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Centre for Environment Education

SYSTEMS THINKING IN EDUCATION FOR SUSTAINABLE DEVELOPMENT

AN EXPERIMENTAL APPROACH TO ASSESSING THE INFLUENCE OF SYSTEMS THINKING ON THE DEVELOPMENT OF SUSTAINABILITY COMPETENCES OF HIGH SCHOOL STUDENTS IN AHMEDABAD, INDIA

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Cover photo: Picture of students of Rachana School, taken while working on mystery exercise. Photos throughout the report were taken at the schools that participated in the experiment.

SUMMARY

Over four decades after Indira Gandhi, then prime-minister of India, effectively coupled environment and development issues by stating environmental problems of developing nations to reflect inadequacy of development, rather than excessiveness of industrialisation, India is little closer to reaching a mode of sustainable development.

There is an apparent need for young people to develop competences to cope with the world's increasing uncertainty connected to sustainability challenges present today and those yet to come. As policy does not prove sufficient, policy-makers are calling upon education to help make society more sustainable. Intergovernmental organisations have issued different programmes on education for sustainable development (ESD) and education has been given an important role in the recently coined Sustainable Development Goals (SDGs).

ESD practitioners and researchers, however, signal a lack of data on the way students develop sustainability competences and experience a lack of methods to capture students' ESD capacities in measurement. Furthermore, although academics has produced multiple lists and categories of competences deemed important for participation is sustainable development processes, there appears to be a lack of attention for the relationship between sustainability competences.

This study set out to test and evaluate the impact of systems thinking on the development of sustainability competences of secondary school students in Ahmedabad, India by designing an educational intervention, testing it in an experiment using Solomon four group design, developing and using a measurement survey to determine its impact, and triangulating the outcomes with qualitative data taken from document analysis, literature review, (non-)participatory observation, and semi-structured interviews.

The main results of this study are as follows:

1. The experiment results confirm an influence of systems thinking on the development of other sustainability competences, to the extent that experiencing a systems thinking process increases a students' ability to understand complex systems, including its spatial, temporal and disciplinary components.
2. To increase sustainability competences through systems thinking, experiencing systems thinking is crucial. In the experiment, results showed a positive impact of doing the measurement, which consisted of systems thinking exercises.
3. In experiencing systems thinking processes, the importance of reflection, evaluation and (teacher) guidance is emphasised. This is signalled as one of the main bottlenecks in the implementation of ESD in Gujarat, India.

Other outcomes include a description of the current state of ESD in Ahmedabad and Gujarat, and a set of recommendations concerning the future application of innovative methods of measuring sustainability competences.

PREFACE

A little over a year before handing in this thesis, I was asked to travel to India for a conference on education as a driver for the newly instated Sustainable Development Goals (SDGs). At the time, I was a part of the board of *Morgen*, a Dutch student-led volunteer organisation that works for the integration of sustainability into higher education. In this role, we had been in contact with the sustainability education part of the *Dutch Enterprise Organisation* (RVO), which in turn had links with the *Centre for Environment Education* (CEE) in Ahmedabad, India. Our contact at RVO had been invited to attend the conference but found that – as the conference would have an emphasis on the role of youth – it would be better for us to go. Within a week of first hearing about Ahmedabad, I was on the plane to India and – upon arrival – was immediately impressed by the people I met and the work they were doing.

In my work for *Morgen* and *Green Office Utrecht*, the sustainability hub of Utrecht University, I had been working on sustainability education for longer, but it was only after my first visit to Ahmedabad that I got an idea of the wealth of work that was being done on this topic worldwide. One of the remarks that made the biggest impression on me on that occasion was the following made by Anil Gupta, profession at the Indian Institute of Management:

Education can either learn to think and act freely, or teach a younger generation to conform.

Where I had previously seen education as a positive force that could be used for the goals of sustainable development, this statement emphasised the urgency of transforming the education system. Education does not only offer an opportunity when it comes to sustainable development, but inaction in this field also continuously reinforces the (unsustainable) status quo.

In the first course of this master programme, I consciously experienced systems thinking for the first time. Since then I have been trying to train myself to see systems in my surrounding and the complexity of processes happening around us has since never seized to amaze me. I have found that it is this amazement that makes me passionate about sustainability and its urgency. I am very thankful for this research project allowing me to combine my interest in systems thinking with my involvement in sustainability education, while offering the opportunity to get to know a new environment in the process.

I would like to express my sincere gratitude to all my colleagues at CEE. Special thanks to Rajeswari Gorana, who was inspiring to speak to when it came to systems thinking, to Bijoy Goswami, who helped me get to know the organisation and the people that I spoke to, to Harshal Korhale, for helping me arrange the schools and transporting me around Ahmedabad on the back of his scooter, and to the director of CEE, Kartikeya Sarabhai, for being incredibly inspirational.

From Utrecht, I would like to thank my supervisor Dr. Bettina Bluemling for her detailed feedback and valuable support.

LIST OF ACRONYMS

CBSE	Central Board of Secondary Education
CCE	Continuous and Comprehensive Evaluation
CCIS	Cosmos Castle International School
CEE	Centre for Environment Education
DESD	Decade for Education for Sustainable Development
EE	Environmental Education
EFA	Education For All
ESD	Education for Sustainable Development
GCERT	Gujarat Council of Educational Research and Training
GSEB	Gujarat Secondary Education Board
IB	International Baccalaureate
ICSE	Indian School Certificate
MDGs	Millennium Development Goals
NCERT	National Council of Educational Research and Training
NCF	National Curriculum Framework
NCTE	National Council of Teacher Education
OECD	Organisation for Economic Co-operation and Development
OECD DeSeCO	OECS Definition and Selection of key Competencies
SDGs	Sustainable Development Goals
St. Kabir DIO	St. Kabir Drive-In Old branch
St. Kabir NAR	St. Kabir Naranpura
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO GAP	UNESCO Global Action Plan
UNFCCC	United Nations Framework Convention on Climate Change

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CHAPTER 1 – INTRODUCTION

1. INTRODUCTION

This chapter introduces the topic of this thesis, after which the problem definition and knowledge gap is given. From this, the research objective and research questions follow.

1.1 INTRODUCTION

"We care about climate change", Sunita Narain, a famous environmentalist and activist in India, states in the 2016 documentary *Before the Flood*, "but the fact is that we are a country where energy access is as much a challenge as climate change, we need to make sure that every Indian has access to energy" (DiCaprio & Stevens, 2016). There are three hundred million people in India without access to energy, which is about thirty percent of the Indian population (DiCaprio & Stevens, 2016). If these people are to move towards coal, a relatively cheap resource in India, that would – in the words of Narain – "really fry the planet" (DiCaprio & Stevens, 2016). She goes on to discuss how energy use per capita is thirty-four times higher in the United States compared to India and concludes that lifestyle and consumption are at the centre of climate negotiations. The next scene in the documentary shows Indian farmers losing their onion crop due to unseasonal rains as a result of climate change.

Forty-four years earlier, another influential Indian woman discussed similar notions at the Stockholm conference on the Human Environment. Indira Gandhi – then prime minister of India – said poverty and need are the biggest polluters and stated environmental problems of developing nations to reflect inadequacy of development, rather than excessiveness of industrialisation (Lagos State University, 2012). The same countries that are telling India it should develop, Gandhi says, are those warning it for their own path of development (Lagos State University, 2012).

India is an excellent example for the urgency of battling climate change, the interconnectivity of environmental issues and development, as well as the opportunities that lie ahead in tackling climate change and choosing sustainable development paths away from the historical example set by Western countries. A difference between the pleads of Narain and Gandhi is in their timing. Where Gandhi's speech was delivered at a conference for the human environment where she was the only head of state present, Narain is speaking over four decades later, in the year of the Paris Agreement that was full of heads of state, when Stern (2015) notes the following:

> The challenges of development, growth, poverty reduction and sustainability are deeply and intricately Interwoven with those of mitigation and adaptation to climate change. […] It is a serious mistake to see action on climate and action on development as in conflict, or action on the former as a 'plot' to slow the latter.

Unlike the times in which Gandhi made her statements, the connectivity between issues of environment and development is generally accepted when Narain appears in *Before the Flood*, and the links are – perhaps even more than in in Gandhi's times – easily found in India. *Down to Earth* is a magazine on the politics of development, environment and health headed by Narain. It takes only one visit to the homepage to find that India was not able to put Gandhi's ideas in practice. On the one hand, the amount of cars and industry has caused India's air pollution to surge, since 1990, early deaths due to PM2.5 have increased by 48 percent, and textile industries are polluting Indian ground water (Kukreti, 2017; Roychowdhury, 2017). On the other, there are conflicts between forest communities and conservationists over human settlement in tiger reserves, and disputes about illegal mining in areas with 13.8 percent unemployment rates (Agarwal, 2017; Chakravartty, 2017). On the one hand, development by industrialisation is still negatively impacting the environment, on the other, environmental issues are hampering people in securing their livelihoods.

Gandhi was not able to avert India from the Western model of development. Even though in the beginning of the 1970s the head of state was signalling these problems and putting them on the agenda on a global stage, not much has changed. Meanwhile, the urgency to tackle climate change is growing and Indian environmental policy remains unable to effectively tackle the challenges at hand (C. B. Field, Barros, Mach, & Mastrandrea, 2014; Government of India, 2013). This calls for a fundamental change that environmental policy alone was apparently unable to achieve.

Education has been accredited different roles in making a society more sustainable. Policy-makers often call for raised awareness on sustainability issues, for which education appears to be the ideal vehicle (UNFCCC, 2014). As noted in the 2007 Stern review:

> Fostering a shared understanding of the nature of climate change, and its consequences, is critical in shaping behaviour, as well as in underpinning national and international action. Governments can be a catalyst for dialogue through evidence, education, persuasion and discussion. Educating those currently at school about climate change will help to shape and sustain future policy-making, and a broad public and international debate will support today's policy-makers in taking strong action now (Stern, 2006, p. xxi).

However, as Wals (2010a, 2011) shows, using education in an instrumental way can be problematic. Teaching learners what they should think and how they should behave considering sustainability would be incorrect from both an ethical and a practical perspective. Ethically, it would not allow people to think freely and move towards indoctrination rather than education, and practically, the past has shown sustainability knowledge to be far from static (Wals, 2011). What was sustainable behaviour ten years ago, might now be considered harmful and vice-versa.

Instead of this instrumental approach to education in making society more sustainable, Wals (2011) argues for an emancipatory approach. A change not primarily in people's behaviour, but rather in people's ability "to understand what is going on in society, to ask critical questions and to determine for themselves what needs to be done" (Wals, 2011, p. 179). As outlined by Wu et al. (2010, p. 521), to participate in processes of sustainable development one needs to be able to understand "the complexity of the global ecosystem and of creative problem-solving to find solutions to 'wicked problems'". Rather than teaching learners what to do or think, the role education to make society more sustainable is in the abilities it can help learners develop, specifically those that help them understand the complex global systems, that cause sustainability issues to change a quickly as they do.

Education for Sustainable Development (ESD) has been a topic in global governance since the Tbilisi Conference in 1977, where Environmental Education (EE) was first explicitly coupled with social and economic issues (UNESCO & UNEP, 1977). At the beginning of the twenty-first century ESD got new momentum with the UNESCO Decade for Education for Sustainable Development (DESD). This decade ended in 2015 and this – together with the newly instated SDGs – has generated an unprecedented collection of reviews of the state of ESD around the world (Gorana & Kanaujia, 2016a; Huckle & Wals, 2015; UNESCO & Wals, 2012). However, the main conclusion is that there is still too little data (UNESCO, 2016). Initiatives towards more structured monitoring of the state of ESD are being taken, for example in the Global Education Monitoring Report issued at the end of 2016. The main outcome of this report is a lack of useful methods to asses ESD and a lack of data on local statuses of ESD implementation (UNESCO, 2016).

This need for building ESD competences has been widely discussed in literature and resulted in various collections and lists of competences deemed necessary for ESD (Brundiers, Wiek, & Redman, 2010; de Haan, 2006; PISA, 2016; Sipos, Battisti, & Grimm, 2008; UNESCO, 2012; Wiek, Withycombe, & Redman, 2011). Each of the author emphasises different competences to be of main importance, but little attention is given to the links between the elements of their lists. Sipos et al. (2008) and Brundiers et al. (2010) make categories of

competences, but do not go into the way these might be interlinked. Although systems thinking is almost always a part of the lists, no thought seems to be given to linkages that might occur between the competences defined.

This research has been done in Ahmedabad, in the Indian state Gujarat. This geographical focus was taken because of the presence of the Centre for Environment Education (CEE), a non-governmental organisation active since 1984 with the mandate to promote environmental awareness nationwide (Centre for Environment Education, 2016b). They have been identified as a key partner in the UNESCO Global Action Programme (GAP) and have their headquarters in Ahmedabad, Gujarat (Centre for Environment Education, 2016a). CEE works on a large selection of projects with schools, teachers and educational bodies. It is from the network of these schools that I was able to take a sample for the experiment done in this study. Additionally, the headquarters of CEE employs ESD experts with extensive experience in ESD in the region and beyond.

1.2 PROBLEM DEFINITION AND KNOWLEDGE GAP

There is an apparent need for young people to develop the abilities to deal with sustainability challenges of today and the future. As such, it should be determined what competences learners should develop and how they can do this. This leads to the following problem definition:

- There is a lack of attention for the relationship between sustainability competences.
- There is a lack of methods to capture students' ESD capacities in measurement.
- There is a lack of data on the way students develop sustainability competences.

The knowledge gap of this thesis is both discursive and methodological. It adds to the discourse on sustainability competence, to the methodological debate around measuring sustainability competence, and to the work that is being done around the Solomon four group design.

Discursively, a knowledge gap exists around the relationship between different sustainability competences, as further discussed in the theoretical framework (chapter 2.2). Often, lists are formulated and competences are presented as separate types of capacities, with little research done on the relationships between them (de Haan, 2006; Sipos et al., 2008; Wiek et al., 2011). In this research, sustainability competences are understood as a system of interrelated skills. By isolating systems thinking in a broader context of sustainability competences, this research attempts to explain the role of systems thinking in a system of, rather than a list of sustainability competences.

Methodologically, a knowledge gap exists in the measurement of sustainability competences. By using an exercise designed to practice systems thinking as a treatment and developing a measurement survey to review the impact of this exercise, this study provides insights into the usefulness of these methods. The assessment of this measurement adds to the debate on measuring sustainability competence.

Additionally, McCambridge et al. (2011) call for more researchers to use the Solomon four group design, in order to increase its familiarity to the research community and to build a collection of research from which the added value of the design can be assessed. The experiment done for this thesis employed such a Solomon four group design.

1.3 RESEARCH OBJECTIVE

To test and evaluate the impact of systems thinking on the development of sustainability competences of secondary school students in Ahmedabad, India **by** designing an educational intervention, testing it in an experiment using Solomon's four group design, developing and using a measurement survey to determine its

impact, and triangulating the outcomes with qualitative data taken from document analysis, literature review, (non-)participatory observation, and semi-structured interviews.

1.4 CENTRAL RESEARCH QUESTION AND SUB-QUESTIONS

Following from the problem definition and research objective, the central research question of this thesis is as follows:

To what extent does systems thinking in ESD influence other sustainability competences of high school students in Ahmedabad, India?

Five sub-questions have been formulated to answer this question:

1 What is the current state of ESD in Ahmedabad and Gujarat?
2 What type of sustainability competences are desirable for high school students to develop?
3 What is the role of systems thinking in developing these competences?
4 What is the effect of the mystery exercise in developing sustainability competences?
5 To what extent are the methods used suited to assess high school students' sustainability competencies?

These questions are answered by use of sequential mixed methods, shown in table 1 and elaborated upon in chapter 3 on methodology.

	Document analysis	**Literature review**	**Conference**	**(Non-) participatory observation**	**Semi-structured interviews**	**Experiment***
SQ1	X		X	X	X	
SQ2		X	X		X	
SQ3		X			X	
SQ4						X
SQ5				X	X	X

* Experiment data results from ex-ante and ex-post measurement by survey on sustainability competences and knowledge.

Table 1. Methods used for different sub-questions. Further explanation under research strategy.

CHAPTER 2 – BACKGROUND AND THEORY

2. BACKGROUND AND THEORETICAL FRAMEWORK

This chapter discusses the theoretical framework of this research. In section 2.1 a background for ESD in a global context, as well as a background for education and sustainability in India is given. Hereafter, sections 2.2 discusses ESD competences, by first going into the competence approach and then outlining the debate around five sustainability competences: systems thinking, spatial, temporal, disciplinary and cultural competence. The chapter concludes with the substantiation of the conceptual model that used throughout the remainder of this thesis.

2.1 EDUCATION FOR SUSTAINABLE DEVELOPMENT

The link between education and sustainable development can be explained in (at least) four ways: education *as* sustainable development, education *about* sustainable development, education *for* sustainable development, and education *as a barrier to* sustainable development. The first – education *as* sustainable development – is apparent in most of the targets of Goal 4, that focus on ensuring education to be accessible, equitable and of good quality (United Nations, 2016). The second – education *about* sustainable development relates to the content of education to include sustainable development. The third – education *for* sustainable development – is about acquiring the knowledge and skills to meaningfully participate in processes of sustainable development . The fourth and last way of viewing the link between education and sustainable development – education *as a barrier to* sustainable development is voiced by Gadotti (2008) as he argues that the current education system "re-enforces the principles and values of an unsustainable economy", which is in line with the often quoted statement of Orr (1994, p. 5) saying that the education system is currently only helping learners to become "more effective vandals of the Earth". Combining these notions, there is not only promise in reshaping the education system, but also an urgency to do so.

ESD IN GLOBAL POLICY

The Tblisi Declaration of 1977 is often taken as a starting point for discussing ESD, because this was the first time that EE was explicitly linked to social and economic issues (UNESCO & UNEP, 1977). Although the document still speaks of environmental education, it specifically states that this type of education "should prepare the individual for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values" (UNESCO & UNEP, 1977). The document goes on to discuss the importance of a holistic approach, an interdisciplinary base and the recognition of interdependency among national communities (UNESCO & UNEP, 1977).

From here, the discourse developed to chapter 36 of Agenda 21, which identifies four thrust areas for education for sustainability: improving access to quality basic education, reorienting existing education programmes towards sustainability, developing public understanding and awareness of sustainability, and providing training. It says that "education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues" and should be a part of all disciplines (United Nations, 1992, 36.3). It is stated that ESD should work to achieve the development of awareness, values and attitudes, skills and behaviour, and to do so, should "deal with the dynamics of both the physical/biological and socio-economic environment and human (which may include spiritual) development" (United Nations, 1992, 36.3).

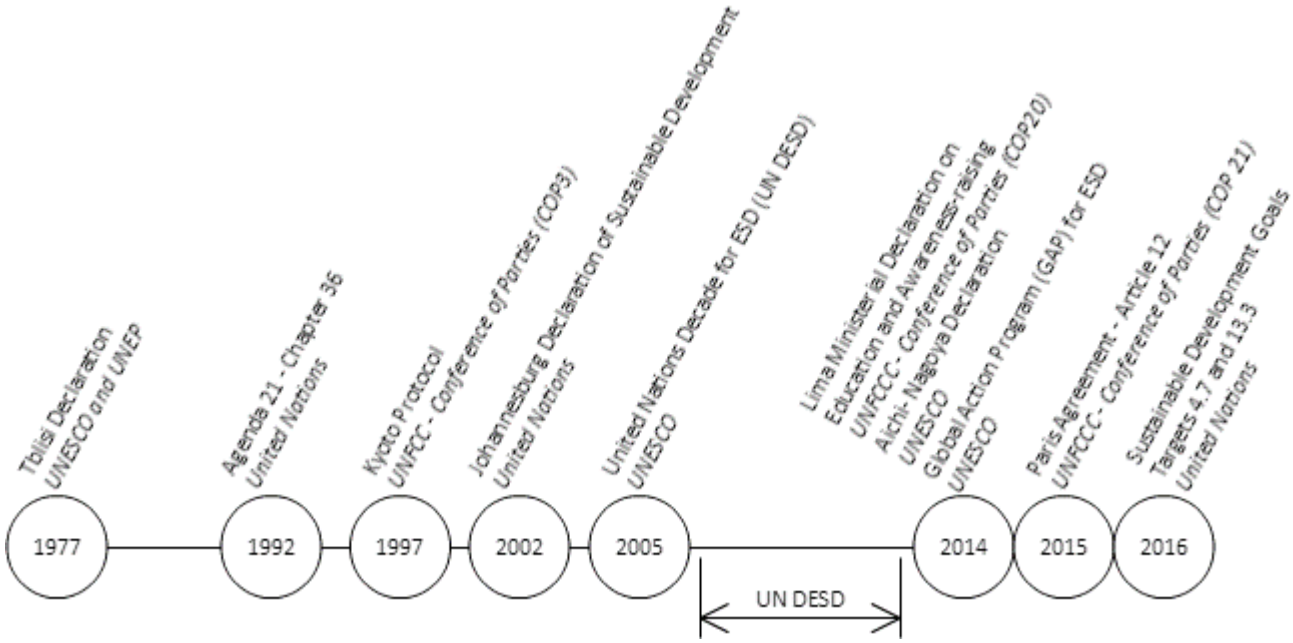


Figure 1. Timeline of most important global policy documents on ESD.

ESD landmarks after Agenda 21 include the Kyoto Protocol, where the importance of education about climate change is discussed, and the Johannesburg Declaration of Sustainable Development, in which education is dubbed an essential element in the fight against underdevelopment (UNFCCC, 1997; United Nations, 2002). At the end of the year of the Johannesburg World Summit on Sustainable Development, the United Nations Decade of Education for Sustainable Development (DESD) was adopted.

Education for Sustainable Development:

- is based on the principles and values that underlie sustainable development;
- deals with the well-being of all three realms of sustainability – environment, society and economy;
- promotes life-long learning;
- is locally relevant and culturally appropriate;
- is based on local needs, perceptions and conditions, but acknowledges that fulfilling local needs often has international effects and consequences;
- engages formal, non-formal and informal education;
- accommodates the evolving nature of the concept of sustainability;
- addresses content, taking into account context, global issues and local priorities;
- builds civil capacity for community-based decision-making, social tolerance, environmental stewardship, adaptable workforce and quality of life;
- is interdisciplinary. No one discipline can claim ESD for its own, but all disciplines can contribute to ESD;
- uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills.

Text box 1. Essential characteristics of ESD as defined in the preparation of the DESD by UNESCO (UNESCO, 2005).

The DESD was an instrument to draw attention to the importance of education in the world's transition towards sustainability and was carried out between 2005 and 2014. The objective of the DESD was as follows:

> […] to integrate values, activities and principles inherently linked to SD in all forms of education and learning and to help realize a change in attitudes, behaviours and values to ensure a more sustainable future in social, environmental and economic terms. The DESD offers national governments the

> opportunity to reorient various dimensions of education, training and governance to enable all stakeholders to view the world through a lens of concern for sustainability (UNESCO & Wals, 2012).

As a part of the DESD implementation scheme, UNESCO (UNESCO, 2005) formulated a list of essential characteristics of ESD. It is emphasised that ESD has no universal model and should always be adapted to a local context.

Towards the end of the Decade a follow-up was designed in the shape of the Global Action Programme (GAP) on ESD, which was launched at the UNESCO World Conference on Education for Sustainable Development held in Aichi-Nagoya, which produced the Aichi-Nagoya Declaration (UNESCO, 2014a). The GAP was set up in the context of the Rio+20 conference that has taken place during the Decade in 2012 and sets two specific objectives: to reorient education and learning so that everyone can acquire the knowledge, skills, values and attitudes that empower them to contribute to sustainable development, and to strengthen education and learning in all agendas, programmes and activities that promote sustainable development (UNESCO, 2014b). It speaks of four dimensions of ESD: learning content, pedagogy and learning environments, learning outcomes, and societal transformation (UNESCO, 2014b). In the same year, COP20 resulted in the Lima Ministerial Declaration on Education and Awareness-raising, which stresses the importance of increased attention to education, training, public awareness, public participation and public access to information specifically on climate change (UNFCCC, 2014).

The three most recent global policy outcomes on ESD were a part of the Paris Agreement, the Icheon declaration on Education in 2030, and the newly formulated Sustainable Development Goals (SDGs). Article 12 of the Paris Declaration repeats the Lima Declaration in saying that "parties shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement" (UNFCCC, 2016). The Icheon Declaration on Education 2030 focuses on the E of ESD, but also states that "education is a public good, a fundamental human right and a basis for guaranteeing the realization of other rights. It is essential for peace, tolerance, human fulfilment and sustainable development" (UNESCO, 2015). In the SDGs, education is at the core of goal 4, as well as integrated into the other goals (United Nations, 2017). ESD is most explicitly found in targets 4.7 and 13.3 (see text box 1).

Target 4.7:

"By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development."

Target 13.3:

"Improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning."

Text box 2. ESD in the SDGs (United Nations, 2017).

The SDG process is being monitored by the use of indicators formulated for each of the targets. For target 4.7 these are the extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment and the percentages of

students by age group (or education level) showing adequate understanding of issues relating to global citizenship and sustainability (United Nations, 2017).

The documents mentioned in the timeline in figure 1 have ESD play a specific and large role in them. Aside from these policy documents, ESD plays a less explicit role as a means towards a certain end in documents on – among other issues – climate change, biodiversity, disaster risk reduction, sustainable consumption and production, and children's rights (UNFCCC, 2012; United Nations, 1989, 1992b, 2005, 2012). Because ESD considers itself with the intersection of education and sustainable development, it is a part of two core areas of the United Nations and became an important area of focus for both UNESCO and UNEP, for UNESCO most prominently as the GAP, for UNEP within the Environmental Education and Training segment (UNESCO, 2014b). The UNFCCC concerns itself with ESD on the topic of climate change (UNFCCC, 1997, 2016). ESD also links to multiple other programmes of the United Nations. ESD was closely interlinked to the Millennium Development Goals (MDGs) where education was used as an input and indicator, and still is closely linked to the earlier mentioned SDGs and the Education For All (EFA) movement which deals with access to education (UNESCO, 2005).

EDUCATION AND SUSTAINABILITY IN INDIA

Gorana and Kanaujia (Gorana & Kanaujia, 2016b) define ESD as not being "about educating people about the nature of sustainable development per se[,] but more broadly [aiming] to provide the basis to enable people in different settings to address the challenges that threaten the economic, social, environmental and cultural realms of their society at local and global levels". As in other areas, the Indian context of ESD is dependent on the attention for education and for sustainability. Before going into the specifics of ESD in India, it is important to set the stage by exploring the way these two topics in the Indian context.

THE CONTEXT OF EDUCATION IN INDIA

Education in India is a shared responsibility between central and state government. Topics dealt with on the different levels (central and state) are split up into three lists that indicate which governmental level has the primary responsibility for a certain topic: the Central List, the State List, and the Concurrent List, the latter of which shows topics that are dealt with by both levels of government (Pandya, 2016). After the enactment of the Constitution of India in 1950, education was on the state list, but since 1976 it has been on the Concurrent List, which means the Central and State Governments have a joint responsibility when it comes to education. As outlined by Pandya (2016):

> "The Central Government establishes broad education policies for the development of school curricula and management practices that serve as guidelines for states. Decisions regarding the organization, structure of education, curriculum and textbook development are largely the concern of the states. Within each state there is a State Education Department with academic and administrative structures. The efforts of the Central Government in educational planning and administration is supplemented by the efforts and inputs of other expert bodies."

A number of institutions is in place to coordinate education throughout the country, the most important of which are the National Council of Educational Research and Training (NCERT) and its state-sub-branches, e.g. for Gujarat the Gujarat Council of Educational Research and Training (GCERT). Schools are run under different educational boards, which include state boards like the Gujarat Secondary Education Board (GSEB), national boards like the Central Board of Secondary Education (CBSE) and the Indian School Certificate (ICS) system, as well as international boards like the International Baccalaureate (IB). These boards use different curricula and examinations. The national boards use the same curricula throughout the country, and the international boards use an internationally recognised curriculum.

On a different level, there are three main types of schools: government schools, aided schools and private schools. Schools run by either the state or central government fall into the first category. The second entails schools that receive most of their funds from the government but are run by private management and the third type of school is (mostly or wholly) privately funded, which gives them the right to select students (Pandya, 2016). Within these different school types, different languages are spoken. One can generally find English-medium, Hindi-medium and vernacular-medium schools, the latter of which use Gujarati in the area where this research was done. The general school programme lasts for ten years, after which students can do another two years in a certain discipline to prepare for university (Pandya, 2016). Most schools offer these 10+2 years in one institution, which means that unlike in the Dutch system, it is quite uncommon for students to switch schools after their primary education and students between the age of 6 and 18 reside in the same building. The average annual drop-out rate in primary and upper primary is around 4 percent, when reaching secondary school however, this is around 18 percent, due to students opting not to do the +2 years (Government of India, 2016). Drop-out percentages are slightly higher for the minority groups of scheduled casts and tribes (Government of India, 2016).

It is difficult to say anything about a definite difference in quality between these types schools, although multiple interviewees made the distinction between boards when they explained differences in engagement with EDS (see chapter 4.1) . During the conference *ESD for transforming education for children and youth*-conference (after this: ESD conference), a remark was made about government school versus private schools by Abdesh Kumar Gangwar, who implied government schools to be of lower quality when he said to be curious what government schools would look like when all children of government officials would have to go there (GEM launch, 16-09-2016, ESD conference). According to Jitendra (2014) over a fourth of rural Indian students is choosing private schools to receive better education. It is shown that although the right to education has been well instated, the pupil to teacher ratio of government schools has been increasing yearly. Meaning higher pressure on the teachers and less attention for the students (Jitendra, 2014).

THE CONTEXT OF SUSTAINABLE DEVELOPMENT IN INDIA

When discussing the context of sustainable development in India, there are two features that make it distinctly different from the West. Firstly, while conducting interviews, it became clear that interviewees do no discuss environmental issues without discussing social and economic issues (Annex 6 – Interview transcripts). For example, it does not make sense to discuss a body of water like a lake, without discussing the quantity and the quality of the water, as well as the access to it. Where in the Netherlands, it can be perfectly acceptable to talk about a body of water without mentioning the people surrounding it and whether or not they use the water, this in unthinkable in an Indian context. In our interview, Gorana called this 'in-your-face-sustainability' (Annex 6 – Interview transcripts). Secondly, when discussing sustainable development, it becomes clear that countries like India cannot just repeat what Western countries have already done (Sarabhai, 2010). Current sustainability issues were caused by primarily Western development and now we know the consequences, this should not be repeated. This is then of course where sustainable development comes in, but it is important to realise that a country like India, because of this situation, actually has to lead a movement and find a new road, rather than follow development pathways of the West, to reach sustainable development.

When discussing these notions, almost all Indian-authored resources on sustainability and many others here refer to Indira Gandhi, then Prime Minister of India, who at the Stockholm conference in 1972 spoke about the links between environmentalism and poverty in her speech "Man And Environment" (see text box 3).

