development in the post-Independence period, Jawaharlal Nehru, the first prime minister of independent India set up several large-scale technoscientific development projects with the ostensible aim of addressing greater good for greatest numbers. Some of these projects included the atomic energy and hydro-electric power plants with the purpose of meeting energy requirements. These projects were followed

by several other government initiatives such as the green revolution and the white revolution to boost up food and dairy production in the country. The setting up of most of these 'development' projects have resulted in conflicts with the people living in the vicinity of these projects and and have had far-reaching ecological impacts. In other words, development comes at the cost of the lives of marginalized people and the environment. Hence, another theme that I explored as part of this study concerned the conflicts associated with development projects.

Since the MH social science textbook does not present development as an issue of contention where various stakeholders could possibly have a conflict of interest, it is not surprising that the teachers did not bring it up in their teaching either. Only on one occasion, as noted, did Mr. Sudhakar talk about the conflict around Tata Nano project to make a point about the preparedness and willingness of people for the development of a region though he seemed to be of opinion that big industrial projects like Tata Nano offer employment to local people, bring prosperity to the region, and therefore, people should welcome such initiatives. For Mr. Sudhakar, a middle-class person who opted for teaching in a school on a short-term basis, what mattered most were the benefits of the project and not the objections raised by local people or the environmental cost of the project.

> The other thing is preparedness of people for using the resources. If people there are not prepared, if people there are not willing to take the risk and see if something is there, if people there are not ready to do research and find resources, then development won't happen. An example would be the story of Tata Nano. It was supposed to be manufactured in West Bengal in a village called Singur. But the farmers there did not want to give away their lands. Agricultural land it was. They were not happy with the amount of money they were getting from Tata in exchange of land. So they told Tata to go away – we don't want you to make a factory there. So what happened – Tata moved away from West Bengal to Sanand in Gujrat. Sanand is also a village there and Tata Nano is manufacturing there and development is happening in Sanand while Singur is at the same place. People's main occupation in Singur is still agriculture and per capita income... like people who earn money are still earning the same amount of money as they used to do ten years back.

> [Observation notes, Mr. Sudhakar's class, Day 1]

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The theme of conflict induced by development projects was discussed at length in the two out-of-school workshops. The students were provided a brief story about an upcoming steel factory in a tribal village and the potential conflict among various stakeholders (see Appendix XIV for the detailed story). The discussion around the story revealed students' deep concern for the poor and the marginalized in the society as well as an implicit understanding of the state-industry nexus when it comes to these matters. Following are a few excerpts from the discussion:

> Farhana: Sir, there are two points that are very important in this context. The people living in that area are basically relying on farming and the tribals are also settled there and do not want to leave that place. The government's promise that the steel plant will lead to development and generate income, that is also correct because the government always thinks of people's welfare. The government is also right, and people are also right if they are concerned about their own future. If they are uprooted, where will they go? The factory owners can always use some other place so that local people don't have to face any inconvenience and development is also not restrained. People can always go to the other site and work… Iron can be mined from some other place which is not inhabited by people.

> Nikhat: They can give those people land at some other place and then make a factory there.

> Aalia: But villagers are concerned that they will get very little compensation for their land.

> Nikhat: They should set up the factory where no one lives.

> Farhana: People are living there and they will suffer if a factory comes up on their land.

> Saadat: But they will also get money, right?

> Farha: Tribals have been living there generations after generations and they get their livelihood from there, so they don't want to leave that place... They should be allowed to stay there and not displaced to any other place.

> Mohsin: The government will not listen to them. It will only run after taxes.

When asked whether local villagers should have any say in deciding the future of the steel factory, most students felt that the villagers must be consulted as per the new law that puts a

binding on companies to first seek permission from the local bodies such as *Gram Sabha*, but otherwise also. For instance, Aalia said,

> Aalia: How can the government decide? The decision should be taken by the villagers because they live there and they know what is best for them. If the government lives there, then only they will get to know.

However, after a long deliberation when the students were asked to take a decision about the proposed project assuming the position of power to make decisions, the opinion was divided. While some were concerned about the development and how it would positively impact city dwellers' lives and generate employment in the region, some others were more sympathetic to local people's livelihood concerns.

When probed further on the idea of 'sacrifice in the name of larger good' and the inevitability of collateral damage in any development project, Mohsin argued that sacrifice should not be imposed on people, sacrifice makes sense only if people do it willingly. On the issue of displacement of people in the name of development, Aalia recalled her experience of the government rehabilitation scheme which made her familiy shift from a *chawl* (small residential buildings with shared toilets mostly inhabited by the poor) to a small independent flat and she seemed satisfied about that move. However, Zareena, citing her experience of rehabilitation, mentioned that the compensations are never adequate. She also claimed that if the government plans rehabilitation of slum dwellers, it only provides basic infrastructure – only four walls and the roof. On another occasion, Imran talked about the lives of slum dwellers in cities and how vulnerable those people are.

> Himanshu: Many people who live here in *Cheetah camp* are living illegally. Isn't it? But they have somehow managed to make arrangements for their stay.
>
> Many students (simultaneously): Yes sir
>
> Himanshu: They are not being thrown out. Even though they don't own land here, they have a shelter.
>
> Imran: Sir, when it comes to clearing the space, they are simply moved (by the government). It happened near our house. Time of the day does not matter. Houses were completely demolished though people came back to the same place after a few days.

In the context of the proposed steel factory, students also raised environmental concerns. For instance, Aalia and Nikhat seemed concerned about water and air pollution that would be caused by the factory.

> Aalia: If the factory comes up, waste water will also be released (in rivers)… When this water will reach sea, it will affect the marine life as well.

> Nikhat: The smoke arising from the factory will also cause problems to local people. Farming will also get affected as people will start working in the factory.

The excerpts above reveal that the students' own experiences with housing and rehabilitation made them especially sensitive to issues related to displacement and violation of rights around development projects. They pointed out the injustice that would be caused to local people as a result of the project. During our interactions with them, they not only showed empathy towards other marginalized (tribal) communities that would be affected by the proposed factory, but were also concerned about the natural environment. This experience is in contrast to the interaction that we had with them on the uneven distribution of water supply in the M(East) ward in which case they were not making systemic connections (see Section 5.4.3 for details). Perhaps the fictional story of a steel plant – used as a trigger to initiate the discussion with the students - helped them think through the issue, identify various stakeholders, and analyze their vested interests. Similar instruments can be deployed in the future to make students critically conscious of their socioeconomic reality and resolve moral dilemmas around sociopolitical issues.

5.6 Discussion

In this chapter, I critically examine the educational discourse on development and environment to understand how this discourse is positioned vis-à-vis the concerns, experiences, and out-of-school knowledge of the students of the M(East) ward. The findings indicate that the science and social science textbooks conceptualize nature in slightly different ways. While the science textbook adopts a technical approach to discuss ecosystems and the interconnections between humans and nature, the social science textbook portrays nature merely as a pool of resources. At times, the textbooks employ a utilitarian language to discuss nature. These observations are consistent with the findings of other studies such as the one conducted by Sharma & Buxton (2015), who point out through a critical discourse analysis of

a middle-grade science textbook used in the schools of state of Georgia that the relationship between natural and social systems and the role of human agency in these relationships is shaped by the "dominant science and technology discourse" and the "discourse of neoliberalism" (p. 277).

The MH science textbook emphasizes the need for nature's mechanism of maintaining a balance. As discussed in Section 5.4.1, the idea of a balance or equilibrium in nature is contentious. However, apart from the scientific tenability of the balance of nature argument, it also needs to be argued that the discourse on balance of nature and the role of human beings in maintaining this balance places humans outside nature invoking a binary between humans and nature while the relationship is a deeply enmeshed one especially for marginalised groups whose livelihoods are closely tied up with rivers, forests and, agricultural land (Sharma, 2017). Moreover, the educational discourse indiscriminately puts the onus of maintaining the balance of nature on people, and seems insensitive to the lived realities of the marginalized groups who barely manage to procure resources for sustenance.

One also notes that while discussing human-nature interdependence, most participant students could not think of how nature is dependent on humans, and I speculate that it might have to do with their socioeconomic conditions. Residing next to the city's garbage mountain, they seemed more concerned about how they were getting affected by their surrounding environment, and not so much about how they would be disturbing their environment.

When conversing about nature and human-nature relationship, most participant students referred to religious scriptures such as *Quran* and invoked an anthropocentric stance in their arguments. They seemed to believe that nature was created to serve humans. Such beliefs contradict with an ecological understanding of the human-nature interdependence as well as a holistic stance propagated in several Islamic texts including *Quran*. For instance, discussing environmental ethics in Islam, Kamla et al. (2006) point out *Tawheed* (Unity of God) to be one of the key guiding principles[14] in Islam.

> The concept (*Tawheed*) implies the unity and equality of all God's creations in the
> worship of God and their equality as partners in terms of the due respectful recognition of
> the existence of all and the due appreciation of interdependency and interconnectedness

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14 Some other guiding principles in Islam are trusteeship or *Khalifah* (vicegerent), equilibrium, free will, *Umma* (community principles), holism and the future, and the appreciation of the beauty of nature (Kamla et al., 2006; Rizk, 2014).

between all… There is thus an equilibrium ruling the natural world, and all God's creations are understood to be in balance or in harmony in this respect, having been created in a measured way or by measure, a measure not to exceed or to fall short of.

<div align="right">(Kamla et al., 2006, p. 249)</div>

They argue that "Islam extends its concerns beyond an anthropocentric focus, towards the well-being or balance of the ecosystem and general flora and fauna" (p. 254). Obsessive extravagance (*Israf*), excessive consumerism, conspicuous consumption and waste generation are seen in negative light in Islam. Thus, it is important that such values are emphasized even in religious education.

On the question of rights over natural resources, most students seemed to take an egalitarian approach and argued that everyone has equal rights over water, air or land. When probed further on limited and differential access to water in their homes, they tried to explain it in terms of overpopulation, controlling officer's will, amount of rains in an year, or logistical problems in distribution but did not connect it with their socioeconomic status.

In the context of development, one notes that the ideology of sustainable development dominates recent curriculum documents in India (NCERT, 2006a). The analysis of a chapter on regional development and classroom teaching practices shows that development is discussed in a holistic sense and not merely in terms of economic growth. It is noteworthy that any kind of conflict related to these issues is avoided in the curriculum and the content is presented in an apolitical manner. For instance, the social science textbook explains the regional variation in development levels merely in terms of geographical factors and people's willingness to utilize resources, and the complexities and conflicts around development do not get any mention in the textbooks.

In my interactions with the students and teachers, I observed that both the groups (teachers and students) had a nuanced understanding of development. They not only explained the ward-wise variation in terms of sociopolitical factors but also demonstrated an awareness of the role of state and industry in determining the fate of people's livelihoods and the environment. They too did not advocate unfettered economic growth rather they seemed concerned about those who suffer the consequences of big development projects. For instance, while discussing the story of a steel plant, most participant students were empathetic towards the other marginalized groups (tribal communities) expressing concern for their

livelihoods despite having very little knowledge about the lives of these communities. Perhaps their own experiences had made them sensitive to issues related to displacement, violation of rights of local people, complexities of rehabilitation, and the absurdity of sacrifice in the name of larger good. A few students also raised environmental concerns in this context. Since most students did not express broader sustainability concerns during this discussion, I wonder if it is because their imaginations are shaped by the pressures of their lived realities where day-to-day struggles for livelihoods are prominent.

While discussing levels of development and the regional variation in development, the teachers seemed to be making an attempt to contextualize the subject matter (see Section 5.5.2 and 5.5.3). As argued earlier, these efforts were limited in scope and the students did not engage much with those examples. Still I believe these small efforts of teachers to simplify and contextualize the content for their students need to be acknowledged, appreciated, and supported through well-designed professional development courses. As part of their professional development, teachers must get an opportunity to learn about which examples and strategies work better in a particular context.

Another important question of concern is how to deal with the cultural beliefs of those students who come from marginalized backgrounds if those beliefs are not in agreement with the ones that science educators seek to propagate. Several studies have documented students' scientific and religious beliefs across cultures in the context of topics such as biological evolution and the origin of life on the earth (Allgaier, 2008; BouJaoude, Wiles, Asghar & Alters, 2011; Reiss, 2011). Teachers' religious beliefs and views on science have also been well documented by science educators. For instance, Mansour (2010, 2011) examined Egyptian science teachers' views on religion and science within the context of Islam, and noted that teachers' personal religious beliefs are central to their views on issues concerning science and Islam, and that science teachers often find themselves conflicted about the relationship between science and religion.

Since science and religion are often presented as incompatible or incommensurable knowledge systems that are in conflict with each other, I wonder how critical science educators could help students make sense of the scientific discourse on nature without discarding their cultural beliefs that advocate an anthropocentric position. From a cultural perspective, Aikenhead (1996) argues that "science educators, Western and non-Western, need to recognize the inherent border crossings between students' lifeworld subcultures and the

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subculture of science, and that we need to develop curriculum and instruction with these border crossings explicitly in mind, before the science curriculum can be accessible to most students" (p. 2). Jegede & Aikenhead (1999) elaborate how science learning could be an alienating experience for students whose lifeworlds are at odds with the culture of science.

> When the culture of science is generally at odds with a pupil's life-world, science instruction will tend to disrupt the pupil's worldview by trying to force that pupil to abandon or marginalize his or her life-world concepts and reconstruct in their place new (scientific) ways of conceptualizing. This process is *assimilation*. Assimilation can alienate pupils from their indigenous life-world culture, thereby causing various social disruptions... or alternatively, attempts at assimilation can alienate pupils from science, thereby causing them to develop clever ways (school games) to pass their science courses without learning the content in a meaningful way assumed by the school and community.

> (Jegede & Aikenhead, 1999, p. 47, emphasis in original)

Respecting cultural beliefs of marginalized groups and accommodating them in science classrooms is a major challenge for science educators committed to social and environmental justice. Shedding some light on how to go about helping students navigate the two apparently contradictory discourses, Southerland & Scharmann (2013) argue that "an equitable approach to science education must also be cognizant of students' religious beliefs" (p. 64). They suggest that science should be presented as one of the ways of knowing, and not the ultimate way of knowing the world. Students should learn that there is no implied hierarchy to these ways of knowing. In order to help students reconcile the conflict between scientific and religious beliefs on matters, they advocate an "early, explicit consideration of the nature of scientific knowledge with a particular focus on the boundaries of science" (p. 64), i.e., what questions come under the purview of science, what methods are employed for knowledge construction and validation in science, and what are the overlaps and differences among various knowledge systems. To help science teachers overcome the conflict between science and religion, Mansour (2010) maintains that -

> …compatibility is needed between religious education and science education. In cultures where religion has a major influence on people's lives the development of science curricula should be made in a partnership between science educators and religion scholars, especially with regard to socioscientific issues associated with religion. This process would provide opportunities to challenge teachers' personal religious beliefs, to

introduce appropriate perceptions of religious attitudes, and to leave the door open for different views and different understandings (p. 138).

Thus, an alternative model of science/ environment education committed to principles of social and environmental justice must engage with onto-epistemologies of science and religion and examine how these knowledge systems construe human-nature relationships and what value frameworks are prescribed. How to help learners resolve the conflict between the two discourses without undervaluing their cultural identities remains a big challenge for critical science/ environment educators.

6. Towards a justice-centered science and environment education

सिर्फ़ हंगामा खड़ा करना मेरा मकसद नहीं,

मेरी कोशिश है कि ये सूरत बदलनी चाहिए

[Dushyant Kumar]

[Translation: My intentions are not merely to create some ruckus,

what I seek is to radically transform reality]

This thesis bases itself on the premise that inculcating Critical Scientific, Technological, and Environmental Literacy (CSL) among students enables them to work towards transforming the world into a more equal and just space (Hodson, 2003). One of the ways to achieve such a politicized goal is through organizing the curriculum around contextualized themes, adopting dialogic pedagogy in classrooms, and engaging students in sociopolitical action.

Given that India has immense diversity in terms of caste, class, gender, faith, language and culture, any discussion on critical science and environment education needs to factor in sociocultural and political conditions at the local level. Thus, from the lens of a Critical Pedagogy of Place (CPP), it made more sense for me to initiate conversations on social and environmental justice and explore the possibilities of transformative education in the region where I spent most of my time during my doctoral work, i.e., the M(East) ward in Mumbai and explore this question in the context of an issue (waste) that is relevant to the community living in the region. The region is known to host one of Asia's largest landfill sites. Primarily inhabited by Muslims and Dalit Bahujans, the M(East) ward is the most neglected community in the city, having a Human Development Index value as low as 0.05 (MCGM, 2009).

In the particular context of the M(East) ward, I argued in Chapter 3 that waste is a potential theme to raise social and environmental justice concerns with students. As a curricular theme, waste is closely linked with other curricular themes such as materials, health, environment, and development. All these themes are an integral part of the secondary science and social science curriculum in India. In this thesis, I have focused on three such themes: waste, environment and development. The themes on health and materials are discussed only in the context of waste.

This thesis set out to achieve three main objectives –

1. Critically examining the educational discourse on waste, environment and development from the standpoint of the M(East) ward community

2. Exploring students' lived experiences and out-of-school knowledge with regard to focal themes

3. Conceptualizing a model of justice-centered science and environment education in the context of the M(East) ward.

In Chapters 4 and 5, the theoretical framework of CSL and CPP was employed to problematize the educational discourse on the focal themes (waste, environment and development) from the standpoint of the M(East) ward community. A summary of the critique is presented in Section 6.1 below. The out-of-school interactions with students provided me with an opportunity to know them as individuals, understand their daily struggles, concerns, and aspirations, and explore the knowledge they have constructed as part of their social upbringing. This piece of data corresponds to the second research question and is discussed in Chapters 4 and 5 of the thesis. Unfortunately, the school curriculum does not value this everyday knowledge, and the students too often remain conflicted about its validity. I imagine a space where there is a possibility of dialogue between the formal educational discourse and students' everyday discourses. This is where I see my ideas resonating with what scholars have called a 'hybrid' space of learning. I discuss this idea at length in Section 6.2. In the subsequent section (Section 6.3), I turn my focus to the third objective of the thesis and offer a contextualized alternative for the consideration of the science and environment education community. Some potential concerns in adopting a justice-centred approach to science and environment education are also highlighted. Finally, in Section 6.4, I discuss the study's implications for curriculum development, teacher education and further research.

6.1 Characterizing Educational Discourse on Focal Themes

The analysis of the formal educational discourse on focal themes shows that the overall approach to dealing with the concerned topics is techno-managerial. For instance, the chapter on waste focuses on teaching how to 'manage' waste through 'scientific' methods, and the participant teachers also adopted a similar narrative in their teaching. Moreover, the teachers' interviews reveal a heavy emphasis on sustainable development, which is about striking a balance between economic growth and utilization of natural resources through technoscientific innovations. Within a sustainable development paradigm, natural resources are maintained at an optimum level with the use of technology and other measures for the purpose of economic growth. However, the nature and pace of economic growth and its ultimate consequences on people and the environment are not problematized.

The nature of the educational discourse is also individualistic. For instance, in the chapter on waste, systemic explanations are not offered for the problem of waste. Instead, the problem is shown to be rooted in individual behaviour and attitudes, and the measures are suggested for individuals to follow. Similarly, the responsibility of maintaining the balance of nature is invested in individuals. In the discussion on the 3 R's, we note that the idea of reduce is limited to reducing the use of specific things but the scale of consumption or consumerism per se is not questioned, though who consumes more in the society also needs to be discussed critically. Reuse and Recycling are also discussed, only in a cursory manner in the textbook.

Another important insight that emerged in the analysis is the class and caste character of the discourse. While there is complete silence on sociopolitical questions such as the caste character of the sanitation work in India, the political economy of waste does not qualify to be a part of the textbook or classroom discourse. The textbook also sidelines the connections between waste generation, consumerism and the capitalist economy. Neither does the textbook engage with the question of why waste gets generated at an enormous scale, nor do the teachers in their classes raise the question. When teachers were asked to share their understanding of the root cause of the aggravating waste problem, they offered explanations such as burgeoning population, unscientific management of waste, lack of political will, and people's attitudes towards the environment.

With regard to the effects of improper waste management, one observes that aesthetic effects are privileged over other effects, including the impact of waste on people's health and the

natural environment. The concerns of common people whose lives are entangled with waste in multiple ways (e.g. sanitation workers, rag pickers, or those who live close to landfill sites) are swept under the carpet. Moreover, the risks and threats that waste processing industries pose to local livelihoods are downplayed, indicating a tendency of the official discourse to protect corporate interests. This clearly shows the class character of the discourse and is a characteristic of 'bourgeois environmentalism'[15] (Baviskar, 2002). Further, the environmental behavior and practices that the textbook promotes range from waste segregation to composting and reducing specific consumption practices. The textbook also seems to assume a middle-class audience since it takes for granted the readers' access to resources like a backyard, dustbins to segregate waste, and money to spend on consumer goods.

We also noticed that the discussion on waste segregation, handling and transportation had no connections with the lived experiences of the M(East) ward people. While students are being taught lessons on segregating waste into dry and wet categories, what they see in their immediate surroundings is waste lying unsegregated and unprocessed in the landfill. There needs to be more sensitive engagement with this reality in the classroom. For people who live in overcrowded slums, there is no system in place for regular waste collection. Therefore, suggestions such as keeping different bins for different kinds of waste at home seem highly insensitive. Ironically, the educational discourse on waste offers a sanitized and depoliticized discourse on the topic, which is consistent with the dominant narrative of presenting science as a value-free discipline.

With regard to the educational discourse on the natural environment, the findings indicate that how nature is conceptualized is different in the science and social science textbook. While the science textbook adopts a slightly technical approach to discuss concepts such as ecosystems, the balance of nature, food chains, food webs, and the interdependence between humans and nature, the social science textbook portrays nature merely as a pool of resources. At times, both textbooks employ a utilitarian language to discuss nature. The teachers, too, talked about

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15 From a political ecology perspective, an ideology of 'bourgeois environmentalism' has emerged as an organized force in cities, where upper class concerns around aesthetics, leisure, health and safety shape the discourse on environmentalism in urban spaces. Bourgeois environmentalists are primarily concerned about ordering urban spaces so that the threat of disease, crime, and unpleasant sights and smells could be minimized, which is, in some ways, an extension of their concern about their bodily well-being, which is an individualistic, self-centered approach.

nature merely in terms of resources and adopted an anthropocentric perspective to describe nature's worth.

Environment and development are closely interlinked concepts. Hence, I also undertook an analysis of how development is discussed in the science and social science textbooks. The analysis of the social science textbook chapter on regional development shows that the idea of development is not explained merely in terms of economic growth despite the prevalence of the sustainable development ideology in the educational discourse. There is a detailed discussion on Human Development Index in the textbook chapter. Various social and geographical factors such as the abundance of natural resources, quality of available resources, people's willingness and skills to utilize resources, and infrastructure, are offered as explanations for the regional variation in development. However, these factors might not be sufficient to explain the local variation in development indicators in urban spaces especially xenophobia towards migrants of the Northern states of the country. When the participant teachers were asked to explain the ward-wise variation in development indicators in Mumbai city, they brought up sociopolitical factors as well and demonstrated an awareness of the role of state and industry in determining the fate of people's livelihoods and the environment. However, the teachers also mentioned the importance of maintaining a balance between environment and economic development, i.e., the idea of sustainable development. Moreover, we observed that there is complete silence in the official as well as enacted curriculum on the conflicts around development projects; for instance, the issue of displacement never appears in the discussion.

The analysis of classroom teaching reveals that the textbook essentially structures the teaching. However, we also observed that some teachers tried to simplify the content and contextualize the subject matter for their students (Examples discussed in Chapters 4 and 5 of the thesis). These attempts to contextualize the content need to be acknowledged and given due appreciation in teacher education programs. However, many more possibilities exist for contextualization which I will outline later in this chapter.

In a nutshell, the analysis of formal educational discourse on the focal themes reveals a decontextualized and depoliticized character of the discourse. Since school education provides hardly any space for the M(East) ward students to share their experiences, concerns, questions or knowledge on issues that are so central to their lives, it works more like an instrument of

'symbolic violence' on students, and can certainly not be seen as providing an empowering experience for the students (Bourdieu & Passeron, 1977).