Man and Environment, speech by Indira Gandhi, Stockholm 1972

"[… M]y deep interest in this our `only earth' was not for itself but as a fit home for man. […] We share you concern at the rapid deterioration of flora and fauna. […] Even though our industrial development is in its infancy, and at its most difficult stage, we are taking various steps to deal with incipient environmental imbalances. The more so because of our concern for the human being--a species which is also imperilled. In poverty he is threatened by malnutrition and disease, in weakness by war, in richness by the pollution brought about by his own prosperity.

[…]

It is said that in country after country, progress should become synonymous with an assault on nature. […] *Many of the advanced countries of today have reached their present affluence by their domination over other races and countries, the exploitation of their own natural resources.* […] Now, as we struggle to create a better life for our people, it is in vastly different circumstances, for obviously in today's eagle-eyed watchfulness we cannot indulge in such practices even for a worthwhile purpose. […] *Are not poverty and need the greatest polluters?* […] How can we speak to those who live in villages and in slums about keeping the oceans, the rivers and the air clean when their own lives are contaminated at the source? *The environment cannot be improved in conditions of poverty.*

[…]

Our industrialization tended to follow the paths which the more advanced countries had traversed earlier. […] Countries with but a small fraction of the world population consume the bulk of the world's production of minerals, fossil fuels and so on […] The inherent conflict is not between conservation and development, but between environment and reckless exploitation of man and earth in the name of efficiency.

[…]

Pollution is not a technical problem. The fault lies not in science and technology as such but in the sense of values of the contemporary world which ignores the rights of others and is oblivious of the longer perspective. […] *The environmental problems of developing countries are not the side effects of excessive industrialization but reflect the inadequacy of development.*

[…]

Life is one and the world is one, and all these questions are inter-linked. The population explosion; poverty; ignorance and disease, the pollution of our surroundings, the stockpiling of nuclear weapons and biological and chemical agents of destruction are all parts of a vicious circle. Each is important and urgent but dealing with them one by one would be wasted effort."

Text box 3. Fragments from Gandhi's speech in Stockholm (Lagos State University, 2012). Emphasis added.

An point is made by Kartikeya Sarabhai (Sarabhai, 2010) when he discusses the UNEP campaign slogan for World Environment Day 2008: 'CO2: Kick the Habit!'. Although this slogan was clearly meant to be universal (seeing as it is for World Environment Day), Sarabhai and others wondered what such a slogan would mean to some groups of people in their country.

> "'What would such a slogan mean to a person in a village in India who perhaps has never had an electricity connection, and has no running water and no toilet?' Which CO2-intensive activity was a poor rural Indian family meant to 'kick'? Or take those who live in a city in India. 40 per cent of urban dwellers in India live in slums with no real access to energy-intensive amenities. How are they going to kick a habit that they could never afford to have in the first place?" (Sarabhai, 2010).

Sarabhai (Sarabhai, 2010) pulls this wider by stating that while sustainability and ESD might mean having to 'kick the habit' in some contexts, in India and other developing countries alike, it is about "embark[ing] on an alternative development pathway by making choices that were indeed different, appropriate and sustainable".

As education and sustainability are distinctly different in this region compared to the rest of the world, so is ESD. Chapter 4.1 further goes into the current state of ESD in India in answering the first sub-question of this research on the current status of ESD in Ahmedabad and Gujarat.

2.2 SYSTEMS THINKING AND OTHER SUSTAINABILITY COMPETENCES.

This section outlines the competence approach after which a selection of five sustainability competences are discussed in detail: systems thinking, spatial, temporal, disciplinary and cultural competences. These have been selected by means of a literature review discussed below. The five competences serve as an input for the conceptual model that it given in section 2.3.

THE COMPETENCE APPROACH

During the Decade for Education for Sustainable Development (DESD), UNESCO strived towards "a world where everybody has the opportunity to benefit from education and learn the values, behaviour and lifestyles required for a sustainable future and for positive societal transformation" and defined a set of essential characteristics of ESD (Mochizuki & Fadeeva, 2010). Although these characteristics help to clarify what ESD is and what it is not, they do not discuss what concrete outcomes are to be expected and what should be done to get there. As put by Frisk and Larson (Frisk & Larson, 2011a), "the lack of efficacy in sustainability-related educational programs is at least partly due to faulty assumptions about knowledge automatically leading to action, and by extensions, the information-intensive methods that focus largely on declarative knowledge regarding how environmental systems work". They signal a need for different forms of knowledge, as well as a clearer focus on how to move towards action.

Figure 2. Schematic visualization of the classic approach to environmental education as discussed by Frisk and Larson (Frisk & Larson, 2011a).

Figure 3. Schematic visualization of competence approach as used by the OECD PISA (PISA, 2016).

The competence approach is discerned as opposed to an approach focused solely on acquiring knowledge. The focus is on the student output of a program, rather than the teacher input (Frisk & Larson, 2011a). When designing a new learning module, people following the competence approach will start with the prospected results, rather than with the method they want to use for the information they want to get across. As put by Mochizuki and Fadeeva (Mochizuki & Fadeeva, 2010): "competence can be defined as what the students will be more capable of doing after completing the learning activity". When discussing competences for sustainable development, we are then looking at what students should become capable of, for them to be able to cope with current and future sustainability issues.

Critiques to the competence approach concern the lack of attention for needed institutional change, the individual approach, and the understated context dependency. perceived universality of "key competencies".

Mochizuki and Fadeeva (Mochizuki & Fadeeva, 2010) claim that there has been too much attention on specifying competences, instead of organisational and institutional change that is needed to get a competence-approach to work in the educational system. On the content of the competences specified, they state that there is too little attention for human agency and individual and cultural differences (Mochizuki & Fadeeva, 2010). Mogensen and Schnack (Mogensen & Schnack, 2010) discuss the importance of thinking about competence beyond the individual and consider its implications for collective action. According to Rychen and Salganik (Rychen & Salganik, 2003), competences are dependent on action and context in that they are developed in connection to needs of a society, job or environment, and are realized through actions, which in their turn suggest an intention and a goal.

As outlined in the methodology (chapter 3), an extensive literature review has been done of a selection of peer-reviewed papers and grey papers. From this, four competences were deemed to be most important in relation to systems thinking in ESD: spatial, temporal, disciplinary and cultural competence. These competences will also be central to the conceptual model to be discussed in section 2.3. A selection of thirteen articles has been systematically reviewed to fine-tune the definition of these four competences and the central systems thinking competence. These articles have been given in table 2, along with a checklist showing whether or not they discuss the different competences that are outlined in the remainder of this section. Competences that did not come back consistently and/or relate less to system thinking is not further explained. However, some of them do play a big role in the scientific debate around ESD competency and should thus be mentioned here. These include action competence, empathy, normative or ethical competence, teamwork or conflict resolution, motivational competence, creative competence, and implementation skills (Brundiers et al., 2010; de Haan, 2006; Hofman, 2015; OECD, 2005; Rieckmann, 2012; Sipos et al., 2008; UNECE, 2011; Wiek et al., 2011).

Publication	Systems thinking	Spatial competence	Temporal competence	Disciplinary competence	Cultural competence
OECD DeSeCo (2005)		√			√
De Haan (2006)			√	√	√
Sipos et al. (2008)	√	√		√	
Wals (2010)		√	√	√	√
Brundiers et al. (2010)	√		√	√	√
Mochizuki et al. (2010)		√		√	√
Wiek et al. (2011)	√		√		√
Frisk and Larson (2011)	√		√		√
UNECE (2011)	√	√	√	√	√
UNESCO (2012)	√	√	√	√	√
Rieckmann (2012)	√		√	√	√
Hofman (2015)	√		√		
OECD PISA (2016)	√	√		√	√

Table 2. The role of the selected competences in the selected publications. See Annex 5 for full table for full summary of literature review.

The definition of competence to be used in the remainder of this paper is as follows: *The ability that a learner develops during, through and because of a learning activity*. This definition uses Mochizuki and Fadeeva (Mochizuki & Fadeeva, 2010)'s notion of competence and adds the fact that developing competences is an

ongoing process that does not stop at the end of the activity in question (Mogensen & Schnack, 2010). During the ESD conference, Thomas Hoffman said competence to be an ability and a way to handle knowledge. Literally, he defined it as "a positive combination of knowledge, ability and willingness in the availability of the individual to cope successfully and responsibly with situations" (Workshop: Competencies for SD and ESD, 17-09-2016, ESD conference). For the remainder of this research, sustainability competence is defined as follows: *An ability desirable for participation in processes of sustainable development that a learner develops during, through and because of a learning activity*.

SYSTEMS THINKING

Systems thinking is included in nine out of thirteen articles that were used in conceptualizing sustainability competences (see table 2). Sipos et al. (Sipos et al., 2008) see systems thinking as the encouragement of complex thinking with an ecosystem approach, in which it becomes clear how social, ecological and economic systems are interconnected. Wiek et al. (Wiek et al., 2011) discuss systems thinking competence as the ability to assess connectivity across domains and scales. They put emphasis on doing this while using systems thinking features like cascading effects, inertia and feedback loops (Wiek et al., 2011). When UNESCO (UNESCO, 2012) writes about knowledge, local issues, skills, perspectives and values, the ability to think about systems is an example of a skill. An emphasis is put on the fact that one should think about both natural and social systems and that this way of thinking is preferable for problem-solving (UNESCO, 2012). However, as Frisk and Larson (Frisk & Larson, 2011a) mention: " [a]lthough understanding the larger system is important, it may actually create a barrier to change as individuals realise that their actions alone will not lead to substantive outcomes". On a related note, Rieckmann (Rieckmann, 2012) adds the ability to handle complexity to systems thinking competence. This can be traced back to Uphoff's (Uphoff, 2014) statement that thinking in systems is by no means a guarantee for meaningful action.

As outlined by de Vries (de Vries, 2013) a system is "an interconnected set of elements that is coherently organised around some purpose". This implies that systems have three entities: elements, connections and purpose. This latter notions seems mostly to connect to the human part of the system, but the purpose of a system can also just be to sustain and evolve itself, which makes it easier to link it to natural components as well (de Vries, 2013). At the core of system dynamics are causal relations, which, when quantified, can help define a system in terms of stocks and flows. Causal relations can be captured in a causal loop diagram, a simple example of which is shown in figure 4. Except for elements, (causal) connections, stocks, and flows, the image shows feedback loops. These show elements that amplify existing effects, either positive or negative.

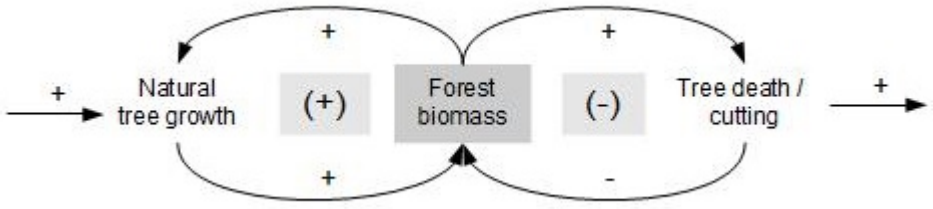


Figure 4. Example of causal loop diagram of a dynamic process. The simple system is that natural tree growth has a positive effect on forest biomass and that a rise in tree death/cutting reduces the amount of trees (forest biomass). Feedback loops are then added to show that an increase in forest biomass also means an increase in natural tree growth which then feeds back into the forest biomass. An increase in forest biomass, however, also has a positive effect on tree death/cutting, which negatively feeds back into the stock of forest biomass. Image taken from de Vries (de Vries, 2013).

Systems thinking was first used in 'hard science' such as biology and physics, where it would describe systems and feedbacks of natural occurrences (Connell, Remington, & Armstrong, 2012). There was overlap with sustainability issues, when natural systems are disrupted by humans, like in predator-prey relationships and

overshoot-and-collapse models. Systems thinking gained prominence as an alternative to reductionism, in which solutions were found in close examination of one element, without looking at its place in wider phenomena (Connell et al., 2012). Moving towards 'soft science', systems thinking is not only used in an ontological sense–how the world works–, but also as a way of looking at the natural and social world, a method of structuring knowledge, i.e. rather epistemologically (Connell et al., 2012). In this way, systems thinking becomes a way to further understand a phenomenon holistically though, different from 'hard science'-systems, not necessarily objectively. Systems thinking is found important in sustainability because of the epistemological character described above. It is a way to holistically assess a progressively complex world with increasingly intricate sustainability issues.

The definition of systems thinking to be used in the remainder of this paper is as follows: *The ability to connect cause and effect across spatial, temporal, disciplinary and cultural scales.* This definition combines Wiek et al. (Wiek et al., 2011)'s capability to analyse across domains and scales, and Wals (Wals, 2010b)'s addition of spatial and disciplinary scales, which are not added into systems thinking in Wiek et al. (Wiek et al., 2011)'s definition. In this research, systems thinking is central in the answering of sub-questions 3 and 4 on the role of systems thinking in developing sustainability competences and the effect of the intervention from the experiment, which is designed using the 'mystery'-method (see section 3.2) to enhance systems thinking skills.

SPATIAL COMPETENCE

Spatial competence is included in seven out of the thirteen articles used. As such, it is the least mentioned of the competences included in the table (see table 2). The main way in which spatial competence comes back through the different texts is through global citizenship and acting within a bigger picture (OECD, 2005; Sipos et al., 2008). Different authors signal the importance of place-based education and the earlier mentioned notion that competences and ESD are not universal (Mochizuki & Fadeeva, 2010; Sipos et al., 2008). In their paper from 2012, UNESCO emphasizes the need to understand local issues in a global context and see how cause and effect might stretch across such scales. In the UNECE (UNECE, 2011) paper, competences for educators are discussed and here spatial competence can be found in "the interdependent nature of relationships within the present generation", as opposed to those between generations, which would be a part of temporal competence. In the PISA document by the OECD, spatial competence is conceptualized as the understanding of global issues and an attitude of 'global mindedness' (PISA, 2016).

According to Tuan (Tuan, 1977) the difference between space and place is value. As soon as one gives value to a space, it becomes a place. Sense of place is a part of spatial competence as it is about having (a part of the world) as your home and considering its connections to the rest of the planet. In 1992, Agenda 21 connected spatial awareness to environmentalism when it included the importance of local action in a global system as one of the three vanguards of chapter 5 on demographic dynamics and sustainability (United Nations, 1992a). Since then, discussions on sense of place have often been about globalisation as much as about being a part of a local place. Chapin and Knapp (Chapin & Knapp, 2015) define sense of place as "processes by which individuals or groups identify, attach to, depend on, and modify places, as well as the meanings, values, and feelings that individuals or groups associate with a place". They suggest to move towards stewardship of types of places at multiple levels: regional, national and global (Chapin & Knapp, 2015). They signal that especially the latter: sense of place on a global scale, does not get much (research) attention, "despite its relevance to global problems and opportunities and challenges emerging with rapidly increasing information accessibility and human mobility" (Chapin & Knapp, 2015). They here advocate a *rooted cosmopolitanism* as defined by Kymlicka and Walker (Kymlicka & Walker, 2012) as attempting to "maintain the commitment to moral cosmopolitanism, while revising earlier commitments to a world state or a global culture, and affirming instead the enduring reality and value of cultural diversity and local or national self-government".

The definition of spatial competence to be used in the remainder of this paper is as follows: *The ability to realise that solutions to local problems can have global consequences, to identify and localize phenomena in the context of their global relations and effects, and to see one's own situation in both a global and a local context*. This definition combines UNESCO (UNESCO, 2012)'s emphasis on causality from local to global and Sipos et al. (Sipos et al., 2008)'s place-based notions. This definition is employed because it highlights the facets of spatial competence important to systems thinking. The three parts of the definition illustrate the understanding of complexity, the ability to work with this complexity, and the ability to apply this to one's own context. In this research, spatial competence is used as one of the elements of systems thinking, as well as a driver of the development of systems thinking skills (see figure 5, conceptual framework). Furthermore, the experiment done to answer sub-question 4 measures spatial competence as a part of determining whether the treatment positively influences students' sustainability competences.

TEMPORAL COMPETENCE

Temporal competence is mentioned in one way or the other in ten out of thirteen articles used. De Haan (de Haan, 2006) uses it as foresighted thinking, which he explains to be "the capacity to deal with uncertainty and future prognoses, expectations and plans [which] characterises the sub-competence of being able to think beyond the present". He emphasizes the importance of recognizing the future to be something we can influence and discerns creativity, fantasy and imagination to be playing important roles in this competence (de Haan, 2006). Brundiers et al. (Brundiers et al., 2010) include an understanding of history and the current state, and speak of assessing these, as well as envisioned future states "against value-laden principles of sustainability". Frisk and Larson (Frisk & Larson, 2011a) add to the value element, that one should also take responsibility and ownership of their impacts on generations yet to come and in this way promote intragenerational equity.

History and future are important elements of sustainability. Related to cultural competence as described below, (un)sustainable traditional practices can be deeply rooted into a society and thus influence an area's ability to change. On another note, thinking back to Indira Gandhi's speech from the last section, it is clear how historical events have an impact today. However, the main topic of most discussions on sustainability is the future and the current generation's responsibility of what that may look like for future ones.

When discussing role-play as a pedagogy for sustainability, Gordon and Thomas (Gordon & Thomas, 2016) find that students show the ability to visualise what should change (in this case at businesses, governments and non-government players) in order to get to certain goals. Bell (Bell, 2016) calls futures thinking a critical element of ESD and states that it should not only enhance a student's capacity to envisage a more sustainable situation, but also needs to enable them to see the steps that can take them from their current situation to that more sustainable state and thus enable them to take action. As an example of futures thinking, he mentions the formulation of the Sustainable Development Goals, that clearly set targets for where to go and how to get there (Bell, 2016).

The definition of temporal competence to be used in the remainder of this thesis is as follows: *The ability to forecast, to backcast, and to understand and value the past, present and different scenarios of the future*. This definition combines the earlier discussed notions of Brundiers et al. (Brundiers et al., 2010) and Frisk and Larson (Frisk & Larson, 2011a). This definition of temporal competence has been formulated as it summarises the different ways in which temporal competence was used in the publications reviewed. In this research, temporal competence is used as one of the elements of systems thinking, as well as a driver of the development of systems thinking skills (see figure 5, conceptual framework). Furthermore, the experiment done to answer sub-question 4 measures temporal competence as a part of determining whether the treatment positively influences students' sustainability competences. One of the exercises in the measurement attempted to gauge the students' ability to envision future scenario's. Due to a lack of validity, this exercise has

not been analysed in sub-question 4. Because this is still considered an essential part of temporal competence as a part of systems thinking, this element is still included in this definition.

DISCIPLINARY COMPETENCE

Disciplinary competence is taken up in some way in nine out of thirteen articles from table 2. De Haan (de Haan, 2006) differentiates between interdisciplinary learning and interdisciplinary work, where the former is needed to improve the skills in the latter. Interdisciplinary learning is about finding out the complexity of problems and interdisciplinary work about solving these while working together across and beyond disciplinary boundaries. Sipos et al. (Sipos et al., 2008) focus on transdisciplinarity in the curriculum, which entails the use of a curriculum that "integrates knowledge from numerous distinct disciplines, embedding streams of knowledge into one another and integrating them in new ways". Here, the input is interdisciplinary, rather than the process or output of a project. Wals (Wals, 2010b) speaks of the disciplinary Gestalt, which is supposed to be a mode of switching between different mind sets of natural and social sciences, whereas Brundiers et al. (Brundiers et al., 2010) focus more on Interdisciplinarity as a condition for cooperation.

Sustainability as a branch of research has proven itself to be a collection of complex issues that more often than not is impossible to tackle using one discipline. Multiple forms of integrated research have come up to deal with this fact, notably multi-disciplinary, inter-disciplinary and trans-disciplinary research. Stock and Burton (Stock & Burton, 2011) discuss the need for disciplines (shared language, accreditation of practitioners, and epistemological and ontological assumptions that do not need to be questioned continuously), but also show this to be insufficient. Three types of research that goes beyond disciplinary boundaries are multidisciplinary research (where different disciplines work within the same context, but not towards the same goal), interdisciplinary (where new knowledge is created by combining and crossing boundaries between different disciplines), and transdisciplinary (where different disciplines are complemented by actors from outside of academics and the group jointly works beyond the sum of disciplines) (Stock & Burton, 2011). The authors note that the more integrated the approach, the harder it is to attain (Stock & Burton, 2011).

Applying it to education in general and ESD in specific, a multitude of methods can be found to work on sustainability in an integrated manner. Taking for instance some of the methods put forward by Winowiecki et al. (Winowiecki et al., 2011), we find dialogue about underlying assumptions, mind mapping, imagining ideals and back casting. Fortuin and Van Koppen (Fortuin & van Koppen, 2015) find two components of reflexivity important when teaching and learning inter- and transdisciplinarity: the assessment of "relative contributions of scientific disciplines and non-academic knowledge in addressing environmental issues", and – as also mentioned by Winowiecki et al. (Winowiecki et al., 2011), the role of norms and values. Lang et al. (Lang et al., 2012) specifically focus on the involvement of non-academics when they state doing this would not only integrate the most knowledge, but also create ownership for both problems and solutions.

The definition of disciplinary competence to be used in the remainder of this thesis is as follows: *The ability to communicate, work and learn across dimensions (economic, social and environmental) and disciplines, and to understand the necessity and added value of doing so*. This definition takes from De Haan (de Haan, 2006) and Brundiers et al. (Brundiers et al., 2010). The working and learning part stems from the former and the collaborative aspects from the latter. This definition was chosen because it highlights the elements of multi/inter/transdisciplinarity important to systems thinking. In this research, disciplinary competence is used as one of the elements of systems thinking, as well as a driver of the development of systems thinking skills (see figure 5, conceptual framework). Furthermore, the experiment done to answer sub-question 4 measures disciplinary competence as a part of determining whether the treatment positively influences students' sustainability competences.

CULTURAL COMPETENCE

Intercultural understanding plays a big role in the OECD Definition and Selection of key Competencies (DeSeCo) (OECD, 2005) document, where relating well to others and defending and asserting rights, interests, limits and needs are found to be parts of key competences. De Haan (de Haan, 2006) speaks of cultural competence in two of his key competencies, namely "cosmopolitan perception, transcultural understanding and cooperation", and "distanced reflection on individual and cultural models". Less explicit is another of his key competencies: "the capacity for empathy, compassion and solidarity" (de Haan, 2006). Where the first is being curious about events and people in the rest of the world, the second is about knowing one's own context and how this influences them, the third is about "a certain global 'we' feeling" (de Haan, 2006). Here again we see the cultural aspects of sustainability on different levels.

Brundiers et al. (Brundiers et al., 2010) speak of being able to deal with a diversity of perspectives, which comes back in almost all of the collections of competences. In their *ESD Sourcebook* UNESCO (UNESCO, 2012) takes this one step further by taking up the ability to find the values that cause these different perspectives and analyse them. The *Learning for the Future* publication by UNECE (UNECE, 2011) of one year earlier adds the importance of attention for indigenous knowledge and *Global competency for an inclusive world* by PISA (PISA, 2016) contributes the ability to adopt one's own behaviour to changing contexts and situations.

Throsby (1995) finds two types of culture: culture in the functional sense, which includes the arts and other cultural industries, and culture in an anthropological or sociological view, "as a set of attitudes, practices and beliefs that are fundamental to the functioning of different societies". The author then proposes the term culturally sustainable development as defined in four ways: advancement of material and non-material well-being, intergenerational equity and the maintenance of cultural capital, equity within the present generation, and the recognition of independence (Throsby, 1995). In the previous section on sustainability in India, we have found that cultural elements can also play a role in sustainable development as traditions that promote or prohibit a certain type of behaviour, and values that underpin the way in which the status quo is organised and in what way this can be changed.

The definition of cultural competence to be used in the remainder of this thesis is as follows: *The ability to reflect on individual and cultural models in an objective and adaptive manner, to be able to see oneself in one's own cultural context, and to be able to locate others in theirs with respect, solidarity and compassion*. This definition combines notions described above by De Haan (de Haan, 2006) and PISA (PISA, 2016). This definition is used as cultural models represent a vital part of using systems thinking skills towards sustainable development. Cultural competence brings value into systems thinking, in the way that it allows one to see a situation from different human perspectives. Although cultural competence is seen as a crucial element in systems thinking, it is not included in the remainder of this study, as no methodologically valid means were found to measure it in the experiment. However, cultural competence is seen as one of the elements of systems thinking, as well as a driver of the development of systems thinking skills, and comes back in the conceptual framework, as well as the answer to sub-question 3 on the sustainability competences desirable for high school students to develop.

2.3 CONCEPTUAL FRAMEWORK

From the literature review outlined in section 2.2, a conceptual framework has been developed. It zooms in on the development of systems thinking skills and the role of other sustainability competences in the process of developing systems thinking skills. This process has been understood to consist of different stages, in which the continuous experience of systems thinking processes positively influences the skills needed to do these processes: spatial, temporal, disciplinary, and cultural competence. When this loop has been done a certain

number of times, the systems thinking as well as its components reach a new level of understanding, here visualised by adding a +.

One starts on the left of the framework, with basic or no spatial, temporal, transdisciplinary and cultural competence. Any improvement in these skills further one's systems thinking skills. Experiencing systems thinking (by hearing someone explicitly describe a system for instance) improves the spatial, temporal, transdisciplinary and cultural competences, which in turn positively influences one's systems thinking skills. This loop continues until a certain level (in this case 'to be able to follow an example') is reached. At this stage, one reached a higher level of complexity, in this model portrayed as reaching 'spatial competence +', 'temporal competence +', 'transdisciplinary competence +', and 'cultural competence +', hereby further developing 'systems thinking +', until the next stage (here ++) is reached. Each new state reached, represents a higher level of complexity.

In developing this framework, three levels of systems thinking were established based on personal correspondence with CEE personnel. The first level is understanding examples, the second understanding systems thinking as a tool, the third being able to apply systems thinking to real-life examples. Further stages might include translating notions taken from systems thinking into action and the ability to teach it. The main characteristics of the framework are the fact that each loop only moves on from 'systems thinking (+/++) after a succession of loops, in which the experience of the systems thinking process strengthens the spatial, temporal, transdisciplinary and cultural competences, until these can shape the input for a higher level of systems thinking, with an increasing level of complexity. The experiment used to answer sub-question 4 thus only represent one loop.

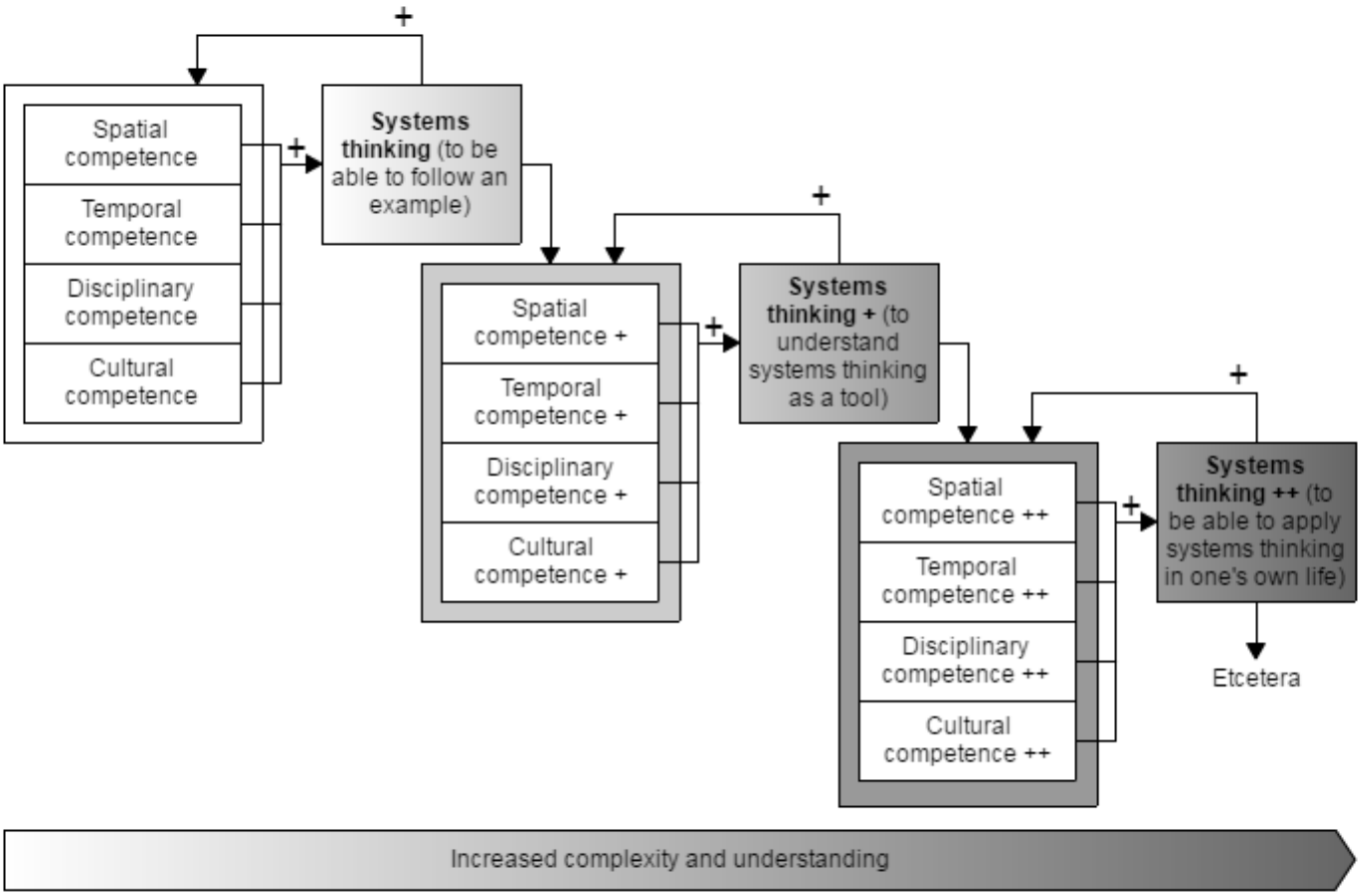


Figure 5. Conceptual framework explaining the process of increased systems thinking skills, showing the interdependent process of developing systems thinking skills together with spatial competence, temporal competence, transdisciplinary competence and cultural competence.

CHAPTER 3 – METHODOLOGY

3. METHODOLOGY AND JUSTIFICATION

In chapter 1.3 the objective of this research was defined as follows: To test and evaluate the impact of systems thinking on the development of sustainability competences of secondary school students in Ahmedabad, India **by** designing an educational intervention, testing it in an experiment using Solomon's four group design, developing and using a measurement survey to determine its impact, and triangulating the outcomes with qualitative data taken from document analysis, literature review, (non-)participatory observation, and semi-structured interviews. In this section, the latter part of this objective is discussed and substantiated.

3.1 RESEARCH STRATEGY

As can be found in the framework below, the *research perspective* is made up out of the notions discussed in the previous chapter, including theory on ESD, competences and pedagogy for SD and more specifically systems thinking. Semi-structured interviews, (non-)participatory observation and desk research were used to set up the experiment that is be further outlined below. The outcomes of this experiment have been triangulated with the outcomes of semi-structured interviews as well as further (non-)participatory observation, to answer the central and sub-questions of this research as reflected in the expected results in the most right box of the framework.

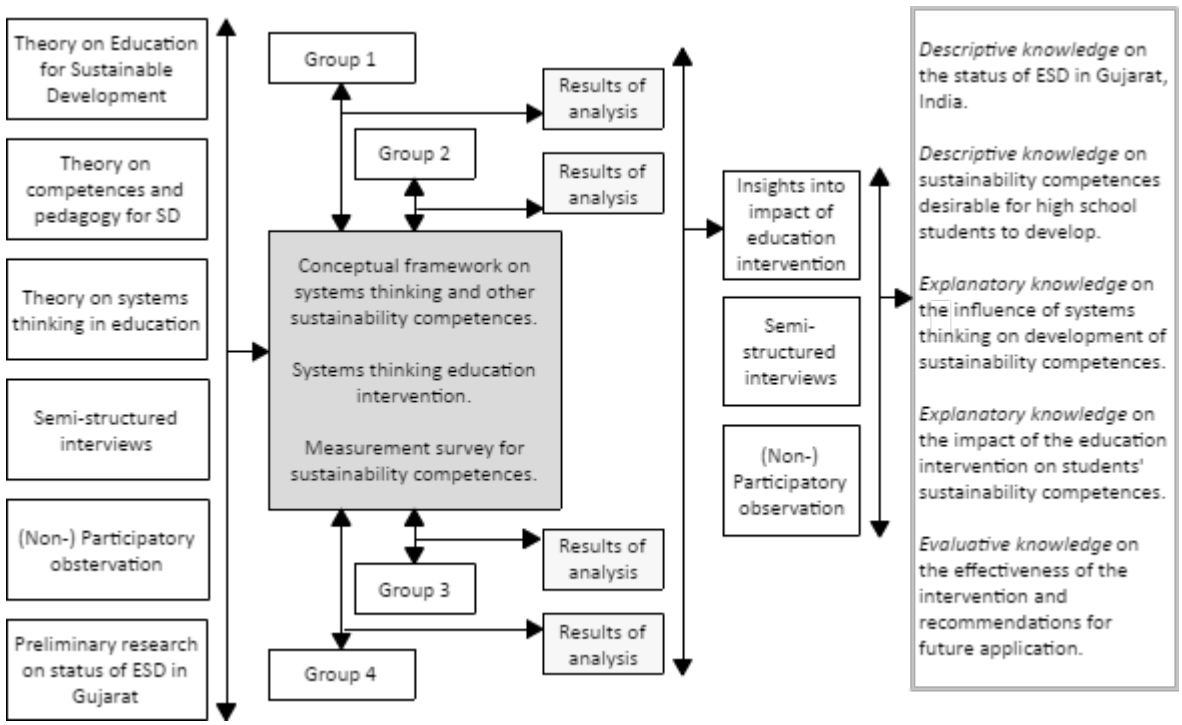


Figure 6. Research framework as a flow chart from inputs on the left to outputs on the right. Groups 1 to 4, are the four groups used in the experiment that consist of students from three different schools in Ahmedabad, Gujarat.

3.2 DATA COLLECTION

Data collection for this research has been done using multiple methods in sequence. The central method is the experiment, which was prepared and interpreted by means of qualitative methods like document analysis, (non-) participatory observation and semi-structured interviews.

Orientation	Preparation	Experiment	Interpretation
Literature review Document analysis Conference	(Non-)participatory observation *Teacher and* expert interviews	Solomon four group experiment	Expert interviews *Teacher interviews*

Table 3. Sequential mixed methods design. Teacher interviews are in italic, because they were not used as planned.

In the orientation phase I have worked on literature research and document analysis. Main sources used were Scopus, Taylor & Francis and Google Scholar, from which the snowball-method was employed to find more studies relevant to the field. Search terms used included 'education for sustainable development', 'environmental education', 'adjectival education', 'sustainability competence', and variations to these terms. To get an idea of the current state of ESD in the region, I have reviewed teaching material. This included materials specifically directed at ESD (supplied by CEE) as well as regular material used for courses like social sciences and English. At the *'International conference: ESD for transforming education for children and youth'* (after this: ESD conference), I attended working group sessions on ESD competencies, high school students' attitudes towards ESD and the SDGs in India, the Earth Charter and ethics, and pedagogies and approaches for ESD. The preparation phase consisted of (non-)participatory observation – sitting in on classes and helping out with CEE projects – as well as semi-structured interviews with teachers and ESD experts. During the experiment, I have gathered data by visiting secondary school classes and having them fill out one survey as an ex-ante and ex-post measurement. This was done with at least one day and a maximum of one week between the treatment and post-measurement. To interpret results coming from the experiment, I supplemented the data collection described above with semi-structured interviews and conversations carried out with a selection of teachers and employees of CEE. These included the interviews done in the preparation phase, informal conversations during the experiment phase, and discussion with colleagues while interpreting the data.

The remainder of this section outlines the methods used in the different stages of this study.

EXPERIMENT

SOLOMON FOUR GROUP DESIGN

In order to answer the main research question, an experiment is executed using the Solomon four group design. This design measures the compatibility of the groups (A), the marginal effect of the treatment (B and C), the impact of the treatment (D and E) and the impact of the pre-measurement (F and G). Figure 7 gives a visual representation of this design.

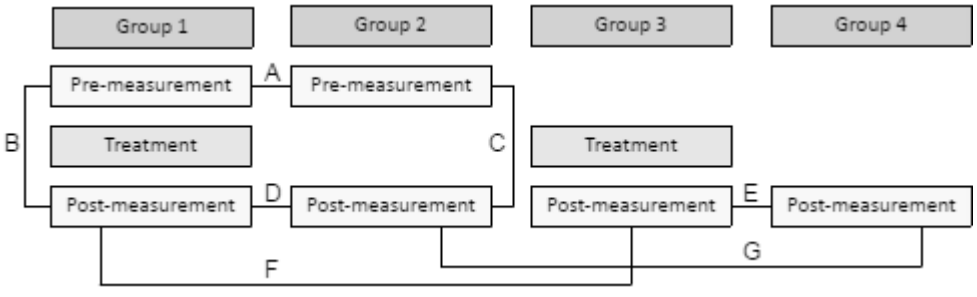


Figure 7. Visual representation of Solomon's four group design (Solomon, 1949).

Instead of a classical experiment with one experimental group and one control group, the Solomon four group design employs three control groups. The second and third control group is added to assess the impact of the pre-measurement and the impact of external effects between the pre- and post-measurement (Solomon,

1949). All groups are stratified random samples, so if no external events influence the students' performance, the outcomes of the post-measurement of group 4 should be comparable with the pre-measurements of group 1 and 2.

Link	Implication
A	This link is used to establish the compatibility of the groups. A significant effect would indicate that the groups are not compatible.
B	This link is used to establish the marginal effect when receiving the treatment. A significant effect would indicate an impact of the treatment.
C	This link is used to establish the marginal effect when not receiving the treatment. A significant effect would indicate a learning effect or external effect in the time passed between the pre- and post-measurement.
D	This link is used to establish the effect of receiving the treatment and the pre-measurement, compared to only receiving the pre-measurement. A significant effect would indicate an impact of the treatment.
E	This link is used to establish the effect of receiving the treatment, compared to no prior measurement. A significant effect would indicate an impact of the treatment.
F	This link is used to establish the effect of doing the pre-measurement before receiving the treatment. A significant effect would indicate a learning effect.
G	This link is used to establish the effect of doing the pre-measurement. A significant effect with higher scores for group 2 would indicate a learning effect.

Table 4. Overview of links in Solomon four group design (Solomon, 1949).

As discussed in the introduction (chapter 1.1), the choice for this has been made to isolate the treatment effect and get additional insights into a possible learning effect, since the pre- and post- measurement consist of the same exercises. Furthermore, a need for more studies using this design has been identified in literature (McCambridge et al., 2011).

DESIGNING THE TREATMENT AND MEASUREMENT

Designing the treatment

The treatment used the educational game 'mystery'. This is a teaching method "[c]reating cognitive maps with links between facts and concepts, theories and real-life and different contexts" (Karkdijk, van der Schee, & Admiraal, 2013, p. 184). It gives students a mysterious situation that they cannot easily explain, after which they split up in groups and get a set of cards that show the different steps of the process leading to the explanation of the situation, which they try to make sense of (Karkdijk et al., 2013). The mystery method is a part of the 'thinking-through-geography' pedagogy, first coined by David Leat (Leat, Van der Schee, & Vankan, 2005).

In earlier assessments, using classic experiments with one control group, find a positive impact on students systems thinking skills, but varying effect sizes (Karkdijk et al., 2013; Leat et al., 2005; van der Schee, Leat, & Vankan, 2006). Van der Schee, Laet and Vankan (2006) suggest differences in effects by the mystery method to be explained with different teaching styles and amounts of experience with 'thinking-through-geography'. This suggests that it is desirable to have one person teach all interventions. CEE has confirmed this and found me doing it myself the best option. Because the groups were quite large (60 students per school, out of which 30

participated in the treatment) I arranged for two interns of CEE to help me during the experiment itself. Lena Lukow and Theresa Kofler are interns from a German government programme who arrived at CEE around the same time as I did. Before helping with the experiment at the schools, I briefed them about my research and they joined me when I carried out the test runs at St. Kabir DIO, before finalising the measurement survey and the treatment.

In preparation of the experiment, I designed two mystery sets in two topics. The first was on tiger conservation and the second on water. Both exercises dealt with the various social, environmental and economic dimensions of the topics. During the ESD conference, Thomas Hoffmann spoke of the importance of proximity to make the issues more relatable for students (see Annex 5 – Field work diary). After discussing with colleagues at CEE (Harshal Korhale, Rajeswari Gorana, Bijoy Goswami) who were more aware of the proximity of certain problems to high school students in Ahmedabad, I chose to use the water-mystery. The tiger-mystery was set in Ranthambhore National Park which is located in a neighbouring state of Gujarat, but still 500 kilometers away, which – colleagues assured me – meant most of the students will have never visited the place, and many might not know it.

To get an idea of the various water issues around Ahmedabad and Gujarat, I spoke with the water experts in CEE and joined a programme of Water Walks organised by CEPT, the local university, in which a group of academics, water professionals and others interested walked along the banks of the Sabarmati river, while discussing various issues of water quality and quantity (see Annex 5– Field work diary). Additionally, I have had help of another student of Utrecht University, Martien Aartsen, who was in Ahmedabad working on the Ahmedabad Water Blueprint for one month while I was designing the treatment. His insights into current water issues in Ahmedabad helped to select the issues most relatable to the students.

Designing the measurement survey

When developing the measurement, different methods of measuring competency were explored. Initially, the Sulitest and PISA measurement were used as inspiration to make the survey, but it turned out to be difficult to use these for measuring system thinking and the other competences (PISA, 2016; Sulitest, 2014). The Sulitest is meant to measure sustainability literacy of university graduates and only measures knowledge (Sulitest, 2014). The test employed by PISA was meant for younger learners, but mostly employed self-reporting, which does not fit the competences measured here (PISA, 2016).

The pre- and post-measurement consists of a survey, consisting of four exercises testing systems thinking, as well as spatial, temporal and disciplinary competence (see Annex 1 – Measurement survey). Exercises were designed for the competences outlined in the conceptual framework (chapter 2.3). The methods used to measure the competences are further evaluated in chapter 4.5, on the experiment as a tool to measure sustainability competences. An overview of operationalising the competences is given in section 3.3 of this chapter.

Pilot and outcomes

After designing the treatment (e.g. the mystery exercise), I carried out a pilot of the pre-measurement, the treatment and the post-measurement at St. Kabir DIO (see Annex 4 for an overview of the schools used in the experiment). I analysed the results of the measurement survey together with Harshal Korhale (CEE employee) and we found some clarifications were needed in the formulations of the measurement exercises. Korhale also assisted me in adapting the wording of the mystery exercise to better fit with the language of Indian high school students. Together with Lena and Theresa, I analysed the outcomes of the mystery exercise and added some more facts and pictures for links that students were not able to make. The mystery that was used as the treatment can be found in Annex 2 – Mystery exercise.

From literature, it was found that it was important to schedule ample time to debrief after the exercise (Karkdijk et al., 2013). This was also experiences in the try-out. At each school we schedule 15 to 20 minutes to discuss the results by calling the groups to come to the front of the class and answer questions on the system they had made. Questions considered the links between the elements found in the mystery. According to Karkdijk et al. (2013) the debrief allows students who did not immediately get all the links to also experience the full extent of the exercise.

Figures 8-11. Pictures showing the mystery exercise. Top left shows the students of St. Kabir NAR working on the exercise in groups. Top right shows one of the charts made by the students from Rachana School. Although the size is too small to read to text, the picture shows the way in which the student made links. Bottom left shows a chart made by the students from CCIS. Here the students have written extra comments like "did you know?" between the pictures. Bottom right shows a group of students presenting their chart for the class. The two examples of charts are added in Annex 2 to illustrate the outcomes of the treatment.

GROUP SET-UP AND SAMPLING SELECTION

The population consisted of eighth grade high school students, going to school in Ahmedabad, Gujarat, following an English-medium education. From this population a convenience sample of four schools was taken by Harshal Korhale (project coordinator at CEE). He selected four of the schools he was working with on the CEE-project Swachhagraha (on cleanliness in schools). From this convenience sample, a stratified random sample was taken to form the four groups outlined in figure 7. The numbers of students per school varied between 45 and 60. However, only the results of the students that attended both the measurement moments were used, meaning that the number of surveys used per school was between 35 and 50 (see table 5). At the three schools used for the experiment, four groups were made at random, by handing out the pre-measurement and a mock-survey. Then, half of each of these groups received the treatment and half (those

with the mock-survey) went to attend their regular classes. The groups were made to be the same size on the first measurement day, but due to students from different groups not being there the second measurement day, the groups of surveys that were used were not all the same size. As can be found in table 5, a total of 131 respondents were used in this study. For group 1 and 2, both the pre- and post-measurement were used, which means that a total of 198 measurement surveys was used in analysis.

	St. Kabir NAR	Rachana	Cosmos Castle	**Total**
Group 1	15	10	13	**38**
Group 2	8	8	13	**29**
Group 3	13	9	9	**31**
Group 4	14	8	11	**33**
Total	**50**	**35**	**46**	**131**

Table 5. Amount of students from different schools in each group. As the exercise at St. Kabir DIO was done as a pilot, there were no groups made and the number of students are not added to the total of the sample used in the experiment (also see: list of school visits – Annex 1). A total of 131 respondents were used in this study. Of group 1 and 2, both the pre-measurement and the post-measurement was used, which means that a total of 198 measurement surveys was used in analysis.

Of all four schools, the participants were taken from the eighth grade. St. Kabir Drive-In Old Branch (St. Kabir DIO), Rachana and Cosmos Castle International School (CCIS) follow the CBSE syllabus. St. Kabir Naranpura Branch (St. Kabir NAR) follows the state board syllabus (CCIS, 2016; Rachana School, 2014; St. Kabir, 2013). CEE employees have suggested to make a comparison between boards, but it was found that for this study, the sample is too small to isolate the impact of following a different syllabus. Because the students of St. Kabir NAR are spread across the four groups, a possible impact of following a different syllabus does not influence the outcomes of the experiment.

SEMI-STRUCTURED INTERVIEWS

Semi-structured interviews were carried out with Ahmedabad-based experts on ESD. The option to interview people outside of CEE was explored, but it turned out that since CEE is the only organisation involving itself with ESD in Ahmedabad, all relevant people were located there.

I also planned to interview teachers and students after having done the experiment, but this did not turn out to be as helpful as expected. Students were extremely positive when asked to give feedback and although I tried to give them the feeling that they could be critical and speak freely, their comments did not go much beyond the exercise being “fabulous” and them wanting to do projects like these all the time. With the teachers there were also some difficulties, as the schools were very eager to make a good impression. I did one interview with two teachers of St. Kabir NAR, which gave me some context to their school and the role ESD was playing there, but could not go beyond anecdotes of the environmental project they had done. As such, I decided to add this conversation into my observations, rather than analyse it as a part of the interviews.

Name	**Role within CEE**	**Expertise**
Harshal Korhale	Project coordinator Swacchagraha	Education policy, field experience at schools.
Ketki Gadre	Project leader waste group	Field experience at schools.
Madhavi Joshi	Youth Coordinator	Education policy, international ESD developments, CEE organisational strategy.

Partesh Pandya	CEE West	ESD as a pedagogy, long-term transition plans for schools, Gujarat-based ESD.
Pramod Sharma	Project leader Handprint	ESD competences, CEE organisational strategy, systems thinking, teacher training.
Rajeswari Gorana	Project leader Children's Media Unit	Education materials, systems thinking, environmental education, international ESD developments.

Table 6. Overview of interviewees and their roles and expertise within CEE.

Based on the research questions outlined for this study, an interview guide was designed (Annex 3 – Interview guide). This guide made an interview guide based on my preliminary research and edited this after reviewing it with supervisors in the Netherlands and India. My first interview was with Harshal Korhale, who I had been working with a lot and already knew well. I used this interview as a pilot and edited the interview guide afterwards. There was some variation in the order in which I asked the questions and – based on the expertise of the interviewee – the amount of time spent on different topics. Transcripts of the interviews can be found in Annex 7 – Transcripts.

(NON-)PARTICIPATORY OBSERVATION

Throughout my time in India, I have done overt ethnography or observation on a number of occasions (Bryman, 2012). Firstly, I participated in the *conference* that was being held on ESD's potential to transform education (ESD conference). Here, I spoke to international ESD experts and teachers and education professionals from throughout India. I made notes of conversations and sessions in a field work diary. Secondly, I did *school visits* to five schools as a part of the Swachhagraha project, educating high school children on cleanliness (list of school visits, Annex 4). During these classes, I sat in the back of the class and observed the way the CEE project was carried out, how the teacher and the students interacted, and how the students responded to the different issues raised. The visits to the schools would always include a visit to the head master or mistress which would allow me to get an image of the different types of schools and the way they were being led. Korhale took me to schools from different educational boards and a selection of private and public schools. Thirdly, myself, as well as Lena and Theresa, made notes of our experiences when carrying out the experiment and of the conversations (and excessive amounts of tea) we had before and after with the school's teachers, supervisors and head masters or mistresses. The fourth and final mode of observation was *living and working at CEE* and making notes of interesting conversations or points that came up during lunch or work.

Access to all of these settings was arranged by CEE and more specifically Bijoy Goswami and Harshal Korhale. This will have influenced the type of schools I have visited as they were all participating in the Swachhagraha project. However, Harshal had already visited all of these schools once before and could therefore give me some context as to how representative these schools were of the general population. For the school visits, Korhale selected five schools with different general income scales, connected to different educational boards), as he wished to show different ways in which schools around Ahmedabad were taking up ESD. As outlined earlier, for the experiment, Korhale selected three schools I had not visited before that were relatively compatible. The pilot was executed at St. Kabir DIO, a school that I had visited before.

3.3 OPERATIONALISATION

In order to measure the possible increase in sustainability competence, a measurement survey has been designed after operationalising the competences described in chapter 2.2. The different competences do not mean the same thing in every context. High school students are not expected to have developed the full competences already.

Definitions

- Sustainability competence = An ability desirable for participation in processes of sustainable development that a learner develops during, through and because of a learning activity (Mochizuki & Fadeeva, 2010).
- Systems thinking = The ability to connect cause and effect across spatial, temporal, disciplinary and cultural scales (Wals, 2010b; Wiek et al., 2011).
- Spatial competence = The ability to realise that solutions to local problems can have global consequences, to identify and localize phenomena in the context of their global relations and effects, and to see one's own situation in both a global and a local context (Sipos et al., 2008; UNESCO, 2012).
- Temporal competence = The ability to forecast, to backcast, and to understand and value the past, present and different scenarios of the future (Brundiers et al., 2010; Frisk & Larson, 2011a).
- Disciplinary competence = The ability to communicate, work and learn across dimensions (economic, social and environmental) and disciplines, and to understand the necessity and added value of doing so (Brundiers et al., 2010; de Haan, 2006).
- *Cultural competence = The ability to reflect on individual and cultural models in an objective and adaptive manner, to be able to see oneself in one's own cultural context, and to be able to locate others in theirs with respect, solidarity and compassion* (de Haan, 2006; PISA, 2016).

Text box 4. Definitions of competences. The definitions used here are substantiated in section 2.2. Cultural competence is marked italic because it was not used in the experiment due to methodological difficulties.

In the measurement applied to the experiment, five types of exercises are used, as shown in table 7. Initially, it was planned to measure cultural competence by means of self-reporting, but it turned out to be very difficult to formulate questions that would indicate an isolated effect in cultural competence. This difficulty would have been there when formulating such questions within the context of your own culture, let alone when doing this in a different one. As such, it has been decided not to measure a possible increase in cultural competence in this experiment.

Competence	**Measurement**	**Resource**
Systems thinking	Linking SDGs	(Karkdijk et al., 2013)
Spatial competence	Sequencing; The odd one out	(Geoworld, 2017) (van der Schee et al., 2006)
Temporal competence	Sequencing; Looking forward	(Geoworld, 2017) Not founded in literature
Disciplinary competence	Relating to pictures; The odd one out	Not founded in literature (van der Schee et al., 2006)
Cultural competence	*Self-reporting*	(PISA, 2016)

Table 7. Overview of operationalisation of competences. Cultural competence in italic because this method was not used in the end.

To measure the sustainability competences of the students, different tools from the 'thinking-through-geography' pedagogy were used (Leat et al., 2005). For part I of the survey, the students are asked to put four pictures into order ('sequencing'). Out of the four questions, two were meant to make the students think in spatial dimensions and two in temporal dimensions (see table 7). In part II of the survey, the students are asked to lay links between three themes: poverty, health and climate change ('linking SDGs'). This exercise was earlier used by Karkdijk, van der Schee and Admiraal (2013) to measure systems thinking skills after use of the Mystery-method. They used the Millenium Development Goals, out of which they chose three, and had

students draw maps to connect these. In their experiment the students also had to explain each link that they laid, for which was no time in this measurement, making the analysis of this part more challenging. This is further discussed in chapter 5. Part III asked the students to relate terms to two pictures, one of a traffic jam and one of a cow eating litter in the streets ('relating to pictures'). In a second part, students' temporal competence was measured by asking them what they thought the picture would look like if the problem would be solved ('looking forward').

The measurement survey used is not a traditional survey, but rather a collection of exercises that are assumed to require a certain competency to correctly answer them. The four competences that were defined to feed into systems thinking competence, while at the same time being stimulated by systems thinking, were operationalised in six ways of measuring. The measures that were chosen were 'linking SDGs', 'the odd one out', 'sequencing' (in the analysis called 'put into order'), 'anticipatory thinking', 'relating to pictures', and – initially – 'self-reporting' (table x). The survey was set out to measure each of the three competences with at least two ways of measurement, as 'sequencing' and 'the odd one out' are used for two competences, there are 4 measurements for 3 competences (spatial, temporal and disciplinary). The reason to do this was to be able to triangulate outcomes per competence (so in the case of spatial competence that would mean comparing the results of the spatial questions in 'the odd one out' and the spatial questions in 'sequencing'). However, after finding that the questions asked to indicate a specific competence, were not always interpreted by the students in the expected way, it was decided invalid to analyse the results separately for each competence. As this meant the scores analysed would now be combining the three competences, the triangulation between measurements per competence was no longer applicable.

LINKING SDGS

To measure systems thinking a measure was designed based on the exercise outlined by Karkdijk et al. (2013), who conducted an experiment to test the impact of the 'mystery'-method. However, they did not use it to test the impact of systems thinking on other sustainability competences, but the impact of doing mysteries on students' systems thinking skills (Karkdijk et al., 2013). They assessed systems thinking skills before and after the treatment by means of a pre- and post-test that were not the same, but had the same structure. The tests gave an assignment "to create a map with accurate relationships between facts and concepts that were connected to the UN Millenium Goals" (Karkdijk et al., 2013, p. 187). Both tests consisted of three assignments which were scored on the amount of accurate relations discerned by the participants (Karkdijk et al., 2013). The authors do not specify the way they judged relations to be accurate or not, which makes it difficult to judge the validity of this assessment.

This study set out to use test systems thinking skills by using a similar exercise, applied to the SDGs instead of the MDGs. However, due to time constraints of the schools, there was little time to explain about the SDGs and the measure had to be less time-consuming. It was decided not to explicitly use the SDGs, so as to save the time needed to explain these, but to give three themes for the students to connect. To again save time, the concepts the students had to use to link the three themes were given and respondents were not asked to explain why they put a certain concept as a link between themes. Especially this last decision made it impossible to analyse the results validly. Whether a student would write down deforestation as a link between environment and poverty or poverty and health in itself does not indicate a higher or lower level of systems thinking skills. As a result, this measure was not included in the analysis of results.

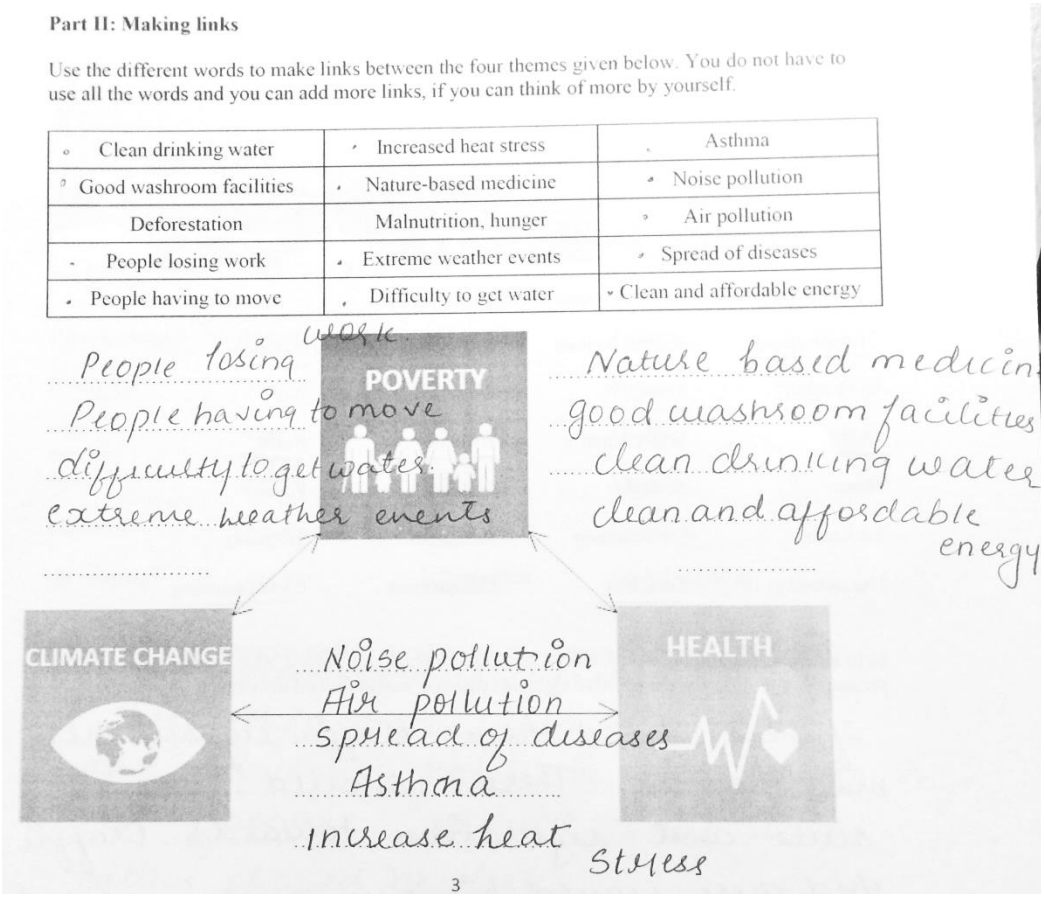


Figure 12. Example of the 'Making links' exercise in the measurement survey.

THE ODD ONE OUT

To measure spatial and disciplinary competence, the exercise 'the odd one out' was used. This exercise is one of the Thinking Through Geography strategies, the collection of which also includes the 'mystery'-method (Leat et al., 2005; van der Schee et al., 2006). It was used to measure systems thinking in an experiment done by Van der Schee et al. (2006), who assessed the effect of 'mystery' as well as two other Thinking Through Geography strategies. The exercise gives the respondent four terms (in the original geography purpose of the exercise for instance cities or geographical processes) out of which they have to identify the odd one out. They then have to provide a reason why this element does not belong with the group, as there are multiple correct answers. For example in the question given below in figure 9, some of the students made the connection made here (three of the places are in the state of Gujarat), while others found Ahmedabad to be the odd one out, as the other three are natural areas and Ahmedabad is an urban area. Both of these answers are correct. This question was meant to indicate spatial competence and by coincidence, both of the answers do indicate insight into spatial relations. However, it was found that in some of the questions of 'the odd one out' and 'sequencing', students made links that were correct, but did not reflect the expected competence. As such, the competences have not been separately analysed, but 'the odd one out' and 'sequencing' were separately analysed, after which the combined scores were analysed. These two exercises could be combined because they both resulted in scale variables.

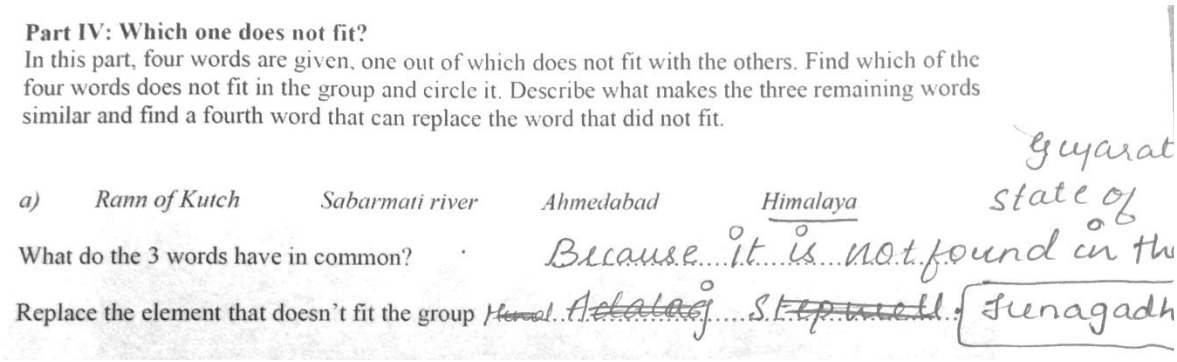


Figure 13. Example of 'the odd one out' exercise in the measurement survey. This question was meant to indicate spatial awareness. The respondent answered correctly, by making a group of places in Gujarat and replacing the element that does not fit (the Himalaya) with Junagadh, a city in the state of Gujarat.

Each correct answer was awarded 3 points. Weak links (in case of figure x for example: Himalaya is the odd one out, because the others are not mountains) were awarded 1 point, incorrect or incomplete links were awarded 0 points. The total scores for this exercise were unevenly distributed. As such, they were analysed in SPSS using Mann-Whitney U tests and Wilcoxon tests. Furthermore, the scores were combined with the scores of the 'sequencing' exercise, and the combination was analysed using paired and independent sample t-tests. Groups are compared according to links A to G defined for the Solomon four group design (see figure 7).