6.2 Understanding students' life worlds

Since the world of school does not offer an empowering experience to the M(East) ward students and by extension, for most students, if we adopt the perspective that a transformative curriculum aligned with the ideals of CSL and CPP should respond to the needs and the political mobilization of the most marginalised learner, there is a dire need to formulate a contextualized alternative that the students can connect with and that would be transformative for them as well as their communities. The first step in this direction would be to explore the world outside school that the students have access to and understand their lifeworlds, particularly their lived experiences, knowledge, values, aspirations, cultural beliefs, and political views. Osborne & Wittrock (1985) call it the generative learning model wherein teachers engage in constructivist pedagogy by encouraging students to express and reflect on their experiences or preconceptions. Therefore, a key objective of the study was to explore the lifeworlds of the M(East) ward students and develop pedagogical resources that draw on experiences in their everyday lives. In the three workshops that we conducted with the students, we attempted to provide them with opportunities to share their lived experiences and views in the context of the focal themes.

The first-hand accounts of the students from the community that I gathered during my interactions with them in the workshop context further confirm the ground reality documented in various reports on the socio-economic conditions of people in the M(East) ward (see Chapter 3, Section 3.1 for details). The students' self-reports indicate that their families lacked access to basic amenities like adequate healthcare facilities, nutritious food, potable water, toilets, and public hygiene, which are crucial for people's health (Srivastava, Khan & Raveendran, 2018). When presented with context-specific vignettes, students demonstrated a thorough understanding of the complex linkages between health, hygiene, nutrition, access to healthcare, and poverty. Their rich understanding of the social determinants of health could only be attributed to their individual and collective struggle for basic amenities on an everyday basis.

In the context of the discussion on waste, the out-of-school interactions revealed that the students had a rich understanding of the recycling economy, especially on recycling value, and the extraction and recycling process of various materials (see Chapter 4, Section 4.4.1 for details). With regard to the environment-development debate, they manifested a nuanced understanding of the notion of development explaining the local variation in development indicators in terms of sociopolitical factors. They also demonstrated an awareness of the role of state and industry in determining the fate of people's livelihoods and the environment. In the previous chapter, I have discussed the nature of the students' conversations around development and what makes a city a good city. The students revealed their experiences of various crimes, including substance abuse and physical violence. While reading the narratives of ragpicking children from another context, the participants shared their personal experiences of violence, substance abuse, sexual harassment, and the discriminatory behavior of the police towards their community.

In the discussion on health, students referred to alternative medical practices that existed in the community, including prayer, black magic, and home remedies. Similarly, when conversing about nature and the human-nature relationship, most participant students referred to religious scriptures such as the *Quran* and invoked an anthropocentric stance in their arguments. They seemed to believe that nature was created to serve humans. Such beliefs conflict with an ecological understanding of human-nature interdependence and a holistic stance adopted by the *Holy Quran* itself. Engaging sensitively with the cultural beliefs of marginalized communities, and at the same time enabling them to critically evaluate their cultural beliefs in a classroom context remains a big challenge for critical science and environment educators.

In the context of the documentary 'Story of Stuff' that we watched together in one of the workshops, the students pointed out a significant facet of the current political economy, i.e., the nexus between the government and the industry, how they mutually safeguard each other's interests, and how they exploit the common people. We also had a discussion on what they aspire to do in the future. In that context, most students expressed interest in doing something for the betterment of their community in addition to pursuing their specific professional interests.

Certain affective responses such as shame, agitation and empathy for other vulnerable groups also emerged in our discussions. For example, while discussing the fictional story of a steel

plant, most students showed empathy towards tribal communities. They expressed concern for their livelihoods despite having very little knowledge about their lives. The fictional story 'Elections in a jungle' helped us gain some access to their political views. They were agitated by the government's discriminatory actions against the Muslim community in the country.

These planned and unplanned explorations into the students' lifeworlds opened a Pandora's box full of experiences, values, knowledge, concerns, cultural beliefs, political views, and more importantly, a mixed bag of feelings such as shame, agitation and hope that their living conditions can be improved. These epistemic, affective and socio-cultural aspects of their lives are shaped by their interactions in their families, peer groups, community, and popular culture. These resources are socially distributed, accumulated over time, and strategically employed by individuals and communities for survival and wellbeing. Moll et al. (1992) define these "historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and wellbeing" as "Funds of Knowledge" (FOK) (p. 133). It is striking that while prevalent deficit discourses explain the underachievement of minority students in terms of deficiencies lying with students, their families and their cultures, the funds of knowledge perspective turns the deficit-theorizing upside down by acknowledging and valuing the rich tradition of knowledge and values owned by marginalized communities. It also disregards the power hierarchy between school knowledge and everyday knowledge (Hogg, 2011).

Scholars have argued that the inclusion of funds of knowledge makes learning more accessible for students from marginalized communities as they find familiar starting points. Barton & Tan (2009) claim that "(v)aluing diverse funds of knowledge and Discourse as legitimate science classroom resources positions minority students as rightful experts of certain knowledges directly related and applicable to school science" (p. 52). Zipin (2009) calls attention to students' *dark* funds of knowledge which include prior bad experiences such as bullying, alcoholism, harassment and discrimination. However, if seen as learning assets, the dark funds of knowledge can also be potentially empowering and transformative for students. When invoked in a learning context, the dark funds of knowledge trigger a feeling of discomfort among students and teachers and generate high student participation and provide opportunities to converse on things that matter to students. If teachers direct their focus on exploring students' funds of knowledge and Discourses, bring it up for discussion in their classrooms and value that as a learning resource, they would be enabling a learning

environment for minority students and scaffolding their learning. However, often the school curriculum discredits what students know from their everyday experiences. Thus, it is essential that a space is created which provides affordance for dialogue between the academic and everyday discourses.

Moje et al. (2004) emphasize the need for integrating students' academic and everyday knowledge and Discourses. Drawing upon scholarship in various fields, they make a case for conceptualizing a 'hybrid space' of learning and offer three distinct meanings of the concept:

1. Hybrid space as a *bridge* or *scaffold* that links marginalized funds of knowledge and Discourses to academic funds and Discourses to ensure better academic achievement,

2. Hybrid space as a *navigational space* in gaining competency and expertise to negotiate different discourse communities and, in the process, generate new knowledge and Discourses,

3. Hybrid space as a *space of cultural, social, and epistemological exchange* where competing funds and Discourses coalesce into each other.

Everyday knowledges and Discourses are integrated with disciplinary learning in ways that challenge, destabilize and eventually expand the boundaries of official Discourse. In the next section, I build upon these ideas and aim to offer a way forward.

6.3 A way forward

Having developed a systematic critique of the educational discourse on focal themes from the standpoint of the M(East) ward people and having explored students' lifeworlds, in this section, I aim to delineate a plausible model of justice-centered science and environment education in the context of the M(East) ward. I have chosen 'waste' as a theme[16] to illustrate how an interdisciplinary theme can be developed in a justice-centered framework.

6.3.1 Unpacking the theme from a justice framework

As discussed earlier, waste is a theme that is closely connected to various other curricular topics such as health, materials, environment, and development. Moreover, there are several

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16 In the course of my interactions with students, I realized that 'water' could also have been an alternative theme to explore in this context as the water crisis is a local problem that most students seemed to relate with.

dimensions of the theme and to get a comprehensive picture of it, one must engage with the science of waste, the philosophical and ethical aspects involved, the political economy of waste, the sociocultural dimensions of waste, the technologies involved as well as the policies related to waste management.

Since all these dimensions are interlinked, there need not be any particular order in exploring the theme with students. However, at every level, one must ask whether this particular topic or this particular way of teaching would eventually help achieve a more equal, just, and sustainable world. In Fig. 6.1, I have tried to unpack the issue under three broad categories – 1) Understanding Waste, 2) Understanding its impacts, and 3) Exploring solutions.
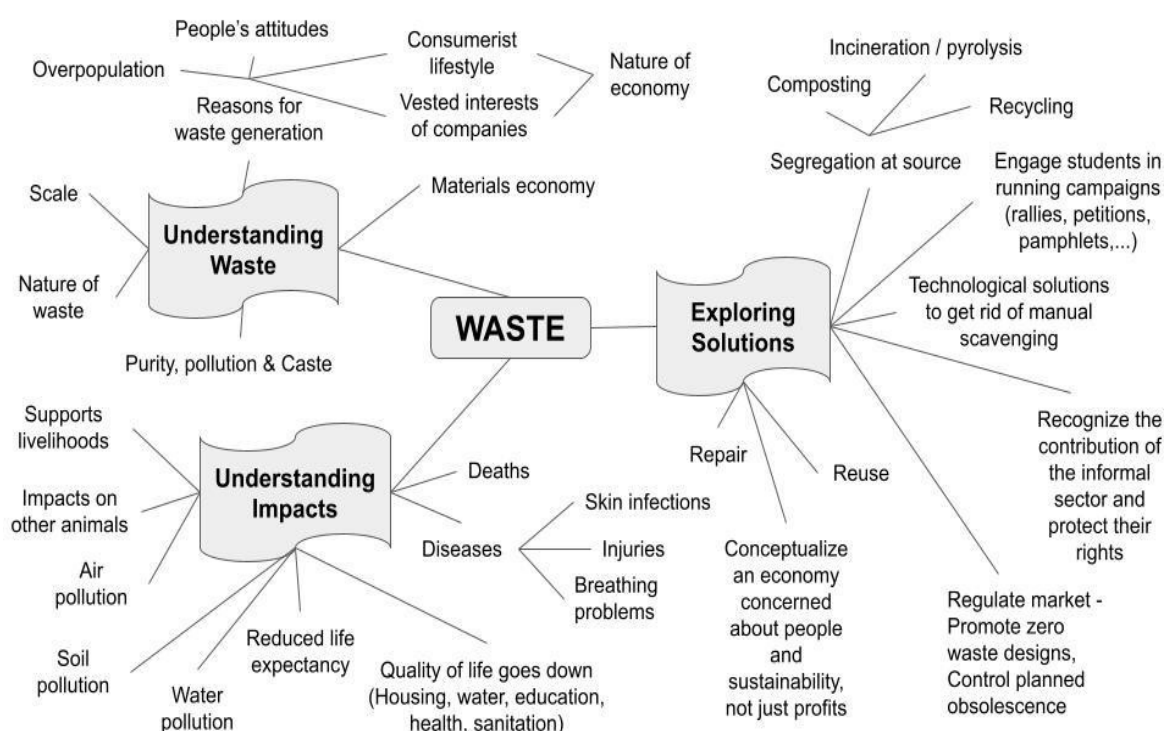
Fig. 6.1 Various sub-themes related to waste

Following a justice-centred approach, understanding waste would mean engaging students with the enormous scale and the nature of waste produced in the city, the reasons for large-scale waste generation, the materials economy, and the connection between purity, pollution, and caste. Understanding the impact of waste on people and the environment would include both kinds of impacts - positive as well as harmful. While it is important to examine the nature and extent of the impact of waste on soil, air and groundwater, its impact on the

M(East) ward people's lives in terms of their reduced life expectancy, poor quality of life, diseases and deaths that waste causes to sanitation workers, it is equally important to recognize that waste also supports millions of livelihoods. While exploring the solutions, students could analyze the risks and benefits of various waste management techniques like segregation at source, composting, and incineration. They can explore the potential of technological solutions to do away with manual scavenging and look into the alternatives such as zero-waste designs. They can also engage with questions of planned and perceived obsolescence (Fox & Leonard, 2007), and start thinking of alternative ways to profit-oriented economy – an economy that is concerned about people and sustainability.

6.3.2 Potential learning resources and activities

To illustrate the possibilities of a justice-centred curriculum, I present a few discussion points, learning resources, and classroom activities in this section. These are based on my interactions with the students in out-of-school settings. The description of the learning resources and brief responses of students presented below are not aimed at adducing further evidence for the aruguments already made (although they are consistent with them). Rather they are intended as anchors to think about future possibilities for justice-centred science and environment education in the context of the M(East) ward.

To initiate a discussion on the scale of the city's waste, I used a poster[17] (Fig. 6.2) depicting the enormous scale at which Mumbai is generating waste. The left side of the poster shows waste coming from housing societies. The green color cutout at the bottom has a piece of information that says that everyday 7000 tonnes of waste is generated in the city of Mumbai. This waste is then depicted on the right side of the poster in form of a big bin. In the discussion, it emerged that a large proportion of the waste that is dumped in their backyards is not the waste that their community is generating. Earlier, some students had expressed that the waste lying at the Deonar dumping ground was their own and blamed their community for producing waste at that scale.

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17   This poster was originally designed for a session on waste as part of an annual event organized by Homi Bhabha Centre for Science Education for the students from neighbouring schools and colleges. Two of my colleagues, Dr. Deborah Dutta and Ms. Adithi Muralidharan, played a key role in conceptualizing the session, and developing activities and resources for the same including this poster.
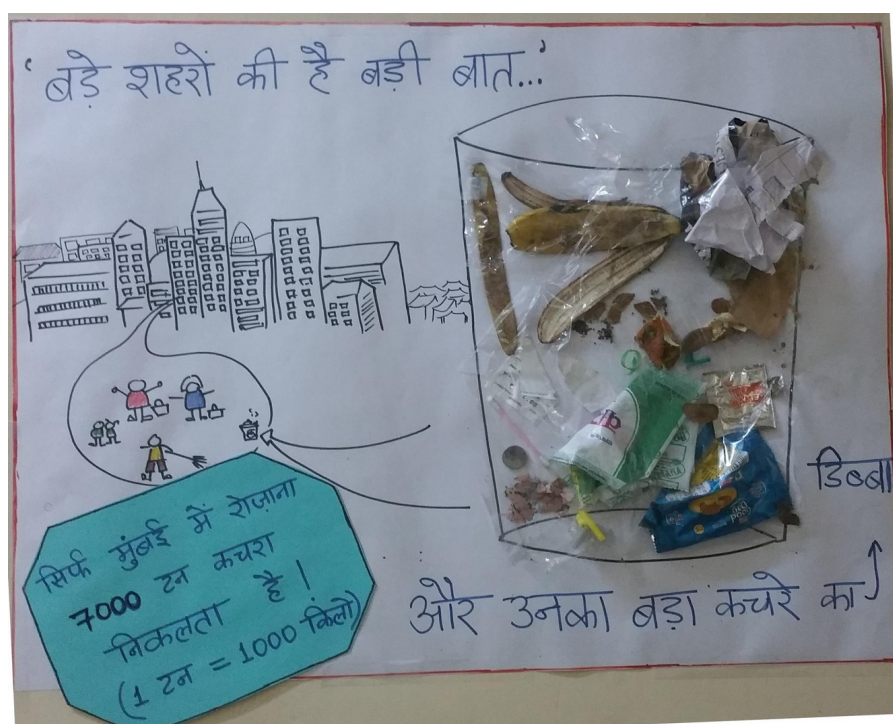
Fig. 6.2 Poster used to discuss the enormous scale of waste generated in Mumbai

In another instance, we had asked participant students to write or draw an incident or narrate an experience related to the dumping ground. The students' responses revealed how closely and critically they observed and engaged with that physical and social space. For example, Zeena wrote about how vital that landfill site is for the community that lives close to it. Their livelihoods depend entirely on the waste they pick from the dumping ground (Fig. 6.3).
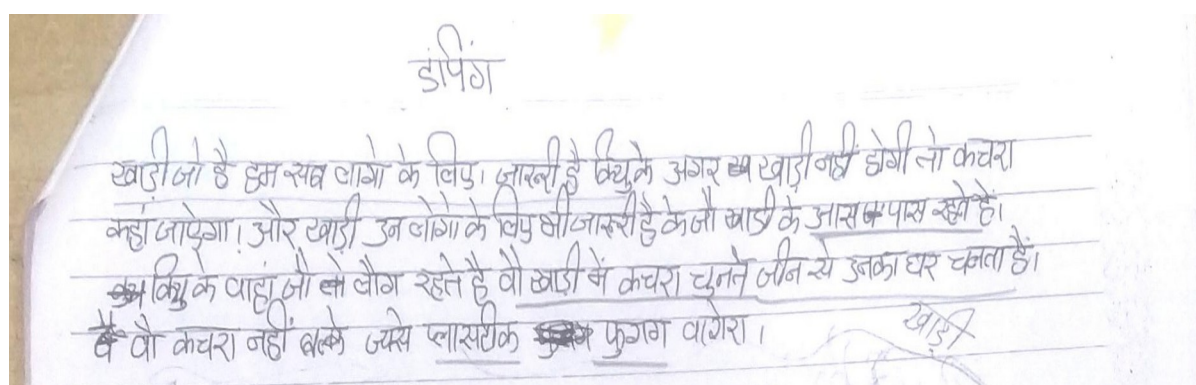
Fig. 6.3 An excerpt from Zeena's writeup on the dumping ground

Translation of the excerpt in Fig. 6.3:

[Dumping: The creek[18] is necessary for all of us because if the creek does not exist, where will the waste go! Also, the creek is important for the people who live in it's neighborhood. Because they pick the waste from the creek and make a living. Actually that is not waste, it's only plastic, balloons, etc.]

Among students who preferred drawing over writing, Tahir made a meticulous drawing of the dumping ground (Fig. 6.4).

Fig. 6.4 Drawing of the Deonar dumping ground made by Tahir in Workshop III

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18 The interactions with students revealed that numerous words are used to refer to waste and the dumping ground in the community. While waste is commonly called *kachra*, *kooda*, *kabaad and bhangaar* by local people, the dumping ground is referred as *khaari* (that translates to creek). Geographically, the Deonar dumping ground is located at the shores of a creek. Probably, that is why most people in the M(East) ward refer to the landfill as creek. Students in Cheetah Camp area use *khaari* in two senses (for Deonar dumping ground as well as the salt pane in their neighborhood) and often asked for clarification.

The drawing shows the mountain of garbage, the huge gate and the boundary walls of the dumping ground, the municipal corporation lorries transporting and emptying waste in the dumping ground, and cranes clearing the passage for the lorries. It shows how closely M(East) ward students observe this space. What stands out for Tahir about the space seem to be its dyanamicity indicated through the vehicles' movements and various activities. For others, it seemed to be the shanties in the neighborhood, people picking waste, and the nearby open drain.

In the workshop context, students were also asked to write autobiographies of an object (for example, a pen, pair of shoes, a water bottle, or a book), resulting in detailed stories about the life cycles of those objects and, in particular, how they are disposed of once they run out of use. A similar exercise can be used to elicit students' understanding of the life cycles of materials.

Interestingly, the categorization game that I had designed for students to play during out-of-school interactions could not elicit the categories that rag pickers commonly use to sort waste. In this game, various objects of daily use are kept in front of the class, and the class is divided into two groups. One group randomly selects an object from the pile, and the second group has to guess the item that the other team has thought of by asking questions that can be answered only as Yes or No. The team that guesses the selected item in fewer questions wins the game. When we played this game during workshops, the participants employed four different categories to identify the selected item: 1) Utility of the item, 2) Frequency of usage (daily vs occasional), 3) Source (directly received from nature vs man-made), and 4) The material it is made of. Recyclability (or recycle value) of a particular item did not appear as a criterion in that conversation though on other occasions they did talk about the recycle value and recycling process for various materials.

Sanitation and hygiene are significant determinants of public health. However, in addition to the importance of maintaining cleanliness and basic hygiene, the discussion on waste and health must include the health risks to those who handle waste on an everyday basis such as the injuries and infections that rag pickers suffer due to the lack of protective gear, sanitation workers' heavy reliance on alcohol to avoid stench coming from septic tanks, and occasional deaths that can be easily avoided by employing technological support. The discussion on lower life expectancy in areas near dump sites and among sanitation workers is another

paramount health concern. Contextualized narratives (Appendix XI) that I used to trigger discussions on the complex linkages between health, poverty, nutrition, sanitation, and access to healthcare facilities helped elicit participants' ideas of social determinants of health (Details in Sec. 4.4.2 in Chapter 4 of the thesis). Some of these vignettes are presented in Fig. 6.5.

> Shadab's house is right next to the drain that flows near the dumping ground. In rainy seasons, the water starts overflowing the drain. The boundaries get blurred and the house itself becomes part of the drain.

> Rukhsar lives in a small society. People there pack their daily waste in polythene bags and throw those bags on the street. Mostly this garbage keeps piling There for days. It starts rotting and smells bad.

> Shafiq's house is also close to the dumping. Every morning all the men in his house go to the dumping to defecate. Women go to a private toilet where the water is not so clean.

Fig. 6.5 Sample vignettes used to elicit students' understanding of social determinants of health

The political economy of waste also needs to be unpacked as students learn about waste. They must engage with questions like how various commodities come into being, which involves asking where and how various things are produced, sold, consumed, and disposed of, who are the people involved at various stages of production, whose interests are served and who is at a loss in the whole production-consumption process. I used an animated documentary titled 'Story of Stuff' by Annie Leonard to elicit students' views on the materials economy, vested interests of industries in waste generation, and how that is ensured even at the stage of designing and manufacturing various commodities. This film triggered interesting discussions among students, who saw a parallel in the Indian context and pointed out the nexus between the ruling government and two prominent industrialists.

To initiate conversations on sanitation workers' living and working conditions with the students, I had used photographs[19] taken by a well-known photojournalist, Sudharak Olwe of sanitation workers in action (see Appendix XIX). The photographs did not have any caption or an accompanying text and were, therefore, fully open to interpretation. While we assumed that these photographs would be moving for students, it actually triggered uncomfortable laughter among students. Perhaps those photos caused a sense of embarrassment among them. Pointing out the crucial role of emotions and affect in pedagogical processes, Zembylas (2016) argues that "Failing to understand how students' emotional attachments are strongly entangled with epistemological, cultural and historical circumstances and material conditions will undermine teachers' pedagogical interventions" (p. 546). This also implies that while designing a tool, one needs to pay close attention to what emotions get triggered among students when the tool is used. In retrospect, I think Olwe's photographs caused too much emotional burden on the students. Perhaps a combination of Olwe's photographs and text might work better to deal with sensitive issues of this kind.

When written accounts of the children of rag-picking communities in Bhopal were used in the workshop context, and we had discussions in smaller groups of two to three, the participants could easily connect with those anecdotes and share their personal experiences with us. Such narratives are powerful in eliciting students' views and sharing experiences.

In addition to the resources and activities that I employed myself to explore students' understanding of focal themes, there are many more activities that scholars have used in other cultural contexts which I will discuss in the section that follows. I believe many such activities and resources can also be helpful in the context of the M(East) ward. However, this part is more speculative as these activities have not been tested in this particular context.

6.3.3 Additional activities and resources

To help develop a systemic perspective on waste, curricular experiences that engage students with the socio-material aspects and trajectories of waste practices and materials might be helpful (Jørgensen, Madsen & Læssøe, 2018). For example, Levinson (2009) highlights the importance of bringing out *interlocking* narratives that would facilitate students to understand science in its social context, appreciate the systemic nature of science and connect the local to the global. To demonstrate the possibility of developing such narratives, he takes up the story

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19   https://www.sudharakolwe.com/insearch.html

of aluminium and shows how the extraction and purification of aluminium are linked to the lives of waste collectors in Rio de Janeiro, Brazil (Levinson, 2014). Similar narratives can be developed and used as pedagogical resources in the classroom context.

Students should be encouraged to question why the city's waste is being dumped in their backyards, why it is even getting generated at this scale, and explore the relation between waste generation, consumerist culture, and the nature of the economy. They could investigate how landfills affect various people's lives, including sanitation workers and those who live close to a landfill. An exciting activity that students could engage in is directly interacting with sanitation workers. They can interview them, prepare a socio-economic profile of the people involved in sanitation work, and situate it in a historical context to understand the casteist and gendered nature of the work. They could explore why only certain castes are involved in sanitation work and how that can be changed.

During my interactions with the officials of SWaCH and KVSS members, the respondents had pointed out various issues that rag pickers and sanitation workers face in their work context. These include meager wages, no bonus, no identity cards, no protective gear, occupational health risks, the precariousness associated with the temporary nature of their work-contracts, lack of comfortable work-spaces, practical challenges involved in waste collection, accountability, collecting monthly charges from users, and dignity of labor. These issues have also been documents in several media reports[20]. Students would be propelled to act against these injustices if they interacted with people of local organizations and engage with various reports and resources[21] these organizations working with sanitation workers have developed over time (Chikarmane, Narayan & Chaturvedi, 2008). Thus, the students could be engaged in a project in which they would accompany a rag picker from early morning till the end of the day, interact with them, and document their work, similar to the case studies[22] developed by organizations like SWaCH. As part of the project, they could also analyze various media reports[23] on the Deonar dumping ground and the socioeconomic conditions of people in the M(East) ward.