SEQUENCING

To measure temporal and spatial competence, an adaptation of the 'sequencing' exercise of Thinking Through Geography was used (Geoworld, 2017). Originally, this method gives sentences that have to be put into order, for instance of different stages of an occurring flood. For this measurement survey, pictures were used that the students had to order.

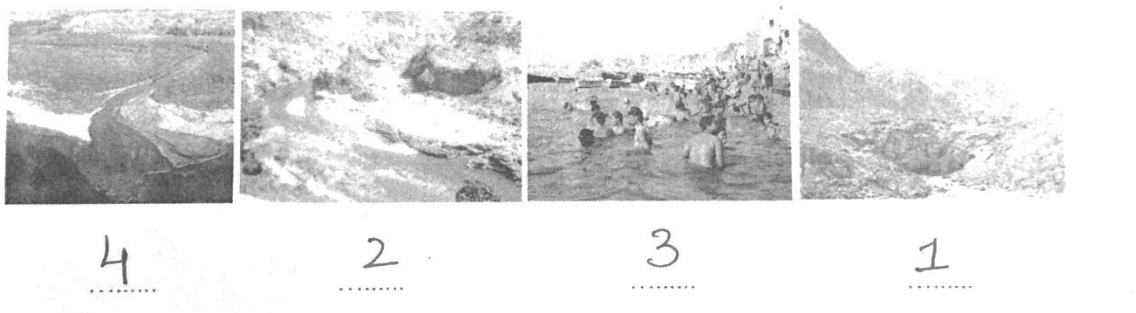


Figure 14. Example of 'sequencing' exercise in the measurement survey. This question can be explained to indicate both temporal and spatial awareness. The respondent answered correctly, by ordering the pictures as follows: mountains, mountain stream, river, river ending in the ocean.

Each correct answer was awarded 3 points. When a student would misplace one picture, but otherwise show the correct order, they were awarded 1 point. When this was not the case, 0 points were given. The total scores for this exercise were unevenly distributed. As such, they were analysed in SPSS using Mann-Whitney U tests and Wilcoxon tests. Furthermore, the scores were combined with the scores of the 'sequencing' exercise, and the combination was analysed using paired and independent sample t-tests. Groups are compared according to links A to G defined for the Solomon four group design (see figure 7).

RELATING TO PICTURES

To measure disciplinary competences the exercise 'relating to pictures' was designed. The idea to use pictures came up during one of the skype calls with my supervisor at Utrecht University. Disciplinary competence is measured by the words that the students can relate to two given pictures: one of a traffic jam and one of a littered street with a cow eating the litter (see Annex 1 – Measurement survey).

Photo 2 – Litter on the streets

c) Circle the words that you can relate to this photo.

Climate change	Animal welfare	Money loss	Pollution
Biodiversity	Transport	River	War
CO2	Water scarcity	Hygiene	Health
Peace	Sunlight	Gender	Poverty
Education	Consumption	Resources	Inequality
Use of energy	Time loss	Urbanisation	Global warming

Figure 15. Example of the 'relating to pictures' exercise in the measurement survey. The picture shows a cow in a street filled with litter. The students are asked to show which of the concepts given below the picture they can relate to the scene shown.

The analysis of this question was done by comparing the percentages of groups that marked each of the given concepts. Chapter 4 shows tables that indicate the differences between groups. Groups are compared according to links A to G defined for the Solomon four group design (see figure 7).

	Core concepts	Affiliated concepts	Peripheral concepts
Traffic jam	Pollution, transport, resources, use of energy, time loss.	Climate change, money loss, hygiene, health, education, consumption, urbanisation, global warming.	Animal welfare, biodiversity, river, war, water scarcity, hygiene, health, peace, sunlight, gender, poverty, inequality.
Cow and litter	Animal welfare, pollution, transport, hygiene, consumption, resources.	Climate change, biodiversity, CO2, health, education, use of energy, urbanisation, global warming.	Money loss, river, war, water scarcity, peace, sunlight, gender, poverty, inequality, time loss.

Table 8. Classification of concepts into core, affiliated and peripheral concepts for the pictures of the 'relating to pictures' exercise. The concepts that are underlined are seen as global processes.

The concepts found in the exercise were classified into core, affiliated and peripheral concepts, as shown in table 8. As another researcher might have classified the concepts differently, there is a definite subjective influence in the analysis of this exercise. For each of the links from the Solomon four group designs, the percentage of students marking a certain concept are compared. The core concepts are expected to be marked by most of the students, the affiliated concepts are expected to show a students' ability to think beyond the most obvious links. Because there is no clear link between the peripheral concepts and the scenes shown in the pictures, these are not used in assessing students' performances, as the rationale behind marking them is ambiguous. Table 8 also shows underlined concepts, these are representing global processes. Marking these indicates a students' ability to link a daily scene to a global mechanism. It is expected that the students that receive the treatment mark more of the affiliated and underlined concepts.

LOOKING FORWARD

To measure temporal competence and specifically the ability to understand and value different scenarios in the past, present and future (as found in the definition in chapter 2.2) an exercise on 'anticipatory thinking' was employed. This exercise used the same pictures as the previous exercise and asked the students to describe what these pictures would look like if the problem they picture would be solved.

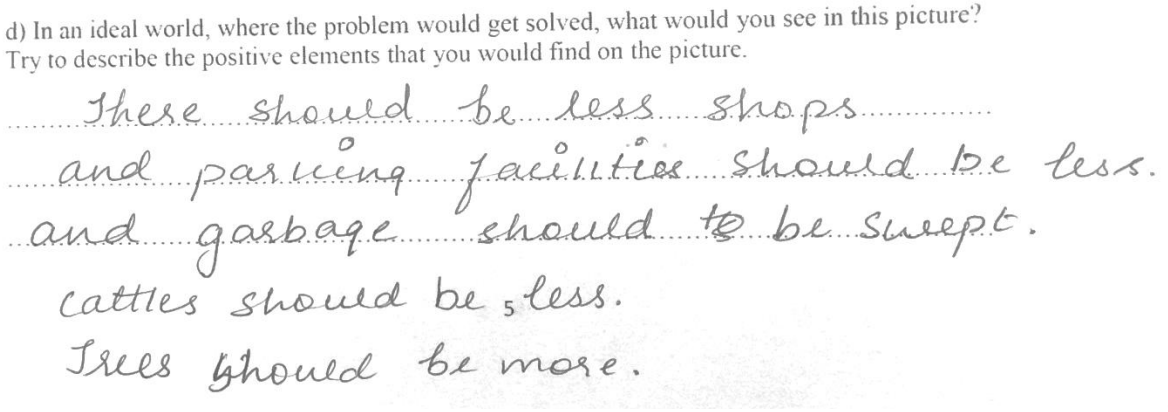


Figure 16. Example of the 'looking forward' exercise in the measurement survey. The respondent was asked to describe what the picture of the cow in the littered street (see previous figure) would look like when the problem would be solved. Her answer is as follows: "There should be less shops and parking facilities should be less. And garbage should be swept. Cattles should be less. Trees should be more."

When analysing the measurement surveys, it became clear that the question formulated for the 'looking forward' exercise had not been clear for a large percentage of the respondents. While creating the measurement survey, I have repeatedly evaluated the wording of the questions with colleagues and adapted them to be clearer and more suited to the students. In the case of this exercise it proved to still be lacking clarity. Initially, it was planned to categorise the answers given by the respondent on a scale to be determined by the variance in responses. However, the low amount of usable responses rendered such an analysis invalid.

SELF-REPORTING

Initially, cultural competence was meant to be measured by means of self-reporting. While designing the survey, however, it proved difficult to formulate questions that would suit the context. The questions used in the PISA (2016) measurement did not all translate well to the Indian context (for instance: 'how do you act when you are abroad?' While only a small portion of the children had ever been outside of India). Attempts to adapt these questions were no satisfactory. Moreover, to interpret the answers coming from a different

culture, would have been an extra difficulty. As such, it was decided not to include cultural competence into the measurement survey.

For future application, self-reporting can be useful. However, the designing and interpreting process would have to take place with ample knowledge of the context in which cultural competence is being tested. Test rounds with evaluation interviews with respondents might be useful to arrive at the right measurement questions.

3.4 DATA ANALYSIS

A selection of *literature* has been analysed by contrasting them on what they said on systems thinking and the other focal sustainability competences (see Annex 6 – Literature review). The selected literature was first used to find the current streams of thought within the topic, from which the sustainability competences used were determined. After defining these, the articles were tested for the way and frequency in which they mentioned them. The semi-structured interviews were used to validate the sustainability competences found.

The *document analysis* was done qualitatively, without coding software or something similar. Two type of documents were analysed: sustainability publications provided by CEE and text books used throughout the two most common educational boards in Gujarat. One limitation here was that due to language barriers only the English-medium books could be analysed, while especially the state schools use Hindi- and Gujarati-medium materials.

The *interviews* were used to validate the outcomes of the literature review. Subsequently, a simple coding structure was used to analyse the interviewees' quotes on systems thinking and the other focal competences. The interview analysis was then used to validate the conceptual framework outlined in chapter 2.3.

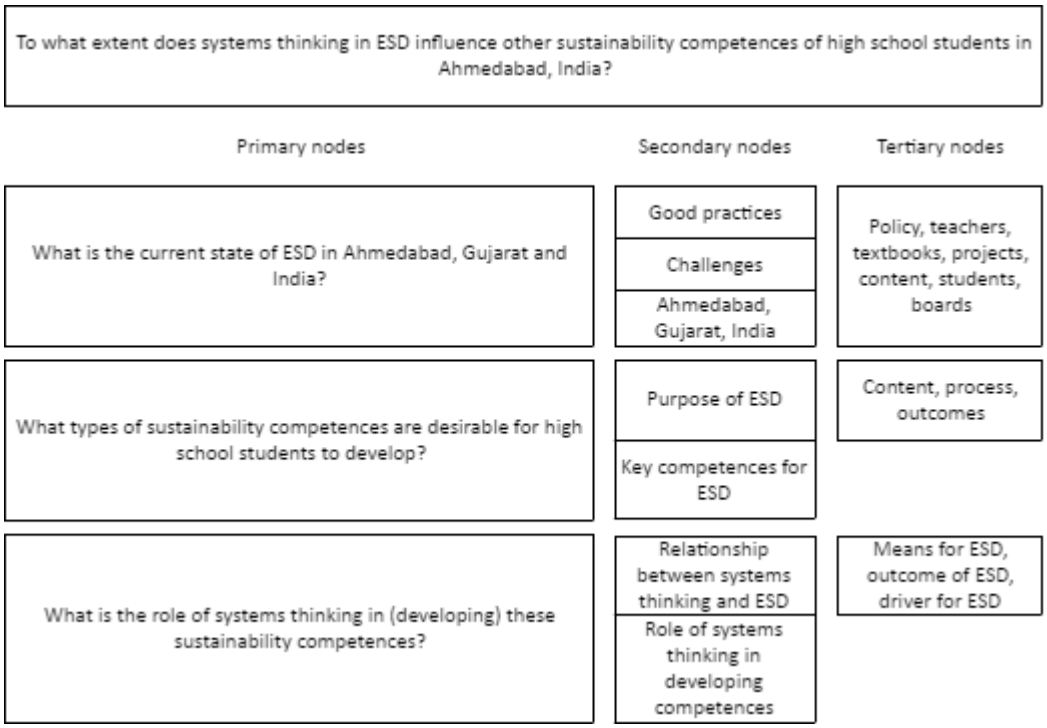


Figure 17. Coding structure used in the analysis of semi-structured interviews. The primary nodes represent the different sub-question for which the interviews were used. The secondary nodes make the distinction between themes within these questions and the tertiary nodes are based on concepts that were frequently mentioned by the interviewees. For example, I did not have a specific question on textbooks, but was mentioned frequently when discussing challenges for ESD in Gujarat.

The *observations* were compiled in a field work diary (see Annex 5 – Field work diary), that has not been coded but used to help interpretation of other collected data.

For the *experiment*, the main part of the analysis was done in SPSS. Parts I and IV of the survey (see above, section XXX) were analysed used independent and paired t-tests, to test the links in image 7. Parts I and IV were tested separately and combined. The separate measurement of part IV turned out to be unevenly distributed, which is why for this exercise, Mann-Whitney and Wilcoxon tests were used. For part III, the seven links were explored using the differences in means between the groups. Outcome tables and their connected graphs were qualitatively contrasted with what one would expect the outcomes to be in the Solomon four group experiment.

Initially, it was planned to separately analyse the different sustainability competences, but when assessing the results of the measurements, it was found that not all students interpreted the questions of the 'sequencing' and 'the odd one out' exercises in the way they were designed, which would make such a measurement invalid. As such, the analysis is concerned with the combination of spatial, temporal and disciplinary competence.

3.5 RELIABILITY, VALIDITY AND SUITABILITY

RELIABILITY

The reliability of a certain measurement is made up out of three elements: stability, internal reliability and inter-observer consistency (Bryman, 2012). A *stable* measurement is a measurement that does not fluctuate over time, meaning that the results would be the same, when a measure were to be repeated under the same conditions. In the case of this research, a test of stability is built-in to the design in the shape of link C in the four group design. Group 2 received the measurement twice, with no change but in time. An *internally reliable* measurement is a measurement that is built up logically, meaning that the indicators used in a construct change consistent with the construct. In the case of this research, the scale or index variables used were sums of scores on different exercises, of which the outcomes did not influence one another. *Inter-observer consistency* is not a problem within this research, as all observations and analyses were done by one person. However, when explaining inter-observer consistency by stating the same results would be found by another observer doing this study, this could be questioned. The results found in this study are influenced by the fact that I am from abroad, doing this research from a specific perspective and relatively unaware of the local context.

VALIDITY

The validity of a measurement is about "the issue of whether an indicator (or set of indicators) that is devised to gage a concept really measures that concept" (Bryman, p. 171). Bryman (Bryman, 2012) discusses several ways of establishing validity. Face validity is an intuitive process in which experts in the field are asked to judge whether they think the measure is valid. For this research, face validity was established by discussing the survey with experts at CEE and my supervisor in the Netherlands. Furthermore, the survey was tested on colleagues as well as on a fourth school from the same population. After this test, several questions were adapted to more closely fit the measure in mind.

Due to the innovative approach used in this study, the validity of the measurement survey can still be questioned. As discussed under operationalisation, two out of five exercises were excluded from analysis due to a lack of validity, and for the measures that were analysed, their measurement validity is debatable. Some of the answers showed students to interpret the question different than intended, which raises the question whether their answers indicate the competences the questions intended to measure. One way in which this could be handled in future application is to include more explanations for answers, as done in the 'odd one out'

exercise. Here, students were asked to explain their choice of answer, which gave more insights into the reasoning behind the answer. Over all, there is an argument to be made that the concept of competences is too complex to capture in a measurement survey of thirty minutes. However, the responses do indicate that many of the students were able to lay the right connections and the experiment results do show an increase of scores after practicing systems thinking in the treatment.

Concerning measurement validity, it would have been interesting to be able to validate the different measurements by contrasting them. This could be done by comparing the differences in scores of students in spatial competence in 'the odd one out' with their scores in spatial competence in 'sequencing'. As described earlier, this could not be done in this study due to the fact that not all students interpreted the questions in the same manner. In sum, for future application, it would be helpful to use multiple measures per competence that can be used to validate each other. This would not yet solve the issue of having exercises be misinterpreted. This could be done by adding more opportunities to explain answers, by using a larger amount of questions so the influence of a misinterpreted question would be smaller, or by conducting the measurement verbally allowing one to ask the respondent for the context to their answer.

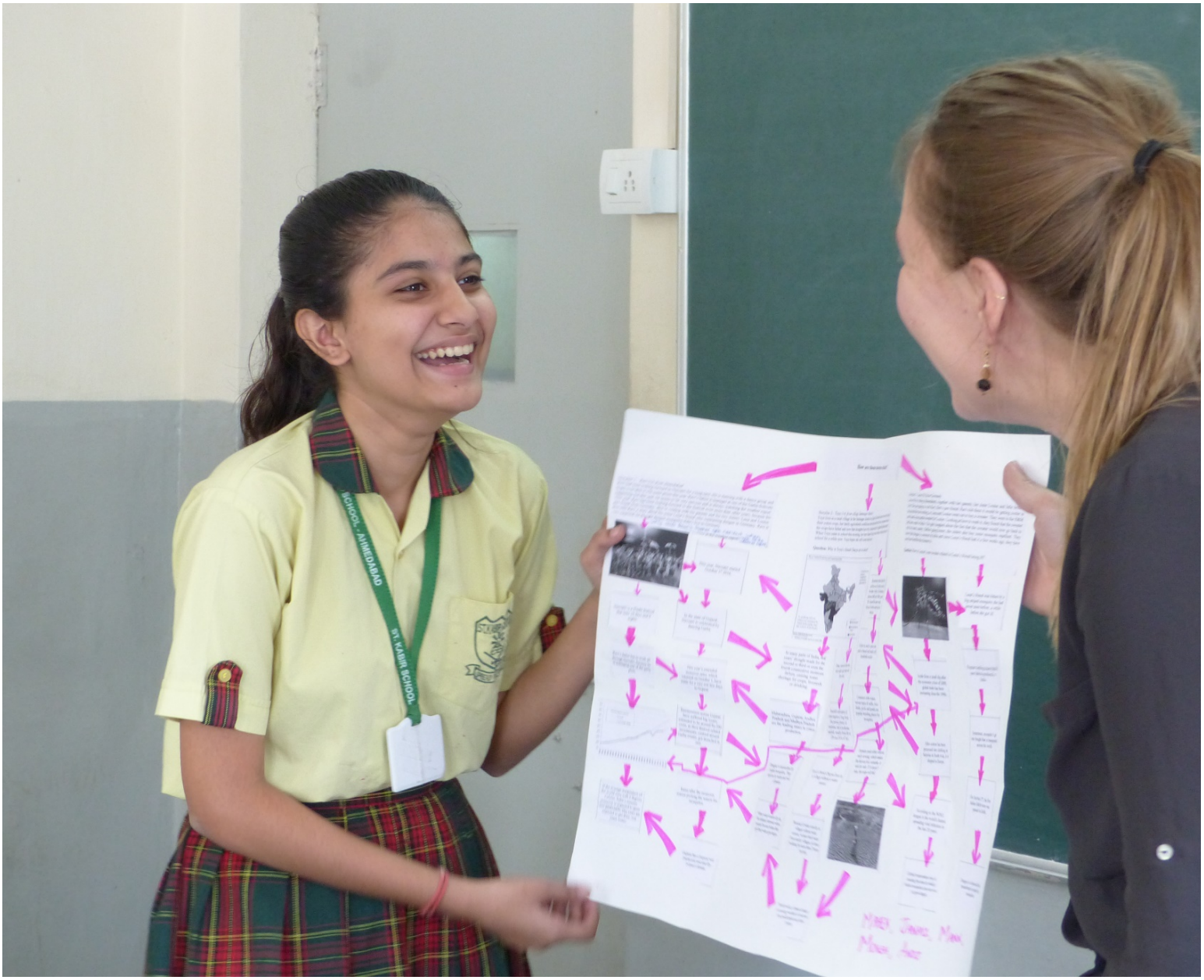
Aside from measurement validity, Bryman (Bryman, 2012) discerns internal, external and ecological validity. These deal with questions of causality (internal validity), the securing of which is one of the assets of the Solomon four group design, generalisation (external validity), which the sample selection allows for, and applicability (ecological validity). These issues are further discussed in the discussion (chapter 5).

SUITABILITY

According to Verschuren and Doorewaard (2010), the choice of research strategy is primarily dependent on three choices. The first is between breadth and depth. As they put it: "whether you want to gain a broad overview of the discipline that you have selected, or whether you are more interested in a thorough investigation of all the aspects of a phenomenon spread out over a span of time and space" (Verschuren & Doorewaard, 2010). The second key decision is whether one wants results to be quantified and the third the choice between empirical and desk research (Verschuren & Doorewaard, 2010).

For this research, the choice has been made for depth, partial quantification and empirical research. The mixed methods that have been employed suit the topic of sustainability education in Ahmedabad, because it gives the opportunity to triangulate results and present quantified results in their respective context. It is especially necessary to include qualitative methods because of how foreign the Indian education context is to me. If I would have only done the experiment without consulting local experts in the process of doing and interpreting it, it is very likely I would have misinterpreted outcomes.

CHAPTER 4 – RESULTS



4. RESULTS

This section discusses the results of this research. The chapter is structured following the sub-questions formulated in chapter 1.4:

1. What is the current state of ESD in India, Gujarat and Ahmedabad?
2. What type of sustainability competences are desirable for high school students to develop?
3. What is the role of systems thinking in developing these competences?
4. What is the effect of the mystery exercise in developing sustainability competences?
5. To what extent are the methods used suited to assess high school students' sustainability competencies?

These questions are answered in pursuit of the answer of the central research question of this thesis: To what extent does systems thinking in ESD influence other sustainability competences of high school students in Ahmedabad, India?

Table 9 shows an overview of the methods used in answering the sub-questions. The answers are given using themes that were established when sorting and coding the results.

	Document analysis	**Literature review**	**Conference**	**(Non-) participatory observation**	**Semi-structured interviews**	**Experiment***
SQ1	X		X	X	X	
SQ2		X	X		X	
SQ3		X			X	
SQ4						X
SQ5				X	X	X

* Experiment data will be resulting from ex-ante and ex-post measurement by survey on sustainability competences and knowledge.

Table 9. Methods used for different sub-questions. Further explanation under research strategy.

Sub-question 5 is not included in this chapter. The answer to the question of the methods' suitability was included in the methods chapter (particularly section 3.3 on operationalisation) and the recommendations in the conclusion (chapter 6).

4.1 THE CURRENT STATE OF ESD IN AHMEDABAD AND GUJARAT

This section provides an answer to sub-question 1: **What is the current state of ESD in India, Gujarat and Ahmedabad?** This question is answered using data from semi-structured interviews, where applicable complimented with data from document analysis, the ESD conference, literature and (non-) participatory observation (see table 9). This section is sorted into six themes: the National Curriculum Framework (NCF), incidental versus structural EE/ESD, the teacher, assessment, the textbook, and differences within India, Gujarat and Ahmedabad. An answer to sub-question 1 is given in the conclusion of this section.

Name	**Role within CEE**	**Expertise**
Harshal Korhale	Project coordinator Swacchagraha	Education policy, field experience at schools.
Ketki Gadre	Project leader waste group	Field experience at schools.
Madhavi Joshi	Youth Coordinator	Education policy, international ESD developments, CEE organisational strategy.

Partesh Pandya	CEE West	ESD as a pedagogy, long-term transition plans for schools, Gujarat-based ESD.
Pramod Sharma	Project leader Handprint and Paryavaran Mitra	ESD competences, CEE organisational strategy, systems thinking, teacher training.
Rajeswari Gorana	Project leader Children's Media Unit	Education materials, systems thinking, environmental education, international ESD developments.

Table 10. Overview of interviewees and their roles and expertise within CEE.

The first sub-section discusses the NCF, an ambitious policy document of/about the Indian education system that provides ample space for ESD to develop. This section discusses the interviewees' ideas about this document and its implementation. The section on incidental versus structural EE/ESD goes into the way in which EE and ESD are taken up by the schools, is this happening only on a project-basis or is it fully infused into the school practices? The sections on the teacher, assessment and the textbook discuss the roles of these elements in Indian education practices. The last section goes into the extent to which the interviewees think there to be differences within India, Gujarat and Ahmedabad. Table 10 gives an overview of the interviewees for this study.

Overall, this section shows that the interview respondents agree on the importance of documents like the NCF and underwrite the general sentiments voiced in it. However, they see challenges in the implementation of these thoughts in several segments of the education system. These challenges mainly stem from the lack of popularity of the teaching profession, the hierarchy in classrooms and the mindset of teachers.

THE NATIONAL CURRICULUM FRAMEWORK (NCF)

One of the main positive points raised by almost all interviewees concerns the National Curriculum Framework (NCF) that was put in place in 2005 (NCERT, 2005). This document outlines a framework for education in India, with five "broad aims of education" and five "guiding principles for curriculum development":

Broad aims of education:

- Independence of thought and action
- Sensitivity to others' well-being and feelings
- Learning to respond to new situations in a flexible and creative manner
- Predisposition towards participation in democratic processes
- The ability to work towards and contribute to economic processes and social change

Guiding principles for curriculum development:

- Connecting knowledge to life outside of school
- Ensuring that learning shifts away from rote methods
- Enriching the curriculum so that it goes beyond textbooks
- Making examinations more flexible and integrating them with classroom life
- Nurturing an overriding identity informed by caring concerns within the democratic polity of the country

Text box 5. Broad aims of education and guiding principles for curriculum development taken from National Curriculum Framework 2005 (NCERT, 2005).

The NCF is the result of critiques on the Indian school system that it was too demanding and "a source of burden and stress on children and their parents" (NCERT, 2005). The document outlines a constructivist vision

on education, with lots of attention for the values of diversity, democracy, environment and peace (NCERT, 2005). The notion of constructivism is here used by explaining learning as 'meaning making', so not just teaching facts, but having the learners construct their own opinions from the material supplied by the curriculum (NCERT, 2005). Although the respondents consider the ideas behind the documents good, they do not see it reflect in day-to-day practice at the schools.

> The curriculum framework is a very very intention document. The curriculum framework only guides the one who makes the syllabus, you know the framework, and the person who writes the textbook. So you know, you can always suspect if all the good intention of the curriculum framework, if it actually translates into […] let us say, designing the syllabus, designing the text books, and then finally for the teacher to be able to, you know, translate it in the way it is envisioned in the curriculum framework. – Rajeswari Gorana, Annex 7.

One of the main elements of the NCF is the integration of subjects. The framework states that "[t]his NCF recommends the softening of subject boundaries so that children can get a taste of integrated knowledge and the joy of understanding" (NCERT, 2005). When asked whether this specific element is reflected in practice, most respondents answered with a giggle on the wording of the quote and then made clear that this was not at all the case. Gorana says first science should be integrated – a biology teacher and a chemistry teacher should be able to communicate – before you can talk about integrating subjects. According to Pandya, integration is not happening because even though the NCF does not know subject boundaries, its output is still a curriculum and a textbook that is defined for a subject, within boundaries. Joshi links it to the teachers and says they are often unable to pull in people from outside of their subject, unless it is for a specific project. As such, she says, integration does happen a little bit, but then only within these projects.

When I asked Sharma about the teacher's understanding of the NCF he interrupted me saying: "you need to understand, it didn't reach the teacher. The essence of it. It got lost. Because there are so many layers, by the time that it reaches the classroom, there are so many layers in between" (Pramod Sharma, Annex 7). Beyond the lack of dynamics between layers of education policy, Gorana reminds us of structural issues at least a part of the schools in a country like India struggle with:

> In the ways things operate in India, so teacher preparation is another weak link in all of this. And of course, there's a lot of structural challenges, like you know there are a lot of first generation learners, classrooms are overcrowded, you know, and that there are not enough resources in a school, not enough textbooks, so that are also the issues. So all these also play a part in how a good document cannot actually be translated into – […] It doesn't make a difference to a child. – Rajeswari Gorana, Annex 7.

Not everyone was one-hundred percent positive about the NCF. Pandya criticises the length of the document and asks why there cannot just be some bullet points. When using myself as an example he says: "Teachers should know what Floor is, that's it. That's my curriculum" (Partesh Pandya, Annex 7). Instead of requiring a student to develop him or herself to do well within a curriculum, the curriculum should be the student itself, who is the student, what are his or her qualities and what is his or her future (Partesh Pandya, Annex 7).

In literature, the NCF and government educational policy in general are seen as strong points of the situation around ESD (Pandya, 2016). Ravindranath (2016) reviews how environmental conservation is in the Indian constitution and environmental education is anchored into multiple directives and Supreme Court rulings. Additionally, she describes how the government of India is shifting from EE to ESD and recognising the latter as a driver towards sustainable development (Ravindranath, 2016). However, the main weaknesses of ESD implementation discerned by Ravindranath (2016) also concern government policy. The funding available is less than necessary and at the same time underutilised, which signals a lack of coordination. The added value of involving community is seldom seen, especially youth is not included in ESD policy and implementation.

In sum, the NCF has great potential concerning the development of ESD in the curriculum, but as it is now, this potential is not realised. Due to the layers in between the policy and the learner, structural challenges like overcrowded classrooms, and a lack of flexibility on the part of the teachers, the ideas from the NCF fail to translate into daily practice.

INCIDENTAL VERSUS STRUCTURAL EE/ESD

In general, environmental education and ESD have entered the classroom. In 1991, the Supreme Court ruled that EE should be compulsory in the formal education system (Ravindranath, 2016). However, Ravindranath (2016) signals that the integration of EE did not happen right away and after a period of high non-compliance, in 2003 and 2004 steps were taken to ensure states could be punished if they did not comply. This, according to Ravindranath (2016), greatly accelerated the integration of EE into formal education. Because of the Supreme Court ruling, schools need to publish reports on their EE activities, which I also noticed during the experiment, where teachers and school leaders were eager to hear what theme the exercise would be on, so they could put it down as hours they exposed their students to EE.

> The challenge [… is] how do you move beyond the symbolism associated with environment. So I won't call it lip-service […] because all those days and celebrations and short-term actions are also important, but how do you get them to understand a long-term perspective and the importance of children to get engaged. – Pramod Sharma, Annex 7.

When asked about EE and ESD being integrated into the curriculum or only done in incidental projects, Sharma – leader of the Handprint and Paryavaran Mitra programs of CEE – talked about a range within the schools, from some who do not engage beyond certain projects or competitions and others who work to integrate the environment into everything they do (See Annex 7). Gadre calls the schools that are more towards the incidental side of the spectrum 'in campaign-mode'. "If there is some competition happening, then they will surely participate, but if there's an entire process of project-based learning involved, then they will not" (Annex 7).

Sharma talks about how to get schools to share their progress with CEE and how they used to find it very difficult to get input from the schools. The big turn-around came when they started working with awards. This worked, because schools want to participate in competitions and do better than other schools. As project leader for the Paryavaran Mitra programme, that helps schools to incorporate ESD into their whole institution, Sharma was one of the people to assess these reports. Although CEE only receives the reports from the schools that are participating in the competitions, they also give an idea of what the other schools are doing. As Sharma states: "Those reports are an indication that the most motivated person and the best school is sending you that and that gives you an idea, […] if the best [schools are] doing this work, what the others must be doing" (Annex 7). Overall, the interviewees indicate that there are a few schools that are integrating sustainability in everything that they are doing, a few that are working with it systematically, many that are working with competitions and campaigns on an incidental basis and some that CEE has no clear idea of.

Bangay (2016) says there is "an urgent need to move beyond anecdotal and 'advocacy' driven research to ensure education maximises its contribution to sustainable development". In the same article, Banday (2016) makes a distinction between educational boards. He writes that environmental topics are relatively well integrated into the CBSE syllabi, the education board whose schools are mostly attended by middle class Indians, while much less is known on the integration into syllabi of the state boards (Bangay, 2016).

THE TEACHER

Throughout the interviews, the most frequently mentioned barriers to the successful implementation of ESD are the teachers and the teacher training they receive. This is found to be the main bottleneck for the dispersion of ideas from the NCF and the further integration of ESD into schools' daily practices.

According to Korhale, the main challenge of mainstreaming EE and ESD, as well as implementing the NCF, is the teacher. As he puts it: the NCF and "[t]he curriculum made a space, but teacher and education systems have not [gotten] this concept of constructivism very well". He is – in his own words – talking about the 'root cause', when he discusses that teaching is not a popular profession and that most of the people who chose this profession go into this direction because they "don't find admissions to other courses" (Annex 7). In the early nineties, more promising jobs entered India and the spending on education and social costs decreased, which decreased available teaching jobs as well. Although this development could and would potentially increase the competition for the existing teaching jobs, Korhale describes how it mainly worked to reduce the popularity of the educational programmes towards becoming a teacher.

> So, teaching is the profession which normally receives comparatively low quality human resources. You should say the so called low quality human resource, academically. [Teaching] becomes their last career choice. And expectations of curriculum makers are very high. So you will always find the differences of opinion and ambitions of the teachers and expectations of the curriculum. So this is the root cause, why it's very difficult to bring a new approach of education like the constructivism or these projects which talk about the behavioural change. – Harshal Korhale, Annex 7.

Korhale adds that of course there are exceptions to this, people who do find teaching to be their passion and who – if they are lucky – also find the schools that allow them to work with the new curriculum framework in a meaningful way, but in the end low qualitative human resource is the root cause of the difficulty to transform the education system: "unless and until becoming a teacher becomes a passion of many people, the problem will not be solved" (Harshal Korhale, Annex 7).

When asking about the predominant teaching style at schools in Ahmedabad, I got varied responses. Gadre spoke of differences between educational boards. In schools falling under the international, ICSE and CBSE board, she says, there are instances where the teacher speaks and the students listen, but also class and group discussions, as well as third parties coming in to tell the students about experiences outside of school. In state board schools however, it is the teacher talking and the students listening with few opportunities for the latter to discuss or give their opinion (Annex 7). I noticed this during one of the school visits, when a teacher at Cosmos Castle International School (CCIS) spoke about how the CBSE board made them prepare for each examination with two group exercises and two individual exercises, that were then contrasted with a pen-paper test to come up with a final grade (15/12/2016, Field work diary). From the level of the educational board, the school was made to have children work in groups. At the opening panel discussion of the ESD conference, Abdesh Kumar Gangwar, CEE employee stationed in the Himalaya office, discusses the difference between government schools and non-government schools when he asks if the situation would be different if all children of government officials would be made to attend government schools (GEM launch, 16-09-2016, ESD conference).

Gorana talks about the general hierarchy in the classroom: "The teacher will know, the teacher will teach, we will learn, and then […] we go to the next level. […] The teacher has answers for everything and the teacher cannot go wrong" (Annex 7). She adds to this an anecdote about her 5-year-old daughter's education:

> I have a daughter who is in first standard and she learns in the class, when I come and try to teach, being from CEE […], she says no, that is wrong. What my teacher says is right. […] So even when I try and teach her, I know that my daughter gets into anxiety: my mother is teaching me something new

> and if my teacher will ask and I will say something, my teacher will say this is not right. She's just in first standard, but she's already experiencing that. – Rajeswari Gorana, Annex 7.

Another dimension to this issue is teacher training. Gorana mentions the lack of contact between the NCERT and the National Council of Teacher Education (NCTE) and the educational boards that are operating the schools (like the CBSE, ICSE and state boards). Korhale talks about the quality of the training programs as a concern area and Sharma says that "all the content is in the textbook, all the everything is there, it is my [the teacher's] capacity to give that to the student, so it ultimately boils down to the capacity of the teacher" (Pramod Sharma, Annex 7).

According to Erach Bharucha, the two main problems in the implementation of EE and ESD are the teacher's world view and the teacher's gap in knowledge. (Plenary: Inquiry-based approaches, 18-09-2016, ESD conference). When discussing teacher quality, Thomas Hoffman distinguished SD competences and ESD competences, in which the former are competences to participate in SD processes and the latter is the ability (of teachers) to create, design and realise lessons for students to develop SD competences (Workshop: Competences for SD and ESD, 17-09-2016, ESD conference, Annex 7). Teacher training should focus on developing these ESD competences within teachers, in order enable them to help students develop SD competences. The challenge of teacher training is also found by Ravindranath (Ravindranath, 2016), who assesses that although EE has been made compulsory in schools, it is still an optional subject in teacher training programmes.

During the field visits and the experiment, I did not find one predominant style of teaching, although this might have to do with the fact that I would attend classes from teachers working with CEE, that are somehow already affiliated with ESD. The teachers whose classes I attended did seem to change in style according to the board the school we visited belonged to, as was confirmed by Korhale. At the CBSE schools, and specifically the ones Korhale said to be more high-end, the teachers were more involved with the activities. Not seldom, they interrupted Korhale while he was speaking or broke in to his lesson to add examples or link the Swachhagraha project to other things they had been studying (19/10/2016, 25/10/2016, Field work diary). Teachers from the government and relatively lower-income schools seemed to be less active during the classes and did not interfere as much.

ASSESSMENT

Alongside these broader aims, the NCF also introduced a new system of assessment: Continuous and Comprehensive Evaluation (CCE), which Korhale describes as follows: "the teacher is supposed to mark, they do observation on the student in the given format, […] the academic performance in the classroom, the things the teacher could observe on the playground or maybe the assembly or the personal skills". However, he continues, "teachers are seeing it as just a data entry tool and […] teachers are just doing it for the sake of doing it or […] teachers are not doing it at all". According to Korhale, this could be the assessment tool for ESD, since it shows knowledge, skills and attitudes of a specific child which would allow you to redesign your pedagogy and lesson plan. But the true question for him again boils down to what was discussed above: "How are we going to change the mindset of the teachers?"

On assessment, Gorana talks about the importance of exams in the Indian education system. Until recently, from fifth standard onwards, every year students had to clear an examination to progress to the next standard. Because of this, Gorana claims, the teachers have come to focus a lot on the textbook, because this is the information that the students are tested on.

> What happens is, the textbook is given, the lessons are taught, children are supposed to learn those lessons, at the end, there will be a test based on the lessons and at the end, you clear and you go. Now, in a situation like this, if you want to translate a very intentional document like NCF, which says

> we should follow constructivism, we should invite elders, you know, we should look at different abilities in a class - it is not possible. It is not possible. – Rajeswari Gorana, Annex 7.

A further problem is – as Hannes Siege mentions during the conference – that often the amount of ESD in the school system is being measured by use of input indicators, such as the number of courses in the curriculum that discuss sustainability. However, these indicators do not say anything about the extent to which this information reaches the students or the level of their competence (Plenary: Shared vision for a sustainable world, 18-09-2016, ESD conference.

During the field visits and the experiment, I found that at some of the schools, the pressure of teachers on students to do well was quite high. At St. Kabir NAR for instance, the teachers are very eager to hear from me what the students can improve from the experiment and they call out to the students that they must try their best and show they are 'St. Kabirians' (30/11/2016, 6/12/2016, Field work diary). There seems to be no shame for students in doing well. After the class I attended at Calorx public school, the teacher said "they are very good students", after which the entire class sat up straight and smiled proudly.

On the topic of assessments, literature discerns three separate concerns. The first is voiced by Bangay (2016) when he describes the importance of exams in India and that the extent to which environmental education is incorporated into examinations lacks clarity. The second concern considers assessment of ESD processes. Ravindranath (2016) writes that there is insufficient monitoring, evaluation, and documentation when it comes to EE and ESD processes, which is needed for their development and improvement. The last concern considering assessment is again brought up by Bangay (2016) who names the "inherent tension between individual exam performance and collective environmental action". When the first barrier is the measurement of individual sustainability competence, the next will be to assess whether and how this translates into collective action.

THE TEXTBOOK

Since the NCF has come out, a change has been visible in the textbooks that are being used in schools. As Korhale states, the new textbooks do not prescribe arguments to be wrong or right, but rather come up with different accounts of a situation (Annex 7). This was a change from the general school atmosphere where the teacher speak and the student remembers, but as Gorana described her daughter's situation earlier, this is not happening a lot. Korhale described how the intention for this change was certainly given in 2005, but also signals that today, the practices from before the NCF are still continuing (Annex 7).

Gorana, who has analysed textbooks as a part of her role at CEE, mentions the lack of continuity in textbooks.

> If you talk about, atmospheric gasses today, tomorrow you should be able to talk about [..] greenhouse gasses, and in the third level you should be able to talk about impact of global greenhouse gasses on [the] water cycle. So you need to improve the complexity. [..] If there is a continuity, or if there is an increase in complexity, [then] you can bring systems thinking. – Rajeswari Gorana, Annex 7.

There is also the issue of who is writing the textbooks. When Sharma did his PhD-research on assessment, he noticed that "the social sciences textbook reflected sustainability thinking, but from a social side or economic side. [In the] science textbook it was totally lacking". When asking why, it turned out that the social science books were written by educators instead of scientists. Sharma continues: "The larger purpose of education is to engage with issues of society in presence and future. So you find all that content, but since they don't understand it, they don't draw the linkages or put it as a coherent context" (Pramod Sharma, Annex 7).

On the one hand, links are not being made and on the other, there is a lot of overlap in textbooks. Sharma recalls a time he was invited to work on an environmental education textbook and a group of professors was

each assigned a certain topic for a chapter. When finalising the book, they found that there were lots of phenomena described in multiple chapters, without referring to each other. So before even thinking about making links between textbooks, the continuity and connectivity within the textbook can be an issue.

In general, Indian education is centred around the textbook, which is connected to the centrality of exams discussed earlier. The textbook is also a shared resource for both the student and the teacher, so there are no separate teaching methods. As Gorana puts it: It [predominant teaching style] is textbook based, for one. Whatever is in the textbook is certainly taught in the classroom [… and] if you know the textbook, you can clear that [examination]". This authority of the textbook is also at the heart of an anecdote told by Kartikeya Sarabhai, director of CEE, at the ESD conference: "When a girl gets asked in class what birds eat, she replies: 'birds eat cows'. [She has seen vultures eat cow carcasses in time of drought and puts one and one together], This is correct, but the child will fail, so the bird will eat what the textbook says it eats" (Plenary: Partnership for the Global Action Programme, 17-09-2016, ESD conference). Like Gorana, Sarabhai illustrated that the authority of the textbook is at least partly due to the centrality of exams.

Gadre also finds differences between educational boards when it comes to the use of different teaching resources:

> So international boards are generally the good schools, they have a lot of infrastructure, facilities, as well as learning and exchange opportunities that the students are exposed to. […] Teachers rely on the age-old teaching methods, that is the textbook, as well as they are utilising the new technologies that are coming in. […] They are taking a lot of field visits, whether it is a factory, manufacturing factory or say a forest, so understanding biodiversity or taking them to a dump site to understand how the city sanitation or the waste management system works. […] Similarly I would say that the CBSE and ICSE do try to do this kind of methodology and they are, in this particular matter, at par with the international board. [..] But in state board again depending on the vernacular language, the state language, there is a difference between the state-run English-medium schools and the state-run vernacular languages. So the English-run schools will still have a component of maybe one or two field visits or they may have computers but not really smart classes or smart boards at their disposal, while in vernacular languages is just the textbook. – Ketki Gadre, Annex 7.

In her piece on developing textbooks in India, Pandya (Pandya, 2016) confirms the statements made by respondents above in saying that "the teacher teaches what is written in the textbook, lesson by lesson, and limits recapitulation and evaluation to what is given as exercises at the end of each lesson" (Pandya, 2016). One of the impacts of the NCF on Indian textbooks, the author discusses, is the focus on 'themes' instead of 'topics', "which allow[s] for a connected and interrelated understanding of different aspects of different environments – national, social and cultural – to develop" (Pandya, 2016). Considering environmental studies textbooks, she finds that some of the vanguards of the DESD were taken into account, but still finds deficits when it comes to connections between different disciplines, the handling of plurality of Indian society, the discussion of sensitive subjects, and the connectivity to students' daily lives (Pandya, 2016). Another challenge that is discerned here is the extent to which teachers will be able to utilise the new textbooks (Pandya, 2016).

DIFFERENCES WITHIN INDIA, GUJARAT AND AHMEDABAD

Considering differences within India, Gujarat and Ahmedabad, there was lots of variance in the answers of the interviewees. Korhale said that instead of seeing states to be a variable, one should look at different kinds of schools: high or low-income, private or state-owned. Considering the difference between Ahmedabad and the rest of Gujarat, he thinks the proximity of the headquarters of CEE will definitely have an impact on the prominence of ESD in the schools (Harshal Korhale, Annex 7). Pandya comes up with another distinction when he talks about the difference between urban and rural areas.

> The small kids, in the village, their fathers are the farmers [with] a small piece of land, they are doing farming. […] They don't care what they're teaching in the schools. Why? Because their connection with the schools is not for the livelihood. […] And then in the city area, where the parents don't have any [other] option for the livelihoods rather than doing some job. […] So both concerns is about the livelihood. So not the schools, or the parents, or even teachers, or even systems are even talking about what are the life skills and what are requirements, [because] both are very much concerned with the livelihood. – Partesh Pandya, Annex 7.

He stresses that it is not a question of urban and rural, but purely of livelihoods. A farmer who knows their child will have a secure livelihood at their farm will not push his or her child to do well in school, while in city areas, your child's livelihood is (at least partially) dependent on the height of their marks. As an example, he mentions how in Gujarat, one of the wealthier states of India with a literacy rate of 77 percent, only 12 percent of people are finishing their full fifteen years of education, while in Bihar, the poorest Indian state with 65 percent literate people, this number is 14%. One explanation Pandya has for this is the Gujarati mentality or culture. All over the country, Gujarati's are known for their business minds and – as Pandya explains – this also shows in students dropping out of school earlier to start their own businesses or work for their families' ones. To get back to the livelihoods, it is not necessary for them to graduate to secure an income.

Where Korhale and Pandya found it difficult to generalise geographically, Sharma – who has experience working with schools all over the country – answers my question on geographical differences differently: "Yes, yes, yes, yes. You just hide the name of the school and give me a report and I will tell you from what part of India the school is. To that extent we know that" (Pramod Sharma, Annex 7).

> Because, that is the other thing that happened when I shifted from a regional office, to a national and then we started looking at all the reports, because in the initial phase we weren't looking at [that]. […] So we find that as we move North from South, it's more, Southern states have taken it seriously, small curriculum week, small project group, as you move North, there is more symbolism, more photo-opportunities, less depth in their work. And so that difference in terms of engagement is visible. – Pramod Sharma, Annex 7.

Within Gujarat he mainly sees a difference in Ahmedabad due to the vicinity to CEE. "It takes two to three years for a school to really get into project based learning more. And, so, the school which are in our vicinity get more exposure, more interaction, more sharing between them compared to other places, so that difference is visible, that difference is there."

During the GEM report presentation at the ESD conference, Aaron Benevot discussed how education inequalities within cities are as big if not bigger than between cities and rural areas. He especially accredited this to an uneven distribution of quality of teaching (GEM launch, 16-09-2016, ESD conference). Ravindranath (Ravindranath, 2016) speaks of how schools without good facilities have more trouble implementing EE and ESD. Additionally, she mentions how the diversity of India asks for region and target group specific programmes in order to fully engage learners in ESD processes (Ravindranath, 2016).

During school visits, differences were visible between schools. With regard to the schools I have visited (see Annex 4), I noticed the amount of sustainability related activities that seemed take place. In one of the schools, students had worked with plastic bottles to make holiday decorations, in another there were quotes about the environment hanging on the wall, and again in another, there were posters made by students on the theme of earth day.

CONCLUSION

The formal state of ESD in India and Gujarat is arranged relatively well: Environmental education is a mandatory subject in schools, there is a reflexive and flexible assessment system since the implementation of

the CCE, and the overall government view on education expressed in the NCF 2005 is revolutionary internationally in its consideration for child-centred learning, interdisciplinarity, and the space it provides for mainstreaming ESD (Wals & Kieft, 2010). However, this is not translating into learners' experiences due the failed translation through the layers between the learner and the government. These layers include the contact between government and education bodies and boards, the curricula, the textbooks and the teachers. The education system is said to give a central role to teachers, textbooks and examinations, which is said to make it even more difficult to make change disseminate into the system.

The respondents spoke the most about the role of the teacher and teacher training. Structural issues they signal are the inadequacy of teacher training, the lack of popularity of the teaching profession, the hierarchy in the classroom where the teacher is always right, and the general mindset of teachers that work strictly out of the textbook, because this is what will be assessed at the exams.

In sum, ESD is currently rather incidental then structural, differences between schools are due to structural issues (like availability of proper facilities and learning supplies), the educational boards they are governed by, whether they are private or public schools, and their proximity to (non-)governmental organisations working on ESD.

4.2 SUSTAINABILITY COMPETENCES FOR HIGH SCHOOL STUDENTS

This section will provide an answer to sub-question 2: **What types of sustainability competences are desirable for high school students to develop?** This question will be answered using data from literature review, the ESD conference, and semi-structured interviews (see table 9). This section is sorted into two themes: the definition and purpose of ESD, and key competences for ESD. The literature review on this topic has been discussed mainly in section 2.2 of the last chapter and will be summarised before giving an answer to sub-question 2 in the conclusion of this section. Furthermore, a summary of the literature review is given in Annex 6.

The main output of the literature review discussed in detail in chapter 2.2 are the importance of spatial, temporal, disciplinary and cultural competence as both elements and drivers of systems thinking competence. Out of the selected articles, these were conceptualised as these themes came back throughout the selection (see table 2 in chapter 2.2). Aside from the competences that were deemed important with respect to systems thinking, competences that returned in multiple publications included include action competence, empathy, normative or ethical competence, teamwork or conflict resolution, motivational competence, creative competence, and implementation skills (Brundiers et al., 2010; de Haan, 2006; Hofman, 2015; OECD, 2005; Rieckmann, 2012; Sipos et al., 2008; UNECE, 2011; Wiek et al., 2011).

Overall, this section shows that the interview respondents mainly find general competences not specific to ESD to be the desired outcomes of ESD processes and put an emphasis on decision-making processes.

DEFINITION AND PURPOSE OF ESD

As discussed in chapter 1.1, ESD can be interpreted as either instrumental or emancipatory (Wals, 2011). The instrumental approach has an emphasis on content, while the emancipatory approach focuses on competence. Although all interviewees adhere to the competence approach, they show some variations in way they define ESD and its purpose.

There are some differences in the way the respondents define ESD. Korhale focuses more on the social sciences part of it and feels that sustainable development and in particular ESD can bring utility to social sciences. According to Korhale, ESD helps to bring more attention to social issues, by connecting social issues like gender equality to environmental and economic challenges as done in the SDGs. The purpose of ESD then, he

continues, is to create sensibility towards social problems. Examples mentioned here are the Indian caste system and untouchability, as well as the Hindu-Muslim problem in India. He says that he hopes that ESD as a new concept, might attract teachers and the rest of the education systems to touch upon issues of gender, well-being and the other SDGs more (Harshal Korhale, Annex 7).

Sharma defines all of ESD as a competency for the teacher: the ability to give someone perspective.

> It is everything, for me now, it is the ability to give […] perspective. [...] When you interact or engage, […] can you bring in the social perspective, the environmental perspective, ecological perspective, economy perspective and understand that what is the cultural context to it? That for me is ESD. And the moment I say that means that you are giving a competency. – Pramod Sharma, Annex 7.

Sharma's definition of ESD has some overlap with Pandya, who speaks of the 'what' becoming 'how'. So instead of looking at what something is, ESD is about learning what it can mean in different contexts. He describes how a learning process should be ESD and have mutual understanding central, rather than what is true (Partesh Pandya, Annex 7).

Gadre sees ESD as a means for sustainable development. To her, education and students are an essential part of leap frogging towards sustainable development, without taking the classic route of development Western countries have taken earlier. She says the process is the most important part of ESD and claims that "unless and until a student really goes through the process, he will not understand how and why it [sustainable development] really needs to be done" (Ketki Gadre, Annex 7). This is similar for Joshi who stresses that the term is Education FOR Sustainable Development, and thus ESD should be about the content, but especially about delivering the content in a way that enables people to make critical choices (Madhavi Joshi, Annex 7).

When asked about her definition of ESD, Gorana goes into the difference between EE and ESD:

> Many felt that […] what we call EE in India, is already ESD. Because […] when you're talking about water, you are already talking about who accesses water, what is the water going to do for a farmer, how does it affect your health, so already there was an interface that had the environmental, the social, the economical and the cultural aspects included. So many people at that time, I was a new joinee, argued that what is this new term, we are doing EE perfectly and EE for us involves everything, what is being defined as sustainable development is a very Western concept, you know, we already have it. – Rajeswari Gorana, Annex 7.

In the end, Gorana describes, CEE started communicating what they had been doing for EE as ESD. The main shift was the change in jargon and Gorana says that to her – like most CEE people – ESD and EE are pretty much the same. However, as Erach Bharucha mentions during the ESD conference, there is a difficulty here as the mandate that exists in India is specifically for EE, and not for ESD (Plenary: Inquiry-based approaches, 18-09-2016, ESD conference, Annex 7). So this makes for a situation in which the use of the term ESD suits better with international events, while domestically, working on EE is anchored in policy. This is similar to the way Gorana describes CEE's current view of ESD:

> CEE […] believes that you should do an active learning approach, that you should take the context into account, that you should also appreciate that the learner himself has some knowledge and experience in it. Building that into the learning process is important. So, I guess, for us ESD is both about content and about the processes. – Rajeswari Gorana, Annex 7.

She does add to this that she believes that ESD thinking has to be further widened, more towards citizenship education: "it needs to certainly include what do I do, what can I contribute, how do I act as an individual, as a collective entity for a global cause or let's say for a wider cause" (Rajeswari Gorana, Annex 7).

In conclusion, the differences between the interviewees are not large, although Pandya's full focus on process, diverts from the others. All respondents find ESD to be emancipatory. Gadre does seem to see ESD as

instrumental, but adds that the only way behavioural change can be attained, is when people themselves understand how and why sustainable development should be done.

KEY COMPETENCES FOR ESD

In chapter 2.2, sustainability competence was defined as an ability desirable for participation in processes of sustainable development that a learner develops during, through and because of a learning activity.

Looking at situations from different perspectives and global citizenship come back multiple times, during the interviews, as well as at the ESD conference. Reiner Mathar adds some more perspectives to this when he speaks of the need to review situations from different generations, region, cultures, disciplines, historical periods and one's own perspective (Plenary: Global citizenship for a Sustainable World, 17-09-2016, ESD conference). This fits the spatial, temporal, disciplinary and cultural competence earlier discussed in chapter 2.

When asked about key competences for ESD, Korhale and Pandya both talk about life skills. According to Korhale, this concept includes problem solving, critical thinking, team work, social intelligence and empathy. He says that the "education systems should look for creating different opportunities for students, where they can be exposed to the diversity across the world. […] Different sets of people, their lifestyle, their values […] which would help students to understand the nature of the changing world" (Harshal Korhale, Annex 7). Pandya adds conflict resolution and having an opinion to this list of life skills and emphasises that the development of life skills is a life-long process, that does not start or end with going to school.

Gadre judges knowledge, attitude, disposition and behavioural change to be the ESD outcomes you want to see in a student (Ketki Gadre, Annex 7). For Sharma, it is very close to the definition of ESD, giving a perspective. Education, to him, is reflection, thinking and questioning. Like Korhale and Pandya, Sharma mentions life skills, but he mainly goes into ESD as a competence for educators as the ability to give a learner perspective. Gorana mentions a set of skills that has some overlap with the life skills earlier mentioned:

> For me, the competencies would be leadership skills, citizenship skills, to be able to synthesize information and act in a particular way. You know, to be able to communicate, you know, there are many of course, value and judgment, there are many and these are essential. – Rajeswari Gorana, Annex 7.

Using an example about transportation, she explains that the goal is for a student to realise that they have a choice and to have the information to make an informed decision (Rajeswari Gorana, Annex 7).

All respondents somehow include a combination of value, judgment and decision-making into their idea of sustainability competence. Empathy is mentioned by Korhale and Pandya discusses forming an opinion. Joshi claims that being able to think differently is the most important thing, empowering students to make critical choices and giving them a context to do this is (Madhavi Joshi, Annex 7). The interviewees point towards sustainability competence being – among other things – the ability to connect fact and values to shape informed decisions toward sustainable behaviour.

CONCLUSION

In order to establish the learning outcomes that ESD should have, this chapter first discussed the definition and purpose of ESD. Main differences between the interviewees consist of the focus on social sciences versus natural sustainability, and the distinction between ESD *as a goal of* sustainable development and ESD *as a means to* sustainable development. The dichotomy between the social and natural side of ESD is mainly visible when comparing statements of Korhale and Gadre. Korhale clearly focuses on the social side of the spectrum, while continuously refers back to the importance of education for sustainability. The distinction between ESD

as a goal and a means is mainly seen between Pandya (goal) and Gadre (means). For Pandya, ESD is primarily about processes and the way education is shaped, while Gadre it is also about transferring the urgency of sustainability issues and giving students ways of working on these. The other respondents talk about both sides of this spectrum.

In comparison to the competences found in literature, the interviewees, as well as the discussion at the ESD conference, focus on more general skills. This can be explained by the clear focus on systems thinking in the literature review. When comparing the interviewees' statements with the competences found in the primary literature review (the ones that were not further discussed in the theoretical framework), there is more overlap. Notable competences brought up by the interviewees include life skills (as a collection of more general competences such as problem solving, conflict resolution, critical thinking, team work), leadership skills and the ability to process information. Wiek et al. (2011) explicitly do not use these more general types of competences, which they find to have overshadowed specific sustainability competences. As they state: "This distinction [of competences and key competences] does not imply that 'regular' competencies, such as critical thinking and basic communication skills, are not important […], rather, it emphasizes the competencies considered essential for sustainability that have not been the focus of traditional education and therefore require extra attention" (Wiek et al., 2011, p. 204).

In general, the competences found by the interviewees are sooner traditional education competences than key sustainability competences. One aspect that came back for most of the interviewees was the combination of value and judgment. It is deemed important that – as a result of doing ESD – a learner is able to give value to different elements and situation in his or her life and distract a judgment from this.

4.3 ROLE OF SYSTEMS THINKING

This section will provide an answer to sub-question 3: **What is the role of systems thinking in developing these competences?** This question will be answered using data from literature review and semi-structured interviews (see table 9). This section is sorted into two themes: systems thinking in ESD and systems thinking to develop competences. The literature review on this topic has been discussed mainly in section 2.2 and will be summarised before the conclusion of this section. The full summary of the literature analysed on this topic can be found in Annex 6.

The most important results found in this section are that all interviewees see a role for systems thinking in ESD, some of them see an overarching role for systems thinking in ESD, and multiple interviewees emphasise the importance of guidance and evaluation when developing systems thinking skills.

SYSTEMS THINKING IN ESD

Discussing the role of systems thinking in ESD, all respondents agreed that this ability should be a part of it. According to Korhale, systems thinking or connecting dots as he simplified it to, should be both a means to ESD as well as an outcome:

> If [systems thinking is] the objective, then naturally, it would be your mean as well. If a teacher is expecting students [to learn] how local is connected to global […] then he is supposed to unfold different dots. […] [When] using connecting dots as a means, ultimately students end up in that mindset of connecting the dots, to see a development from a holistic perspective. So, this means and outcome as well. – Harshal Korhale, Annex 7.

Joshi agrees with Korhale's classification of systems thinking as both a means and an outcome to ESD: "to do an ESD process, you need to know how systems thinking is done" (Madhavi Joshi, Annex 7). Gorana positions herself as a great believer in systems thinking and agrees that systems thinking should always be linked to ESD.

> [ESD has to be] taught and learned and communicated in that way, because otherwise, […] how do you tell them that mosquito breeding, rains in September, my driving a car, that […] all these are connected. Who tells them? […] If the geography lesson says that if there are rains in September, then there will be crop loss and you stop there, then that is simplifying facts, which don't have any meaning. – Rajeswari Gorana, Annex 7.

Gorana concludes she would agree to all three of the options I posed: systems thinking as an outcome of ESD, a means of doing ESD, and as a driver towards the goals of ESD or competences. What she said next has been integrated into the final conceptual framework I came up with:

> Because maybe in the initial stage, you have to know what systems thinking is, so you have [to] really explain by giving examples. So, that way, you're talking about a particular way of looking at things or it's a means. But once having introduced that, you should be able to see how you actually examine certain cases while using this. So that is again another level of skill and finally that you should be able to see, to take action or to look in the larger perspective of real life situations in the systems concept. – Rajeswari Gorana, Annex 7.

Sharma argues that systems thinking cannot be a means, because there are certain prerequisites that need to be in place. The systems are always there, he describes, but the thinking also needs to happen to make it systems thinking. People participate in systems every day, but as long as they do not consciously experience it, systems thinking is not taking place. According to Sharma, in order to be able to consciously consider the worlds' systems, one needs a certain amount of basic information (Pramod Sharma, Annex 7). After discussing my conceptual framework and describing an instance in which I first got into contact with systems thinking in one of my classes, we come to the conclusion that maybe you cannot 'do' systems thinking without certain information, but you can experience it while someone else 'does' it:

> "It's also lot of exposure. […] The key word that you here use is experiencing. The more you experience, the more you are able to do it, kind of thing. So, how do you create the opportunity for children to experience it."
> – Pramod Sharma, Annex 7.

SYSTEMS THINKING TO DEVELOP COMPETENCES

After discussing competences for ESD and the link between systems thinking and ESD, I asked the respondents to combine these notions and think about the role of systems thinking in developing the competences we had earlier discussed. Korhale states that systems thinking does play a role, but not very directly. For Gadre, the role of systems thinking is in facilitating meaningful change in behaviour:

> Ultimately, if we are saying that we want behavioural change, then just the waste management behaviour is not going to help me reach a sustainable development, I need to have the behavioural change in sanitation, in water, in my attitudes towards the labour class who is working. So, behavioural change and systems thinking [are both needed for] ultimately reaching […] sustainable development. – Ketki Gadre, Annex 7.

Joshi goes deeper into the way in which systems thinking can play a role in developing the competences she defined earlier (the ability to make critical choices, to be empowered and to see things in context). She says that just doing systems thinking is not good enough.

> As you start thinking, you start getting more and more, deeper into that issue and then the complexity increases. So, that's where the problem is, especially with schools and students. […] Y]ou're getting them to think deeper, but then they also have to understand that there are no simple solutions to all the problems. So again, a good facilitator is required to do […] that. […] T]hey need to develop a pedagogy that takes them from say starting to understand to getting into deeper kind of enquiry of the issue. And I think it is, it definitely is an important process and it should be done. But I think it

> needs training. […F]acilitators, teachers, I think people need to know how to handle it. Because it is not an activity, because it, that is the danger with this one, or any of these activity-based learning approaches, because this is a very serious tool to be able to reflect. And reflection should become a part of learning. And after doing the systems thinking process, one, that loop, one needs to reflect. Every time. We did it once and then they go back, they do, they actually do, work in the field, come back. And then they sit and reflect. And then we do another systems thinking process, so you know, it has to get into deeper issues and more questions. And that's where the learning and critical thinking process will come. – Madhavi Joshi, Annex 7.