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20 https://www.theguardian.com/global-development-professionals-network/2013/jun/06/rummaging-through-rubbish

21 https://swachcoop.com/resources/

22   https://swachcoop.com/sugandhabai/

23   For instance, students could read and analyze some of these reports: https://www.thehindu.com/opinion/op-ed/on-the-margins-in-a-city-of-dreams/article8414442.ece

While discussing the impacts of waste on people, it needs to be pointed out that toxic gases released from piles of garbage could be fatal for people working with waste. In addition, the frequent fires at dumping sites could cause breathing issues to those who live near such sites. Therefore, discussion on questions such as what kind of waste is more likely to produce a specific gas, under what conditions these gases are produced, and how to detect the presence of these gases may help the survival of those who are involved in rag picking at landfill sites and those who get down to clean choked sewers and septic tanks. Stories, reports and pamphlets compiled by *Safai Karmchari Aandolan*[24] are valuable resources to initiate a conversation on this topic. Questions related to access to clean air, water, and sanitation facilities for those who live near dumpsites or earn their livelihoods from city waste every day also need to be raised at some point. A 19-minute long documentary, *City's edge*, prepared by the School of Media and Cultural Studies at Tata Institute of Social Sciences, Mumbai, illuminates the people's hardships in the M(East) ward. However, when using such sensitive audio-visual material, special attention must be paid to the nature of the emotions that such material might trigger in participants, and a careful assessment of the nature of the content should be made.

If composting at the household level is not possible, students can be engaged in running a composting facility at the community level. While maintaining the facility, they can discuss the science of biodegradation, such as microbial pathways that help decomposition, various degradation stages and the relationship of microbial pathways with the growth and propagation of disease vectors. They could test the soil and groundwater in the neighborhood and the protocol that was developed for collecting data on the air and water quality and conducting a health survey as part of the Health and Environment: Action-based Learning

https://timesofindia.indiatimes.com/city/mumbai/Medical-waste-incinerator-spews-poison/articleshow/5113527.cms

https://mumbaimirror.indiatimes.com/mumbai/cover-story/Maximum-shity/articleshow/45243503.cms

https://scroll.in/article/692846/How-Indian-firms-use-dirty-tricks-to-deny-sanitation-workers-their-rights

24 Information about the movement against manual scavenging:

https://www.safaikarmachariandolan.org/movement

Link to Bhim Yatra reports: https://drive.google.com/drive/folders/1PJNZY-kZl602D9yJDA9zGon2lmMJGDRz

Here is a short video on the struggle and hardship encountered by manual scavengers to turn their life around and live a life with dignity and pride https://youtu.be/n7myJ3nloHE

(HEAL) program of HBCSE could be employed for the same (Mahajan, Bellara & Nair, 2005). Investigations on the high prevalence of certain diseases in the region and life expectancy and other health indices in the ward could also be conducted. While discussing the incineration process, teachers could refer to the local incinerator owned by a private company and the risks associated with it. Students could also be engaged in investigative journalism on these issues, and if students' writing skills are not adequate, they can be encouraged to do video documentation.

The discussion on recycling could be connected to the chapter on properties of materials (discussion on metals, non-metals and alloys) and metallurgy that is discussed in textbooks in higher classes. References can be made to what they are already familiar with, such as recycling values of various materials and how various materials are extracted, cleaned and processed. Numerous ideas are available on the Internet for upcycling household waste. Scientific toys[25] can also be made of trash.

One of the exercises that a participant teacher had used in his class was to design a waste management plan for Mumbai city and share the plan with the local government official. The students could take up such open-ended tasks. The case studies of cities that successfully manage their waste have been documented[26] by institutions like the *Center for Science & Environment*. Students can analyze some of the best practices and use them to make their case.

Moreover, one of the key aspects of inculcating critical scientific, technological and environmental literacy (CSL) is to prepare students for sociopolitical actions. *Apnalaya,* a Non-Government Organization (NGO) operative in the area has engaged students in the community in various sociopolitical actions. For example, as part of the 'Bal Sansad' of motivated students, the students review election manifestos of various parties, talk to their leaders, and raise their concerns. Occasionally, they organize a rally in the community to make people aware of their rights, prepare and perform street plays on social issues (Fig. 6.6), and put pressure on government representatives. During my fieldwork, I also volunteered for the organization and got a flavor of these activities. Interactions with people associated with similar organizations in the region could also help determine what actions are possible at the collective level.

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25   https://www.arvindguptatoys.com/toys-from-trash.php

26   https://www.cseindia.org/not-in-my-backyard-solid-waste-mgmt-in-indian-cities-6746

Fig. 6.6 Youth associated with Apnalaya performing a street play

6.3.4 Pedagogical approach and potential challenges

From a Freirean perspective, Dos Santos (2009) advocates a dialogic pedagogy for critical science education. In the Indian context, Sharmila Rege, a feminist scholar, draws upon the educational philosophies of Phule and Ambedkar and argues that a transformative critical pedagogy must integrate the Buddhist principles of *Prajna* (critical understanding), *Karuna* (empathetic love), and *Samata* (equity) (Rege, 2010). In the M(East) ward context, *Prajna* would translate to a critical, systemic understanding of the sociopolitical conditions prevalent in the community. *Karuna* would entail enacting this critical understanding through a *culturally relevant* pedagogy (Ladson-Billings, 2014), engaging with students' cultural context, listening to their experiences, and making empathetic connections. This would translate to bridging the gap between school science discourse and students' lifeworlds and

creating a '*hybrid*' space where educational discourse and out-of-school discourses converse with each other (Barton, Tan, & Rivet, 2008). Enacting the principles of *Prajna* and *Karuna* will create the necessary conditions for *Samata* or equity.

Enacting a politicized pedagogy in the classroom context comes with numerous challenges. One of the major concerns is how one can facilitate students from marginalized contexts to develop a critical understanding so that they start questioning experiences that are otherwise mundane; and help them connect their particular experiences with the larger picture and systemic issues. Developing empathy for other marginalized groups remains another critical challenge. Another matter of concern is how one should engage in a responsible discussion around the health risks and other possible threats with students from marginalized communities when most people in the community are dependent on those jobs and are bound to live in those conditions. Holding these discussions with students without invoking a sense of shame, humiliation or hopelessness is a major challenge for teachers. It is also important to think of how to channelize the experiences of marginalization as a political tool and how to deal with students' aspirations, political views, and deep-rooted cultural beliefs in a classroom context. There are no easy answers to these questions. The study sheds some light on what is possible and how it can be achieved, but a lot of work needs to be done in terms of working out the appropriate material to be used and the nature of pedagogies that need to be adopted.

Before I conclude, I recollect a conversation with a sanitation worker affiliated with KVSS who had said that education must be "helpful for our community". Similarly, in a conversation, one of the leaders of KVSS, Milind Ranade, insisted that formal education is not proper education; instead, becoming aware of one's rights and fighting for the same is proper education. In that spirit, the challenge ahead for researchers, teachers, and teacher educators is to work with the general principles outlined by Rege (2010) and enable transformative possibilities for communities such as the M(East) ward.

6.4 Future directions

Even though this study is exploratory, certain implications can still be drawn for curriculum designing, teacher education and further research in science and environment education. The study emphasizes the importance of the local, the importance of context in learning. It makes a strong case for a contextualized, politicized curriculum committed to social and

environmental justice. Students' voices will have a crucial role in such a curriculum, and students' experiences, questions, concerns and everyday discourses would need to be incorporated with due respect. If teachers have to teach using such an approach, they would need support in contextualizing and politicizing the subject matter. They would need to know their students better, and it would be necessary for them to get involved in exploring communities' funds of knowledge and discourses. The teacher education programs could provide such avenues.

The study also points towards the need to work with marginalized groups on a sustained basis, explore their lives, concerns, and struggles, and work with them to develop contextually relevant, meaningful, and transformative educational material for learners. While formulating an alternative, a more participatory model could be adopted. I hope future researchers would take up some of these challenges head on and explore possibilities in the context of many more marginalized communities in diverse geographies. This study is just a humble beginning in that direction.

Appendices

Appendix I

Consent form for school management to record classroom observations and teacher interviews

To,   Date:

_____

The Principal

_____

_____

Sub: To seek permission for classroom observations and interaction with students of class IX in your school

Dear Sir/ Ma'am,

I am a PhD student at the Homi Bhabha Centre for Science Education, Mankhurd, Mumbai. My doctoral work is in the area of environmental education. In the context of this work, I want to observe science teaching in class IX particularly when Chapter 8 (Highway to Health), Chapter 16 (Bonding with Ecosystems) and Chapter 17 (Solid waste: Eco-friendly management) are taught. I also want to interact with students to understand their perspective on environment related issues and their understanding of various underlying concepts. Once the observations are over, I plan to interview the volunteer science teacher and interact with some students on one-to-one basis.

The classroom teaching for the three chapters will be video-recorded to ensure a comprehensive analysis of the data. To let children ease off with the camera, I will video-record additional three or four days before the actual data collection. The interactions with individuals will be audio-recorded and this data will be used for academic purposes only. In the whole process, the identity of the school, the participating teachers and students will be kept confidential. I will also ensure that this data collection does not disturb the regular functioning of classes.

I request you to facilitate the proposed research work in your school.

Best regards,   Approved by,

Himanshu Srivastava   Prof. K. Subramaniam

Research Scholar   Dean

HBCSE, TIFR   HBCSE, TIFR

Appendix II

Consent form for teachers to seek their permissions for classroom observations and interviews

<div align="center">

होमी भाभा विज्ञान शिक्षण केंद्र

टाटा मूलभूत अनुसंधान संस्थान

वी. एन. पूरव मार्ग, मानखुर्द, मुंबई

रजामंदी दस्तावेज़

</div>

पर्यावरण (माहौलियात) और निजी सेहत से जुड़े मसले हम सभी के लिए दिनोंदिन जरूरी होते जा रहे हैं और अखबारों में, टी.वी. वगैरह में भी हमें इनके बारे में काफी कुछ सुनने को मिलता रहता है । इनको नजरअंदाज करना आने वाले समय में काफी खतरनाक साबित हो सकता है। इसे ध्यान में रखते हुए हम अपने सेंटर में एक रिसर्च कर रहे हैं जिसमें हम यह समझना चाहते हैं कि इन मसलों पर क्लास में क्या बात होती है और टीचर्स इसके बारे में क्या सोचते हैं ।

इसी सिलसिले में हम आपकी क्लास में चुपचाप बैठकर देखना चाहते हैं कि आप इस तरह के सबक को कैसे पढ़ाते हैं और क्या सोचते हैं। स्कूल मैनेजमेंट की रज़ामंदी मिलने के बावजूद हमें लगता है कि आप अगर खुद को इस प्रोजेक्ट का एक हिस्सा समझते हुए अपनी रज़ामंदी दे देंगे तो हमारे लिए बहुत अच्छा होगा।

आपको ऐतराज़ ना हो तो हम आपकी क्लास को वीडियो रिकार्ड और आपके इंटरव्यू को ऑडियो रिकार्ड करना चाहते हैं ताकि जरूरत पड़ने पर बाद में वापस सुना जा सके और उस जानकारी को बच्चों की पढ़ाई को बेहतर बनाने के लिए चल रहे रिसर्च में उपयोग किया जा सके। हम आपको भरोसा दिलाते हैं कि इस वीडियो/ऑडियो रिकार्डिंग का इस्तेमाल सिर्फ रिसर्च या तहकीकी कामों में किया जाएगा। इस बात का भी पूरा ख्याल रखा जाएगा कि स्कूल या आपके नाम का ज़िक्र किसी भी रिपोर्ट में ना किया जाए। फिर भी अगर किसी वजह से आपको आपकी क्लास या आपके इंटरव्यू को रिकार्ड करने में किसी भी तरह का ऐतराज़ है तो आप नीचे लिखकर बता दीजिए । आपका शुक्रिया !

आपका नाम –_____   स्कूल का नाम – _____

_____

आपकी क्लास में पीछे बैठकर नोट्स ले सकते हैं –   हां / नहीं

आपकी क्लास की वीडियो रिकार्डिंग कर सकते हैं –   हां / नहीं

आपके इंटरव्यू की ऑडियो रिकार्डिंग कर सकते हैं –   हां / नहीं

दस्तखत – _____

Translation:

<div align="center">

Homi Bhabha Centre for Science Education

Tata Institute of Fundamental Research

V N Purav Marg, Mankhurd, Mumbai

Consent Form

</div>

Environment, development and health are a few important areas in education. Discussion on these topics with students is very crucial given the highly reported escalating environmental crisis and the contemporary debates around development. Keeping this in mind, we have taken up a research project in our centre to explore how these topics are discussed at secondary level and what teachers think about them.

In this context, we want to observe your classes when you teach these topics and conduct your interview subsequently. Though we have already procured official permission from the school management, we want to ensure that you participate in this project voluntarily. If, for any reason, you have some reservations and you don't want to take part in this study, please let us know upfront. And, if you decide to volunteer for this study, please provide your consent in writing through this form.

Given no objections, we would also like to video-record your classes and audio-record your interview so that we can go back to these recordings at the time of analysis and use that data in the educational research happening in the centre. We want to assure you that your identity or the school's identity will be kept confidential and the data will be used only for research purposes. However, if you are not comfortable with this procedure, please express your discomfort in the space given below.

Thanks a lot.

Your Name - _____   Name of the School - _____

Can we sit in your class and take notes while you teach ?   Yes / No

Can we video record your class?   Yes/ No

Can we audio-record your interview?   Yes/ No

Signature _____

Appendix III

Consent form for schools for conducting workshops after school hours

To,   Date: _____
The Principal

_____

Sub: To seek permission for interacting with students of class IX in your school

Dear Sir,

I am a PhD student at the Homi Bhabha Centre for Science Education, Mankhurd, Mumbai. In the context of my doctoral work, I plan to interact with the students of grade 9 to understand their perspective on environment related issues and their understanding of various underlying concepts.

In consultation with my supervisor, Prof. K. Subramaniam, I plan to organize a 15-day long workshop in your school and interact with class IX students to get a sense of their conceptual understanding of solid waste, health and environment. The primary objective of the workshop is to explore students' understanding, value commitments and attitudes toward nature, development, and social change. As you know, all these topics are very important from the point of view of environmental education. In the workshop, the students will be engaged in some carefully chosen activities. The discussions around those activities will help them reflect on the interconnections between these concepts. Part of the workshop will also venture into students' critical thinking and analytical skills.

We plan to start with some learning activities in mathematics and move on to the discussions on waste, health and other issues. We plan to conduct these sessions in the month of June and July. Every day, a two-hour long session will help us to finish things off in time. In this period, we hope that their regular studies will not get disturbed much and participant students will also gain something meaningful out of this workshop. We assure you that all the resources that will be used in the workshop will be arranged by us. We expect only very basic infrastructural support from the school.

We would also like to video-record these sessions to ensure a comprehensive analysis of the data. A separate consent letter will be given to all the participant students which they will have to get approved from their parents. The video data will be used for academic purposes only and the identity of the school and the participating students will be kept completely confidential. We assure you that the data will not be used for financial benefits.

We, hereby, request you to facilitate this workshop in your school.

Best regards,   Approved by,
Himanshu Srivastava   Prof. K. Subramaniam
Research Scholar, HBCSE, TIFR   Dean, HBCSE, TIFR

Appendix IV

Consent form for students' parents with regard to workshop participation

होमी भाभा विज्ञान शिक्षण केंद्र
टाटा मूलभूत अनुसंधान संस्थान
वी. एन. पूरव मार्ग, मानखुर्द, मुंबई

रज़ामंदी फॉर्म

माहौलियात और निजी सेहत से जुड़े मसले हम सभी के लिए दिनोंदिन ज़रूरी होते जा रहे हैं और अख़बारों में, टी.वी. वगैरह में भी हमें इनके बारे में काफी कुछ सुनने को मिलता रहता है । इनको नज़रअंदाज़ करना आने वाले समय में काफी ख़तरनाक साबित हो सकता है । समय की नज़ाकत को समझते हुए इन मसलों पर बच्चों की समझ को पुख़्ता करना बेहद ज़रूरी है और इसी मक़सद से तारीख़ _____ तक _____ में बच्चों के लिए एक कैंप रखा गया है ।

कैंप इन तारीख़ों में बच्चों की स्कूल की पढ़ाई के साथ–साथ चलेगा और कोशिश रहेगी कि उनकी रोज़मर्रा की पढ़ाई में कोई दिक्क़त ना आए । इस कैंप में बच्चों के साथ हुई बातचीत को हम वीडियो कैमरे की मदद से रिकॉर्ड करना चाहते हैं ताकि ज़रूरत पड़ने पर बाद में सुना जा सके और उस जानकारी को बच्चों की आगे की पढ़ाई को बेहतर बनाने के लिए चल रहे रिसर्च में उपयोग किया जा सके । वीडियो रिकॉर्डिंग के लिए आपकी रज़ामंदी ज़रूरी है ।

हम भरोसा दिलाते हैं कि इस वीडियो रिकॉर्डिंग का इस्तेमाल सिर्फ बच्चों की पढ़ाई को बेहतर बनाने के मक़सद से किया जाएगा और कैंप में शामिल होने वाले बच्चों के नाम का या स्कूल का ज़िक्र आपकी मर्ज़ी के बगैर किसी भी रिपोर्ट में नहीं होगा । फिर भी अगर किसी वजह से आपको बच्चों के साथ होने वाली इस बातचीत को रिकॉर्ड करने में कोई ऐतराज़ है तो नीचे लिखकर बता दें । वरना अपना नाम और दस्तख़त करके अपनी रज़ामंदी दे दें।

शुक्रिया !

बच्चे का नाम –

आपका नाम –   बच्चे के साथ आपका रिश्ता –

दस्तख़त –   तारीख़ –

Translation:

<div align="center">

Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research
V.N. Purav Marg, Mankhurd, Mumbai

Consent form

</div>

Issues related to the environment and health are becoming increasingly important for all of us, and we keep hearing about these in the newspapers and on the television. Turning a blind eye to these issues could be a dangerous for the times to comes. Therefore, it is essential that we develop children's understanding of these issues. With this aim, we are arranging a workshop for students from _____ to _____ at _____.

The workshop will be conducted alongside the school schedule and we will try not to let children's everyday studies get affected due to this. The conversations with children during this workshop will be video recorded so that, if needed, we can listen to them again. This will help us make further learning better for children and may be useful in our research towards this purpose. Your permission is necessary for the video recording.

We assure you that the video recordings of the workshop will only be used for making teaching and learning better. Also, name of the school and the children attending the workshop will not be mentioned in our reports without your permission. If you still have any doubts about recording our conversations with the children or do not want us to record it, please inform us by writing in the space given below. If you are willing to permit your child's participation in the workshop and the video recording, please give us your consent by signing this form and providing the details requested.

Thank you!

Student name:

Your name: Relationship with the child:

Signature: Date:

Appendix V

Request letter to Apnalaya to facilitate interactions in the community

To,   Date:

_____

_____

_____

Sub: Seeking cooperation in facilitating my doctoral work

Dear Sir,

I am a PhD student at the Homi Bhabha Centre for Science Education, Mankhurd, Mumbai and my doctoral work is in the area of environmental education. I am interested in exploring the possibilities of social transformation through science education. As of now, science education is quite depoliticized and serves only the interests of the privileged class. Many topics which have socio-political dimension to it are also treated in very technical or managerial way. For example, the issue of waste is discussed as a problem of 'management'.

In empirical terms, my work involves: a) problematizing the nature of educational experience 14-16 year olds living in the close vicinity of India's largest dumping ground go through about waste, consumption, health and hygiene, b) mapping their knowledge base, values and attitudes regarding waste and its political economy, and c) offering an outline for an alternative educational experience. An understanding of the gaps in their knowledge about various aspects of waste, the political economy of waste and their value commitments will help outline a model for transformative science education.

While part of my work involves analysis of science textbooks and relevant curriculum documents and observing classrooms when environment related topics are discussed, I also plan to interact with children, teachers and people living close to the dumping ground and/or engaged in rag picking, recycling and other small scale enterprises.

Since Apnalaya has been actively working in the field from last 40 years, I seek cooperation from your organization at various levels. It will be helpful if Apnalaya could assist me in making contacts in the community as well as share your data and the insights that the organization has gained over time, particularly related to education and health. I can also volunteer for various activities of the organization whenever possible.

I request you and the Apnalaya team to facilitate the proposed research work in the community.

Best regards,   Approved by,

Himanshu Srivastava   Prof. K. Subramaniam
Research Scholar, HBCSE, TIFR   Dean, HBCSE, TIFR

Appendix VI

Observation schedule for the researcher

Before any class, ask the teacher -

1. What do you think of the chapter? How is it connected with the other related chapters? How is it different from rest of the chapters in the book? Is this chapter an important/ interesting / quite easy/ more difficult chapter?

2. What is your plan for the class?

3. Any particular reason for deciding that?

Name of school _____

Class _____   Section ____   Duration of the period ____ minutes

Date _____   Starting time _____   End time _____

Name of the science teacher _____

Topic _____

Medium of instruction _____

No. of students present in the class _____ (Total) _____ Boys _____ Girls

No. of windows _____   No. of fans _____   No. of tube lights ____

Whether the teacher has a chair to sit   Yes / No

Whether the teacher has a table to keep her/his stuff   Yes / No

Seating arrangement ____ Columns ____ Rows

Separate rows for boys and girls   Yes / No / Mixed manner of seating

Black board/ White board /Green board/ Smart board _____

Frequencies of various classroom features (to be done in the class)

Please put a tally mark whenever there is a favouring incidence i.e. draw a vertical bar (|) in front of the statement. The fifth bar will cross the previous 4 ||||| bars like

Teacher's role -

S. No.	Feature	Tally Marks
1	The teacher brought in her/his experiences to the discussion	
2	The teacher initiated a discussion in the class	
3	The teacher asked a question to the class or to a particular student	
4	The teacher introduced a conflict situation to the discussion	
5	The teacher pointed out the conflict associated with an issue	
6	The teacher challenged students' ideas	
7	The teacher punished students for their misbehavior in the class	
8	The teacher appreciated students' ideas on various topics	

The teacher encouraged students to -

S. No.	Feature	Tally Marks
1	ask questions	
2	talk to each other	
3	argue with each other	
4	bring examples from their daily lives	
5	take notes	
6	copy from the board	
7	articulate their positions	
8	write down their positions	

Students' participation -

S. No.	Feature	Tally Marks
1	A student shared his/her experience in the class	
2	Students were engaged in hands-on activities	
3	A student asked a question to the teacher	
4	Students argued with each other	
5	A student(s) argued with the teacher	

6	A student(s) challenged the teacher	
7	A student initiated a discussion in the class	
8	A student brought in conflict situation from his/her experience	

Inclusion-Exclusion issues

S. No.	Feature	Tally Marks
1	Any signs of exclusion in terms of gender	
2	Any signs of exclusion in terms of caste	
3	Any signs of exclusion in terms of religion	

Any other interesting observation which might be relevant. (Also mention reference time)

Content organization (Please draw a schematic diagram. Also mention reference time)

The mechanism of maintaining discipline in the class – (To be filled in after the class is over)

The teacher shouted at them   (   )
The teacher just stared at them and students calmed down   (   )
The teacher used physical force for punishment   (   )
Students were expelled from the class   (   )
Students were made to stand up   (   )
Students were asked to raise hands   (   )

Students were asked to submit their ID card/diary ( )
Students were asked to bring their parents ( )
Students were sent to the principal office ( )
Any other _____

Pedagogy (To be filled in after the class is over)

Rate the following features on the scale given below:

Hardly (1) → To a small extent (2) → Somewhat (3) → Moderately (4) → Quite a lot (5)

➢ How closely the teacher followed the textbook?
  – Chapter organization _____
  – Activities done in the class _____
  – Questions-Answers _____

➢ The teacher built up classroom discussion on students' prior knowledge _____

➢ Disciplinary measures ate up class time _____

➢ The teacher roamed around the class _____

➢ The teacher made technically incorrect statements in the class _____

➢ Pace of teaching was appropriate _____

➢ There was stress on definitions and facts _____

This class can be broadly categorized as - (to be filled in after the class is over)

Action-oriented ( )
Authoritarian ( )
Connecting learning with students' prior knowledge and experiences ( )
Democratic ( )
Explaining key concepts being the main focus ( )
Geared towards scoring well in exams ( )
Inquiry-based ( )
Lecture method with an emphasis on learning facts ( )
Transmissive ( )
Challenging the status-quo ( )
Value-clarification oriented ( )
Any other_____

Also mention some indicators to support the markings above.