For Joshi, the competences will not come from doing systems thinking, but rather from the whole process around it and reflection on the activities done. She talks about how it can have adverse effects when systems thinking is taught without proper guidance, which links to Aaron Benevot's statements in the opening panel of the ESD conference, where he states that people often see education as a magical pill that can only have positive effect. He urged people to also consider the negative impact of education and not to overstretch what education can do (GEM launch, 16-09-2016, ESD conference, Annex 7). Joshi's focus on reflection fits Gorana's views on the role of systems thinking in developing leadership skills, citizenship skills, the ability to synthesize information and act in a specific way, the ability to communicate, value and judge. She goes as far as to say that when she would evaluate her own work and find that there is no systems thinking involved, she would say that is not good work (Rajeswari Gorana, Annex 7).

Pandya and Sharma are undecided about the role of systems thinking in developing sustainability competences. During our conversation, Pandya was thinking out loud about the question coming to the conclusion that life skills help built a systems thinking attitude. Life skills to him are really the essential things, the inputs for thinking in systems.

Sharma starts by saying systems thinking is an outcome of many competences. "For example, when a person is not able to think critically, how [will] that person […] think in systems? […] So you can see systems thinking as a competence, because, yes, it will reflect as a competency, but it requires many other competencies to be able to do it" (Pramod Sharma, Annex 7). He defines systems thinking as the ability to think of any issue in terms of cause and effect. "You can get gender perspective or a migrant perspective, anything, why it's happening, that kind of thing, so moving beyond the spatial understanding of it. Systemic, so connecting spatial parts of the earth is one way of looking at it" (Pramod Sharma, Annex 7). Before you can think systemically, Sharma argues, you need to understand the content of it and you need to learn about different perspectives to be able to make links between them. And that is where ESD comes in, giving perspectives.

CONCLUSION

Considering the role of systems thinking in ESD, most interviewees see it as both a means and an end to ESD. As Korhale puts it, it helps to see a situation holistically. Gorana goes the furthest in the role she awards to systems thinking when she says systems thinking should always be a part of every ESD activity you do. In the literature review, it was found that systems thinking is present in almost all of the articles listing sustainability competences, but it never has an overarching role. It is generally presented as one of multiple 'key competences' or even as a component of a larger collection of competences, as done by (Brundiers et al., 2010; de Haan, 2006; Sipos et al., 2008; Wiek et al., 2011).

The interviewees particularly stress the importance of being guided in developing systems thinking skills. Joshi discusses the importance of evaluation, as the place where the real learning takes place, and Gorana talks of the way systems thinking should be used to evaluate other ESD processes. Sharma concludes that systems thinking can be done without prior knowledge, but then has to be experienced. For this, a teacher is needed to give the student the different perspectives from which systems thinking allows one to see a situation.

When looking at the role of systems thinking in developing the earlier we see that two of the respondents do not see a role for systems thinking, as they view it as an activity needing prior (life) skills. Both Pandya and Sharma consider systems thinking to be an output of life skills and knowledge, rather than an activity or skill that would help develop this. Gadre connects systems thinking to behavioural change. She discusses how, in order to reach meaningful behavioural change, learners have to see how their behaviour impacts their surrounding and what they can do to change this. In this way systems thinking can be a tool in achieving behavioural change.

4.4 THE IMPACT OF INCREASED SYSTEMS THINKING SKILLS ON SUSTAINABILITY COMPETENCES

This section will provide an answer to sub-question 4: **What is the effect of the mystery exercise in developing sustainability competences?** This question will be answered using data from the experiment.

In this section, the quantitative data coming from resulting from the experiment will be analysed. The same measurement survey was used as pre- and post-measurement and a mock survey was used for the groups who did not receive the pre-measurement. The measurement survey consisted of four parts, outlined in table 11.

	Exercise	**Competence measured**	**Analysis**
Part I	Sequencing	Spatial competence Temporal competence	Analysed using SPSS in the first part of this chapter, first independently, then combined with part IV.
Part II	Linking SDGs	Systems thinking skills	Not analysed (as explained in chapter 3.3)
Part III	Picture the problem ('relating to pictures' and 'looking forward')	Disciplinary competence Temporal competence	'Relating to pictures' is analysed by comparing means, in the second part of this chapter. 'Looking forward' is not analysed (as explained in chapter 3.3)
Part IV	The odd one out	Spatial competence Disciplinary competence	Analysed using SPSS in the first part of this chapter, first independently, then combined with part I.

Table 11. Overview of exercises in measurement survey.

In the following, the way in which the different groups were composed will be described, after which an analysis of the different parts is given and some remarks are made on the overall results. The analysis is split up into two sections, one on the exercises analysed using parametric and non-parametric tests: 'sequencing' and 'the odd one out', and one on 'relating to pictures', which was analysed by comparing means.

GROUPS

As described in the methods section of this paper, the Solomon four groups design works with four groups, out of which two work as a classic experimental design: pre- and post-measurement with one group receiving treatment and one not receiving treatment. The Solomon four group design adds two more groups that indicate the effect of the pre-measurement on the outcomes in the post-measurement.

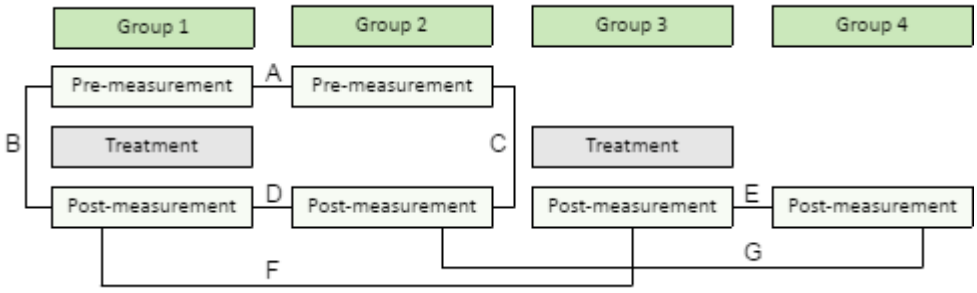


Figure 18. Visual representation of four groups out of the Solomon four group design and the links (A-G) that will be analysed in this section.

Link	Implication
A	This link is used to establish the compatibility of the groups. A significant effect would indicate that the groups are not compatible.
B	This link is used to establish the marginal effect when receiving the treatment. A significant effect would indicate an impact of the treatment.
C	This link is used to establish the marginal effect when not receiving the treatment. A significant effect would indicate a learning effect or external effect in the time passed between the pre- and post-measurement.
D	This link is used to establish the effect of receiving the treatment and the pre-measurement, compared to only receiving the pre-measurement. A significant effect would indicate an impact of the treatment.
E	This link is used to establish the effect of receiving the treatment, compared to no prior measurement. A significant effect would indicate an impact of the treatment.
F	This link is used to establish the effect of doing the pre-measurement before receiving the treatment. A significant effect would indicate a learning effect.
G	This link is used to establish the effect of doing the pre-measurement. A significant effect with higher scores for group 2 would indicate a learning effect.

Table 11. Explanation of the links from the Solomon four group design and the links (A-G) that will be analysed in this section.

The groups are made up out of the 8th grade of three schools: St. Kabir, Rachana and Cosmos Castle. Table 1 shows that the number of children coming from Rachana school is significantly lower than from the other two schools. This is due to the girls of this school being on an excursion the day of the pre-measurement, which left only the boys to participate in the experiment. However, as the students from the different schools are divided over the four groups and the means of these groups are used for analysis, this should not influence the results.

	St. Kabir NAR	Rachana	Cosmos Castle	**Total**
Group 1	15	10	13	**38**
Group 2	8	8	13	**29**
Group 3	13	9	9	**31**
Group 4	14	8	11	**33**
Total	**50**	**35**	**46**	**131**

Table 12. Representation of the three schools in the four groups (the groups with both pre and post measurement are made up out of the same students).

PART I AND IV – 'SEQUENCING' AND 'THE ODD ONE OUT')

In the following, the scores of the different groups are compared using independent and paired sample t-tests, as well as Mann-Whitney U and Wilcoxon tests. The results are shown in diagrams resembling image 1 and overview tables for which the colouring scheme shown below is used (see table 2).

Significant negative effect	Non-significant negative effect	No effect	Non-significant positive effect	Significant positive effect

Table 13. Explanation of the colour scheme used for the remainder of this section.

Paired samples t-tests are used for links B and C. Paired samples t-tests for the normally distributed data and Wilcoxon tests for the skewed samples. Link A, D, E, F and G are analysed using independent sample t-tests for the samples with normal distribution and Mann-Whitney U tests for the samples that are not normally distributed.

For the three different parts of the analysis (part 1, part 4 and the combination of both), images were drawn up to reflect the results of the different groups and seven different links (A-G) between these groups. Within image 11 and 13, the means and standard deviations for the groups are given, as well as the t-values and significance of the tests (independent sample t-tests for A, D, E, F, G and paired sample t-tests for B and C). In image 12, the mean rank and sum of ranks are given for each group, as well as the U-value (for Mann-Whitney tests for links A, D, E, F and G) and the Z-value (for Wilcoxon tests for links B and C).

The results are presented in three sections: 'sequencing', 'the odd one out', and the combination of both.

SAMPLING DISTRIBUTION

To distinguish whether the variables should be analysed using independent and paired sample t-tests or Mann-Whitney U and Wilcoxon tests, descriptives were generated to check the sample distribution. For the independent samples (link A, D, E, F and G) the descriptives of the variables are shown in table x. For the paired samples (links B and C), the descriptives of differences in means are shown in table x. Initially, histograms were plotted to determine the sampling distribution, but it was not entirely clear whether the charts were sufficiently bell-shaped. As such, the distribution will be judged using skewness descriptives.

	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
'Sequencing'	195	7,81	-,217	,174	-,635	,346
'The odd one out'	192	10,43	-1,809	,175	5,709	,349
Combination	189	18,22	-,705	,177	1,683	,352

Table 14. Descriptives of variables to determine distribution for independent sample tests.

Multiplying the skewness statistic's standard error by two, creates the range in which the skewness statistic should fall, if the sample is significantly normal (A. Field, 2009). This is the case for 'sequencing' (,174*2=,348), but not for 'the odd one out' (,175*2=,35) and the combination of both (,177*2=,354). This means that link A,D, E, F and G will be analysed using independent t-tests for the 'sequencing' exercise, and Mann-Whitney U tests for the 'odd one out' exercise, as well as the combination of both exercises.

	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Difference in means 'Sequencing'	67	1,55	,313	,293	-,985	,578
Difference in mean 'The odd one out'	65	1,06	2,520	,297	9,724	,586
Difference in means combination	65	2,05	,773	,297	,176	,586

Table 15. Descriptives of variables to determine distribution for paired sample tests.

For the differences in means, the normalcy of the sample distribution is determined in the same way. Here we again find that the 'sequencing' exercise is normally distributed (,293*2=,586), but the 'odd one out' (,297*2=,594) and the combination of both (,297*2=,594) are not. This means that link B and C of the 'sequencing' exercise will be analysed using paired sample t-tests, and the 'odd one out' and combination will be analysed using Wilcoxon tests.

PART I – 'SEQUENCING'

Part I of the measurement survey ('sequencing') is meant to test spatial and temporal competence. The respondents are presented with four groups of four pictures that they are asked to put into order. In the first, the pictures show the state of Maharashtra, the city of Pune, the continent Asia and the flag of India. In the second, pictures are given of a field that is being harvested, a supermarket, a transport truck and a field being sowed. The third group consists of a picture of the ocean, of a stream, of a river and the mountains. The last picture group consists of a newspaper, the news, a radio and a computer with Facebook on it. The first and third group are meant to specifically test spatial competence and the second and fourth to test temporal competence.

Per correct answer, each participant was awarded 3 points. In the 'sequencing' exercise, a respondent that had ordered one picture wrong received 1 point (this means the order was there, but one picture was misplaced. A wrong answer received 0 points. If a respondent did not fill out an answer, while the rest of the exercise was filled out, the respondent got 0 points. If the entire exercise was blank, the values were reported as missing and are thus not used in the analysis.

	Measurement	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Group 1	Pre	38	11	1	12	8,11	2,659	7,070
	Post	38	9	3	12	8,68	2,195	4,817
Group 2	Pre	29	9	3	12	7,41	2,368	5,608
	Post	29	8	4	12	7,28	2,562	6,564
Group 3	Post	31	11	1	12	7,55	2,767	7,656
Group 4	Post	33	9	3	12	7,39	2,318	5,371

Table 16. Descriptives for the 'sequencing' exercise.

From table 16, it shows that group 1 scored highest in both the pre- and post-measurement. Group 2's score declines in the second measurement, although the minimum goes up, so this is likely not to do with one outlier. The scores of group 3 and 4 are relatively similar, although group 3 scores a little higher than group 4 and quite a bit higher the post-measurement of group 2.

Independent and paired sample t-tests work in a similar way. When comparing the means of two groups from one population, it is assumed that these will not differ a lot. By chance, they will probably differ a little, but differences are expected to be small. In a t-test, the means collected from the data are compared to this assumption: equal means (Field, 2013). The standard error is used to assess how likely large differences are,

which results in a value t. In an independent sample t-test, two groups are compared on their means. In a paired sample t-test, groups are compared on the means of the differences between them. The degrees of freedom have been used to compute the effect size r (Field, 2013). Every value of r below .1 indicates no effect, a value between .1 and .3 a small effect, a value between .3 and .5 a medium effect, and a value larger than .5 a large effect (Field, 2013).

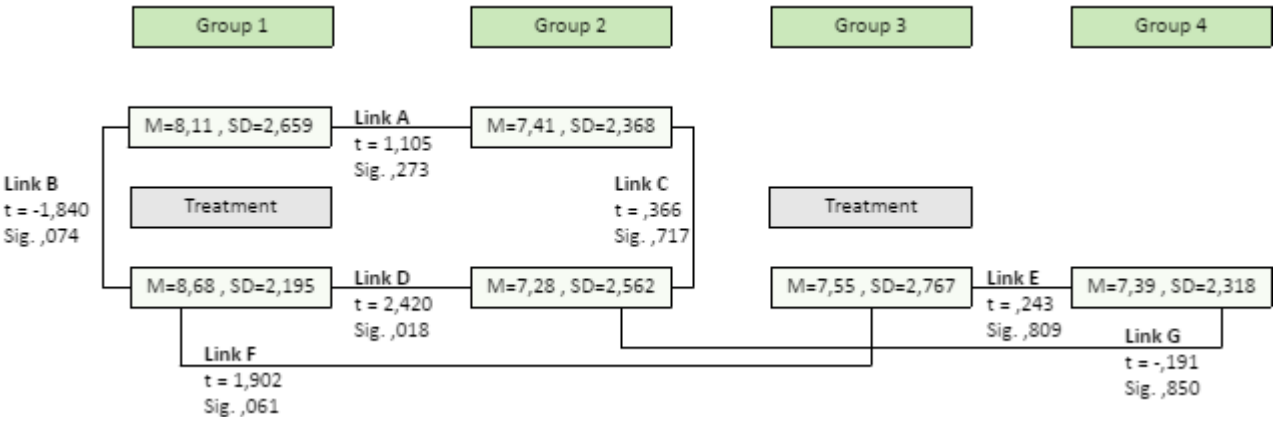


Figure 19. T-test results for the total scores of the questions of the 'sequencing' exercise.

Link	Effect found
A	Non-significant, small effect (p=.273, r=.14). Groups 1 and 2 are compatible. The r-value just exceeds the benchmark for a small effect.
B	Non-significant, small/medium effect (p=.074, r=.29). Group 1 scored higher after receiving the treatment.
C	No effect (p=.717, r=.07). Group 2 did not score higher in the second measurement.
D	Significant, small/medium effect (p=.018, r=.29). Group 1 scored significantly higher than group 2.
E	No effect (p=.809, r=.03). Group 3 did not score higher after receiving the treatment.
F	Non-significant, small effect (p=.061, r=.23) Group 1 scored higher than group 3 after having done the pre-test.
G	No effect (p=.850, r=.02) Group 2 did not score higher after having done the pre-test.

Table 17. Overview of (significant) effects found in links for the 'sequencing' exercise.

Link A indicates that groups 1 and 2 are compatible, although the effect size just exceeds the benchmark for a small effect (r=.14), so something of a difference in the groups can be found. The tests show a significant effect D, which would indicate that receiving the treatment has caused group 1 score higher on the post-test than group 2. Effect B, though not significant, has a relatively high effect size and shows the progress of group 1, where group 2 did not progress. This also indicates a positive influence of the treatment. An implication of group 1 already scoring high (as shown in the descriptives in table 16) is that there is less of an opportunity for them to improve after receiving the treatment, which might be of influence in link B not being significant. This positive influence of the treatment could be confirmed by a positive link E, but this is not the case. The combination of lacking of effects for link C and E indicate that there has been no learning for group 2 (one might expect this group to do better when they do the same exercises again). The small effect F would indicate that there was a positive impact of doing the pre-measurement for group 1, as their score is somewhat higher than that of group 3. This effect is not significant.

PART IV – 'ODD ONE OUT'

Part IV of the measurement survey ('odd one out') is designed to test spatial and interdisciplinary competence. The respondents are given four groups of four words and have to select the odd one out. The first group consists of the Rann of Kutch, the Sabarmati river, Ahmedabad and the Himalaya, the second of a bear, a tiger, an orangutan and a cobra, the third of a mall, swimming, a boat and fish, and the fourth of building houses, making pickle, generating energy and drying clothes. There are multiple options for the odd one out per exercise.

Per correct answer, each participant was awarded 3 points. In the 'odd one out' exercise, a respondent that had found a link, but not a very strong one (for instance with the animals: the cobra is the odd one out, because the others are all not snakes), they also received 1 point. A wrong answer received 0 points. If a respondent did not fill out an answer, while the rest of the exercise was filled out, the respondent got 0 points. If the entire exercise was blank, the values were reported as missing and are thus not used in the analysis.

	Measurement	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Group 1	Pre	38	6	6	12	10,21	1,803	3,252
	Post	38	4	8	12	10,71	1,659	2,752
Group 2	Pre	27	12	0	12	9,81	2,909	8,464
	Post	28	10	2	12	10,61	2,114	4,470
Group 3	Post	31	9	3	12	10,03	2,121	4,499
Group 4	Post	33	5	7	12	10,79	1,431	2,047

Table 18. Descriptives for the 'odd one out' exercise.

From table 18, it shows that again, group 1 scored relatively high in the pre-measurement, although this time the difference with the other groups is smaller and the highest score belongs to group 4. Unlike in the past exercise, group 2 improved in the post-measurement. The pre-measurement of group 2 and the post-measurement of group 3 score the lowest. The low score of group 2 could be due to a negative outlier, as the minimum score is 0.

In table 14 and 15, the data for 'odd one out' shows to be unevenly distributed, which makes it unsuitable to compare using means. Instead, Mann-Whitney tests and Wilcoxon's rank-sum tests were used. Both tests rank scores and compare the ranks between groups. If there is no or little difference between groups, the sum of ranks will be similar. The larger the difference, the larger the difference in sum of ranks (A. Field, 2009). Mann-Whitney tests were used for links A, D, E, F and G. Link B and C were analysed using Wilcoxon's rank-sum tests, which is used to analyse paired samples (A. Field, 2009). Both the Mann-Whitney test and the Wilcoxon rank-sum test rank scores low to high, meaning that the group with a lower mean rank, will have more low scores, while a group with a higher mean rank, will contain more high scores (A. Field, 2009).

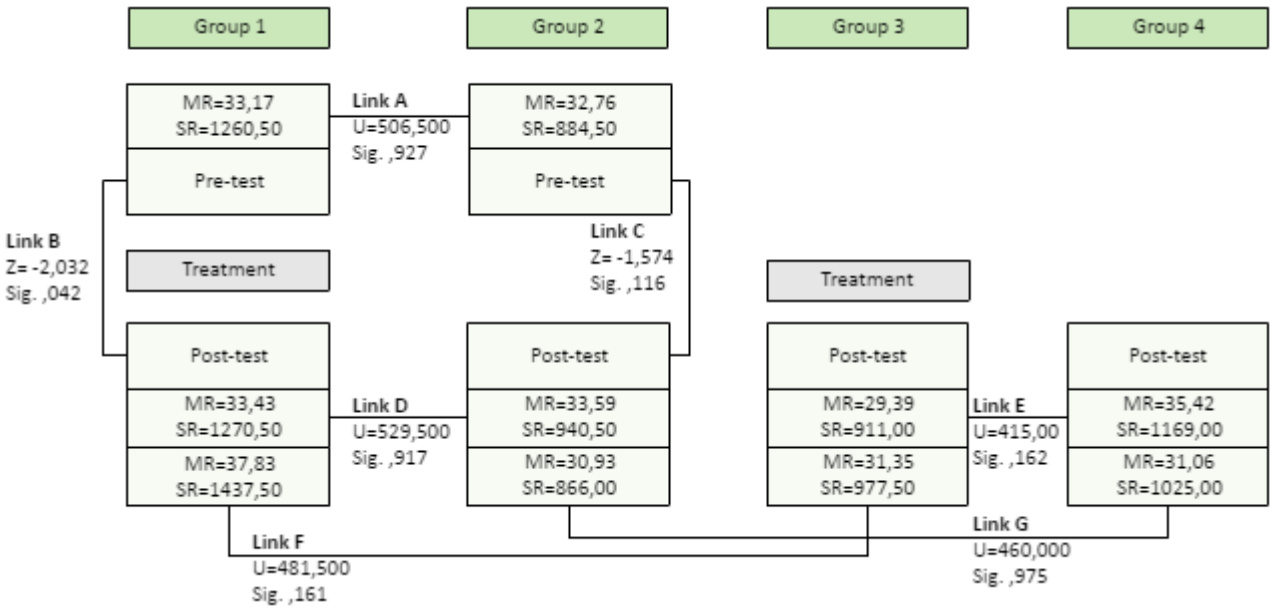


Figure 20. Results of analysis of total scores of questions in 'odd one out' exercise.

Link	Effect found
A	No effect (p=.927, r=-.01) Groups 1 and 2 are compatible.
B	Significant, medium effect (p=.042, r=-.33) Group 1 scored significantly higher after receiving the treatment.
C	Non-significant, small/medium effect (p=.116, r=-.29) Group 2 scored higher in the second measurement.
D	No effect (p=.917, r=0) Group 1 did not score higher than group 2 after receiving the treatment.
E	Non-significant, small effect (p=.162, r=-.17) Group 3 scores lower than group 4 after receiving the treatment.
F	Non-significant, small effect (p=.161, r=-.17) Group 1 scores higher than group 3 after having done the pre-measurement.
G	No effect (p=.975, r=0) Group 2 does not score higher than group 4 after having done the pre-measurement.

Table 19. Overview of (significant) effects found in links for the 'odd one out' exercise.

There is no effect for link A, which indicates that groups 1 and 2 are compatible. There is also no effect for link D, which shows that receiving the treatment did not cause group 1 to score higher than group 2. We do see, however, significant medium effect for link B – indicating that group 1 scored better in the post-test then in the pre-test – and a small to medium effect for link C, which measures the same for group 2. This would indicate some influence of the treatment. There is a small negative effect for link E, which would indicate that the group that received the treatment in fact did worse in the question from part 4 than the group that did not receive the treatment. The small effect from link F would indicate that there was a learning effect for group 1 as opposed to group 3 as the former also did a pre-test. However, the lack of effect for link G detracts from this again. Important to note here is that only link B was significant. Links E and F are both not significant and both dependent on the relatively low score of group 3, which might point at group 3 just not being a good group, however their performance in the first exercise was average.

PART 1 AND 4 COMBINED – 'SEQUENCING' AND 'ODD ONE OUT'

Earlier it was shown that the sampling distribution for the combined variable is not normal. As such, Mann-Whitney U tests are used for links A, D, E, F and G, and Wilcoxon tests for link B and C.

	Measurement	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Group 1	Pre	38	13	11	24	18,32	3,394	11,519
	Post	38	10	14	24	19,39	3,000	9,002
Group 2	Pre	27	19	3	22	16,96	3,917	15,345
	Post	28	18	6	24	17,79	4,022	16,175
Group 3	Post	31	16	8	24	17,58	3,784	14,318
Group 4	Post	33	12	12	24	18,18	2,698	7,278

Table 20. Descriptives for the combination of the 'sequencing' and the 'odd one out' exercise.

Table 20 shows the highest mean for the post-measurement of group 1 and after that the pre-measurement of group 1. The lowest mean belongs to the pre-measurement of group 2, that has quite a difference with group 3, which has the then lowest mean. This is most likely due to one or multiple respondents in group 2 scoring much lower than average. This shows from the minimum for pre- and post-measurement being 3 and 6, while for group 1 for instance, this is 11 and 14.

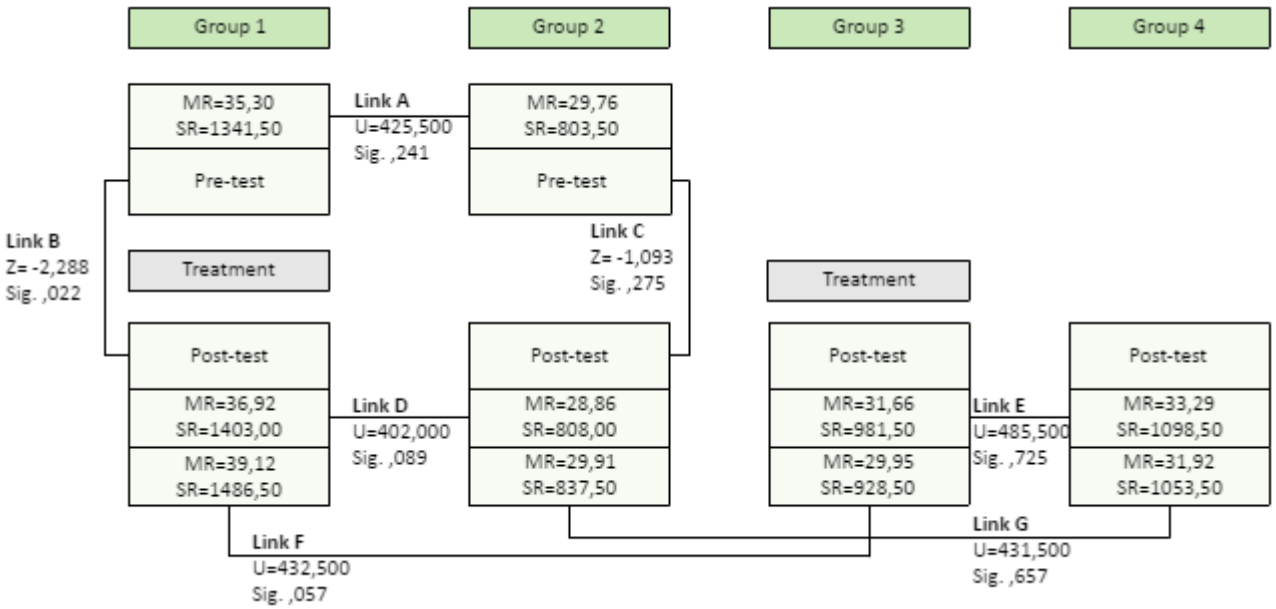


Figure 21. Results of analysis of the combination of scores in the 'sequencing' and the 'odd one out' exercise.

Link	Effect found
A	Significant, small effect (p=.241, r=.15) Groups 1 and 2 are compatible. The r-value just exceeds the benchmark for a small effect.
B	Significant, medium effect (p=.022, r=.37) Group 1 scored significantly higher after receiving the treatment.
C	Non-significant, small effect (p=.275, r=.20) Group 2 scored higher in the second measurement.
D	Non-significant, small effect (p=.089, r=.21) Group 1 scored higher than group 2 after receiving the treatment.
E	No effect (p=.725, r=.04) Group 3 does not score higher than group 4 after receiving the treatment.
F	Non-significant, small effect (p=.057, r=.23) Group 1 scores higher than group 3 after having done the pre-measurement.
G	No effect (p=.657, r=.06) Group 2 does not score higher than group 4 after having done the pre-measurement.

Table 5. Overview of (significant) effects found in links on the questions from part 1 and 4 combined.

Similar to part 1, a small, though non-significant, effect is found for link A. When comparing the scores of group 1 to those of group 3 and 4, it seems that they did not score excessively high, but rather, group 2 scores relatively low on the first measurement. In this exercise, one significant effect has been found, for link B. Link B indicates a positive effect of the treatment, which could be corroborated by link E, but here no effect is found. The combination of link B and D still shows a positive treatment effect. When comparing link B and C, the effect size of link B is much higher (r=.37 vs. r=.20). This indicates most of group 1's increase of performance to be due to the intervention. Link F shows a small effect that is almost significant, with group 1 scored higher than group 3, which would suggest an advantage for group 1 in already having done the pre-test. If this advantage would be there independent of the treatment, this would also show in link G. Here, no effect is found, although the descriptives in table 20 showed group 2 to score exceptionally low, so this result might have been different if this were not the case.

OVERALL INTERPRETATION OF 'SEQUENCING' AND 'THE ODD ONE OUT'

Over all, we can see an indication of a positive impact of the treatment from link B and D, although there was no effect for link D in the 'odd one out' exercise and there were non-significant effects for link B in 'sequencing' and link D in the combination of both exercises. However, when comparing link B and C, group 1 increased in score more than group 2. One would expect this to also reflect in link E, but here only a small effect for 'odd one out' is found. This could either indicate a sub-average performance of group 3, or a positive impact of the pre-measurement done by group 1. The same is true for link F, where a small effect is found (although non-significant). This also indicates either a sub-average performance of group 3, or a positive impact of the pre-measurement on group 1. The descriptives of table x, x and x do not show group 3 to score excessively low, which suggests at least part of these effect to be due to a learning effect from doing the pre measurement. In sum, it seems that the combination of the pre-measurement and the treatment has the largest positive effect. This is not surprising, since the measurement consists of a collection of systems thinking exercises, that – thinking back to the conceptual model earlier described – would help students experience systems thinking and might make the treatment more effective. Important here is to note that link A, while not significant in any of the three sets of scores, does show a small (r=.14 and .18) effect. This does not mean that groups 1 and 2 are not compatible, but there is a slight difference in scores, which should be taken into account when assessing the importance of link D. More importance could be given to the comparison of links B and C, instead of link D, which might be impacted by the initial difference between groups 1 and 2.

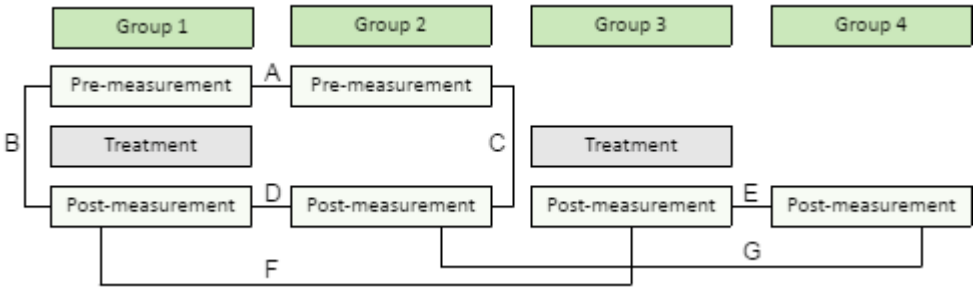


Image 22. Visual representation of four groups out of the Solomon four group design and the links (A-G) that have been reviewed in this section.