_____
_____
_____

Appendix VII

Observation Schedule for the co-observer

Name of school _____

Class _____   Section _____   Duration of the period _____ minutes

Date _____   Starting time _____   End time _____

Name of the science teacher_____

Topic   _____

Name of the observer _____

Frequencies of various classroom features (to be done in the class)

Please put a tally mark whenever there is a favouring incidence i.e. draw a vertical bar (|) in front of the statement. The fifth bar will cross the previous 4 ⦀⧵ bars like

Teacher's role -

S. No.	Feature	Tally Marks
1	The teacher brought in her/his experiences to the discussion	
2	The teacher initiated a discussion in the class	
3	The teacher asked a question to the class or to a particular student	
4	The teacher introduced a conflict situation to the discussion	
5	The teacher pointed out the conflict associated with an issue	
6	The teacher challenged students' ideas	
7	The teacher punished students for their misbehavior in the class	
8	The teacher appreciated students' ideas on various topics	

The teacher encouraged students to -

S. No.	Feature	Tally Marks
1	ask questions	
2	talk to each other	
3	argue with each other	
4	bring examples from their daily lives	
5	take notes	
6	copy from the board	
7	articulate their positions	
8	write down their positions	

Students' participation -

S. No.	Feature	Tally Marks
1	A student shared his/her experience in the class	
2	Students were engaged in hands-on activities	
3	A student asked a question to the teacher	
4	Students argued with each other	
5	A student(s) argued with the teacher	
6	A student(s) challenged the teacher	
7	A student initiated a discussion in the class	
8	A student brought in conflict situation from his/her experience	

Inclusion-Exclusion issues

S. No.	Feature	Tally Marks
1	Any signs of exclusion in terms of gender	
2	Any signs of exclusion in terms of caste	
3	Any signs of exclusion in terms of religion	

Any other interesting observation which might be relevant (Also mention reference time)

Content organization (Please draw a schematic diagram. Also mention reference time)

```



```

The mechanism of maintaining discipline in the class – (To be filled in after the class is over)

The teacher shouted at them	( )
The teacher just stared at them and students calmed down	( )
The teacher used physical force for punishment	( )
Students were expelled from the class	( )
Students were made to stand up	( )
Students were asked to raise hands	( )
Students were asked to submit their ID card/diary	( )
Students were asked to bring their parents	( )
Students were sent to the principal office	( )
Any other _____	

Pedagogy (To be filled in after the class is over)

Rate the following features on the scale given below:

Hardly (1) → To a small extent (2) → Somewhat (3) → Moderately (4) → Quite a lot (5)

- ➢ The teacher built up classroom discussion on students' prior knowledge _____
- ➢ Disciplinary measures ate up class time _____
- ➢ The teacher roamed around the class _____
- ➢ The teacher made technically incorrect statements in the class _____
- ➢ Pace of teaching was appropriate _____
- ➢ There was stress on definitions and facts _____

This class can be broadly categorized as - (to be filled in after the class is over)

Action-oriented	( )
Authoritarian	( )

Connecting learning with students' prior knowledge and experiences ( )
Democratic ( )
Explaining key concepts being the main focus ( )
Geared towards scoring well in exams ( )
Inquiry-based ( )
Lecture method with an emphasis on learning facts ( )
Transmissive ( )
Challenging the status-quo ( )
Value-clarification oriented ( )
Any other_____

Also mention some indicators to support the markings above.

_____
_____
_____

Your reflections about the class (What struck you in this class?)

Appendix VIII

Workshop Instrument: Tell us a little about yourself

<div align="center">

जान–पहचान की शुरूआत

</div>

नोट:

नीचे तुम्हारे बारे में कुछ सवाल दिए गए हैं।

इनमें से कुछ सवालों के जवाब हां/ नहीं में देने हैं। तुम जो भी जवाब देना चाहते हो, उस पर गोला बना दो।

कुछ सवालों के आगे खाली जगह दी हुई है, उनका जवाब दी हुई खाली जगह में ही लिखना है।

किसी भी सवाल में अगर कोई दिक्कत लगे या कोई बात समझ में ना आ रही हो तो हम लोगों से फौरन पूछ सकते हो।

हम एक बार फिर यकीन दिलाते हैं कि तुम्हारी मर्ज़ी के बगैर तुम्हारी कोई भी बात स्कूल में किसी और के पास बिल्कुल नहीं जाएगी – ना क्लास में किसी और बच्चे के पास, ना किसी टीचर के पास। इस बारे में तुम बेफिक्र रहो।

---

1. तुम्हारा पूरा नाम – _____

2. उम्र – _____

3. घर का पूरा पता – _____

4. तुम्हारा गांव कहां है? _____

वहां से मुंबई कब आए? _____

मुंबई आने की क्या वजह थी? _____

गांव में खुद की जमीन है क्या?   हां / नहीं

अगर खुद की जमीन है तो गांव से कुछ अनाज वगैरह आता है क्या?   हां / नहीं

अगर हां, तो अंदाज़न कितना अनाज आता है?   _____

5. मुंबई में तुम्हारा खुद का घर है या किराए पर रहते हो?   _____

अगर किराए का घर है तो कितना किराया देते हो?   _____

6. तुम्हारे घर में कौन–कौन सी ज़ुबान बोलते हैं?   _____

   तुम कौन–कौन सी ज़ुबान समझते हो?   _____

7. कौन–कौन से त्यौहार मनाते हो घर पर?   _____

8. घर में तुम्हारे जिम्मे क्या–क्या काम है?   _____

9. घर में राशन कार्ड है?   हां / नहीं

   राशन कार्ड किस कलर का है?   _____

   राशन कार्ड से घर में क्या–क्या आता है?   _____

10. घर में किसका–किसका वोटर कार्ड बना है?   _____

11. घर में किसका–किसका आधार कार्ड बना है?   _____

12. घर में गैस है?   हां / नहीं

13. घर पर बिजली का कनेक्शन है?   हां / नहीं

    अंदाजन कितना बिल आता होगा?   _____

14. घर पर मोबाइल या टेलीफोन है?   हां / नहीं

    स्मार्ट फोन है या रेगुलर?   स्मार्ट फोन / रेगुलर / दोनों

15. घर पर कंप्यूटर या लैपटॉप है ?   हां / नहीं

    कौन–कौन इस्तेमाल करता है?   _____

    क्या तुमने कभी इस्तेमाल किया है?   हां / नहीं

16. क्या कभी इंटरनेट का इस्तेमाल किया है?   हां / नहीं

अगर हां, तो किस काम के लिए?   _____

कहां इस्तेमाल किया है?   _____

17. घर में अख़बार आता है क्या?   हां / नहीं

अगर हां, तो कौन–सा अख़बार आता है?   _____

अख़बार में तुम क्या–क्या पढ़ते हो ?   _____

18. घर में टी.वी. है क्या?   हां / नहीं

तुम्हारे मनपसंद प्रोग्राम कौन–कौन से हैं?   _____

19. घर में नहाने के लिए बाथरूम है?   हां / नहीं

घर में टॉयलेट है?   हां / नहीं

अगर नहीं है, तो टॉयलेट के लिए कहां जाते हैं?   _____

अगर पब्लिक टॉयलेट में जाते हैं, तो हर बार के लिए कितना पैसा देना होता है?   _____

टॉयलेट के लिए महीने का कार्ड बना है क्या?   हां / नहीं

20. क्या तुम्हारे घर के लोगों में से कोई किसी संगठन, तनज़ीम या पार्टी के साथ जुड़ा है?   हां / नहीं

अगर हां, तो उस संगठन या पार्टी का नाम लिखो।   _____

21. पीने का पानी कहां से आता है?
                हैंडपंप   हां / नहीं
                पाइप लाइन   हां / नहीं
                खुद के घर की मोटर   हां / नहीं
                टैंकर   हां / नहीं
                खरीदकर   हां / नहीं
                कुछ और   _____

पानी भरने में अगर कोई दिक्कत होती है तो उसके बारे में थोडा तफ़सील से बताओ। मसलन, कितने बजे से कितने बजे तक पानी आता है, खरीदना पड़ता है क्या, अगर खरीदना पड़ता है तो किस भाव में ख़रीदते हो, कितना पानी ख़रीदते हो, वगैरह।

_____

_____

22. क्या स्कूल में कोई फीस लगती है?   हां / नहीं

   क्या तुम कोई ट्यूशन भी जाते हो ?   हां / नहीं

   अगर हां, तो वहां की फीस कितनी है?   _____

23. क्या तुम पढ़ाई के अलावा कोई और हुनर / काम भी जानते हो?   हां / नहीं

   अगर हां, तो कौन–सा ?   _____

24. क्या स्कूल आने के पहले या स्कूल से जाने के बाद कहीं काम करते हो?   हां / नहीं

   अगर हां, तो क्या काम करते हो?   _____

   काम कितने बजे से कितने बजे तक रहता है?   _____

   कितना कमा लेते हो? (रोज़ाना / हफ़्ते का / महीने का)   _____

25. घर के लोगों के बारे में मालूमात नीचे दी गई टेबिल में भरो। मिसाल के तौर पर –

	पूरा नाम	तुम्हारे साथ रिश्ता	कितनी पढ़ाई की है?	आजकल क्या काम करते हैं?	महीने का कितना कमा लेते हैं?
0	शाहनवाज़	मामू	कुछ भी नहीं	गैराज में काम करते हैं	3000 रूपए
1					
2					
3					
4					
5					
6					

Translation:

Tell us a little about yourself

Note:

Here are a few questions to help us get to know you better.

Some of these questions can be answered in a simple Yes or No. Circle the option that you want to choose.

Some questions would need a longer answer. Write your answer in the blank space given for each of such questions.

If you have difficulty in answering any of these questions or something is not clear, please let us know immediately.

Once again, we assure you that without your consent we will not share your information with anyone else in the school – neither with any other student nor with any teacher.

_____

1. Your full name: _____

2. Age: _____

3. Home address: _____

4. Where is your native place? Where are you originally from? _____

When did your family come to Mumbai from there?   _____

What was the reason for the migration?   _____

Does your family own land in your native place?   _____

If you own land/ have a farm in your village, do you get food grains/ other supplies from there? If yes, how much?   _____

5. Do you own a house in Mumbai or do you stay in a rented house?   Yes / No

If you stay in a rented house, how much is the rent?   _____

6. Which language(s) do you speak at home?   _____

Which languages can you understand?   _____

7. Which festivals do you celebrate at home?   _____

8. What are the chores assigned to you at home?   _____

9. Does your family have a ration card[27]?   Yes/ No

If yes, what is the colour of the ration card?   _____

What supplies does your family get using the ration card?   _____

10. Which of your family members hold a voter's ID card?   _____

11. Which of your family members have an Aadhar card[28]?   _____

12. Do you have an LPG gas connection at home?   Yes/ No

13. Do you have an electricity connection for your home?   Yes/ No

Can you give an estimate of the electricity bill amount for a month_____

14. Do you have a telephone or mobile phone at home?   Yes / No

Do you have a smart phone or a regular mobile phone?   Yes / No

15. Is there a computer or laptop at home?   Yes/ No

If yes, who uses the device?   _____

Have you used this device at home?   _____

16. Have you ever used the internet?   Yes/ No

For what purpose? Where have you accessed it?   _____

---

27 Ration card issued by the Government of India (GoI) is a document that serves as a proof of identification and residence for a family as well as entitles them to a ration of food, fuel and other groceries at a subsidized rate. Ration cards are issued in different colours depending on the economic status of the household for variable access to subsidies.

28 Aadhar card, issued by GoI to a resident of India, provides a unique identity number linked to their information such as demographic and biometric data. Although purported to be voluntary, the Indian state mandates it for accessing subsidies and services.

17. Do you get a newspaper at home?   Yes/ No

If yes, which one?   _____

What sections do you read in a newspaper?   _____

18. Do you have a television at home?   Yes/ No

What TV programs are your favourites?   _____

19. Do you have a bathroom in your house?   Yes/ No

Is there a toilet in your house? If not, where do you go?   _____

If you use a public toilet, how much do you have to pay each time?_____

Is there a monthly pass for the public toilet?   Yes/ No

20. Is anyone in your family a member of any organization or a political party?   Yes/ No

If yes, please tell us the name of the organization or political party _____

21. What is the source of drinking water supply for your house?

                    Hand pump   Yes/ No

                    Pipelines   Yes/ No

                    Metered water tap at home   Yes/ No

                    Water Tanker   Yes/ No

                    Bought from suppliers   Yes/ No

                    Others   _____

If you face any kind of difficulty in getting the required amount of water, please describe. For
example, is the duration of time (when water supply is available) limited or if you have to buy
water, what is the rate and how much do you need to buy?

_____

_____

22. Do you have to pay school fees?   Yes/ No

Do you go for (out-of-school) tuition classes?   Yes/ No

If yes, how much do you pay for these classes?   _____

23. Apart from studying at school, are you involved in any work or skilled trade? Yes/ No

If yes, what kind of skills/ abilities do you use?   _____

24. Do you work before or after school hours?   Yes/ No

If yes, what is the work that you do?   _____

What are the working hours?   _____

How much do you earn? (Daily/ weekly/ monthly)   _____

25. Please give details of your family members in the table below. For example -

	Full name	Relationship with you	Level of education/ Last grade completed	Occupation/ What work are they involved in?	How much do they earn in a month?
0	Shanawaz	Maternal uncle	Not formally educated/ Has not gone to school	He works in a garage	3000 Rs.

1					
2					
3					
4					
5					
6					

Appendix IX

Workshop Instrument: Points for discussions on the theme of waste

कचरे की समझ

अगले दो दिन हम बात करने वाले हैं waste की, कचरे की। आम बोलचाल की भाषा में और क्या-क्या शब्द इस्तेमाल करते हैं कचरे के लिए?

अब बात कचरे की है तो जरा ये बताओ सबसे ज्यादा कचरा कहां दिखता है - डंपिंग पे। तो बात आगे बढ़े, इससे पहले हम एक छोटा-सा काम करेंगे। हम आपको एक कागज दे रहे है, उसमें डंपिंग के बारे में आपको लिखना है। अच्छी बात ये है कि आप जो भी लिखना चाहते हैं, वो लिख सकते हैं। मसलन वहां क्या होता है, उससे जुड़ा कोई वाकिया, कोई वारदात, कोई याद। अगर चाहो तो चित्र भी बना सकते हो।

जब आप खाड़ी के बारे में सोचते हो तो आपके दिमाग में क्या-क्या चीजें आती हैं ?

कचरा क्या होता है?

कचरा भला होता क्या है? जैसे कोई कह सकता है कि हर वो चीज जो हम इस्तेमाल करके फेंक देते हैं, वो waste है। आपको क्या लगता है? कुछ उदाहरण दे सकते हैं? क्या किसी भी चीज को एक हद के बाद फेंकना ही पड़ता है? जब आप waste/ कचरा शब्द सुनते हो तो आपके दिमाग में क्या-क्या चीजें आती हैं ? ये चीजें कचरे से कैसे जुड़ी हैं?

कचरे के प्रकार

हमारे सामने कचरे का एक ढेर रखा है। आपको बताना है कि किन-किन तरीकों से इस कचरे की छंटनी की जाती है ?

(दवा का रैपर, टूटा हुआ कांच, ब्लेड, बाल, चॉकलेट का रैपर, चाय का कप (प्लास्टिक), सड़ा हुआ खाना, पॉलीथीन थैली, दूध की थैली, थर्माकोल का टुकड़ा, लोखंड का टुकड़ा, दवा की पट्टी, डायपर वगैरह)

आज हम एक खेल खेलेंगे। आपको चीजों का एक ढेर दिख रहा है, इसमें से ज्यादातर चीजें आपने पहले भी कहीं ना कहीं देखी होंगी। तो सबसे पहले तो हम इन चीजों को एक-एक करके देख लेते हैं कि इसमें है क्या-क्या ?

एक टीम को इसमें से किसी भी एक चीज के बारे में मन में सोच लेना है और उसका नाम एक कागज में लिखकर मेरे पास देना है। दूसरी टीम को सिर्फ हां/ ना में जवाब दिए जा सकने वाले सवाल पूछ-पूछ कर उस चीज का पता लगाना है। ऐसे सवाल पूछो जिससे ज्यादा से ज्यादा चीजें हटती चलें। हर एक सवाल पर दूसरी

टीम का 1 पॉइंट बढ़ता जाएगा, तो आपको कम से कम सवाल पूछकर उस चीज का पता लगाना है। जिस टीम का स्कोर ज्यादा होगा, वो टीम जीत जाएगी।

और क्या तरीके हो सकते हैं कचरे की छंटनी के लिए?

- कचरे के वैसे तो कई तरीकों से **ग्रुप** बनाए जा सकते हैं, पर उसमें से दो **प्रमुख** तरीके हैं - 1) गीला कचरा-सूखा कचरा और 2) बायो-डिग्रेडेबल- नॉन-बायो-डिग्रेडेबल। इन दोनों तरीकों से कचरे को बांटने में क्या अंतर है?
- बायो-डिग्रेडेबल मतलब क्या?
- गीले और सूखर कचरे के उदाहरण
- एक गीली प्लास्टिक की थैली को किस समूह में रखना सही होगा - गीला कचरा या सूखा कचरा?
- एक सूखे नारियल को ?
- तुमने e-waste के बारे में कुछ सुना है क्या? कहीं देखा है? यह क्या होता है?
- जो लोग कचरा चुनते हैं घर-घर जाकर या डंपिंग पर, वो किस तरह का कचरा चुनते हैं? क्या-क्या नहीं चुनते? ऐसा क्यों?
- कौन-कौन से मेटल मिलते हैं कचरे में?
- कोई चीज मेटल है कि नहीं, इसका पता कैसे चलता है?
- कौन-सा कचरा सबसे महंगा बिकता है?
- बाकी कचरे की क्या कीमत मिलती है?

कचरा प्रबंधन

- कचरे के निपटारे के लिए क्या-क्या तरीके इस्तेमाल किए जाते हैं?
- कुछ लोग कूड़े-कचरे से खाद बनाने की भी बात करते हैं। तुमने कुछ सुना है इसके बारे में? कूड़े से खाद कैसे बन सकती है? तुम किसी को जानते हो जो ये काम करते हों?
- कुछ लोग अपने घर का कचरा जलाते हैं। वे ऐसा क्यों करते हैं? अगर नहीं सुना है तो अंदाज़ से बताओ कि वे ऐसा क्यों करते होंगे?
- कचरा जलाने पर क्या होता है? जलने के बाद क्या बचता है?
- क्या सारा कचरा जलाया जा सकता है? क्या सारे कचरे को जला देना चाहिए? क्यों या क्यों नहीं?
- किसी ने इन्सीनरेटर (कचरा जलाने वाली भट्टी) के बारे में सुना है? इन्सीनरेटर क्या होता है?
- क्या कुछ कचरा जहरीला भी होता है? जैसे क्या?
- अगर कचरे का ठीक से निपटारा ना किया जाए तो क्या-क्या दिक्कतें होती हैं या हो सकती हैं?
- तुमको क्या लगता है कचरे के निपटारे के लिए और कौन-से तरीके अपनाए जाने चाहिए?
- क्या ऐसा हो सकता है कि इस तरह से चीजें डिजाइन की जाएं कि बिल्कुल भी कचरा पैदा ना हो?

वस्तुओं की अर्थव्यवस्था

ठीक है, अभी हम एक छोटी-सी गतिविधि करेंगे। यहां पर कुछ चीजें रखी हैं। आप इनमें से कोई एक चीज चुन लो। अभी आपको इसकी आपबीती लिखनी है - मतलब ये कहां से आया (Extraction) , कैसे बनता है (Production), कहां-कहां से गुजरा (Distribution), क्या-क्या खुशियां और गम देखे इसने अपनी जिन्दगी में (Consumption), कब इसने मौत को गले लगाया, मरने के बाद उसका क्या-क्या हुआ (Disposal), कैसे-कैसे किन-किन लोगों से होता हुआ यह आज इस कहानी का हिस्सा बना है , सब कुछ।

चीजें-

1. ट्रेन में मिलने वाली पानी की बोतल (प्लास्टिक वाली)
2. कोल्ड ड्रिंक पीने के बाद बची खाली कांच की बोतल
3. चाय की दुकान पर मिलने वाला प्लास्टिक का कप
4. सब्जी वाले के पास मिलने वाली पॉलीथीन
5. साल खत्म होने के बाद पुरानी हो चुकी कापी-किताबें
6. पुराना मोबाइल जिसको अब रिपेयर नहीं किया जा सकता
7. किसी अस्पताल में भर्ती मरीज की पट्टियां
8. सड़ा हुआ खाना
9. बच्चों के डायपर
10. स्टेशन के पास उगाई जाने वाली पालक
11. यूज एंड थ्रो पेन
12. लोकल साबुन
13. शराब की बोतल
14. लेडीज चप्पल

कचरे के सामाजिक, आर्थिक और राजनैतिक पहलू

आखिर इतना कचरा आता कहां से है? ज्यादा कचरा कहां से आता है?

कचरे को अक्सरकर एक समस्या के रूप में देखा जाता है। ऐसा क्यों?

हमारे कचरे का कुदरत पर कैसे असर पड़ता है?

इन दिनों कई लोग 3R — Reduce, Reuse, Recycle की बात करते हैं। 'Reduce' से तुम क्या समझते हो?

कचरे को कम करने के लिए क्या किया जा सकता है? ऐसा क्यों है कि कचरा कम होने की बजाय दिनोंदिन बढ़ता ही जा रहा है।अभी से 30–40 साल पहले भी इतना ही कचरा पैदा होता था क्या? तुमको ऐसा क्यों लगता है?

इतने कचरे के लिए किसको जिम्मेदार मानते हो?

साइंस और टेक्नालॉजी का क्या रोल है कचरे की समस्या बढ़ाने में ? निपटने में?

लोग

कचरे को एक जगह इकट्ठा करने में, उसकी छांटबीन में, उसे लाने-ले जाने में, उसका बंदोबस्त करने में किस-किस तरह के लोग लगे हुए हैं? तुम किसी को जानते हो जो इस काम में लगे हों?

इन तस्वीरों को ध्यान से देखो। ये किन लोगों के फोटो हैं? वो क्या कर रहे हैं? उनके काम और उनकी ज़िंदगी के बारे में तुम क्या जानते हो ? जो लोग कचरे के इंतज़ाम में लगे हैं, वो किस तबके से आते हैं?

सीवर या गटर कौन साफ करता है? कितना पैसा मिलता है उनको?

हर काम में कुछ-ना-कुछ खतरा होता है।
- कचरा चुनने में किस-किस तरह का खतरा होता है?
- गटर साफ करने में किस-किस तरह का खतरा हो सकता है ?
- कचरा ना हटाया जाए किसी जगह से तो आसपास रहने वाले लोगों को किस-किस तरह का खतरा होता है?

कचरे से जुड़ी सरकारी नीतियां और अभियान

'स्वच्छ भारत अभियान' क्या है? कब शुरू हुआ? किसने शुरू किया? उसके तहत क्या-क्या करने की कोशिश की जा रही है? तुमको क्या लगता है उसका कितना असर हो रहा है? ऐसा क्यों लगता है तुमको?

मैला ढोना, गटर साफ करना वगैरह (मैनुअल स्कैवेंजिंग) के खिलाफ किसी कानून के बारे में कुछ सुना है क्या?

Translation:

Understanding of waste

Getting started

Over the next two days, we are going to talk on 'waste'. Which other words are used (colloquially) for 'waste'?

While on this topic, first and foremost - where do we see most of the waste dumped? The Dumping ground, right? So before we continue our discussion, let's first gather our thoughts on this. We are giving you a sheet of paper. Please write what you know about the dumping ground, anything that comes to mind. For example, what happens there, any incidence or memory associated with it… You can also draw instead or illustrate your writing if you want to.

When you think of the creek, what are all the things that you associate with it?

What do you understand by waste?

What is meant by waste actually? When does something become waste? Somebody might say that waste is whatever we throw away after it's no longer of use. What do you think? Can you give some examples to explain? Does everything have to be thrown away eventually?

Tell us all that comes to your mind when you hear the word 'waste'. How is it connected to waste?

Understanding different types of waste

a) Suppose we have a heap of waste materials in front of us. Tell us in what different ways can we categorize/ segregate these materials.

(Medicine wrappers, broken glass, razor blades, hair, chocolate wrappers, used (disposable) plastic tea cups, spoiled food, polythene bags, empty milk bags, blocks of thermocol/ styrofoam, bits of iron rods, a strip of expired medicine tablets, diaper etc.)

b) Let's play a game today (a version of "I spy"). You see there a collection of things. You must have seen most of these things at some point in time. Firstly, have a good look at all the things that are here, go over them one by one.

Now, the game involves two teams. A team will choose one of the things from our collection, note their choice on a strip of paper and give it to me. The other team has to guess what this object is using questions which can only be answered with a "Yes" or "No". For each question that this team asks, the other team will get a point. So, the guessing team has to use minimum number of questions possible. For this, make sure that your questions eliminate a large

number of the articles and narrow down the choices. After a few rounds, the team with highest score wins!

c) What can be the alternative ways of segregating waste?