Part 1	Part 4	Part 1 & 4
A	A	A
B	B	B
C	C	C
D	D	D
E	E	E
F	F	F
G	G	G

Table 21. Overview of (significant) effects found in links in different parts..

PART III – 'RELATING TO PICTURES'

For part III, the students were asked to circle any number of terms out of 24 given words that they could associate with a given picture. The question was asked for two pictures (see figures 19 and 20). The terms that the students could mark were climate change, animal welfare, money loss, pollution, biodiversity, transport, river, war, CO2, water scarcity, hygiene, health, peace, sunlight, gender, poverty, education, consumption, resources, inequality, energy use, time loss, urbanisation, and global warming (see Annex 1 for the full measurement survey). Some of these terms clearly relate to one or both of the pictures (animal welfare, transport, time loss), others relate to larger global processes (climate change, biodiversity, consumption, urbanisation, global warming), and again others do not particularly relate to either of these (river, war, sunlight, peace).

Figures 23 and 24. The photos given in the exercise. In image 1 (left) a traffic jam is shown. In image 2 (right) a cow can be seen eating from litter, while some scooters drive past.

Important to note here is that the pictures both represent situations that are very much a part of the students' lives. Most of them will witness the two scenes on a daily, or at least a weekly basis. This exercise was developed to measure the students' disciplinary competence, this is done by assessing whether students' receiving the treatment were more inclined to make links beyond the most evident connections.

To assess this, the terms given in the exercise were classified into core concepts, affiliated concepts and peripheral concepts for each of the pictures (see table 22). Core concepts are expected to be marked and marking affiliated concepts shows a student is able to think beyond the most obvious links. Because there is no clear link between the peripheral concepts and the scenes shown in the pictures, these are not used in assessing students' performances, as the rationale behind marking them is ambiguous. Table 22 also shows underlined concepts, these are representing global processes. Marking these indicates a students' ability to link a daily scene to a global mechanism.

	Core concepts	*Affiliated concepts*	Peripheral concepts
Image 1 (traffic)	**Pollution, transport, resources, use of energy, time loss.**	*Climate change, money loss, hygiene, health, education, consumption, urbanisation, global warming.*	Animal welfare, biodiversity, river, war, water scarcity, hygiene, health, peace, sunlight, gender, poverty, inequality.
Image 2 (litter)	**Animal welfare, pollution, transport, hygiene, consumption, resources.**	*Climate change, biodiversity, CO2, health, education, use of energy, urbanisation, global warming.*	Money loss, river, war, water scarcity, peace, sunlight, gender, poverty, inequality, time loss.

Table 22. Classification of concepts into core, affiliated and peripheral concepts for both of the pictures. The concepts that are underlined are seen as global processes. In the remainder of this section, core concepts will be marked bold, affiliated concepts italic and global processes underlined.

In the following, the seven different relationships of the Solomon four-group design are shortly discussed. To do so, two ways of visualising results are used. For link A, this is done using bar charts that show the amount of times specific terms were mentioned with the different pictures. For links B to G, this is done by means of tables showing the differences in the percentages of different groups or measurements that marked a specific term. The percentages with which the groups marked a certain term are also given in Annex 8.

To give a quick overview of the most apparent differences in percentages, a colour scheme has been used as explained in table 23.

≤ -15	-15 – -10	-10 – -5	-5 – 0	0	0 – 5	5 – 10	10 – 15	≥ 15

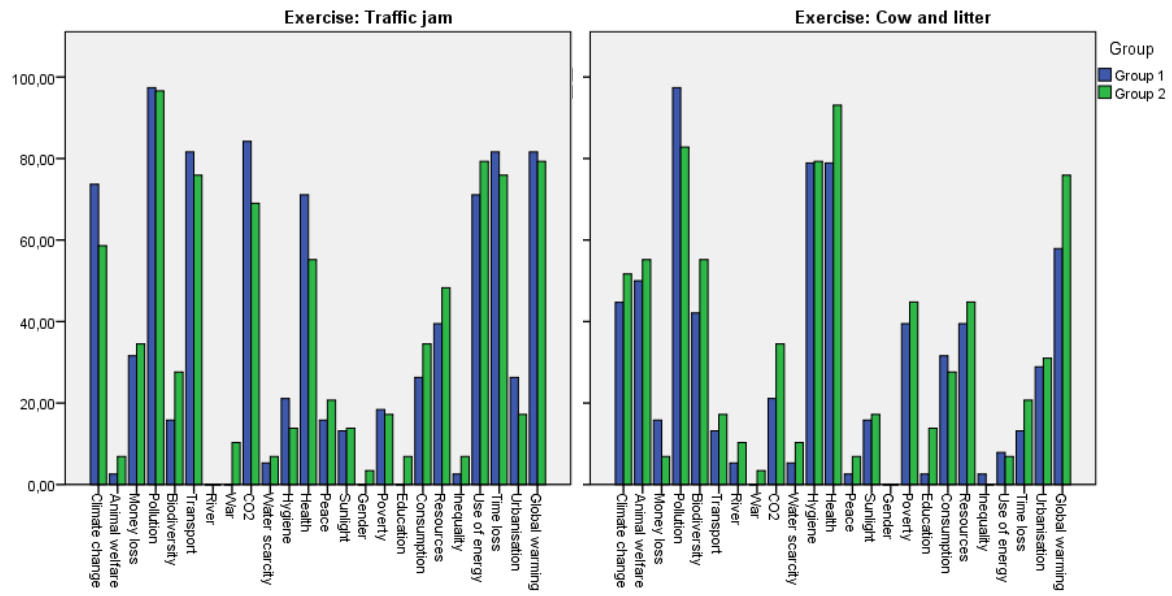
Table 23. Explanation of the colour scheme used for the remainder of this section.

It was considered to also use the absolute change in percentages, but as this does not differentiate between the terms that were marked more or less, the added value of this number to the analysis was limited. As such, it was not included in the analysis.

COMPATIBILITY OF GROUPS

LINK A – COMPARING GROUP 1 AND 2

Images 21 and 22 show group 1 and 2 to be relatively compatible. There are some differences – group two 'scores' slightly higher on a lot of the terms of the second picture, but over all, there are no stark differences. As such, the first link out of the seven shows that both groups can be compared. We can see that for both images, respondents often mark pollution health and global warming. At the traffic jam picture, climate change, transport, use of energy and time loss are also often mentioned. For the cow and litter picture, many mention hygiene.



Figures 25 and 26. Bar charts representing the amount of times the groups mentioned a certain term in the exercise 'relating to pictures'. The blue bar represents the pre-measurement of group 1, the green the pre-measurement of group 2.

MARGINAL EFFECT OF THE TREATMENT

LINK B – PRE- AND POST-MEASUREMENT INCLUDING TREATMENT

When considering the link between the pre-measurement and the post-measurement of group 1, one would expect that after receiving the treatment, the respondents would mark more of the affiliated concepts, as they would supposedly have increased their disciplinary competence. Additionally, one would expect them to be more able to connect the daily scenes given in the pictures to global processes. This would translate into higher percentages of respondents that mark the separate terms, which would show in the table as green cells. Table 24 shows the percentages of the post-measurement of group 1 minus the percentages of the pre-measurement of group 1.

Image 1 (traffic)	*Climate change*	Animal welfare	*Money loss*	**Pollution**	Biodiversity	**Transport**	River	War
	13,1	5,3	28,9	-2,7	-7,9	7,9	0	2,6
	CO2	Water scarcity	*Hygiene*	*Health*	Peace	Sunlight	Gender	Poverty
	-2,6	-5,3	0	-2,7	2,6	5,2	0	-2,6
	Education	*Consumption*	**Resources**	Inequality	**Use of energy**	**Time loss**	*Urbanisation*	*Global warming*
	0	29	21	-2,6	13,1	10,5	7,9	13,1

Image 2 (litter)	*Climate change*	**Animal welfare**	Money loss	**Pollution**	*Biodiversity*	**Transport**	River	War
	5,3	18,4	5,3	0	13,2	-2,7	5,2	2,6
	CO2	Water scarcity	**Hygiene**	*Health*	Peace	Sunlight	Gender	Poverty
	10,5	-2,7	-2,6	5,3	0	-2,6	0	2,6
	Education	**Consumption**	**Resources**	Inequality	*Use of energy*	Time loss	*Urbanisation*	*Global warming*
	5,3	2,6	-5,3	2,7	7,9	-5,3	0	13,2

Table 24. Overview of comparison of percentages that noted a certain term when asked if they associated it with the picture of a traffic jam (top half) and the picture of a cow eating litter (bottom half). The scores are the percentage of respondents noting the term in the post-measurement minus the percentage noting it in the pre-measurement. As such, the positive numbers (green cells) indicate terms a larger percentage noted them after having received the treatment and negative numbers (orange cells) indicate terms that were noted less after the treatment. The grey cells indicate that there was no change between the two measurements. This does not mean that they were both zero. The core concepts are shown in bold, the affiliated concepts in italic and the global processes are underlined.

Table 24 shows more green cells then red cells and darker shades of green than of orange. This indicates that in general, group one noted more terms in the post-measurement. Compared to the pre-measurement there was a rise of almost thirty percent in respondents that marked money loss and consumption for image 1 (traffic). The largest decline is of 5,3 percent for water scarcity in the first exercise and resources and time loss in the one for image 2 (litter). The increases in the marking of affiliated concepts like climate change, consumption, resources, urbanisation and global warming (for image 1) and global warming, climate change and education (for image 2) indicate an ability to connect the pictures at hand to larger global processes. Overall, the table shows a positive tendency with strong effects for image 1 and smaller but more spread positive effects for image 2. The traffic exercise shows positive effects for the global processes, for the litter exercise this is not the case.

LINK C – PRE- AND POST-MEASUREMENT EXCLUDING TREATMENT

Between the pre- and post-measurement of group 2 less of an effect is expected. There might be some impact of learning from the pre-measurement and having spoken to class mates that did receive the treatment, but overall, the scores of the two measurements are expected to be more similar to each other because there has been no intervention. Table 25 shows the percentages of the post-measurement of group 2 minus the percentages of the pre-measurement of group 2.

Image 1 (traffic)	*Climate change* 10,4	Animal welfare 6,9	*Money loss* 17,2	**Pollution** 0	Biodiversity -3,5	**Transport** 13,8	River 0	War 6,9
	CO2 -3,5	Water scarcity -3,5	*Hygiene* 10,3	*Health* 20,7	Peace 20,7	Sunlight 0	Gender 0	Poverty 0
	Education 13,8	*Consumption* 10,3	**Resources** 10,3	Inequality 0	**Use of energy** 0	**Time loss** 3,4	*Urbanisation* 6,9	*Global warming* 0

Image 2 (litter)	*Climate change* -6,9	**Animal welfare** 10,3	Money loss 6,9	**Pollution** 0	*Biodiversity* -10,4	**Transport** 0	River 3,5	War 0
	CO2 -10,4	Water scarcity 3,5	**Hygiene** -6,9	*Health* 0	Peace 3,4	Sunlight -3,4	Gender 0	Poverty -6,9
	Education 0	**Consumption** 10,3	**Resources** 3,5	Inequality 0	*Use of energy* 3,4	Time loss -13,8	*Urbanisation* -10,3	*Global warming* -13,8

Table 25. Overview of comparison of percentages that noted a certain term when asked if they associated it with the picture of a traffic jam (top half) and the picture of a cow eating litter (bottom half). The scores are the percentage of respondents noting the term in the post-measurement minus the percentage that did so in the pre-measurement. As such, the positive numbers (green cells) indicate the terms that were noted by a larger percentage in the post-measurement and negative numbers (orange cells) indicate terms that were noted less in the post-measurement. The grey cells indicate that there was no change between the two measurements. This does not mean that they were both zero. The core concepts are shown in bold, the affiliated concepts in italic and the global processes are underlined.

The most obvious feature of table 25 is the amount of times there has been no change in the percentage of students marking a certain term. Fifteen times a cell is coloured grey, which indicates zero change. This does not have to mean that no students marked a specific term, but that in both measurements the same amount of students did so (be it zero or ten). Compared to link B, there are less dark coloured cells, although, especially in the bottom half, there are more differences between 10 and 15 percent. Over all, there is a clear positive effect to be found for image 1 (with positive effects for all affiliated concepts and all but one global process) and a more negative effect for image 2. Both are not especially strong and in both exercises there are a lot of terms for which there is no change.

EFFECT OF TREATMENT VS. NON-TREATMENT

LINK D – TREATMENT VS. NON-TREATMENT (INCLUDING PRE-MEASUREMENT)

Compared to group 2, group 1 is expected to mark more affiliated concepts and global processes, as they were exposed to the treatment in which this was practiced. Table 26 shows the percentages of the post-measurement of group 1 minus the percentages of the post-measurement of group 2.

Image 1 (traffic)	*Climate change* 17,8	Animal welfare -5,9	*Money loss* 8,8	**Pollution** -1,9	Biodiversity -16,2	**Transport** -0,2	River 0	War -14,6
	CO2 16,1	Water scarcity -3,4	*Hygiene* -3	*Health* -7,5	Peace -23	Sunlight 4,6	Gender -3,4	Poverty -1,4
	Education -20,7	*Consumption* 10,5	**Resources** 1,9	Inequality -6,9	**Use of energy** 4,9	**Time loss** 12,8	*Urbanisation* 10,1	*Global warming* 15,4

Image 2 (litter)	*Climate change* 5,2	**Animal welfare** 2,9	Money loss 7,3	**Pollution** 14,6	*Biodiversity* 10,5	**Transport** -6,7	River -3,3	War -0,8
	CO2 7,5	Water scarcity -11,2	**Hygiene** 3,9	*Health* -8,9	Peace -7,7	Sunlight -0,6	Gender 0	Poverty 4,2
	Education -5,9	**Consumption** -3,7	**Resources** -14,1	Inequality 5,3	*Use of energy* 5,5	Time loss 1	*Urbanisation* 8,2	*Global warming* 9

Table 26. Overview of comparison of percentages that noted a certain term when asked if they associated it with the picture of a traffic jam (top half) and the picture of a cow eating litter (bottom half). The scores are the percentage of respondents noting the term in the post-measurement of group 1 minues the percentage of respondents noting the term in the post-measurement of group 2. As such, the positive numbers (green cells) indicate the terms that were noted by a larger percentage in group 1's post-measurement and negative numbers (orange cells) indicate terms that were noted by a larger percentage in group 2's post-measurement. The grey cells indicate that there was no difference between the two measurements. This does not mean that they were both zero. The core concepts are shown in bold, the affiliated concepts in italic and the global processes are underlined.

For image 1 (traffic), large differences for climate change, CO2 and global warming (positive) and biodiversity, peace and education (negative) are seen. The increased noting of climate change and global warming fits the expectation of differences between these groups, as this would indicate that students see the problem of traffic jams in a larger context. Especially the negative effect of education is not expected. In the graph showing the percentages of the respective groups (Annex 8), we can see that education was noted by zero students in group 1, which means that the negative difference of 20,7 percent, stems from that amount of students marking it in group 2. The amount of markings for hygiene and health decline slightly for both pictures, although one would expect these affiliated concepts to be marked more by group 1. For the second image (litter), there are small effects. We see an overall positive tendency, but also some negative effects. Although in this case education was marked by group 1, it was again marked more by group 2 (Annex 8). Like in the traffic jam exercise, there is an positive effect for larger global problems (climate change, urbanisation, global warming), but a negative effect for some other terms that would indicate the understanding of the issue in a larger perspective, such as education, consumption and resources.

LINK E – TREATMENT VS. NON-TREATMENT (EXCLUDING PRE-MEASUREMENT)

Expectations for link E are similar to those for link D. The difference between both is that the groups represented in the below graph were not exposed to the pre-measurement. Compared to link D, this means students are seeing the terms for the first time, there has be no learning effect of doing the exercise twice, and there has been no chance to discuss about the exercises in the time that is between the pre- and post-measurement. Compared to group 4, group 3 is expected to mark more affiliated concepts and global processes, as they were exposed to the treatment. Table 27 shows the percentages of the post-measurement of group 3 minus the percentages of the post-measurement of group 4.

Image 1 (traffic)	*Climate change* 16,8	Animal welfare -5,6	*Money loss* 3,6	**Pollution** -0,6	Biodiversity 3,8	**Transport** 5,6	River -3	War 4
	CO2 5,3	Water scarcity -5,9	*Hygiene* 13,8	*Health* -2,3	Peace 7,4	Sunlight -1,8	Gender -3	Poverty -5,1
	Education -5,9	*Consumption* -13,4	**Resources** -6	Inequality 3,6	**Use of energy** 20	**Time loss** 11,7	*Urbanisation* -1,5	*Global warming* -3,8

Image 2 (litter)	*Climate change* 2,5	**Animal welfare** 25,9	Money loss -1,6	**Pollution** 8,9	*Biodiversity* -6,1	**Transport** 13,7	River 4,2	War -6,1
	CO2 -3,7	Water scarcity 3,8	**Hygiene** -8,1	*Health* 5,5	Peace -3	Sunlight 0,6	Gender 3,2	Poverty -22,5
	Education -5,6	**Consumption** -23,3	**Resources** -4,1	Inequality 3,8	*Use of energy* -5,6	Time loss -5,6	*Urbanisation* 1,6	*Global warming* 13,2

Table 27. Overview of comparison of percentages that noted a certain term when asked if they associated it with the picture of a traffic jam (top half) and the picture of a cow eating litter (bottom half). The scores are the percentage of respondents noting the term in the post-measurement of group 3 minus the percentage of respondents noting the term in the post-measurement of group 4. As such, the positive numbers (green cells) indicate the terms that were noted by a larger percentage in group 3's post-measurement and negative numbers (orange cells) indicate terms that were noted by a larger percentage in group 4's post-measurement. The grey cells indicate that there was no change between the two measurements. This does not mean that they were both zero. The core concepts are shown in bold, the affiliated concepts in italic and the global processes are underlined.

For the first image (traffic), there is a balance between positive and negative effects, although the positive effects are stronger. When looking only at the affiliated concepts, there is a balance between positive and negative effect. Out of the global processes, only climate change was marked. There is a decline in consumption, resources, urbanisation and global warming, although these last three effects are small. Also, when looking at the percentages of both groups (Annex 8), they show that the scores for urbanisation and especially global warming are relatively high and show little difference. For the second image (litter), there is an overall negative effect (meaning that over all, respondents from group 4 noted more terms than those of group 3). An unexpected negative effect is seen, with especially consumption scoring much higher in group 4, the group that did not receive the treatment. We can find small positive effects when it comes to climate change,

urbanisation and global warming. But apart from the latter, these are too small to consider a clear effect of the treatment.

IMPACT OF PRE-MEASUREMENT

LINK F – IMPACT OF A LEARNING EFFECT

This link indicates the impact of having a pre-measurement in combination with receiving the treatment. If there is an overall positive tendency, this could indicate that the pre-measurement has had a positive influence on group 1's scores in the post-measurement. If there is no large effect and the scores are quite similar, this would indicate there has not been a big impact of doing the pre-measurement. If there is an overall negative tendency, this could be explained as a negative effect of the pre-measurement, possibly because respondents are less attentive doing the exercise for the second time or are annoyed by the fact they have to do the same thing twice. During the experiment, this did not seem to be the case, although there was some confusion about having to do the measurement twice. Table 28 shows the percentages of the post-measurement of group 1 minus the percentages of the post-measurement of group 3.

Image 1 (traffic)	*Climate change* 9,4	Animal welfare 1,4	*Money loss* 2,4	**Pollution** 4,4	Biodiversity -5	**Transport** -4	River 0	War -13,5
	CO2 -5,5	Water scarcity -3,2	*Hygiene* -7,9	*Health* 7,1	Peace -4,2	Sunlight -1	Gender 0	Poverty -0,3
	Education -3,2	*Consumption* 26,3	**Resources** 5,9	Inequality -9,7	**Use of energy** 3,6	**Time loss** -1,4	*Urbanisation* 8,4	*Global warming* 7,6

Image 2 (litter)	*Climate change* 8,1	**Animal welfare** -9	Money loss -1,5	**Pollution** 0,6	*Biodiversity* 6,9	**Transport** -15,3	River -8,9	War 2,6
	CO2 -7,1	Water scarcity -10,3	**Hygiene** 8,6	*Health* -6,1	Peace 2,6	Sunlight 3,5	Gender -3,2	Poverty 13,1
	Education 1,4	**Consumption** 18,1	**Resources** 1,9	Inequality -7,6	*Use of energy* 9,3	Time loss 1,4	*Urbanisation* 3,1	*Global warming* 3,4

Table 28. Overview of comparison of percentages that noted a certain term when asked if they associated it with the picture of a traffic jam (top half) and the picture of a cow eating litter (bottom half). The scores are the percentage of respondents noting the term in the post-measurement of group 1 minus the percentage of respondents noting the term in the post-measurement of group 3. As such, the positive numbers (green cells) indicate the terms that were noted by a larger percentage in group 1's post-measurement and negative numbers (orange cells) indicate terms that were noted by a larger percentage in group 3's post-measurement. The grey cells indicate that there was no change between the two measurements. This does not mean that they were both zero. The core concepts are shown in bold, the affiliated concepts in italic and the global processes are underlined.

Compared to the other tables there is not a very strong positive or negative tendency. Group 1 has more attention for the larger global processes mentioned earlier (climate change, urbanisation, global warming,

resources) and marks the term consumption much more often than group 3. Seeing as both groups received the treatment, this might indicate that it is actually the combination of the pre-measurement and the treatment that has a positive effect here. Other than this, the groups are quite similar, which would indicate that it is not the measurement, but the treatment that is having a positive effect on group 1.

LINK G – IMPACT OF PRE-MEASUREMENT (EXCLUDING TREATMENT)

This link indicates the impact of having a pre-measurement without there being a treatment. Like in link F, an overall positive tendency could indicate that the pre-measurement has had a positive influence on group 2's scores in the post-measurement. This would indicate a learning effect, due to doing the measurement twice. If the scores are similar, this would indicate that there is no influence of the pre-measurement. If there is an overall negative tendency, this could be explained as a negative effect of the pre-measurement, possibly because respondents are less attentive doing the exercise for the second time or are annoyed by the fact they have to do the same thing twice. Table 29 shows the percentages of the post-measurement of group 2 minus the percentages of the post-measurement of group 4.

Image 1 (traffic)	*Climate change* 8,4	Animal welfare 1,7	*Money loss* -2,8	**Pollution** 5,7	Biodiversity 15	**Transport** 1,8	River -3	War 5,1
	CO2 -16,3	Water scarcity -5,7	*Hygiene* 8,9	*Health* 12,3	Peace 26,2	Sunlight -7,4	Gender 0,4	Poverty -4
	Education 11,6	*Consumption* 2,4	**Resources** -2	Inequality 0,8	**Use of energy** 18,7	**Time loss** -2,5	*Urbanisation* -3,2	*Global warming* -11,6

Image 2 (litter)	*Climate change* 5,4	**Animal welfare** 14	Money loss -10,4	**Pollution** -5,1	*Biodiversity* -9,7	**Transport** 5,1	River -1,4	War -2,7
	CO2 -18,3	Water scarcity 4,7	**Hygiene** -3,4	*Health* 8,3	Peace 7,3	Sunlight 4,7	Gender 0	Poverty -13,6
	Education 1,7	**Consumption** -1,5	**Resources** 11,9	Inequality -9,1	*Use of energy* -1,8	Time loss -5,2	*Urbanisation* -3,5	*Global warming* 7,6

Table 29. Overview of comparison of percentages that noted a certain term when asked if they associated it with the picture of a traffic jam (top half) and the picture of a cow eating litter (bottom half). The scores are the percentage of respondents noting the term in the post-measurement of group 2 minus the percentage of respondents noting the term in the post-measurement of group 4. As such, the positive numbers (green cells) indicate the terms that were noted by a larger percentage in group 2's post-measurement and negative numbers (orange cells) indicate terms that were noted by a larger percentage in group 4's post-measurement. The grey cells indicate that there was no change between the two measurements. This does not mean that they were both zero. The core concepts are shown in bold, the affiliated concepts in italic and the global processes are underlined.

Table 29 shows no clear negative or positive tendency. For the first image, overall scores are higher for group 2, while for the second image, scores leans more towards group 4. There is a difference of 26,2 in the percentages of respondents that marked peace in the traffic jam exercise, although this term has not played a very big role

in the rest of the data. When looking at the separate graphs of the groups, we can see that the term peace was marked by over forty percent in the post-measurement of group 2, while it does not exceed twenty percent in any of the other measurements and is more often much lower than that. Global processes and affiliated concepts are not marked more by either of both groups.

OVERALL INTERPRETATION OF PART III

The positive effects of link B and D (specifically on the affiliated concepts and global processes) signal a positive influence of the treatment. In the Solomon four group design, this should be confirmed by link E, but here no particular effect can be found. This would then suggest that the 'higher score' of group 1's post-measurement might be due to a learning effect after participating in the pre-measurement, but a learning effect is not found in link G. Link F does not shows only very small effects, which suggests a positive effect of the treatment, rather than the pre-measurement. Overall, these outcomes suggest that the largest positive effects can be found in link B and D, which would mean that the treatment, combined with the pre-measurement has the most positive impact.

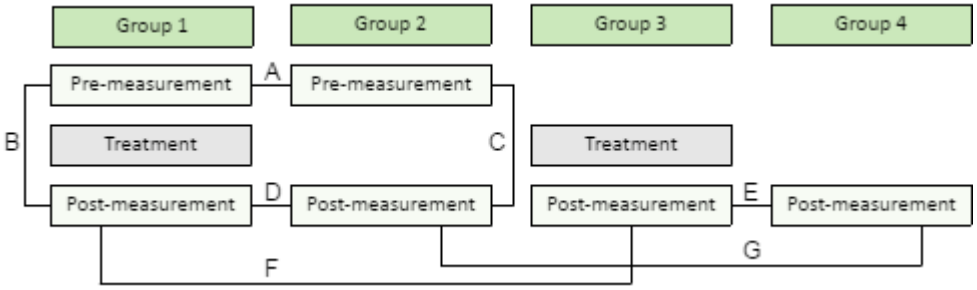


Figure 27. Visual representation of four groups out of the Solomon four group design and the links (A-G) that were reviewed in this section.

	Part III – 'Relating to pictures'
A	The graphs show group 1 and 2 to be relatively compatible.
B	The table shows an overall positive effects for the affiliated concepts and positive effects for all global processes in image 1 and all but one in image 2.
C	The table shows no particularly positive or negative tendency. The scores were relatively similar, as there are a lot of terms for which little or no change in percentages occurred. For image 1, there are small to medium sized effects for all affiliated concepts and all but one global process.
D	The table a balance between positive and negative effects. For image 1, there are positive effect for most affiliated concepts and all global processes. For image two, there are small positive effects for the affiliated concepts, there is a balance between positive and negative effects concerning the global processes.
E	The table shows no particularly positive or negative tendency. Effects that could indicate a positive influence of the treatment are small. There is a balance between positive and negative effects concerning affiliated concepts and global processes.
F	The table shows the groups to be similar showing only small effects. For both images, all global processes are marked more by group 1. *This suggests that it is the treatment, rather than the measurement, that has a positive effect on group 1.*
G	The table does not shows only small and balanced effects for the affiliated concepts and global processes. There are no results that can be interpreted to indicate any effect of the pre-measurement.

Table 30. Overview of effects found in links in the 'relating to pictures' exercise.

CHAPTER 5 – DISCUSSION

5. DISCUSSION

This section discusses the limitations of this research, puts the main findings into context and assesses its implications for theoretical debate.

INTERPRETATION OF RESULTS

On the current state of ESD in Gujarat, chapter 4.1 showed that from a government perspective, the formal opportunities for mainstreaming ESD are there. However, this situation does not reflect in the learners' daily experiences, mostly due to the amount of layers the policy ideas have to go through before they reach the students, as well as the perceived lack of flexibility of teachers. Korhale signalled the unpopularity of the teaching profession to be the root cause of the teacher's inability to meaningfully integrate the innovative government policy into their lessons. When Chakraborty and Mondal (2014) researched the attitude of prospective teachers of the teaching profession, they find an overall low appreciation of the teaching profession (25 percent of respondents classified their attitude towards teaching as low), and find educational background of teacher to be the only significant variable in this respect, i.e. prospective teachers with higher qualifications, regard the teaching profession higher. Although no research has been done on the readiness of teachers to integrate ESD into their lessons Das and Kuyini (2013) discuss the implementation of inclusive education and review whether teachers are prepared to work with this. They find that in general, teachers' training is lacking. They also find that teachers underestimate their abilities, which again points to low professional self-esteem. Both of these articles support Korhale's statements about the teaching profession not being highly regarded and teachers being ill-equipped in teacher training.

In chapter 4.2 on sustainability competences, the interviewees primarily spoke of general skills (critical thinking, conflict resolution, communication etc.), rather than specific sustainability skills as focused on in literature on this topic (Brundiers, Wiek, & Redman, 2010; de Haan, 2006; Mochizuki & Fadeeva, 2010; Wals, 2010). When specifically going into key sustainability competences, Wiek et al. (2011) substantiate their decision not to focus on general educational skills by stating that compared to these, key sustainability competences been out of focus of the academic debate and thus require extra attention. Quite possibly, it is the same academic debate Wiek et al. (2011) refer to, that the CEE experts learn about ESD from. In the interviews, I found that the interviewees most prone to discuss these 'general competences' were the ones who had entered into ESD from an education background. Sharma was educated to be a science teacher, Korhale did a Master's in Educational Science, and Pandya worked for the Gujarat Centre for Education, Research and Training (GCERT) before joining CEE. However, Gorana and Joshi also considered 'general competences' to be key to ESD, while they have their background in environmental and communications science. An explanation could then be that these 'general competences', while being the focus of the academic debate on sustainability competences also became the internal focus of CEE.

In chapter 4.3, the role of systems thinking was defined in three ways: as an overarching competence and the way of doing ESD, as one of multiple means of doing ESD, and as an outcome of ESD. In literature, systems thinking was most commonly discussed as one of multiple (key) competences (an outcome of ESD) (de Haan, 2006; Sipos, Battisti, & Grimm, 2008; UNESCO, 2012; Wiek et al., 2011). Concerning the interviewees, there were some differences and an explanation for this variation could agin be the background of the respondents. The interviewees that gave an important role to systems thinking were the ones coming from a non-educational background. Gorana and Gadre both studied Environmental Sciences and continued to work in environmental research before joining CEE. Joshi did her studies in Communication Science and worked at a space research institute before joining CEE. A possible explanation could be that especially Gorana, Gadre and Joshi will have encountered systems thinking in their work prior to CEE and have thus incorporated it more in their ways of working.

The results from chapter 4.4 show a positive effect of the treatment and hint at a learning effect, although both results are not supported as expected by the second and third control group. This indicates a positive effect of the combination of the measurement and the treatment. Although no earlier experiments were found on the relationship between sustainability competences, in the literature on Teaching Through Geography, multiple successful experiments have been done on the mystery method (Karkdijk et al., 2013; Leat et al., 2005; van der Schee et al., 2006). The authors of these studies have repeatedly called for more longitudal studies in the development of systems thinking skills. This recommendation is also made after this study. This is further outlined under theoretical implications.