Waste material can be categorized into various groups. Two of these ways of segregation are well known - (1) Wet and dry waste and (2) Biodegradable and non-biodegradable. What is the difference in these two methods of waste segregation?

- What is meant by 'biodegradable'?

- Give examples of dry and wet waste.

- In what category should we place a wet plastic bag – dry waste or wet waste?

- What about a dry coconut shell?

- Have you heard about e-waste? Have you seen it? What is it?

- The people who pick trash from the dumping ground or going house-to-house, what kind of trash do they pick? What kind of waste do they not collect? Why is that?

- What kinds of metal are found in trash?

- How would we know if something is a metal?

- Which kind of waste is sold at the highest rate?

- Do you know the rates for other kinds of waste material?

Technical aspects of waste management

- What are the methods used for managing waste?

- Some people talk about composting waste. Do you know about composting? How can trash be converted into compost? Do you know anyone who does composting?

- Some people burn their household trash. Why do they do that? Even if you haven't heard about this before, try to think and answer - why would they burn trash?

- What happens when trash is burnt? What remains after trash is burnt?

- Can all the trash be burnt? Should all kinds of waste material be burnt? Why or why not?

- Does anyone of you know about an incinerator? What is an incinerator?

- Is some waste toxic by nature? Do you know of any example?

- If waste is not disposed properly, what kind of problems does/ can it lead to?

- Do you have any suggestions for better waste management? Can you think of any other strategies that should be adopted?

- Is it possible to design products and processes in a way that leads to zero waste?

Understanding of materials economy (Extraction, Production, Sale, Consumption, Disposal)

We are going to do an interesting activity now. Some objects are listed here. Choose any one of them and write an autobiography for this article. Include its life journey - where did it come from (extraction), how is it made (production), the paths that it traveled (distribution), what ups and downs did it go through in its lifetime/ what purposes did it serve (consumption), when did its life end, what happened to it after that (disposal), how its life intertwined with that of various people… weave a story of all these events, illustrating the life of the object right up to the time when it became the central character of the story today.

Objects to choose from -

1. An empty, plastic drinking water bottle left back in a train

2. A glass bottle, trashed after drinking cold drink from it

3. A disposable plastic cup in a tea stall

4. A polythene bag at a vegetable vendor's stall

5. Old notebook at the end of the school year

6. A broken mobile phone that cannot be repaired

7. Bandages of a patient in a hospital

8. A delicacy that is now spoiled food

9. An infant's diaper

10. Spinach grown next to Mankhurd railway station

11. Use and throw pen

12. A locally made soap

13. Liquor bottle

14. Ladies' footwear (High heeled shoes)

Understanding of the political economy of waste

Where does so much trash come from? Where is much of the waste generated? Do some people generate a larger share of waste?

Waste generation is often seen as a problem – why is that?

How does our waste affect the natural environment?

Nowadays, many people talk of the 3Rs – Reduce, Reuse and Recycle. What do you understand by 'Reduce'? What can be done to reduce the amount of waste generated? Why is that instead of reducing, the amount of trash keeps on increasing with each passing day?

Did we produce a similar amount of trash 30-40 years ago? Why do you think it was that way?

According to you, who is responsible for the excessive waste generation?

What is the role that Science and Technology play in adding to the problem of waste? What role do they play towards solving the problem of waste?

People involved

What kind of people are involved in various stages of waste – collecting waste, sorting it, transporting waste, disposing of it and so on. Do you know anyone who does such work?

Look at these pictures carefully (used in National Science Day). Who is in these photographs? What are they doing? What do you know about the nature of their work and life? Which class of people are involved in work related to waste?

Who cleans the sewers/ gutters? Do you have an estimate of how much they earn?

There are occupational hazards for all kinds of work. What are the risks involved in picking waste?

What could be the risks involved in cleaning sewers? If waste is not disposed, what kinds of trouble does it cause for people living in its vicinity?

Relevant policies

What do you know about 'Swachch Bharat Abhiyaan' (Clean India Mission)? When did it start? Who started it? What is being attempted though this mission? What do you think has been its impact? Why do you think so?

Do you know of the law against manual scavenging?

Appendix X

Workshop Instrument: The fire at Deonar dumping ground

देवनार डंपिंग ग्राउंड में लगी आग

तुमने साल की शुरुआत में देवनार डंपिंग ग्राउंड में लगी आग की खबर तो सुनी ही होगी। आग इतनी भयानक थी कि उसके धुएं से सारे शहर का दम घुटा जा रहा था। अभी कुछ दिन पहले फिर से वैसी ही आग लगी थी। इस सबको देखते हुए कई लोग इस डंपिंग ग्राउंड को हमेशा के लिए बंद करने की मांग कर रहे हैं ताकि लोग साफ हवा में सांस ले सकें। कोर्ट के एक आदेश के हिसाब से तो इस डंपिंग ग्राउंड को कई साल पहले ही बंद कर देना चाहिए था क्योंकि इसमें रोज़ाना जमा होने वाला कचरा इसकी हैसियत से कहीं ज्यादा है।

तुमको सोचना है कि –

1. इस डंपिंग ग्राउंड पर इतना कचरा कैसे जमा हो गया है?

2. क्या डंपिंग ग्राउंड के इतना करीब होने की वजह से नज़दीकी इलाकों जैसे – बैंगनवाड़ी, शिवाजी नगर, मानखुर्द, गोवंडी वगैरह में कुछ दिक्कतें होती हैं? अगर हां, तो किस तरह की दिक्कतें?

3. डंपिंग ग्राउंड में जो आग लगी थी, उसके बारे में तुम क्या जानते हो? उससे क्या दिक्कतें हुईं?

4. डंपिंग ग्राउंड में बार–बार आग क्यों लगती है?

5. कोर्ट के आदेश के बावजूद BMC डंपिंग ग्राउंड को कचरा फेंकने के लिए क्यों इस्तेमाल कर रही है?

6. ऐसी आग दोबारा ना लगे, उसके लिए सरकार को क्या कदम उठाने चाहिए?

7. इस समस्या से निपटने के लिए शहर की अवाम क्या कर सकती है?

8. अगर तुम महाराष्ट्र के वज़ीरे–आला होते, तो डंपिंग ग्राउंड की समस्या कैसे हल करते?

9. डंपिंग ग्राउंड को हमेशा के लिए बंद करने के मशवरे के बारे में तुमको क्या लगता है?

10. अगर डंपिंग ग्राउंड हमेशा के लिए बंद हो जाए तो किसको क्या फर्क पड़ेगा?

11. और क्या रास्ता हो सकता है इस समस्या से निपटने का?

Translation:

The fire at Deonar dumping ground

You may have heard about the fire that broke earlier this year at the Deonar dumping ground. The intense smoke from the fire caused a lot of problems for everyone. A similar fire broke again a couple of days back. Many citizens are demanding that the dumping ground be closed permanently. If you go by the court order, this dumping ground should have been shut long back because it has exceeded its limit. Here are some questions for you to think about -

1. How has such enormous amount of waste accumulated at this dumping ground?
2. Do people living in the areas surrounding the dumping ground (like Shivaji nagar, Mankhurd, Govandi or Cheetah Camp) face any problem because of their close vicinity to the dumping ground? If yes, what kind of problems?
3. What do you know about the much talked about fire at the dumping ground? What problems did it lead to?
4. Why does fire break so often at the dumping ground?
5. Why is the Bombay Municipal Corporation (BMC) still using the Deonar dumping ground to dispose of waste in spite of restricting court order?
6. What preventive measures should the government take to avoid such fires in the future?
7. What can citizens do about this problem?
8. If you were the chief minister of the state of Maharashtra, what could you do towards solving this problem?
9. What do you think of the suggestion of shutting down this dumping ground permanently?
10. If the dumping ground shuts down permanently, how would different people get affected?
11. Can you think of any alternate ways of solving this problem?

Appendix XI

Workshop Instrument: Points for discussion on the theme of health and hygiene

बातचीत के लिए सवाल

1. तुम्हारे लिए 'सेहत' के क्या मायने है?

2. अक्सर कहा जाता है कि सेहत एक दौलत है, सेहत खुदा की तरफ से दी गई एक अजीम नेमत है। इसकी कदर करो। ऐसा क्यों कहा जाता है?

3. अच्छी सेहत रखने के लिए क्या–क्या चीजें जरूरी हैं? जाती सेहत के लिए? कौमी सेहत के लिए?

4. किस तरह का खाना खाना चाहिए?

5. अच्छी सेहत के लिए और क्या कर सकते हैं?

6. किसी सेहतमंद इंसान को जानते हो? तुमको क्यों लगता है कि वो सेहतमंद है?

7. सेहत का एक मतलब है – बीमारी से पाक होना। तुमको क्या लगता है? सेहत बिगड़ने पर क्या होता है?

8. लोग बीमार क्यों पड़ते हैं?

9. किन लोगों के बीमार पड़ने की संभावना ज्यादा होती है और क्यों?

    1. गरीबों के या अमीरों के
    2. शहर के या गांव के

10. नीचे कुछ लोगों के रहन–सहन, खान–पान वगैरह के बारे में कुछ मालूमात दी गई है। सोचकर बताओ कि इनमें से किनके बच्चे ज्यादा सेहतमंद होने की उम्मीद लगती है और क्यों?

> हमीदा एक बैंक में काम करती है और ऐसी सोसाइटी में रहती है जहां सोसाइटी के सभी लोग अपने–अपने घर का कचरा अलग–अलग डिब्बों में निकाल कर रखते हैं और हर सुबह कचरा उठाने वाली गाड़ी टाइम पर आती है और सारा कचरा समेट कर ले जाती है। हमीदा का हसबैंड उसके साथ नहीं रहता, वो अकेले ही अपना, अपने अम्मी–अब्बू का और अपनी बेटी का पेट पालती है।

रूख़सार जिस सोसाइटी में रहती है, वह छोटी सोसाइटी है। वहां लोग अपने–अपने घर का कचरा पॉलीथीन बैग में बंद करके सड़क पर ही फेंक देते हैं। कभी–कभी तो यह कचरा दो–तीन दिन तक वैसे ही जमा होता रहता है, सड़ता रहता है और बदबू भी मारता है।
फरीदा एक डंपिंग पर कचरा चुनने का काम करती है। उसका बड़ा बेटा भी उसके साथ कचरा चुनने जाता है। शाम को कचरा बेचने से जो पैसा मिलता है, उसी से घर के सारे लोगों के खाने का इंतजाम होता है।
फारूख अपने ऐरिया में राशन की दुकान संभालता है। उसकी आमदनी अच्छी है और घर के सारे लोगों को तीनों वक्त का खाना भरपेट मिलता है।
शादाब का घर डंपिंग के पास जो नाला बहता है, उसके बिल्कुल करीब ही है। कभी–कभी जब बारिश में नाले में पानी पूरा ऊपर तक भर जाता है तो घर और नाले में फर्क करना भी मुश्किल हो जाता है।
फयाज़ एक कारखाने में काम करता है। पर एक बार बड़ी बीमारी क्या लगी, अस्पताल के चक्कर लगाते–लगाते उसकी तो टांगें ही घिस गई। सरकारी अस्पताल वहां से घंटे भर के रास्ते पर जो है। मुसीबत पड़ने पर पड़ोस के फकीर से ही दुआ–सलाम कर आता है।
शफीक का घर भी डंपिंग के पास ही है। रोज सुबह घर के सभी मर्द डंपिंग पर ही निपट कर आते हैं। घर की औरतें पास वाले प्राइवेट टॉयलेट में जाती हैं, जहां पानी उतना साफ नहीं होता।
समीर के घर में मोटर का कनेक्शन नहीं है। पानी आने के वक्त आसपास के लोगों की तरह वो भी डिब्बा लेकर लाइन में लग जाता है फारूख के घर के सामने। पीने का पानी तो खरीद लिया जाता है, पर साफ–सफाई के लिए पानी खरीदने का तो सवाल ही नहीं पैदा होता।
प्रकाश एक स्कूल में टीचर है। घर से स्कूल पहुंचने के लिए दो बार लोकल ट्रेन बदलनी पड़ती है। ट्रेन की गर्दी और सड़क पर गाड़ियों के धुएं और शोर–शराबे से उसका तो दम ही निकल जाता है। पिछले कुछ महीनों से उसको आए दिन खांसी का दौरा पड़ने लगा है। डॉक्टरों की सलाह के मुताबिक उसे टी.बी. हो सकती है, उसको अपना इलाज जल्द से जल्द शुरू कर देना चाहिए।
इकरा एक गांव में रहती है। खुली हवा, खुली धूप तो मिलती ही है, पीने का पानी कुएं से भर लाती है। सुबह–सुबह जल्दी उठकर घर के काम निपटाकर खेत पर निकल जाती है। वर्जिश का तो उतना समय नहीं होता, पर खेत में दिन भर कड़ी मेहनत करती है। घर पर खाने की सब्जियां खुद के खेत से ही आ जाती हैं।
अफसाना शादी के बाद से दिल्ली में रहती है। उसका शौहर एक बड़ी कंपनी में मैनेजर है और सुबह–सुबह ऑफिस के लिए निकल जाता है। घर के लिए सामान लाने की जिम्मेदारी अफसाना के कंधों पर ही है। वह हर शाम जिम जाती है और लौटते समय मॉल से ही सब्जियां वगैरह ले आती है। एकदम सुडौल, हरी–भरी, चमचमाती हुई सब्जियां और फल देखकर उसका मन खुशी से झूम उठता है।

11. तुम्हारे एरिया में कितने सरकारी अस्पताल हैं? सबसे पास वाले सरकारी अस्पताल का नाम बताओ।

12. क्या तुम कभी उस अस्पताल में गए हो? अपना तजुर्बा, चाहे अच्छा हो या बुरा, अपने दोस्तों को भी बताओ।

13. डॉक्टर के पास लोग किस-किस वजह से जाते हैं? अपने लिए कोई डॉक्टर कोई कैसे चुनता है?

14. क्या तुमने एंटीबायोटिक के बारे में कुछ सुना है? एंटीबायोटिक किस लिए दिए जाते हैं?

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15. अंदाजे से बताओ कि तुम्हारे एरिया में लोग अमूमन कितने साल तक जिंदा रहते हैं ? दूसरे एरिया की क्या स्थिति है? बाकी जगहों पर लोग इससे ज्यादा दिनों तक जिंदा रहते होंगे या कम? तुमको ऐसा क्यों लगता है?

16. हमारा जो एरिया है, वो M-वार्ड में आता है। सरकारी रिपोर्ट से पता चलता है कि M-वार्ड में जीने की औसत उम्र महज 39 साल है, मतलब यहां के लोग अमूमन 39-40 साल तक ही जिंदा रहते हैं। तुमको क्या लगता है इस बारे में? किसी जगह पर औसत उम्र कम, किसी जगह पर ज्यादा होने में क्या दिक्कत है?

17. क्या तुमने अपनी जान-पहचान में कभी ऐसा सुना है कि बच्चा पैदा होते ही खत्म हो गया या बच्चा विकलांग पैदा हुआ? इसकी क्या वजह हो सकती है?

18. एक संस्था की रिपोर्ट के हिसाब से मानखुर्द और गोवंडी की बस्तियों में पैदा होने वाले कई बच्चे छोटी उमर में ही किसी ना किसी तरह से अपाहिज हो जाते हैं।
    - तुमको इस बात में कितनी सच्चाई लगती है?
    - क्लास में अगर अलग मत हैं तो एक ग्रुप के लोगों को पूछा जा सकता है कि दूसरे ग्रुप के लोग उनसे रजामंद क्यों नहीं हैं? क्या वो लोग झूठ बोल रहे हैं? क्या वो लोग कुछ अलग घरों के बारे में सोच रहे हैं? कितने घरों के बारे में बात हो रही है?
    - इस बात का फैसला करने के लिए क्या करना होगा?
    - शुरूआती कुछ सालों में बच्चों के अपाहिज होने की क्या वजह हो सकती है?

जब इस संस्था के लोगों ने सरकारी अफसरों से इस बारे में बात की तो उन्होंने कहा कि उनकी मालूमात के हिसाब से मानखुर्द और गोवंडी की बस्तियों में ऐसा कुछ भी नहीं हो रहा है और इस बात को मानने से बिल्कुल इंकार कर दिया। तब संस्था के लोगों ने अपनी बात को साफ करने के लिए उनके सामने कुछ आंकड़े रखे।
    - तुमको क्या लगता है, संस्था के लोगों ने अफसरों को किस तरह के आंकड़े दिखाए होंगे?

खैर, थोड़ी नोंकझोंक के बाद, अफसरों ने कहा कि हो सकता है आपकी बात सही हो। लेकिन जब उनका खून ही गंदा है तो भला वो इस मामले में क्या कर सकते हैं?
    - अफसर के इस तर्क के बारे में तुम्हें क्या लगता है?

संस्था के लोगों ने बच्चों के अपाहिज होने की बात को उस इलाके में फैली गंदगी और बच्चों को अच्छा पोषक खाना ना मिल पाने से जोड़ा और कहा कि इन्हीं वजह से बच्चे सेहतमंद नहीं हैं और अपाहिज हो जाते हैं।
    - पर इलाके में फैली गंदगी के लिए भला वो अफसर कैसे जिम्मेदार हुआ?
    - बच्चों को अच्छा पोषक खाना क्यों नहीं मिलता? जिम्मेदारी किसकी है?
    - इन बच्चों के मां-बाप इनके लिए अच्छा खाना क्यों नहीं लाते?
    - मानखुर्द और गोवंडी में सब्जियों, फलों, चिकन, मटन पर अक्सरकर काफी मक्खियां बैठती हैं। क्या इससे भी बच्चों के अपाहिज होने का कुछ लेना-देना हो सकता है?
    - इस बात का फैसला करने के लिए क्या करना होगा? छोटी उम्र में बच्चों के अपाहिज होने की वजह का पता कैसे लगाया जा सकता है?
    - गोवंडी में डंपिंग होने का इसके साथ क्या कोई लेना-देना हो सकता है?

19. किसी भी इंसान का सेहतमंद होना क्यों जरूरी है? लोग अगर सेहतमंद नहीं हों तो क्या होगा? किताब में एक बात लिखी है कि - "सेहतमंद लोग / अफरात कौम का सरमाया होते हैं"। तुमको क्या लगता है इस बारे में?

20. यह बात तो समझ में आती है कि लोगों को अपनी सेहत की देखभाल खुद रखनी चाहिए, पर कई बार ऐसा नहीं हो पाता। नहीं? तुमको क्या लगता है? किसी की सेहत की जिम्मेदारी अगर उसकी नहीं है तो किसकी है?

Translation:

Points for discussion on the theme of health and hygiene

1. What do you understand by the term 'health'?

2. We often hear adages that refer to health as wealth or as a treasure given to us by God. Why do they mean when they say such things about health.

3. What factors are essential for maintaining good health - personal and public health?

4. What kind of food do you need to eat for staying healthy?

5. Other than nutritious food, what else is needed for good health?

6. Think about a healthy person you know. What about them makes you think that they are in good health?

7. One of the connotations of being in good health is not having any illness. What do you think, is that enough for good health? What happens when you fall ill?

8. Why do people fall ill?

9. Which categories of people are more likely to get ill and why?

      (a) The poor or the rich

      (b) Those from rural areas or the urban

10. The vignettes given below describe the living conditions and nutritional status of some people. Taking these aspects into consideration, compare the situations. In which contexts do you think children are likely to be healthier and why.

Hamida works in a bank. She stays in a housing society where every household segregates waste in separate bins and garbage trucks visit daily to collect the waste. Hamida's husband does not stay with her. She is the sole bread-winner of her family consisting of her parents and daughter.
Ruksar lives in a locality where residents collect their household trash in polythene bags and throw them on the roadside. Often, the garbage piles up in smelly heaps, not disposed for days.

Farida is a waste picker, making daily visits to the dumping ground. Her elder son also accompanies her to work. Every evening, she sells off the the waste collected for the day to make ends meet for her and her family.

Farooq runs a ration shop (a fair price shop of the public distribution system of the Government of India). He has a regular, fixed income enough for his family to have good, square meals.

Shahdab's home is right next to the drain that flows close to the dumping ground. On some rainy days when the drain wells up with water, one cannot tell where her home ends and the drain begins.

Fayaz is a factory worker. Due to a chronic illness, he needed to make several rounds of the public hospital which is quite far from his home. It takes around an hour to reach and there's a huge queue there. The experience has left him tired and dejected. Now when he has any ailments, he prefers to just go to the Fakir (a Muslim ascetic) in the neighborhood, in the hope that prayers will heal him.

Shafiq's house is also near the dumping ground. Every morning, the men of the house head to the dumping ground to relieve themselves. The women use the nearby toilet facility managed by a private company. However, it is not well maintained and the water supplied there is not very clean.

Samir does not have a water connection at home. He collects water from the tap outside Farooq's house, charged at a fee. During the short time that there is water supply in this tap, he has to wait in a long queue like other residents in his area. He is able to buy limited amount of water which is mostly used for drinking and cooking but not enough for cleaning purposes.

Prakash is a school teacher. To travel to his school everyday, he has to take a local train to a point and then take another connecting train. Traveling in the crowded trains and then walking through the congested paths, along with the air and noise pollution, is exhausting for him. For the past few months, he has a persistent cough. Doctors advise that he should not ignore this and start treatment soon as he might have tuberculosis (TB).

Ikra lives in a village where there is lots of fresh air and sunshine. There is abundant clean, fresh water in the local well. Every morning, she wakes up early and goes to the field after finishing the household chores. There's no time for exercise per se but there's a lot of hard work involved in the field. The vegetable produce from her farm are part of the daily meals for the farm.

Afsana has been living in Delhi since her marriage. Her husband is a manager of a big firm and leaves early to work everyday. It is Afsana's responsibility to get provisions for her home. She goes to the gym every evening and on her way back, drops into a mall to pick up

> vegetables and groceries. She loves picking shiny looking, well packaged fruits and vegetables.

11. How many government hospitals are there in your area? What is the name of the closest government hospital in your area?

12. Have you ever been to that hospital? Share your experience, whether good or bad.

13. What are the reasons for which people visit a doctor? How does one choose a good doctor for oneself?

14. Have you heard about antibiotics? Why does one take antibiotics?

15. Can you give an estimate of the life expectancy of the residents in your area? Do you know if it is different in other areas? Why do you think that the life expectancy in other areas may be more or less than your locality?

16. This area falls in the M-ward of the city. According to government reports, the average life expectancy in M-ward is just 39 years, i.e., residents of this area live till they are just about 39-40 years on an average. What are your thoughts on this? Why is it a problem if some areas have a high life expectancy while some neighboring areas have a low life expectancy?

17. Have you heard of any infant who died as soon as they were born or they were born with a disability? What could be the reason for this?

18. According to the report of an organisation working in Makhurd and Govandi, many children in the slums of the area get disabled at a very young age due to some reason or the other.

- Do you think there is any truth in this claim?

- If the class is divided on the issue, we can hear what the two groups have to say about their view. If some of you believe that the organisation is making a false claim, why do you think so? Are they talking about areas other than you know of? Which kind of households might they be talking about?

- How can we investigate this issue?

- If some children get a disablity in the early years of their life, what could be the reasons?

When the organization shared their findings with the government agencies, the officials denied that any such thing is happening in the Mankhurd and Govandi areas according to their information. The organization then shared some concrete data with them.

- What kind of data would the organization have?

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Anyhow, after some altercations, the officials agreed that there might be some truth in the reports. However, they were of the view that not much could be done about it since it is the bad lineage of these people leading to hereditary diseases.

- What do you think of this argument made by the officials?

The organization has argued that the higher incidence of diseases and disabilities in the children of the area is associated with lack of sanitation and hygiene coupled with malnutrition.

- Are the officials in any way responsible for the insanitary conditions of the area?

- Why do children not get enough nutritious food? Whose responsibility is it?

- Why are the parents not able to provide their children with adequate food?

- One often sees open food items (with flies hovering over them) sold in the stalls along the streets of the area. Could that be one of the reasons leading to illness in children?

- How can we probe this issue? How can we arrive at a conclusion? How can we find the reasons for the high occurrence of illnesses in children of the area?

- Could the presence of the dumping ground in the area have any link to this issue?

19. Why is it necessary for a person to be in good health? What happens when people are not healthy? An excerpt from your textbook reads that "healthy individuals are an asset to the community". What do you think about this?

20. Clearly, it is necessary for people to take care of their own health. However, that is not always possible, is it? What are your views on this? Is the responsibility of maintaining good health solely with the individuals or should it be a shared responsibility? Who else should share this responsibility?

Appendix XII

Workshop Instrument: Worksheet 1 [Health and hygiene]

हम आपको एक फार्म दे रहे हैं। इसमें आपके बारे में कुछ मालूमात पूछी गई है, जिसे उसके सामने दी गई जगह में भरना है। अगर कोई बात लिखने में दिक्कत है तो उस बात को छोड़ सकते हैं।

1. तुम्हारा जनम कब हुआ? _____ तारीख, _____ महीना, _____ साल

2. तुम्हारा जनम कहां हुआ था ?   घर पर / किसी अस्पताल में

3. तुम्हारा ब्लड ग्रुप (अगर पता है तो): _____

4. तुम्हारा वजन: अंदाज़न _____ किलो

5. तुम्हारी लंबाई: _____ फीट, _____ इंच

6. घर में पिछले दो दिनों में क्या-क्या खाया?

दिन	क्या-क्या खाया?	कितने बजे खाया?
आज		
कल		

7. घर में पानी कहां से आता है_____

8. क्या वह पानी पीने लायक होता है? अगर नहीं तो पानी को साफ करने के लिए क्या करते हैं?
_____
_____
_____

9. कौन-कौन से खेल खेलते हो ?
_____
_____
_____

10. खेलने के अलावा और क्या-क्या मेहनत वाले काम करते हो रोज़ाना?
_____
_____
_____

11. क्या तुम्हारे घर में किसी को कोई बीमारी है जिसको साल भर से ज्यादा हो गया है, जैसे - टी.बी., कैंसर वगैरह ? अगर हां तो कौन-सी बीमारी?
_____
_____
_____

12. उस बीमारी के इलाज के लिए क्या कर रहे हैं?
_____
_____
_____

13. बीमार पड़ने पर अक्सर तुम किस डॉक्टर के पास जाते हो?_____

14. डॉक्टर की फीस कितनी है?
_____

15. डॉक्टर की दुकान तुम्हारे घर से कितना दूर है?   _____

16. दवा ज्यादातर कहां से मिलती है?   डॉक्टर के यहां से / मेडिकल स्टोर से / दोनों जगह से

17. बीमारी के वक्त घर के लोग दुआ-तावीज़ करने के लिए क्या किसी बाबा या पीर-फकीर के पास भी जाते हैं ? किसके पास जाते हैं? वहां क्या होता है?
_____
_____
_____

18. किन्हीं पांच बीमारियों के नाम बताओ जो तुम्हारे ऐरिया में सबसे ज्यादा सुनने में आती हैं? ये बीमारियां किन-किन वजह से होती हैं? तुम अपना जवाब आगे दी गई वज़ह में से चुन सकते हो।

(ख़राब सेहती माहौल, पीने का साफ पानी ना मिलना, हवा की आलूदगी, खराब गिज़ा, ज़्यादा वज़नी काम, खुले में टॉयलेट जाना, ज़्यादा शराब पीना, बीड़ी- सिगरेट, पान-मसाला, तंबाकू, ड्रग्स या कुछ और)

		बीमारी का नाम	किस वज़ह से होती है?
2.	1		
5.	2		
8.	3	10.	
11.		12.	
13.		14.	

19. क्या किसी ऐसी बीमारी के बारे में सुना है जो मां-बाप से उनके बच्चों में आ जाती है? अगर हां तो कौन-सी बीमारी के बारे में सुना है?

_____
_____
_____

20. समूह A के शब्दों का समूह B में दी गई बीमारियों के साथ सही मिलान करो।

समूह A	समूह B
पल्स पोलियो का टीका	एड्स
डॉट्स का इलाज	टायफाइड
ऐलिसा (ELISA) टेस्ट	टी.बी.
सालमोनेला टायफी नाम का बैक्टीरिया	डायरिया
बी सी जी का टीका	मुंह का कैंसर
ओ आर एस का घोल	पोलियो
पान-मसाला / तंबाकू खाना	टी.बी.

Translation:

Here is a form. We seek some information about yourself which you would need to fill up at the appropriate places. You are free to withhold any information that you may not wish to disclose.

1. When were you born? _____ Day _____ Month _____ Year

2. Where were you born?   At home/ In a hospital

3. Your blood group (if you are aware of it) _____

4. Your weight: (approximately) _____ Kgs

5. Your height_____ feet, _____inches

6. What did you eat at home in the past few days?

Day	What did you eat?	When did you eat?
Today		
Yesterday		

7. Where do you get the water for your household uses?_____

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8. Is the water potable? If not, what do you do to make it safe to drink?

_____

_____

9. What games and sports do you play?

_____

10. Apart from playing, what all activities do you engage in which require physical exertion?

_____

11. Have any of your family members contracted an illness (like TB or cancer) that lasted for over a year? If yes, can you name the disease they suffered?

_____

12. What kind of treatment did they undergo?

_____

_____

13. Do you consult a doctor when you fall ill? _____

14. How much is the medical consultation fee? _____

15. How far is the doctor's clinic from where you stay? _____

16. Where do you get your medicines from?   From the doctor/ medical store/ both

17. Do you also approach traditional healers like *babas (saints)* or *pir/ fakirs (religious ascetics)* to cure your illness through prayer? What do they do to treat an illness?

_____

_____

18. Name five diseases that are most prevalent in your area. What are the causes for these diseases? You can choose your response from the given examples of causative factors.

(poor immunity, lack of access to clean drinking water, air pollution, spoiled food, overexertion due to strenuous work, open air defecation, alcoholism, *beedi (hand-rolled cigarettes)* /cigarettes, *pan masala* (a mixture of areca nut, slaked lime, catechu and other flavoring agents), chewing tobacco, drugs etc.)

	Disease	Cause/s
1		
2		
3		
4		
5		

19. Have you heard of any diseases that get transmitted from parents to their children? If so, name them. _____

20. Match the contents of column A with that of column B:

Column A	Column B
Pulse polio vaccine	AIDS
DOTS	Typhoid
ELISA Test	TB
Salmonella typhi	Diarrhea
BCG vaccine	Oral cancer
ORS	Polio
Chewing tobacco/ *Pan masala*	TB

Appendix XIII

Workshop Instrument: Worksheet 2 [Health and hygiene]

तबियत बिगड़ने पर होने वाली कुछ आम निशानियां नीचे दी गई हैं। वे किस–किस वजह से हो सकती हैं और वापस ठीक होने के लिए क्या–क्या किया जाता है, उसकी मालूमात को टेबिल में भरना है।

	निशानी /मिजाज	उसकी क्या वजह हो सकती है?	वापस ठीक होने के लिए क्या–क्या किया जाता है?
1	सर्दी या जाड़ा लगकर तेज बुखार आना		
2	बार–बार उल्टी आना		
3	पूरे बदन में तेज ऐंठन होना		
4	खांसी के साथ खून आना		
5	अचानक से वजन गिरने लगना		
6	बार–बार दस्त लगना		
7	सर में बहुत तेज दर्द होना		
8	आंखों से पानी आना		
9	पेशाब में जलन होना		

	निशानी /मिजाज	उसकी क्या वजह हो सकती है?	वापस ठीक होने के लिए क्या-क्या किया जाता है?
10	पेशाब पीला होना		
11	हमेशा परेशान रहना		
12	बात–बात पर घबराना		
13	हमेशा थकावट महसूस करना		
14	मुंह में छाले होना		

Translation:

There are some symptoms associated with certain illnesses. In the table below, fill up what you understand to be the causes underlying these symptoms as well as possible cures.

	Symptoms	Possible causes	Possible cures
1	Cold and cough accompanied by bouts of fever		
2	Repeated vomiting		
3	Severe body ache		
4	Severe bouts of cough with blood in the sputum		
5	Drastic and sudden weight loss		
6	Frequent loose motions		
7	Severe headache		
8	Watery eyes		
9	Burning sensation while urinating		
10	Yellow colored urine		

	Symptoms	Possible causes	Possible cures
11	Constant anxiety		
12	Being excessively tense/ nervous/ edgy		
13	Constant fatigue		
14	Mouth ulcers		

Appendix XIV

Workshop Instrument: Story of a steel plant

<div align="center">स्टील फैक्ट्री की कहानी</div>

इस पेपर में एक स्टील फैक्ट्री के बारे में कुछ बातें दी गई हैं। इन बातों को ध्यान से पढ़ो और अपने ग्रुप में नीचे दिए सवालों पर बात करो।

एक विदेशी कंपनी इंडिया में स्टील बनाने की फैक्ट्री लगाना चाहती है। तुमको मालूम होगा कि स्टील बनाने के लिए कच्चा लोहा चाहिए होता है जो पहाड़ों में मिलता है और पहाड़ की खुदाई करके निकाला जाता है। फैक्ट्री के लिए कंपनी ने एक ऐसी जगह ढूंढी है, जहां से उसे कच्चा लोहा आसानी से मिल सके।

पर नए कानून के हिसाब से आजकल किसी भी कंपनी को ऐसा प्रोजेक्ट शुरू करने से पहले एक सरकारी महकमे से परमीशन लेना होता है। यह परमीशन तभी मिलती है जब आसपास के गांवों की रज़ामंदी हो। पर इस स्टील फैक्ट्री के लिए कंपनी ने जो जगह ढूंढी है, उसके आसपास के गांवों के लोग प्रोजेक्ट का काफी विरोध कर रहे हैं क्योंकि उनकी जमीन इस प्रोजेक्ट में ज़ब्त हो जाएगी। इन गांवों की ग्रामसभाओं ने अपनी नामंज़ूरी सरकार के सामने पहले ही दर्ज करा दी है। पिछले तजुर्बों को देखते हुए गांव वालों को डर है कि उनकी ज़मीन को आधा–अधूरा मुआवज़ा देकर ज़ब्त कर लिया जाएगा और उनकी खेती बर्बाद हो जाएगी। उस ज़मीन पर पीढ़ी–दर–पीढ़ी रहने वाले लोग, जिनमें ज़्यादातर आदिवासी हैं, वहां की ज़मीन पर अपना बुनियादी हक़ मानते हैं और वहां से नहीं हटना चाहते हैं।

लोगों की बगावत जोर–शोर से चल रही है। लोगों का कहना है कि उनकी आवाज़ को बेरहमी से दबाया जा रहा है। कई लोग जेल भेज दिए गए हैं, कई पुलिस के साथ हुई मुठभेड़ में बुरी तरह ज़ख्मी हुए हैं, एक इंसान तो पुलिस की गोलीबारी में मारा भी जा चुका है।

माहौलियात के बारे में मालूमात रखने वाले संगठन कह रहे हैं कि अगर यह प्रोजेक्ट अमल में आया तो खेती और जंगलात को नुकसान होगा, खदान (कानकुनी) वाले इलाक़ों में पानी की दिक्कतें बढ़ेंगीं और कई चरिंद–परिंद के वजूद को भी ख़तरा बढ़ जाएगा।

पर सरकार का कहना है कि यह प्रोजेक्ट तरक्क़ी की ओर ले लाएगा, लोगों को काम मिलेगा, लोगों की जिंदगी में खुशहाली आएगी। सरकार को स्टील फैक्ट्री से काफी सारा टैक्स मिलने की भी उम्मीद है। इस सबके चलते सरकारी महकमे ने ग्रामसभाओं की नामंज़ूरी की परवाह किए बिना कंपनी को प्रोजेक्ट शुरू करने की परमीशन दे दी है।

तुमको सोचना है कि –

1. अगर तुम सरकारी महकमे में मंत्री होते तो –

    • तुम प्रोजेक्ट के बारे में क्या फैसला लेते और क्यों?

    • फैसला लेने के लिए किन–किन मसलों पर गौर करना चाहिए?

    • इन मसलों में तुम्हें सबसे जरूरी मसला कौन–सा लगता है और क्यों?

2. कुदरती वसाइल जैसे पहाड़ों, समंदर वगैरह पर किसका हक ज्यादा बनता है और क्यों?

    • सरकार का

    • वहां रहने वाले लोगों का / मुल्क के सभी लोगों का

    • पहाड़ या समंदर में रहने वाले सभी छोटे–बड़े जानवरों का

    • पहाड़ या समंदर में उगने वाले पेड़–पौधों का

    • इन सभी का

    • किसी का भी नहीं

3. पीढ़ी–दर–पीढ़ी जंगल में रहने वाले आदिवासी अपनी रोजी–रोटी के लिए इन पहाड़ों पर निर्भर हैं, यह कहां तक जायज़ है?

4. सरकार का यह नियम कि किसी जगह प्रोजेक्ट को शुरू करने से पहले आसपास के गांव वालों की रज़ामंदी लेनी जरूरी है, कितना सही है? तुमको ऐसा क्यों लगता है? इसके क्या फ़ायदे या क्या नुक़सान हो सकते हैं?

5. सन् 2006 में एक क़ानून आया जो आदिवासियों को जंगल की ज़मीन और वहां मिलने वाली तमाम चीज़ों पर गुज़र–बसर करने का हक़ अदा करता है। इस क़ानून के बारे में तुम्हें क्या लगता है? यह कितना सही है या कितना ग़लत? तुमको ऐसा क्यों लगता है?

6. हक़ के बारे में कुछ बातचीत

7. नए प्रोजेक्ट के आने से क्या–क्या फ़ायदे होंगे?

8. नए प्रोजेक्ट के क्या–क्या नुक़सान नज़र आते हैं?

9. कुछ लोग कहते हैं कि ये गांव–देहात के लोग और माहौलियात के बारे में थोड़ी–बहुत मालूमात रखने वाले लोग अक्सर तरक्क़ी के रास्ते में आड़े आ जाते हैं। तुमको क्या लगता है?

    • तरक्क़ी के लिए थोड़ी–बहुत कुर्बानी तो देनी ही पड़ती है, नहीं? कहते हैं ना, कुछ पाने के लिए कुछ खोना पड़ता है। फिर? तुमको क्या लगता है?

Translation:

<p align="center">Story of a steel plant</p>

Carefully read this write-up and have a group discussion on the questions given at the end of the text:

A foreign firm intends to set up a steel factory in India. You might know that the key raw material essential for producing steel is iron ore which is mined by drilling and blasting hills. The company has found a suitable place for the factory where iron ore deposits are conveniently available.

However, according to a new law, any company interested in starting such a project would need to take permissions from a government department. This clearance is given only when the surrounding villages agree to give a go-ahead to the project. In this case, the villages surrounding the proposed factory are strongly against it as their land will be taken away for the project. The *gram sabhas (*village councils) have already shared their discontent over the project with the government. The villagers are afraid that similar to their previous such experience, this time too their land will be acquired for the project without a fair compensation and their access to the forest produce will be lost. The people there, most of them from the indigenous tribes (Adivasis), have lived on that land generations after generations. They believe that they have a fundamental right over their land and do not want to get displaced from there.

The people's protest is growing stronger. They report that their voices are being violently stifled. Many of the protesters have been imprisoned, some of them got injured in the scuffle with the police while one person died when the police opened fire on them.

Organizations involved in environmental conservation are also of the opinion that if this project goes forward, cultivable land and forests in the region will be endangered. Moreover, they fear that the water crisis in the area surrounding the mines will increase and it will also lead to loss of numerous plant and animal species.

However, the government maintains that this project will be beneficial as it will lead to development of the region, many people will get jobs, trade will flourish. This will lead to

more taxes for the government. On the basis of these arguments, the governmental department has given the company permissions to begin the project disregarding the opinion of the village councils.

Think and discuss these questions in your group:

1. If you were a minister in the government department -

     a) What would your decision be regarding the project and why?

     b) What are all the factors that need to be considered before making a decision?

     c) Which of the issue amongst all those that are connected with the project seems most significant to you?

2. Amongst the stakeholders listed below, who has the foremost rights over natural resources like the hills and the rivers? Why?

     a) The government

     b) People living in the region/ people of the country

     c) The animals living in the hills/ rivers…

     d) The plants of the region

     e) All of the above

     f) None of them

3. The Adivasis (indigenous tribes) have lived in the forests for generations. They are dependent on the forests for their subsistence. Does that seem legitimate to you?

4. What do you think about that the law that mandates permission for a development project from the people in the surrounding villages? Is that justified? Why do you think so? What could be the pros and cons of this mandate?

5. In 2006, an act was passed that recognized and vested the rights of the (Adivasis and other traditionally forest dwelling communities) on the land of the forests and other forest produce on which they depend for livelihood and habitation? What do you think of this law? Is it necessary? Is it a fair move or not? Explain why you think so.

6. Discussion on rights

7. What would be the benefits of this new project? What problems could it lead to?

8. There is a view that people living in villages or forests and those who talk of saving the environment are against progress. Do you agree with this? Some things have to be sacrificed to achieve what we want, right? So to achieve the progress we desire, some lives need to be sacrificed. What do you think?

Appendix XV

Workshop Instrument: Understanding of nature and our relationship with it

कुदरत और उसके साथ हमारा रिश्ता

1. 'नेचर' या 'कुदरत' का तुम्हारे लिए क्या मायने है? जब तुम कुदरत के बारे में सोचते हो तो तुम्हारे दिमाग में क्या–क्या आता है? एक मिनट लगाकर अपनी कॉपी में लिखो।

2. क्या इंसान भी किसी तरह कुदरत से जुड़े हैं? थोड़ा खुलकर बताओ तुम्हें ऐसा क्यों लगता है?

   • भला, हमारा कुदरत से क्या ताल्लुक है?

   • लोगों के कामकाज का कुदरत पर कैसे असर पड़ता है?

   • कुदरत भी क्या इंसानी कामकाज पर असर डालती है?

   • क्या कुदरत का माशी तरक्की से कोई ताल्लुक लगता है? क्या ताल्लुक हो सकता है?

3. बातचीत के लिए सवाल –

   • कुछ लोग कहते हैं कि कुदरत एक बैलेंस बनाकर चलती है। तुमको क्या लगता है?

   • अगर कुदरत खुद बैलेंस बना सकती है तो फिर हमें कुदरत की हिफाज़त करने की क्या जरूरत है? तुमको क्या लगता है?

      ▪ क्या कुदरत इंसानों के लिए एक अहम वसीला है? क्यों या क्यों नहीं?

      ▪ क्या कुदरत बाकी जानवरों के लिए भी एक अहम वसीला है? क्यों या क्यों नहीं?

   • क्या कुदरत लोगों और जानवरों के लिए महज एक वसीला है या उसके कुछ और भी मायने है ?

Translation:

Nature and our relationship with it

1. What does 'nature' mean to you? When you think of 'nature' what comes to your mind? Take a minute to note down what you understand by nature. You can also draw if you want to.

2. Are human beings related to nature? Please explain your viewpoint.
   - What could be the connection between nature and us?
   - How does nature get affected with human activities?
   - Does nature too have an effect on human activities?
   - Do you see a connection between nature and economic growth? What is the nature of this connection?

3. Discuss these questions in your group and then share with the whole class -
   - Some people say that nature maintains its balance. What do you think of it?
   - If nature does maintain a balance, why do we need to protect the environment?
   - Is nature a valuable resource for human beings? Why or why not?
   - Is nature a valuable resource for other animals too? Why or why not?
   - Is nature nothing but a resource for living beings? Does it mean something else too?

Appendix XVI

Workshop Instrument: Understanding of development and smart city

<div align="center">

स्मार्ट शहर

</div>

1. तुम्हारे दिमाग में एक अच्छे / स्मार्ट शहर की क्या कल्पना है? एक पेज पर एक स्मार्ट शहर का खाका बनाओ।

2. ग्रुप में बात करो।
   1. किसी शहर को स्मार्ट बनाने के लिए क्या–क्या करना होगा? जब तुम किसी शहर को स्मार्ट बनाने के बारे में सोचते हो तो तुम्हारे दिमाग में क्या–क्या ख्याल आते हैं?
   2. क्या कोई ऐसी बात है जिसपे सबसे ज्यादा ध्यान दिए जाने की जरूरत है? तुमको ऐसा क्यों लगता है?

3. तरक्क़ी से तुम क्या समझते हो? यह शब्द सुनने पर तुम्हारे दिमाग में सबसे पहले क्या आता है? कोई ऐसी जगह बताओ जहां पिछले कुछ समय में खूब तरक्क़ी हुई है या जहां कुछ भी तरक्क़ी नहीं हुई है?

Translation:

<div align="center">

Smart city

</div>

1. What is your idea of a good city/ a smart city? On a sheet of paper draw a lay out of a smart city.

2. Points for group discussion:

    a) What needs to be done to turn a city into a smart city? What suggestions would you make to turn any city into a smart city?

    b) Are there any aspects that need special attention? Why do you think these aspects are important for a smart city?

3. What is your idea of progress/ development? What is the first thing that comes to mind when you hear this word? Think of a place that has made a lot of progress in recent times and also a place that hasn't developed much.

Appendix XVII

Workshop Instrument: Elections in a jungle

<p align="center">जंगल में चुनाव</p>

शेर सिंह मोटा ताजा,
पूरे जंगल का राजा,
वेजीटेरियन हो गया ।
पशुओं के प्रेम में खो गया,
नज़ारा इतना विचित्र हो गया ।

शिकार था जो पहले
अब वो मित्र हो गया,
दुश्मनों में प्यार उमड़ आया था,
पता है !
जंगल में चुनाव आया था।

दोस्तों,

पिछले साल खबर आई ही थी कि जंगल में 'चुनाव' होने वाला है कि जंगल में एकदम हड़कम्प मच गया। जगह–जगह गली–मोहल्लों में सुगबुगाहट शुरू हो गई थी, जंगल में छपने वाले सारे अख़बार चुनाव की खबरों से पटे पड़े थे, जानवरों के बच्चे टी.वी. में अपने मनपसंद प्रोग्राम देखने को तरस गए थे। माहौल एकदम बदल गया था। और हो भी क्यों ना, भई जंगल की 'सरकार' का मामला था !

किसी मोहल्ले के नुक्कड़ पे बहस छिड़ी हुई थी कि इस बार किसको 'वोट' देना है तो कोई किसी 'पार्टी' की दुहाई दे रहा था। कौन–सी पार्टी किसको चुनाव में उतारने वाली है – यह तो लगभग तय ही था। कई जानवर इस सकते में थे कि कहीं इस बार भी पीढ़ी–दर–पीढ़ी शासन करने वाली पार्टी 'सदाबहार वांग्रेस' की सरकार फिर से ना आ जाए। इसके लिए वे कुछ भी करने को तैयार थे। विकल्प (options) के रूप में तीन–चार और पार्टियों के उम्मीदवार भी थे।

'जंगली जनता पार्टी' ने खूंखार शेर सिंह को मैदान में उतारा था। पार्टी का मानना था कि जंगल का नेता एक शेर को ही होना चाहिए क्योंकि सत्ता संभालने के लिए जोर से दहाड़ लगा पाना, सबको डराकर चुप करा पाना निहायत जरूरी है और फिर शेर तो पैदाइशी बहादुर होते हैं, वगैरह–वगैरह।

'वानर सेना' नाम से जो पार्टी थी वो आम तौर पर सिर्फ बंदरों के फायदे की बात सोचती थी और इन्हें लगता था कि लंगूरों का इस जंगल पे कोई अधिकार नहीं है और लंगूरों को तो दूसरे किसी जंगल में खदेड़ देना चाहिए। इस पार्टी ने एक नौजवान बंदर को चुनाव में खड़ा किया था हालांकि सभी जानते थे कि चाहे 'जंगली

जनता पार्टी' हो या 'वानर सेना' –इन दोनों को ही एक और बहुत 'पावरफुल' संगठन का सपोर्ट मिला हुआ था जो खुद मैदान में ना होते हुए भी इन दोनों पार्टियों की सारी सरगर्मियों को कंट्रोल करता था।

पर इस बार के चुनाव में एक और पार्टी भी मैदान में सामने आई थी जो ना तो 'जंगली जनता पार्टी' के तरीकों से सहमत थी और ना पीढ़ी–दर–पीढ़ी राज करने वाली 'सदाबहार वांग्रेस' की नीतियों से। इस पार्टी का नाम था – 'आम जीव–जन्तु पार्टी'। नाम से तो ऐसा लगता था कि यह पार्टी आम जानवरों के हित की बात कर रही है, पर जल्द ही साफ होने लगा था कि यह पार्टी भी एकदम पिछड़े जानवरों की मदद करने का ना तो इरादा रखती थी और ना ही उसमें इतनी काबिलियत थी कि वो यह सब कर पाए।

खैर, धीरे–धीरे शुरू हुआ रैलियों का सिलसिला। जहां 'जंगली जनता पार्टी' का नारा था – 'अच्छे दिन' और पार्टी नेता शेर सिंह अपनी हर रैली में जंगल और जंगल के लोगों के 'विकास' (तरक्की) की बात कर रहे थे, 'आम जीव–जन्तु पार्टी' नेता बल्लू भालू जंगल में बढ़ते करप्शन के खिलाफ लोगों को इकट्ठा करने में लगे थे। पार्टी का मानना था कि करप्शन जंगल का सबसे बड़ा मसला था और बल्लू भालू जैसे किसी पढ़े–लिखे नेता के सत्ता संभालने से ही जंगल के निज़ाम को ठीक किया जा सकता था।

'सदाबहार वांग्रेस' की ओर से फिर से बुजुर्ग हाथी चचा को मैदान में उतारा गया था जिनके बारे में चर्चा थी कि वो किसी भी मामले में खुड़पेंच नहीं करते थे। पर हकीकत तो यह थी कि कभी–कभार जरूरत पड़ने पर भी वह कुछ नहीं बोलते थे। उनके इसी शांत स्वभाव के मद्देनजर पार्टी के काम का सारा दारोमदार एक युवक हिरन ने अपने हाथों में ले रखा था। इस हिरन ने चुनाव के एनाउंसमेंट के काफी पहले से ही जंगल के लोगों से बातचीत करना शुरू कर दिया था और जंगल में चलने वाले कुछ चैनल उसको काफी जोर–शोर से दिखा भी रहे थे, पर चुनाव के करीब आते–आते चैनलों का रवैया भी बदलने लगा था। अब चैनल सिर्फ विकास और अच्छे दिनों की बातें करने में लगे थे। बीच–बीच में कुछ छुटपुट अखबार मीडिया के इस बदले स्वरूप की निंदा कर रहे थे और पार्टियों की नीतियों पर सवाल उठा रहे थे, पर इन अखबारों की पहुंच बहुत सीमित थी, ज्यादातर जानवर इन्हें कोई भाव ही नहीं देते थे।

खैर, इन बड़ी–बड़ी पार्टियों और उनकी सियासी चालों के बीच कुछ और छोटी पार्टियां भी थीं – जैसे 'जंगल दल', 'पिछड़ा जानवर फ्रंट', 'वनसमाज पार्टी' वगैरह–वगैरह जिनका मोटे तौर पर मानना था कि जंगल में मेहनतकश जानवर सदियों से पिछड़ते आए हैं, वे मेहनत करते हैं और माल कोई और उड़ाता है। उनका कहना था कि जो व्यवस्था इन जानवरों के अधिकारों की सुरक्षा नहीं कर सकती, उसे ढोने की नहीं बल्कि सिरे से खारिज करने की जरूरत है। इन पार्टियों ने आपस में एकजुट होकर 'मिलजुल मोर्चा'नाम से चुनाव लड़ने का प्लान किया था और इनके उम्मीदवार थे – बघीरा काका, जिनकी ब्लैक पैंथर 'कम्यूनिटी' में काफी इज्जत थी। हालांकि इन पार्टियों के बीच में भी काफी मतभेद थे, इनके नेता भी एक–दूसरे को फूटी आंख नहीं सुहाते थे, पर मरता क्या ना करता – इस समय उनके पास एक–दूसरे के साथ आने के अलावा कोई और चारा भी नहीं था।

तो अब हो जाए कुछ गरमागरम बातचीत–

1. इस चुनाव में कौन–कौन उम्मीदवार मैदान में हैं? किसका क्या एजेंडा है? तुमको किसके जीतने की उम्मीद ज्यादा लग रही है? और क्यों?
2. पार्टी क्या होती है? कुछ पार्टियों के नाम बताओ। तुम और किन–किन पार्टियों के नाम जानते हो? इन पार्टियों के सबसे बड़े नेता का नाम बताओ। सबसे अच्छी पार्टी कौन–सी है? और क्यों?

3. चुनाव क्या होता है? चुनाव कब कराए जाते हैं? क्यों कराए जाते हैं? कौन कराता है? चुनाव के लिए पैसा कहां से आता है? वोट कौन डाल सकता है? तुम बडे होकर किस पार्टी को वोट देने का सोच रहे हो? और क्यों?

4. सरकार क्या होती है? सरकार ना हो तो कोई दिक्कत है क्या? आखिर सरकार की ज़रूरत ही क्या है? सरकार क्या करती है? सरकार कैसे बनती है? आजकल किसकी सरकार है? देश में? महाराष्ट्र में? तुमको क्या लगता है सरकार अपना काम ठीक से कर रही है कि नहीं? ठीक से काम करने के लिए सरकार को क्या करना चाहिए? तुम्हारा कभी आमना–सामना हुआ सरकार से? क्या तजुर्बा रहा?

5. 'पावर' क्या है? तुमको क्या लगता है सबसे 'पावरफुल' कौन है आजकल? क्यों? कोई इंसान औरों से पावरफुल कैसे बनता है?

6. 'कम्यूनिटी' / कौम क्या होती है? 'कम्यूनिटी' कैसे बनती है?

7. क़ानून क्या होता है? क़ानून क्यों बनाए जाते हैं? कौन बनाता है? कैसे बनाए जाते हैं? हमारा क़ानून हमें क्या–क्या हक़ देता है? तुम्हें और कौन–कौन से क़ानून मालूम हैं? क़ानून के बारे में और पता करना हो तो क्या करना पड़ेगा? हक़ ना मिलने पर क्या कर सकते हैं? इंसाफ क्या होता है?

Translation:

Elections in a jungle

Sher Singh, strong and mighty,

The king of the jungle,

Turned vegetarian.

So much did he love his fellow beasts,

That the situation had become unusual.

The ones who used to be the prey

had become friends,

Enemies were expressing love for each other,

You know!

The elections had been announced in the jungle.

Friends,

In the previous year, as soon as the elections were announced in the jungle, the situation became chaotic. At every nook and corner, the animals were talking about it. All the newspapers that came to the jungle were brimming with election news. The little cubs and puppies were craving to watch their favourite shows on the television that now just flashed news after election news. The state of affairs was changing rapidly. And, why should that not be the case, a new 'government' was in the making.

In some corner in the jungle, the animals were debating on whom to 'vote' for. While some were rooting for their favourite 'party', who is going to contest elections from various parties was almost decided. Many animals were worried that *Sadabahaar Vangress* – a party that had ruled the jungle generation after generation – would come back to power. They were willing to do anything to stop that from happening. There were 3-4 other options available from other major parties.

The *Junglee Junta Party* had launched the dreaded Sher Singh. The party believed that the kind of leader who can rule the jungle must be a lion... able to roar loudly, instill some fear

among animals and make everyone shut their mouth. They also believed that lions are courageous by birth, and so on.

The *Vaanar Sena* party was primarily concerned about the benefits of monkeys. They believed that certain animals especially baboons have no rights over the jungle and should be pushed out of the jungle. They had launched a very young monkey as their contestant though everyone knew that whether it is the *Junglee Junta Party* or the *Vaanar Sena* – both parties had the support of a powerful organization that didn't contest elections upfront but controlled the activities and decisions taken in both these parties.

This time a new party had joined the race. This party had disagreements with the policies of both the main parties - the *Junglee Junta Party* and the *Sadabahaar Vangress*. This party was called the *Aam Jeev-Jantu Party*. Through such a name, the party probably wanted to give an impression that it is concerned about common animals but it became evident very soon that this party had neither the intentions nor the ability to help the most marginalized in the jungle.

Gradually, the campaign started and the parties started organizing rallies. While the slogan of the *Junglee Junta Party* was *Achchhe Din (*Happy Days), and the party leader Sher Singh was talking about 'development' in all his rallies, the leader of *Aam Jeev Jantu Party,* Balloo the bear, was trying to mobilize animals on the issue of increasing corruption in the jungle. This party believed that corruption was the biggest issue in the jungle and only an educated leader like Balloo, could improve 'the system' of the jungle.

This time too, a veteran elephant uncle was contesting elections on behalf of *Sadabahaar Vangress*. Everyone knew that he would not interfere in others' matters but the truth was that he would not often speak up even on important matters. Because of his quiet disposition, most of the burden was on the young shoulders of a deer. The deer had begun talking to animals much before the announcement of elections and many TV channels were covering the news. However, as the election dates arrived, the attitude of these channels also changed. They were no longer telecasting news related to 'development' and 'happy days'. Meanwhile, some newspapers would criticize the media's changing character and question the policies of various parties but their reach was limited and most animals would not even pay attention to such news.

Among the big parties, some small regional parties were also contesting elections, such as the *Jungle dal*, the *Picchda Jaanwar Front*, and the *Vansamaj Party* who believed that the labor class in the jungle has been exploited over generations. They perform all the hard labor while a few others reap benefits of it. They would argue that a system that cannot protect the rights of the marginalized must be abolished. These parties had collaboratively formed a group named *Miljul Morcha*. The contestant from *Miljul Morcha* was a *Bagheera* uncle who had a good reputation among the black panther community. Even though there were a lot of differences even amongst these small parties, they didn't stand a winning chance had they contested alone.

Now, let's discuss the questions given below:

1. Who are contesting in the elections this time? What are their agendas? Who is more likely to win and why?

2. What do you understand by 'party'? Name a few parties. Which party is better than others? Why?

3. What do you understand by elections? Why are elections conducted? Who conducts the elections? How are funds raised for the elections? Had you been a part of the jungle, whom would you have voted for and why?

4. What do you understand by 'government'? What if there is no government? What does the government do? How is the government formed? Whose government is ruling at present in India? In Maharashtra? Is the present government functioning properly? What do you think? What should a government do to function properly? Have you ever met a government official? Describe your experience.

5. What do you understand by 'power'? Who is the most powerful in your knowledge? How does one become more powerful than others?

6. What do you understand by 'community'? How is a community formed?

7. What do you understand by law? Why do we need laws? Who makes laws? How are laws made? What rights have our constitution given us? Which laws do you know about? If you want to know more about laws, how would you go about it? What can one do if one's rights are violated? What do you understand by 'justice'?

Appendix XVIII

Workshop Instrument: Dream of a fledgling

एक चूजे का ख्वाब

चूजा ! कौन है ये चूजा?
अपने मां–बाप का अरमान?
अपने खानदान का चिराग?
या सड़क किनारे किसी पोल्ट्री फार्म में
अपने बाकी दोस्तों की ही तरह
अपने परिवार वालों की मौत का तमाशा देखता
और अपनी मौत का इंतजार करता,
एक नादान !

इसके मां–बाप भी तो
इसके जैसे माहौल में
पले–बढ़े थे
दबे–कुचले,
वक्त के मारे !
कभी इंजेक्शन देकर
मोटा–तगड़ा बनाया गया
तो कभी दाना–पानी रोककर
कंट्रोल में लाया गया।
पर भई, मालिक लोगों को कोई
तकलीफ ना होने पाए
ये जिएं जैसे–तैसे
या भले ही मर जाएं।

इनका वजूद तो
बस एक छलावा है।
जब तक अंडे देते रहें, दें
वरना लोगों की,
कभी ना कम होने वाली
भूख मिटाएं।
इससे ज्यादा किसी को
ना कोई फिक्र, ना परवाह।
गंदगी, बदबू, बीमारी और डर के साये में

रहने और जीने को हैं मजबूर !
ना खुली हवा,
ना बीमार पड़ने पर दवा
ना दर्द में कोई राहत
ना किसी ने कभी पूछा कि
क्या यहां दम घुटता है तुम्हारा?

माना जाता था कि ये तो है कुदरत का दस्तूर
चला आ रहा है सदियों से
और यूं ही चलता रहेगा हमेशा–हमेशा
पर इस नादान से चूज़े को ये बातें
ना जाने क्यों समझ में नहीं आती थीं?
कहता था, यह इतना भी सच नहीं है,
आखिर इंसानी भूख हमेशा से तो इतनी बेरहम नहीं थी !

इन दिनों यह चूजा
अपने मां–बाप से, दोस्तों से
सवाल पे सवाल पूछता है
कहता है क्यों हैं हम इस तरह
रहने को मजबूर?
क्यों ज्यादातर चूज़े रहें दड़बों में
और कुछ ही को है सुकून?
क्यों हमको नहीं मिलता
अच्छा भरपेट खाना
पहनने को ठीक–ठाक कपड़े
फुरसत के लम्हे,
आराम करने की जगह
क्यों नहीं हो सकता हमारी
बीमारियों का इलाज ठीक से
आखिर हम भी तो
औरों की ही तरह हैं !

पर औरों के हालात !
औरों के हालात भी तो
किसी से छिपे नहीं थे
बाकी जानवर भी समय के इस फेर को
भांप रहे थे
अनाज की बात हो
या फल, फूल, सब्जियां
वजूद के ये सवाल
सबके लिए उतने ही
जायज और गहरे हो चले थे।

कहने को तो ये चूजा भी बाकियों जैसा ही था
मगर कुछ मामलों में

आजकल सबसे थोड़ा अलग–थलग हो गया था
आखिर ये सवाल जो पूछने लगा था।
बात छिड़े तो हर बार
ख्वाबों का ही ज़िक्र करता है
ख्वाबों की ही बातें करता,
उन्हीं में खोया रहता है।
किसी एक ख्वाब में
शायद देख लिया था उसने वो खुला आसमां !

आंखों में उसके अब
एक अजीब–सी चमक है
शायद एहसास है उसको कि नामुमकिन नहीं है
इज्ज़त की जिंदगी जीना !
अब वो बराबरी की बातें करता है,
इंसाफ की मांग करता है
कहता है अगर आज चुप रहे तो
कल और बहुत कुछ सहना होगा
आंसुओं को पीना होगा
घुट–घुट कर जीना होगा।

पूछ रहा है सबसे आजकल
क्या करें, क्या ना करें
किससे भिड़ें, कहां लड़ें
क्या ना कर डालें
गुस्सा है, छटपटाहट है
बगावत करने को मचलता है उसका मन,
मन में मची है खूब उथल–पुथल
अब तुम ही सुझाओ कोई हल !

1. तुम्हें अपना और अपने परिवार का जीवन ठीक से चलाने के लिए क्या–क्या एकदम जरूरी लगता है?

_____

_____

_____

2. ज़िंदगी में कोई ऐसी चीज़ जो तुम कभी ना कभी जरूर करना चाहते / चाहती हो?

_____

_____

_____

3. तुमने ज़िंदगी में अपने लिए क्या मुक़ाम तय किया है? मतलब आगे जाकर जिंदगी में क्या हासिल करना चाहते हो?

A) खुद के लिए –

_____
_____
_____

B) अपनी फैमिली के लिए –

_____
_____
_____

C) अपनी कौम के लिए –

_____
_____
_____

4. जहां तुम रहते हो उस ऐरिया की सबसे बड़ी प्रॉब्लम क्या लगती है तुमको?

_____
_____
_____

5. इस प्रॉब्लम की अहम वजह क्या है?

_____
_____
_____

6. क्या इस प्रॉब्लम को ठीक किया जा सकता है?   हां / नहीं

7. अगर हां तो क्या–क्या कर सकते हैं?

_____
_____
_____

8. अगर तुमको इस ऐरिया का कारपोरेटर बना दिया जाए तो तुम मोटे तौर पर क्या–क्या बदलना चाहोगे?

_____
_____

Translation:

The dream of a fledgling

A fledgling!
Who is this little chick?
The hope of his parents?
A ray of light for his family?
Or, just like his companions
a helpless bird,
trapped in a poultry cage on the roadside,
witnessing the death of his kin everyday,
waiting to die himself?

His parents also grew up
in similar circumstances,
oppressed,
victims of their times.
Beefed up occasionally
by giving injections,
Controlled some other times
by restraining food.
Only to satisfy their owners' needs
who shouldn't face any trouble
Whether they live,
or they die !

Their existence
is mere a farce...
Till they are fertile, they lay eggs
Or else choked to death

only to satisfy

never-ending human hunger.

No one is concerned

about these chicken otherwise.

Bound to live in the mud, rotting smell,

under so much fear.

Not even sufficient air to breathe,

no medicines if they fall sick,

Nothing to give relief in times of pain,

Neither did anybody ever ask,

do you feel suffocated here?

It was always believed

that this is their destiny

It was always like this

and it will always be...

But why doesn't this naive, little bird,

Decline to accept the reality!

Says, this is not the utter truth

After all human hunger was not always so cruel.

These days, this young one

keeps asking questions

to his parents, to his friends.

Says, why are we compelled

to live in such conditions?

Why most of us live in these small cages,

and only some have peace?

Why do we not get

sufficient food,

proper clothes,

any time or place to relax?

Why can't we be treated

for diseases?

We are also like others, right?

But others, what to say about others.

Others were also struggling to survive

and, it was known to everyone

The other animals were also

confronting the reality of their times

Whether it is a matter of grains,

flowers, fruits or vegetables,

The very question of survival

had become more and more relevant

and difficult for everyone.

But this youngster was different.

Well, he was similar

to his other fellows

in many ways.

But also different

in some other ways.

He had started asking questions after all!

He'd be lost in his dreams,

Whenever he got a chance,

he'd talk about his dreams.

Perhaps he had seen

in one of those dreams

a truly free world !

He has a different kind of spark

in his eyes these days

He has sensed that it's not impossible

to live with dignity.

Now he talks about equality,

demands justice.

Says if you don't speak up today

we'll have to suffer more.

He keeps asking everyone

What to do, and what not

Whom to confront, whom to fight

What all should we do.

Perturbed, agitated,

Eager to rebel,

He is debating himself.

Now, it's up to you,

Suggest a way out.

1. What do you think is absolutely necessary to lead a decent life?
2. Is there anything that you would definitely like to do in your life?
3. What goals have you set for yourself? What do you want to achieve in life? What do you want to do for your family? What do you want to do for your community?
4. What do you think is the major problem in the area you live?
5. What could be the reasons for that problem?
6. Can this problem be addressed? Yes / No
7. If Yes, what can be done to address the issue?
8. If you are made the corporator (a government official) of the area, which issues would you like to address?

Appendix XIX

## Workshop Instrument: Sudharak Olwe's photographs of sanitation workers

Appendix XX

Interview schedule for sanitation workers

1. नाम, उम्र?

2. अपने काम के बारे में थोड़ा खुलकर बताइए, जैसे –
   * कब से ये काम कर रहे हैं आप?
   * क्या–क्या काम रहता है?
   * आप इस काम में कैसे लगे?
   * आपके काम में आपको किस–किस तरह की दिक्कतें आती हैं? कैसे निपटते हैं उनसे?
   * इस काम में कौन–सी बीमारियां होने की ज्यादा संभावनाएं हैं?
   * काम शुरू करते समय BMC या आपके contractor की तरफ से इस काम से जुड़े खतरों के बारे में कोई warning, कोई चेतावनी मिलती है क्या? क्या warning मिलती है?
   * BMC/ Contractor की तरफ से आपकी सुरक्षा के लिए क्या–क्या सामान दिया गया है?
   * सुरक्षा के ये सामान क्या सभी के पास होते हैं ? कभी किसी को नहीं मिलता है, ऐसा भी होता है क्या?
   * सुरक्षा के सामान ना उपयोग करने पर क्या–क्या खतरे हैं? अगर किसी के पास ये चीज़ें नहीं हैं तो जरूरत पडने पर क्या करते हैं?
   * अपनी तरफ से सावधानी के तौर पर और कुछ भी करते हैं क्या?
   * आपको कैसे पता चलता है कि किसी गटर/सीवर में उतरना सुरक्षित है या नहीं?
   * अगर समय पर किसी जगह से कचरा ना हटाया जाए तो क्या दिक्कतें आ सकती हैं? और उन लोगों का क्या, जो कचरे के ढेर के एकदम पास में रहते हैं?
   * कितना मिल जाता है महीने में?

3. जहां रहते हैं, उधर के क्या हालात हैं?

   * घर कहां है? किराए का है या खुद का? कितना किराया है?
   * कितनी खोली / जगह है घर में? बाथरूम है घर में? टॉयलेट के लिए क्या इंतजाम है?
   * कब से रह रहे हैं वहां? कहां के रहने वाले हैं वैसे?
   * पीने के पानी का इंतजाम कहां से करते हैं?
   * बिजली का कनेक्शन है?
   * राशन कार्ड? आधार कार्ड? वोटर आईडी?
   * महीने की कमाई से घर का खर्चा आसानी से चल जाता है या कुछ और भी बंदोबस्त करना पड़ता है? कोई उधारी वगैरह?
   * घर में कौन–कौन है? वो लोग क्या–क्या करते हैं? उनका खर्चा–पानी कैसे चलता है? किस–किस की जिम्मेदारी आपके ऊपर है?
   * किस धर्म को मानते हैं?
   * घर में शादी–ब्याह होता है तो क्या–क्या होता है?

- बच्चे हैं? बच्चे क्या करते हैं? कहीं पढ़ते हैं? कहां?
- बीमार पड़ने पर इलाज के लिए कहां जाते हैं? घर में किसी को कोई लंबी बीमारी? कब से है? क्या इलाज हुआ? किसी बाबा या गुरू को मानते हैं क्या?
- किसी पार्टी या यूनियन के साथ जुड़े हैं क्या? हां तो किस तरह का काम रहता है?

4. इसके पहले की अपनी कहानी बताइए थोड़ा।
   - सब छोडकर मुंबई कैसे आना हुआ?
   - गांव में कौन–कौन है? उनका खर्चा–पानी कैसे चलता है?
   - आपने कहां तक पढ़ाई की? उसके आगे क्यों नहीं पढ़ा?
   - पहले क्या हालात थे अभी की तुलना में?

5. आगे के बारे में क्या प्लान हैं?
   - बच्चों के बारे में क्या सोचा है?
   - अगर अपने या अपने काम के बारे में कुछ बदलने का मौका मिले तो क्या–क्या बदलना चाहेंगे?

Translation:

Interview schedule for sanitation workers

1. Name, Age

2. Please take some time and describe your work.

   - Since when are you doing this work?
   - What does it entail?
   - How did you get involved in this work?
   - What kind of problems do you face in this work? How do you deal with those problems?
   - Which diseases is one likely to contract because of one's engagement with sanitation work?
   - Does one get any warning or precautionary note from the contractor or the Municipal Corporation before one takes up the job? What kind of caution does one get?
   - What safety gear have you got from the BMC or the contractor?
   - Does every sanitation worker get these equipment?
   - What risks are there if one doesn't use safety gear? If safety gear is not available, what do people do in the time of need?
   - Do workers take any precautions on their own?
   - How do you know if it is safe to get down a sewer?
   - What problems might occur if waste is not picked up in time? What happens to those who live next to the pile of garbage?
   - How much do you earn in a month?

3. Please tell me something about the place where you stay.

   - Where is your house? Is it rented or of your own? What is the rent like in that area?
   - Since when are you residing there? Where is your native place?

- How much space is there in the house? Do you have a latrine or bathroom inside the house or do you have to go outside?
- How do you arrange for drinking water?
- Do you have electricity connection at home?
- Ration card? Aadhar card? Voter ID?
- Are you able to manage your expenses with this income or do you have to arrange it through other means as well? Any loans?
- Who all are there at home? What do they do? How do they manage their livelihood? Who all are dependent on you?
- What religion do you follow?
- How are marriages celebrated at home?
- Do you have kids? What do they do? Do they study? Where?
- What do you do when someone in the family falls sick? Is there any incidence of a chronic disease in the family? Since when? What was done for it?
- Are you associated with any party or union? If yes, what work do you do for them?

4. Please tell me something about your past.

- Why did you migrate from your village?
- Who all are there in your native village? How do they manage their livelihood?
- Till what age did you manage to study? Why did you not pursue studies afterwards?
- What were the circumstances in those days in comparison to today's?

5. What are your plans for the future?

- What have you thought about the future of your kids?
- If you get a chance to change something about yourself or your job, what all would you like to change?

Appendix XXI

Interview schedule for rag pickers

- आपका दिन कैसे शुरू होता है, दिन में क्या–क्या काम रहता है – सुबह से लेकर रात को सोने तक?
  - कब से ये काम कर रही हैं आप?
  - इस काम में कैसे लगीं?
  - घर में बाकी लोग भी इसी काम में हैं या कुछ और करते हैं?
  - कचरा चुनने के लिए आप कहां–कहां जाती हैं?
  - किस–किस तरह का कचरा चुनती हैं आप?
  - बाकी कचरे का क्या होता है?
  - क्या कुछ कचरा ऐसा भी होता है जिसे उठाने–धरने में ज्यादा खतरा होता है (जैसे– अस्पताल का कचरा, इलेक्ट्रानिक सर्किट, बैट्री, टूटा हुआ कांच वगैरह)?
  - किस कचरे से सबसे ज्यादा खतरा होता है? किस तरह का खतरा होता है?
  - आप किसी को जानती हैं जिनको खतरनाक कचरा उठाने–धरने की वजह से कोई बीमारी लग गई हो?

- कंपनी को बेचने से पहले कचरे की छंटनी करनी होती है ना, तो छंटनी का क्या तरीका होता है?
  - छंटनी कहां करते हैं? कोई रोक–टोक किसी की तरफ से यहां छंटनी करने में?
  - किस–किस चीज की ढेरी बनाते हैं?
  - क्या कभी कचरे के ढेर में कोई ऐसी चीज भी मिलती है जो समझ में ना आए कि किस ढेरी में जाएगी या फिर जिसके हिस्से अलग–अलग करना मुश्किल होता हो। जैसे– ज्युस के डिब्बे
  - अलग–अलग चीजों की पहचान कैसे करती हैं कि ये लोखंड है, तांबा है, पीतल है, स्टील है, जर्मन है, ऐलुमिनियम है या कुछ और।
  - प्लास्टिक भी अलग–अलग तरह की होती है क्या? आपने इस सबके बारे में कैसे सीखा?

- अलग–अलग कचरे की अलग–अलग कीमत होती है। किसका क्या भाव है आजकल?
  - सबसे महंगा कौन–सा कचरा बिकता है?
  - यह भाव कैसे तय होता है?

- आपके पास से कचरा कहां जाता है?
  - कचरे को लाने, ले–जाने का क्या इंतजाम है?
  - कंपनी में इस कचरे का क्या होता है?

- आपके काम में आपको किस–किस तरह की दिक्कतें आती हैं?
  - इस काम में किस–किस तरह का खतरा रहता है?
  - पुलिस, बड़ी सोसाइटी के लोग, कुत्ते – कैसे निपटते हैं इन सबसे?

◆ कितना मिल जाता है रोज़ का?

◆ आप जहां रहती हैं, उधर के बारे में थोड़ा बताइए।
   ◆ घर कहां है? किराए का है या खुद का? कितना किराया है उस ऐरिया में?
   ◆ कितनी खोली/जगह है घर में?
   ◆ लैट्रीन–बाथरूम घर में ही है या बाहर जाना पड़ता है?
   ◆ आप लोग कब से रह रहे हैं वहां? कहां की रहने वाली हैं वैसे? गांव छोड़कर इधर कैसे आना हुआ?
   ◆ पीने के पानी का इंतज़ाम कहां से करती हैं? खरीदना पड़ता है या सरकारी नल से आता है? कितने का आता है पानी रोज़?
   ◆ बिजली का कनेक्शन? बैंक का खाता? राशन कार्ड? आधार कार्ड? वोटर आईडी?
   ◆ रोज़ की कमाई से घर का खर्चा आसानी से चल जाता है या कुछ और भी बंदोबस्त करना पड़ता है? कोई उधारी वगैरह?
   ◆ घर में कौन–कौन है? वो लोग क्या–क्या करते हैं? किस–किस की जिम्मेदारी आपके ऊपर है?
   ◆ किस धर्म को मानती हैं?
   ◆ बच्चे हैं? बच्चे क्या करते हैं?
   ◆ बीमार पड़ने पर इलाज के लिए कहां जाते हैं घर में सब? किसी को कोई लंबी बीमारी? कब से है? क्या इलाज हुआ?
   ◆ किसी पार्टी या यूनियन के साथ जुड़ी हैं क्या? हां तो किस तरह का काम रहता है?

◆ आगे के बारे में क्या प्लान हैं?
   ◆ बच्चों के भविष्य के बारे में क्या सोचा है?
   ◆ अगर कभी कुछ मांग रखनी हो सरकार के सामने तो क्या मांग रखेंगीं?

Translation:

Interview schedule for rag pickers

- ◆ How do you start your day? What all work do you do from morning till evening?
  - ◆ Since when are you doing this work?
  - ◆ Do you do the same work everyday, or do you do other things as well?
  - ◆ How did you get involved?
  - ◆ Are other members of your family into the same business or do they do something else? What do they do?
  - ◆ Where all do you to go to pick waste?
  - ◆ What kind of waste do you pick?
  - ◆ A heap of garbage has lot of things in it. Why do you pick only certain things? What happens to the remaining waste?
  - ◆ Do you find things in the garbage which could be dangerous (e.g. hospital waste, electronic circuit, broken glass)?
  - ◆ Which is the most dangerous kind of waste? What kind of danger is there?
  - ◆ Do you know of anyone who was affected by handling hazardous waste? What happened to them?
- ◆ The collected waste is sorted out before it gets sold to the companies. Isn't it? So how do you sort the collected waste?
  - ◆ Where do you do the sorting? Has anyone ever raised objections to that?
  - ◆ What all categories are made?
  - ◆ Do you also find things in the garbage which are difficult to dismantle? Or, for which you are not sure which pile will it go to? For instance, juice boxes.
  - ◆ How do you identify various materials – Iron, copper, brass, steel, *german*, aluminium?
  - ◆ Is plastic also of various types? How did you learn about all this?
- ◆ Different kinds of waste is sold at different prices. What are the prices these days?
  - ◆ Which is the most costly waste material?
  - ◆ How are the rates decided?

- Where does the waste go from you?
  - What is the mechanism to transport waste from the place where you sort waste to the company?
  - What happens to the waste in the company?
- What kind of problems do you face in this work?
  - What risks are involved ?
  - Has the police or big societies ever harassed you for doing this work? How do you deal with that?
- How much are you able to earn daily?
- Please tell me something about the place where you stay.
  - Where is your house? Is it rented or of your own? What is the rent like in that area?
  - How much space is there in the house?
  - Do you have a latrine or bathroom inside the house or do you have to go outside?
  - How do you arrange for drinking water? Do you buy it regularly or do you get it from the government water supply? How much do you pay for water everyday?
  - Do you have electricity connection at home? Ration card? Aadhar card? Voter ID?
  - Are you able to manage your expenses with this income or do you have to arrange it through other means as well? Any loans?
  - Who all are there at home? What do they do? How do they manage their livelihood? Who all are dependent on you?
  - What religion do you follow?
  - Do you have kids? What do they do? Do they study? Where?
  - What do you do when someone in the family falls sick? Is there any incidence of a chronic disease in the family? Since when? What was done for it?
  - Are you associated with any party or union? If yes, what work do you do for them?
- What are your plans for the future?
  - What have you planned for your kids?
  - If you are asked to demand something from the government, what demands will you put forward?

Appendix XXII

Interview schedule for scrap dealers

1. नाम, उम्र

2. अपने काम के बारे में थोड़ा खुलकर बताइए, जैसे –
   * कब से ये काम कर रहे हैं आप?
   * क्या–क्या काम रहता है?
   * आप इस काम में कैसे लगे?
   * आप किस–किस तरह का रद्दी / कचरा खरीदते हैं?
   * किस भाव पे खरीदी होती है? किस भाव पे बिकता है?
   * कितना मिल जाता होगा रोजाना का? महीने में?
   * माल असली है या नकली, इसका पता कैसे लगाते हैं?
   * क्या कुछ कचरा जहरीला भी होता है? आपको कैसे पता चलता है?
   * कौन–कौन से मेटल्स मिलते हैं? मेटल्स के अलावा क्या–क्या मिलता है?
   * कभी कोई सामान खुद के इस्तेमाल के लिए भी मिलता है क्या?
   * सामान लाने, ले–जाने का क्या इंतजाम है?
   * आपके यहां से जाने के बाद इस रद्दी / कचरे का क्या होता है? अगर नहीं पता तो एक अंदाजे से बताइए।
   * आपके काम में आपको किस–किस तरह की दिक्तें आती हैं? कैसे निपटते हैं उनसे?

3. जहां रहते हैं, उधर के क्या हालात हैं?

   * घर कहां है? किराए का है या खुद का? कितना किराया है?
   * कितनी खोली / जगह है घर में? बाथरूम है घर में? टॉयलेट के लिए क्या इंतजाम है?
   * कब से रह रहे हैं वहां? कहां के रहने वाले हैं वैसे?
   * पीने के पानी का इंतजाम कहां से करते हैं?
   * बिजली का कनेक्शन है?
   * राशन कार्ड? आधार कार्ड? वोटर आईडी?
   * दुकान की कमाई से घर का खर्चा आसानी से चल जाता है या कुछ और भी बंदोबस्त करना पड़ता है? कोई उधारी?
   * घर में कौन–कौन है? वो लोग क्या–क्या करते हैं? आपके ऊपर कितने लोगों की जिम्मेदारी है?
   * किसी धर्म को मानते हैं क्या?
   * घर में शादी–ब्याह होता है तो क्या–क्या होता है?
   * बचे हैं? बचे क्या करते हैं? कहीं पढते हैं? कहां?
   * बीमार पड़ने पर इलाज के लिए कहां जाते हैं? घर में किसी को कोई लंबी बीमारी? कब से है? क्या इलाज हुआ? किसी बाबा या गुरु को मानते हैं क्या?

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- किसी पार्टी या यूनियन के साथ जुड़े हैं क्या? हां तो किस तरह का काम रहता है?

4. इसके पहले की अपनी कहानी बताइए थोड़ा।
   - सब छोडकर मुंबई कैसे आना हुआ?
   - गांव में कौन–कौन है? उनका खर्चा–पानी कैसे चलता है?
   - आपने कहां तक पढ़ाई की? उसके आगे क्यों नहीं पढ़ा?
   - पहले क्या हालात थे अभी की तुलना में?

5. आगे के बारे में क्या प्लान हैं?
   - अपने काम को आगे ले जाने के बारे में क्या सोचा है?
   - बच्चों के बारे में क्या सोचा है?
   - अगर अपने या अपने काम के बारे में कुछ बदलने का मौका मिले तो क्या–क्या बदलना चाहेंगे?

Translation:

Interview schedule for scrap dealers

1. Name, Age

2. Please take some time and describe your work.

   - Since when are you doing this work?
   - What does it entail?
   - How did you get involved?
   - What all waste/ scrap items do you purchase?
   - At what prices do you buy scrap items? At what prices do you sell those items?
   - How much are you able to earn in a day? On monthly basis?
   - How do you figure if a scrap item is original or fake?
   - Do you find things in the garbage which could be toxic? How do you figure it out?
   - What all metals do you buy from your customers? Do you also buy non-metallic things as well?
   - Do you also get stuff which you can use for yourself?
   - How do you transport scrap items?
   - What happens to the scrap items once they leave your shop? If you don't know, please try to make a guess.
   - What kind of problems do you face in this work? How do you deal with those problems?

3. Please tell me something about the place where you stay.

   - Where is your house? Is it rented or of your own? What is the rent like in that area?
   - Since when are you residing there? Where is your native place?
   - How much space is there in the house? Do you have a latrine or bathroom inside the house or do you have to go outside?
   - How do you arrange for drinking water?

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- Do you have electricity connection at home?
- Ration card? Aadhar card? Voter ID?
- Are you able to manage your expenses with this income or do you have to arrange it through other means as well? Any loans?
- Who all are there at home? What do they do? How do they manage their livelihood? Who all are dependent on you?
- What religion do you follow?
- How are marriages celebrated at home?
- Do you have kids? What do they do? Do they study? Where?
- What do you do when someone in the family falls sick? Is there any incidence of a chronic disease in the family? Since when? What was done for it?
- Are you associated with any party or union? If yes, what work do you do for them?

4. Please tell me something about your past.

- Why did you migrate from your village?
- Who all are there in your native village? How do they manage their livelihood?
- Till what age did you manage to study? Why did you not pursue studies afterwards?
- What were the circumstances in those days in comparison to today's?

5. What are your plans for the future?

- How do you plan to take this work forward?
- What have you thought about the future of your kids?
- If you get a chance to change something about yourself or your job, what all would you like to change?

Appendix XXIII

Interview schedule for science teachers

Personal information

1. Tell me more about you and your interests.
   a. How did you get into teaching?
   b. What all subjects have you taught so far?
   c. Do you like to teach science?
   d. How did you develop this interest?

Views on science and its teaching

2. Why should children learn science? According to you, what are the broader aims of science education?
3. What all is taught in science in high school? Is there anything missing that ought to be there?
4. Some science teachers think that topics like solid waste management, pollution etc which are presently there in the science textbook, should be covered in social sciences. What do you think of it? How to decide whether something should go in science or social science? What difference do you see between the two subjects?
5. Do students learn anything about waste, environment or health before class IX as well?
   a. Which class? What is taught there?
   b. In any other subject?

Views on the observed chapters

6. Let's take the two chapters one by one. One on Health and the other one on Waste management. So,

- What seems to be the objective of the chapter?
- What is the expected learning (take-home message) from the chapter?
- What are the key ideas/ concepts discussed in the chapter?
- What is lacking in the chapter? And, in what ways it can be improved?
- In this chapter, which questions are asked most often in the exam?
- How much is the weightage of the chapter in the exam?

Classroom practices and constraints

7. Though I have already observed you teaching some of these chapters, can you describe your approach in nutshell? How do you go about teaching these topics?
8. What are the major constraints in teaching, in general? To this particular class? In this particular chapter?
9. How do you combat these constraints? What do you do in terms of preparation?

Views on context and contextualization

10. Do you think you would have taught these topics differently if taught in any other school? For example, in an elite school in Colaba? Or, in Gadchiroli?
11. What are students' profiles like in the classes that we observed? What kinds of families do they come from?

Views on the relation between health, waste, environment and development

12. Is there any connection between the chapter on waste management and the chapter on health? If yes, what connection? If not, do you see any connection between these two issues?
13. Some people say that there is a constant tussle between environment and socio-economic development. What do you think about it? How is development related / not related to environment?

Understanding of nature

14. What does 'nature' mean to you? What comes first to your mind when you think of nature?

15. Some people say that nature is a valuable resource for us. Do you agree with it? Why or why not?

16. Do you think humans are dependent on nature in any way? If yes, how? If no, please explain why you think so.

17. Do you think the economic development too depend on nature (natural resources)? If yes, how? If no, please explain why you think so.

Understanding of development

18. What all comes to your mind when you hear the word 'development'? What are the indicators of development for you?

Understanding of waste and related aspects

19. Let us focus on the chapter on solid waste management for some time.
    a. What do you mean by 'waste'? How is the dry waste-wet waste distinction different from the biodegradable-non-biodegradable distinction?
    b. Are there problems at Shivaji Nagar because of its proximity to the dumping ground? If yes, what kinds of problems occur?
    c. What solutions do you see for these problems?
    d. How come so much of waste has accumulated at this dumping ground?
    e. Otherwise also, there is so much of waste all over Mumbai, or in any city for that matter. Isn't it? How do you understand this wastefulness? Has it always been the case? What do you think could be the reasons?
    f. We often hear that toxic fumes are released in air when we burn waste. Is it true for any kind of waste? Which waste is safe to burn and which is not?
    g. Some things decompose easily but some others like thermocol or polythene take lot of time. What could be the reason behind it?

h. If waste is not picked up from a place for couple of days, it starts rotting resulting in bad smell. Any idea what causes this bad smell?

i. Recently, an instrument has been installed at Shivaji Circle to measure air pollution in the area. It shows two parameters namely, PM 2.5 and PM 10 which means no. of particles smaller than 2.5 microns and 10 microns respectively. Do you know anything about it? What other concentrations must be measured?

j. These days many people talk about the 3R's - Reduce, Reuse and Recycle. What do you mean by 'Reduce'? How can waste be reduced? Why is it that the amount of waste is not reducing, in fact it's increasing everyday? Do you think 30-40 years ago, people used to produce so much of waste? Why do you think so?

k. What are various technologies in use for waste management? Which ones are more commonly used? How effective are these technologies?

l. Have you heard of zero-waste / cradle-to-cradle design model? Is it really possible to design things in such a way that no waste is generated?

m. Have you heard of initiatives where people are trying to recover energy out of waste? How can one recover energy from waste?

n. You may have heard of the fire that broke at the Deonar dumping ground on 28th January. How did the fire break that day? It is very much possible that a similar fire breaks out again. What preventive measures should the government take? What can citizens do about it?

o. Do you think your students have good environmental habits? Health-related habits?

p. If yes, in what ways do they reflect in their behavior?

q. If no, why do you think good habits are not reflecting in their behavior in spite of all the messages given in the textbook?

r. Do you perceive a difference among students in their environmental attitudes (if yes, which kinds of students show pro-environmental behavior and which kinds don't? Is there a difference according to gender or any other categories?)

Understanding of health and related aspects

20. Now, let us turn to the chapter on health.

    a. What do you mean by 'health' and for what all reasons, do you think health must be discussed in the school curriculum?

    b. Which are the common diseases in Shivaji Nagar?

    c. What are the causes of the diseases that you listed?

    d. Out of these, which diseases, according to you, occur because of -

        i. poor hygienic conditions

        ii. contaminated water

        iii. polluted air

        iv. poor nutrition

        v. open defecation

        vi. Any other

    e. Are there diseases which can not be attributed to either of these causes?

    f. Some people say that poverty, nutrition, hygiene, people's health - all are linked to each other. What do you think of it?

    g. Are poor people more prone to contract certain diseases? How? People also say that poor people fall ill frequently because they cannot take care of themselves. Do you agree with this view? Why/ Why not?

    h. In one of the classes I observed, one teacher talked about health being the fundamental right of people. What is the current status of the right to health in India? How can it be ensured for everyone?

    i. These days, the government is also taking some initiatives like providing medication for TB in government hospitals, running door-to-door polio vaccination campaign or hand wash campaign in schools, advertising for relatively new diseases like swine flu. How successful or unsuccessful are these efforts? Do you think these benefits are actually reaching the most needy people?

    j. Which medical practice you believe the most? Allopathy / Homeopathy / Eunani ?Will you consider going to a *guruji* / a *baba* / *a fakeer* in a *Dargaah*

recommended by someone when it comes to critical diseases? Why or why not?

  k. Any idea how the effectiveness of a drug is tested or how the price of a drug is determined? Who determines the price of drugs? Who tests drugs' effectiveness? On whom, drugs are tested generally? Is there a possibility that the results of these drug trials are not accurate? In which situations?

21. If you get a chance to modify both these chapters as per needs of the children of Shivaji Nagar or Cheetah Camp, would you recommend any changes? What changes?

Views on science teaching and role of socioscientific issues

22. Are you familiar with the curriculum documents like the Maharashtra Curriculum Framework or the National Curriculum Framework? These documents say that one of the aims of science education is to inculcate skills like critical thinking and scientific temper among students. What do you understand by the term "critical thinking" and "scientific temper"?

23. How can these skills be imparted through science education? What possibility do you see of inculcating these skills through these chapters on health and waste?

Views on Swachh Bharat Abhiyan

24. What is your opinion on initiatives like 'Swachh Bharat Abhiyan'? What is the major thrust of the Abhiyan? How successful/unsuccessful has it been so far? How can Swachh Bharat become a reality?

25. Do you think the Swachh Bharat Abhiyan will help residents of Shivaji Nagar? If yes, In what way? If No, why not?

Appendix XXIV

Interview schedule for social science teachers

Personal information

1. Tell me more about you and your interests.
   a. How did you get into teaching?
   b. What all subjects have you taught so far?

Views on teaching social sciences

2. What are your views on teaching social sciences?
   a. Do you like to teach social sciences?
   b. How did you develop this interest? Particularly in geography?
3. Why should children learn geography? According to you, what are the broader aims of geography education?
4. What all is taught in geography in high school? Is there anything missing that ought to be there?
5. Many a times, science teachers say that topics like solid waste management, sustainable development etc which are presently there in the science textbook, should be covered in the social science curriculum. What do you think of this view? How do you decide whether something should be a part of the science or the social science curriculum? What difference do you see between the two subjects?

Views on the chapter on development

6. What seems to be the objective of this chapter on regional development? How appropriate is it to keep this chapter in the geography textbook?
7. Do students learn anything about development or regional development before class IX? If yes,

     a. In which class? What is taught there?

     b. Is it also taught in any other subject?

8. What are the other chapters in class IX textbook? How is this chapter connected with those chapters? Is there any dependency on other chapters?

9. What is the expected learning (take-home message) from this chapter?

10. What are the key ideas/ concepts discussed in the chapter?

11. What is lacking in the chapter? And, in what ways can it be improved?

12. In this chapter, which questions are asked most often in the exam?

13. How much is the weightage of the chapter in the exam?

Classroom practices and constraints

14. Though I have already observed you teaching the chapter, can you describe your approach in a nutshell?

15. What are the major constraints in teaching, in general? To this particular class? In this particular chapter?

16. How do you combat these constraints? What do you do in terms of preparation?

Views on context and contextualization

17. Do you think you would have taught this chapter differently if taught in any other school? For example, in an elite school in Colaba? Or, in Gadchiroli?

18. What are the students' profiles like in the class you taught for us? What kinds of families do they come from?

Understanding of development and its connection with environment

19. What all comes to your mind when you hear the word 'development'? What are the indicators of development for you?

20. Can you give an example of a developed area (state / country / city / village)? Why do you call it developed?

21. There was some discussion in the class on the GDP and the Human Development Index. I am not sure if I understood it right. Could you please tell me once again about the basic difference between GDP and Human Development Index? Is it okay to say that the human development index is a better marker of development? Why or why not?

22. What are the main reasons for regional imbalance in development, particularly in Maharashtra?

23. There are many places in Maharashtra where agriculture is the primary occupation. What can you say about the state of development in those regions?

24. The current Indian government/ruling party also emphasizes 'development'. How is their idea of development similar to (or different from) the ideas discussed in the chapter?

25. Why do we identify India as a developing country and not as an undeveloped or developed country?

26. Some people say that there is a constant tussle between development and environment. What do you think about it? How is development related / not related to environment?

27. What do you identify as the bottom line when thinking of development i.e. what must be considered / taken care of/ followed?

28. These days government is talking about 'smart cities'. What do you understand by it? What will make a city really 'smart'?

Appendix XXV

Codes used in data analysis on RQDA

Created by RQDA **at 2020-05-17 23:28:41**

1. accountability_of_waste_problem
2. action_competence
3. aspirations
4. associations_with_dumping_ground
5. attitude_root_cause_of_the_waste_problem
6. bhoot (Translation: ghost)
7. biocentric_viewpoint
8. biodegradabale_and_non-biodegradable_waste
9. caste
10. caste_character_of_sanitation
11. class_based_oppression
12. collateral_damage_is_inevitable
13. common_diseases
14. common_practices_of_cure
15. communicable_diseases
16. composting
17. dawa_aur_duwa (Translation: medicine and prayer)
18. daydreams
19. death_penalty
20. definition_health
21. definition_waste
22. determinants_of_health
23. development_conflict
24. difference_humans_animals
25. disability
26. discrimination_based_on_minority_status
27. dry_and_wet_waste
28. election_story_narration_and_comprehension
29. elections
30. extraction_of_materials
31. factors_determining_cost_of_things
32. familiarity_with_factory_structure
33. fire_cheetah_camp
34. fire_dumping_ground
35. food_preference
36. foul_smell
37. functioning_of_govt_bodies
38. functioning_of_political_leaders

39. fundamental_rights
40. general_instruction
41. health_access_to_clean_water_connection
42. health_access_to_healthcare_connection
43. health_access_to_nutrition_connection
44. health_gift_of_god
45. health_hygiene_connection
46. health_immunity_connection
47. health_poverty_connection
48. health_rural_urban_connection
49. human_greed
50. human_nature_dependence
51. idea_of_justice
52. idea_of_rebel
53. identifying_materials
54. impact_of_waste_on_human_societies
55. impact_of_waste_on_nature
56. importance_of_health
57. inflation
58. irrelevant_discussion
59. kaum (Translation: community)
60. life_expectancy
61. lifecycle_of_materials
62. lived_experiences_community_life
63. lived_experiences_healthcare
64. lived_experiences_housing
65. lived_experiences_police
66. lived_experiences_sanitation
67. lived_experiences_water
68. living_and_working_conditions_of_waste_workers
69. markers_of_development
70. mental_health
71. natural_vs_manmade
72. nature_development_connection
73. nature_in_islam
74. negatives_of_setting_up_steel_plant
75. other_fire_in_shivaji_nagar
76. other_words_for_waste
77. overall_feedback_of_students
78. overpopulation_root_cause_of_the_waste_problem
79. panchayat_clearance_rule
80. people_in_sanitation_work
81. perception_of_government
82. perception_of_sociopolitical_problems
83. perception_of_the_community
84. perception_of_tribals_and_tribal_life
85. policies_waste_management
86. pollution_or_aloodagi

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