KEY FINDINGS

The first key finding of this study is the increase of sustainability competences through experiencing systems thinking processes. The experiment showed that the combination of the pre-measurement and mystery exercise had a positive effect on students' sustainability competences. This is explained by the fact that the measurement survey used is not a conventional survey, but rather a collection of systems thinking exercises. Looking at it from this perspective, the measurement was not only a means of assessment, but also an extra opportunity for the students to practice systems thinking and the associated spatial, temporal and disciplinary competence. These outcomes support the conceptual model outlined for this study, where the amount of practice doing systems thinking increases the level of spatial, temporal, disciplinary and cultural competence, which in turn feeds back into systems thinking skills. Another explanation might be that doing the exercise twice caused the higher score in the post-measurement. However, this effect is not expected to be large, as then it would also have shown in the first control group that did the measurement twice, but did not receive the treatment.

The second key finding of this study is the importance of reflection, evaluation and (teacher) guidance in experiencing systems thinking processes. During the mystery exercise in the treatment, at least fifteen minutes were taken with each group to reflect on their activities and share their results. It was found that at times, only a few students found the links to connect all stories in the mystery. By discussing what they found with the entire group and taking time to reflect on every groups' results, the students could learn from each other and – even though they did not reach a certain level of systems thinking themselves – experience the full systems thinking process. During the interviews, experts reflected on the importance of evaluating systems thinking processes. Sharma emphasised that all human activity takes place in systems, but as long as this remains unnoticed, no systems thinking takes place. In order to facilitate students to consciously reflect on the systems they are a part of, teachers are of great importance. Judging from the interview data, the process of enabling teachers to meaningfully integrate systems thinking into their lessons will be the biggest challenge.

Overall, this study's findings imply that experiences systems thinking as a part of ESD enables students to better understand the world's complex systems, which allows them to more adequately respond to sustainability issues happening in these systems (Wu Huang et al., 2010). In line with Wals' (2011) reasoning discussed in chapter 1, this thesis works towards equipping students with the means to decide for themselves on what are right decisions, rather than teaching them what to do. This same sentiment is found in chapter 4.3 where it is discussed that the interviewees emphasise the ability to use value and judgment as a basis for decisions as a part of sustainability competence.

LIMITATIONS OF RESEARCH

The main limitations of this research include the subjective interpretation of the measurement survey, the logistic circumstances of conducting the experiment, the generalisability of the results, and the relative homogeneity of the selection of interviewees.

The tests done in SPSS are reliable, due to their transparency and replicability. However, the scores analysed were arrived at after a subjective process, which might influence the outcomes of the tests. In the 'odd one out' and 'put into order' exercises, students received 0, 1 or 3 points. Correct and incorrect can be objectively judged, but a part of the answers suggested the students had made a correct link, but did not completely fit the correct answer. In order to differentiate between these and answers that showed no understanding at all, these received 1 point. Although this choice made the final scores of the students' capacities more accurate, it made the scoring procedure more subjective.

While conducting the experiment, practical arrangements may have had their impact on the rigour of the results. Initially, it was planned to have one week in between the pre-measurement and the treatment, and one week in between the treatment and the post-measurement. However, it turned out to be impossible to secure three separate moments with the students (two proved to already be a challenge) and the time available was limited. This made it necessary to do the pre-measurement and treatment on the same day and meant both the measurement and the treatment had to be shortened in order to fit into the schools schedules. In practice, the teachers did not put any time pressure on the treatment and there was enough time to do the exercise in a meaningful way. However, especially the 'making links'-exercise in part III of the measurement survey was impaired after shortening it, which in the end led to it being excluded from analysis due to lack of validity (as explained in chapter 3.3).

Because of the application of three control groups, the quantitative results of this study are generalizable to the extent that they can be taken to represent the population: 8th grade students in English-medium high schools in Ahmedabad. The results might be extended to discuss high school students of English-medium schools across India. However, since in India, education is organised both on a national and a state level, it might be that institutional factors would influence results to be different when executing a similar experiment in a different state. Even within the state of Gujarat the generalisability might be low due to discussed differences in schools that follow distinct curricula. This could influence the way in which the students interpret the questions and the way in which they experience and learn from the treatment. The amount of field visits and the lack of context I am able to give the (non-)participatory observations, does not allow me to judge whether the schools I visited represent Ahmedabad and Gujarat.

All interviewees worked for CEE in Ahmedabad. It was attempted to interview people outside of CEE, but it was found that all people working on ESD in the region were affiliated with CEE. Teachers, principals and other education professionals that were not explicitly working with ESD did not know much about it, which would have made their contributions to the interview segment of this research limited. Those who did know about ESD, were – probably because of my affiliation with CEE – inclined to answer my more general questions about ESD and ESD competences with anecdotes on their schools' achievements in ESD and the projects they had done. This was helpful for my general understanding, but not useful as a part of the interview data.

THEORETICAL IMPLICATIONS

In section 1.2, three knowledge gaps were identified. The first around the relationships between sustainability competences, the second in the measurement of sustainability competences, and the third in the use of the Solomon four group design.

On the relationship between sustainability competences, this thesis has argued that systems thinking can be seen as an overarching sustainability competence, that is stimulated by and a stimulus for other competences. The results from the experiment discussed in section 4.4 support this notion. As such, the need to discuss not only lists of competences, but also the relationship between them is added to the debate. It would be interesting to further look into this dynamic by conducting a longitudal study on the same subject, which would allow for more than one loop out of the conceptual model (see figure 5) to be analysed. In this thesis, no

division was made between the four competences defined, out of which three (spatial, temporal and disciplinary competence) were measured. For future research, it would be of interest to make such a distinction and review whether there is a difference in stimulation of competences. This would also help to further specify and test the accuracy of the competences that were now identified to be a part of systems thinking. The hierarchical division made in this thesis with systems thinking as a primary competence that encompasses spatial, temporal, disciplinary and cultural competence can also be further scrutinised.

The measurement of sustainability competences has been discussed in chapter 4.5, where the difficulty of designing measurements to capture the increase in sustainability competences was shown. Further research could further develop the measures used in this study, as well as explore new options to measure these competences in a useful way. Additionally, it would be helpful to how to incorporate more qualitative data into the measurement. In this research, the second part of the 'picture the problem'-exercise has not been used in analysis, because no valid way of categorising the respondents' answers could be established, and because it was unsure whether they all understood what was asked of them. It would be interesting to explore ways in which envisioning sustainable futures can be measured.

By employing a Solomon four group design, this research adds to the collection of applications of this type of experiment. Additionally, it might add to the familiarity of this design in the research community. Due to the character of the experiment conducted, it would be recommended to use the same design for further studies into the development of sustainability competences, especially because chapter 4.4 gave some indication of a learning effect, which would have remained undetected if a classic experimental design with one control group would were employed.

Considering the context of Ahmedabad, Gujarat and India, it would be of interest to further explore the role of teachers in the implementation of ESD and to find ways of meaningfully engaging them in ESD processes. Additionally, multiple interviewees suspected differences in ESD implementation between educational boards. A comparative case-study to this effect would add to the body of literature on ESD in India.

CHAPTER 6 – CONCLUSION AND RECOMMENDATIONS

6. CONCLUSION AND RECOMMENDATIONS

This study set out to test and evaluate the impact of systems thinking on the development of sustainability competences of secondary school students in Ahmedabad, India. It did so by designing an educational intervention, testing it in an experiment using Solomon's four group design, developing and using a measurement survey to determine its impact, and triangulating the outcomes with qualitative data taken from document analysis, literature review, (non-)participatory observation, and semi-structured interviews.

The central research question posed is: *To what extent does systems thinking in ESD influence other sustainability competences of high school students in Ahmedabad, India?*

In order to answer this question, five sub-questions were formulated. These considered the currect state of ESD in Ahmedabad and Gujarat, the type of sustainability competences that are desirable for high school students to develop, the role of systems thinking in developing these competences, and the effect of the intervention used in the Solomon four group experiment. Additionally, the suitability of the methods used suited to assess high school students' sustainability competencies has been assessed.

The key insights of this study concern the experiment results and the connected validation of the conceptual model, and the role of reflection and (teacher) guidance in experiencing systems thinking. The experiment results confirm an influence of systems thinking on the development of other sustainability competences, to the extent that experiencing a systems thinking process increases a students' ability to understand complex systems, including its spatial, temporal and disciplinary components. To increase sustainability competences through systems thinking, *experiencing* systems thinking is crucial. In the experiment, results showed a positive impact of doing the measurement, which consisted of systems thinking exercises. This fits the conceptual model given in chapter 2.3, that indicates multiple loops of experiencing systems thinking to move towards more advanced and complex systems thinking skills. In experiencing systems thinking processes, the importance of reflection, evaluation and (teacher) guidance is emphasised. This is signalled as one of the main bottlenecks in the implementation of ESD in Gujarat, India.

The most important shortcomings of this study involve the subjective interpretation of the measurement survey, the logistic circumstances of conducting the experiment, the generalisability of the results, and the relative homogeneity of the selection of interviewees.

METHODOLOGICAL RECOMMENDATIONS

Concerning the methods used in the measurement survey, this study recommends the following:

All the methods described above can be useful in measuring sustainability competences. 'The odd one out', 'sequencing' and 'relating to pictures' were successfully employed in this thesis, although some modifications could further increase the results' rigour. In the case of 'the odd one out' it should be taken into consideration that as multiple answers are correct, it cannot be assumed that a respondent is using the competences that are attempted to be measured when answering the question. This is why it is important to include the reasoning behind naming one element as the odd one out. It might be an option to further guide the respondent by explicitly stating that the group should be made in terms of spatial competence, but this should again be tested. In the case of 'sequencing', it might be interesting to assess whether it would be of added value to ask respondents to include their reasoning behind a certain order, although the groups of pictures used in this measurement survey, when testing them on colleagues and the try-out group, were not ordered using another reasoning than the one kept in mind while designing it. For 'relating to pictures', the biggest disadvantage is that the analysis is an interpretative process and thus relatively subjective. This means that when analysing the results, it is important to be transparent about the reasoning behind the interpretation.

‘Linking SDGs’ and ‘looking forward’ were taken up in the measurement survey, but were not considered for the data analysis of this study. These methods can still be useful in measuring systems thinking and temporal competence, but would need more available time from respondents (‘linking SDGs’) and more explanation (‘looking forward’).

Based on insights from its application in this study, any adaptation to the original version of ‘linking SDGs’ used by Karkdijk et al. (2013) should be made with caution and plenty of time should be available for conducting the measure. Although the measurement survey of this study was tested and adapted before conducting the experiment, for future application, it would be advisable to also analyse the test cases in order to further establish validity of the measures used.

For future application, ‘looking forward’ can be useful. Contrary to the way it was used in this study, however, it should be made sure that all students understand what is asked of them, perhaps by doing a practice exercise with the entire class. The next concern is the interpretation of results and the way of processing these. For this study, it was planned to categorise the results and compare groups in that manner.

Self-reporting was not used in the measurement survey, because no suitable questions could be formulated. This method could be useful when employed with questions suited to the local context and with help of people more familiar with the local context to interpret the answers.

OTHER RECOMMENDATIONS

It is recommended to continue including systems thinking into ESD processes and to further explore the possibility of using systems thinking as an overarching mode of doing ESD. This would mean putting systems thinking central in every ESD activity and in this way continuously offering learners the possibility to experience systems thinking, hereby helping them further their systems thinking skills as well as their spatial, temporal, disciplinary and cultural competence as shown in the conceptual model in image x.x.

One of the key findings of this research was the importance of experience in developing systems thinking skills. Especially when learners are new to thinking in systems, the better the debriefing and evaluation, the more they will learn from it. Furthermore, during the literature research, the (non-) participatory observation and the experiment it was found that learners specifically reacted to the parts of the system that were close to their own lives. From this, it is recommended to develop place-specific material to practice systems thinking in a way that is relatable for the students.

Supervision and especially guidance are crucial in this stage, which brings attention to teachers’ abilities to guide their students in systems thinking. In this regard, it is recommended to further incorporate systems thinking into pre- and in-service teacher training, as well as to work towards a school environment in which teachers from different courses can easier link their topics and provide a more holistic curriculum.

In their assessment of the state of ESD in the Netherlands, Het Groene Brein (2015) shows that internationally, there is difficulty in raising ESD from the environmental dimension. This study shows that in the case of India, the first step towards more integration between the different dimensions of ESD was to put policy in place to support such a development. However, one of the main findings of this research is that this alone is not enough. As such, it is recommended to consider the translation of ESD policy into daily practice, with an emphasis on the role teachers are expected to play in this process and the support they require to fulfil this role.

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ANNEXES

ANNEX 1 – MEASUREMENT SURVEY

Systems thinking survey

Before you start, read this:

Read all questions carefully before answering. We are interested in your thoughts, so answer all questions by yourself and don't exchange thoughts with your neighbours. We will not share your answers with anyone. We need you to fill in your name so we can analyse the results, but we will not write about you specifically. Feel free to write whatever you think is the best answer. Sometimes multiple answers might be correct.

When you finish, please double-check if you answered all the questions. There is a total of 13 questions.

Thank you for your help!

Name: ……...……... Age: ……...

School: ……...……... Section:……...

I am a O boy O girl

Part I: Put into order

In this part, you are asked to put the pictures into order. Mark the pictures 1 to 4 on the dots under the pictures. Put the numbers 1 to 4 on lines under the pictures to put them into order.

a)



…….. …….. …….. ……..

b)




…….. …….. …….. ……..

c)




…….. …….. …….. ……..

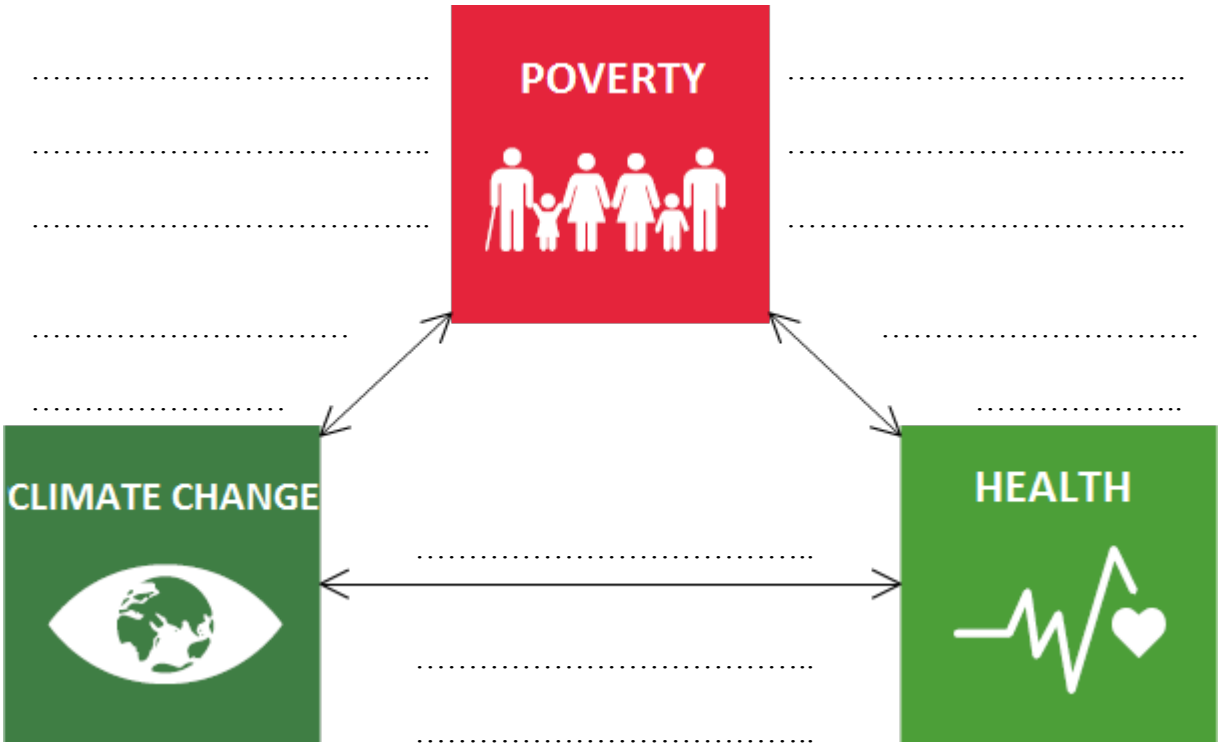
d)

…….. …….. …….. ……..

Part II: Making links

Use the different words to make links between the four themes given below. You do not have to use all the words and you can add more links, if you can think of more by yourself.

Clean drinking water	Increased heat stress	Asthma
Good washroom facilities	Nature-based medicine	Noise pollution
Deforestation	Malnutrition, hunger	Air pollution
People losing work	Extreme weather events	Spread of diseases
People having to move	Difficulty to get water	Clean and affordable energy



Part III: Picture the problem

Photo 1: Traffic jam

a) Circle the words that you can relate to this photo.

Climate change	Animal welfare	Money loss	Pollution
Biodiversity	Transport	River	War
CO2	Water scarcity	Hygiene	Health
Peace	Sunlight	Gender	Poverty
Education	Consumption	Resources	Inequality
Use of energy	Time loss	Urbanisation	Global warming

b) In an ideal, sustainable world, where the problem would get solved, what would you see in this picture? Try to describe the positive elements that you would find on the picture.

……

……

……

Photo 2 – Litter on the streets

c) Circle the words that you can relate to this photo.

Climate change	Animal welfare	Money loss	Pollution
Biodiversity	Transport	River	War
CO2	Water scarcity	Hygiene	Health
Peace	Sunlight	Gender	Poverty
Education	Consumption	Resources	Inequality
Use of energy	Time loss	Urbanisation	Global warming

d) In an ideal world, where the problem would get solved, what would you see in this picture? Try to describe the positive elements that you would find on the picture.

……

……

……

Part IV: Which one does not fit?
In this part, four words are given, one out of which does not fit with the others. Find which of the four words does not fit in the group and circle it. Describe what makes the three remaining words similar and find a fourth word that can replace the word that did not fit.

a) *Rann of Kutch* *Sabarmati river* *Ahmedabad* *Himalaya*

What do the 3 words have in common? ……

Replace the element that doesn't fit the group ……

b) *Sloth bear* *Bengal Tiger* *Cobra (snake)* *Orangutan (monkey)*

What do the 3 words have in common? ……

Replace the element that doesn't fit the group ……

c) *Shopping mall* *Fish* *Boat* *Swimming*

What do the 3 words have in common? ……

Replace the element that doesn't fit the group ……

d) *Building houses* *Generating energy* *Drying clothes* *Making pickle (atjaar)*

What do the 3 words have in common? ……

Replace the element that doesn't fit the group ……

ANNEX 2 – MYSTERY EXERCISE

Tool description:

To increase system thinking capacity I want to use the 'mystery'-method as a tool. A mystery starts with **a challenging question** that triggers students to investigate the issue and solve the problem. This challenging question includes information that intuitively seems to be inconsistent with what the students already know. To solve the mystery, students get 15–30 pieces of information to help them answer the question. Students work in **groups of +/- four**, investigate the issue and solve the mystery by producing arrangements of the pieces of information. At the end of the mystery task a debriefing follows.

1. **Introduction:** There will be a short introduction of the people present and the method used. The topics (Navratri, drought, dengue) will be introduced and we will be asking some introductory questions to the group. (Who celebrated Navratri last month? What did you do? By raise of hands, who knows anyone who has had dengue?)
2. **The mystery:** Three storylines are narrated. One about Ravi living in Ahmedabad, one about Toya from the Jamnagar area, and one about Lena from Germany. Separate questions are posed about their stories, as well as one larger question on how their lives connect.
3. **The pieces of information:** The students are presented with +/- 30 pieces of seemingly random information printed on cards. There is some room for questions and clarifications.
4. **Break-out groups:** Groups of about 4 students arrange the information in a way that makes sense to them. They are encouraged to think of as many linkages as possible and have different cards link to others in multiple direction.
5. **Monitoring:** At least three people will be walking around in the group to answer questions and direct the students towards making systems that are more than a straight line of facts.
6. **Debriefing:** After the students have structured the statements, we will do a plenary recap. Talk about the links that were found and the central questions. What different issues are at play? What is happening socially, economically and ecologically?
7. **Adapting and finalising:** Students get a moment to restructure anything they like on the basis of the debrief and draw their system on a big white sheet.
8. **Wrap-up:** Shortly present the biggest differences, add anything that came up and talk about how the process was.

Supplies needed:
White sheets, markers, pieces of information (storylines, text, pictures), at least 3 people.

Outcomes:
Sheets with groups systems drawn on it, group discussion.

Resources (storylines) :

Storyline 1 – Ravi (13) from Ahmedabad
Ravi had been looking forward to Navratri for a long time. He is dancing with a dance group and hopes to be able to win some prizes this year. Ravi's father is manager at one of the Garba-festivals happening, but this year, he seems to be very nervous and is always watching the weather report. This year, Ravi has been looking forward to the festival even more than other years, because his pen friend from Germany, Ben is visiting with his parents and his two sisters: Lena and Louise. Ben wrote to Ravi about his sister Lena's friend who contracted dengue in Germany, Ravi is very surprised, he thought dengue mosquitos didn't live in Germany.

Question: Why did Ravi's father get nervous when looking at the weather report?

Storyline 2 – Toya (14) from village Jamnagar district
Toya lives in a rural village in the Jamnagar district in Gujarat. Her family earns its money through their cotton crops, but lately agricultural conditions have been quite hard. Due to unseasonal rains, the crops have failed and now that droughts have hit, it has been hard to irrigate the lands properly. When Toya came to school this morning, her best friend Chayya was not there, she has not been in school for a while now. Toya hopes she will come back soon.

Question: Why is Toya's friend Chayya not in school?

Storyline 3 – Lena (19) from Germany
Lena will be visiting Ahmedabad, together with her parents, her sister Louise and little brother Ben. They are going to visit Ravi, Ben's pen friend. Ravi told them it would be getting cooler in the period they are visiting, so Lena and Louise went out to buy a sweater. They went to the H&M and found a nice purple sweater for Louise. Looking at how to wash it, they found that the sweater had been *made in India*. The girls laughed about the fact that the sweater would now go back to visit its home country. Before going home, the sisters also buy some mosquito repellant. They know that dengue is common in India and since Lena's friend had it a few weeks ago, they have seen how horrible the disease is.

Question: How is Louise's new sweater related to Lena's friend being ill?

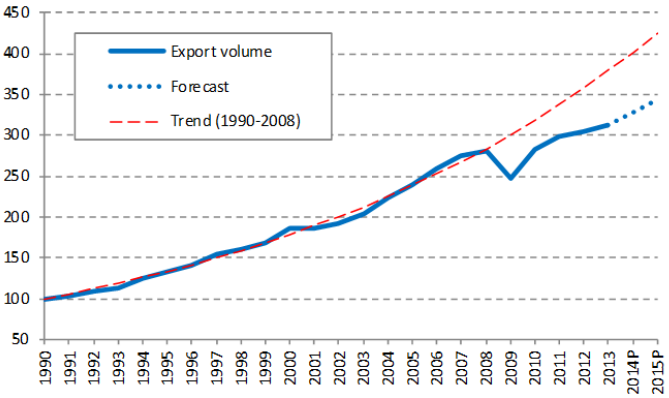
How are these stories related?

Resources (tekst)

World-wide, climate change is causing weather to become less predictable and often hotter.	Dengue is a disease that is transmitted to people by mosquitos.	Cotton is used to spun into yard or thread and make soft, breathable textile.
Researchers think that the earliest use of cotton was in the Indus Valley Civilisation, between 6000 and 5000 years BC. Around the same time, the use of cotton came up in Mexico.	In many parts of India, this years' drought made caused water shortage for crops, livestock or drinking.	If the average temperature of the world rises with 2 degrees Celsius, India's summer monsoon is expected to become less predictable.
Toya's friend Chayya lives in a village without a water source.	Ravi's father has to work all through Navratri, because he is managing one of the party plots.	Often, women are the ones who walk to get water and fire wood.
When water sources dry up, the distance between where people live and where they get their water gets larger.	Gujarat has a tropical wet (monsoon) and and dry (winter) climate.	Dengue is transmitted by Aedes mosquitos. They survive in warm and wet climates.
Global temperature rise is causing the area in which Aedes mosquitos can survive to grow larger.	Farmers must either choose early harvest, which makes the harvest less valuable, or wait for rain. If it doesn't rain, the crops will fail.	Gujarat is one of the leading states in cotton production.

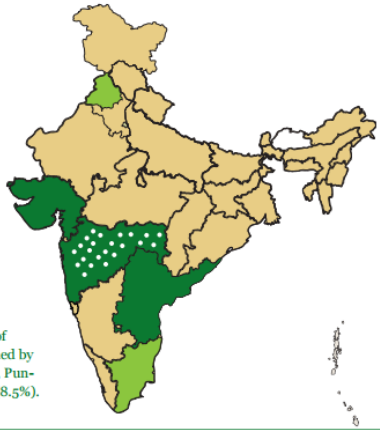
Toya's friend Chayya is not in school.	Containers with water, various types of wells, rice-fields, pools and ponds are popular breeding places for mosquitos.	Successfully growing cotton requires a long frost-free period, plenty of sunshine, and a moderate rainfall.
Popular clothing chain H&M uses fabrics produced in India.	Rains after the monsoon season prolong the season for mosquitos.	After cotton has been processed into clothing in factories in South Asia, it is shipped to Europe.
Ravi's father is looking nervous while watching the weather reports.	This year's extended monsoon rains, which returned on October 1, have made for a very wet few days in Gujarat.	Businessmen across Gujarat have suffered big losses, estimated to be around Rs.500 crore, as their festival-related investments, centred around Garba events.
Sometimes, mosquito's get into the boxes in which export goods are transported across the world.	Navratri is a Hindu festival that lasts 10 days and 9 nights.	In the state of Gujarat, Navratri is celebrated by dancing Garba.
Aside from a small dip after the economic crisis of 2008, global trade has been increasing since the 1990s.	This year, Navratri started October 1st 2016.	Lena's friend was bitten by a big striped mosquito she had never seen before, a while before she got ill.
On October 2nd, the first Indian H&M store was opened in Delhi.	Louise's purple H&M sweater was exported from India to Europe this August.	Because of climate change, the weather in Europe is getting warmer and wetter.

Resources (visual)



H&M

Fig 3: Cotton Producing and Consuming States



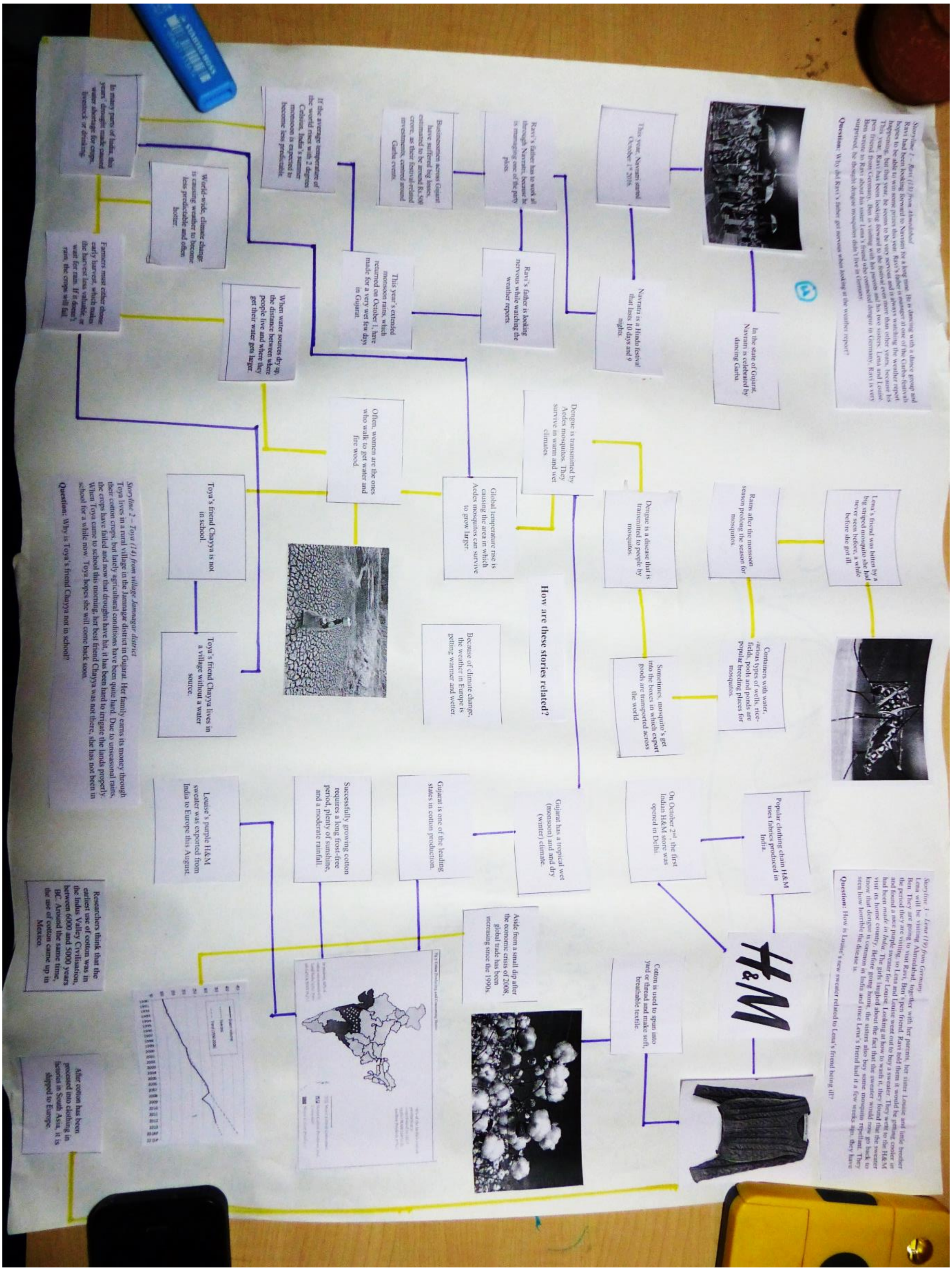
76% of the India's cotton production is contributed by GUJ (33%) MAH (26%) & Andhra Pradesh 17%)

In 2008-09, 66% of cotton was consumed by Tamil Nadu (43%), Punjab (14%) & MAH (8.5%).

Major Cotton Consumer
Major Cotton Producer and Consumer
Major Cotton Producer

Source: YES BANK Research

4 Ministry of Textiles report on Cotton fibre


How are these stories related?

Storyline 1 – Kavi (13) from Ahmedabad
Kavi had been looking forward to Navratri for a long time. He is dancing with a dance group and
practising for hours every day. Navratri is a Hindu festival that lasts 10 days and 9 nights.
Unfortunately, he has not been able to participate in the dance performances in the past two years.
This year, Kavi has been looking forward to the festival even more, watching the weather for
days. His friend from Germany, Ben is visiting with his parents and has been invited to perform.
Ben, Kavi and his sister Lena go to the community garden in the evening to practise. Lena is very
surprised, by Kavi's dance moves (she didn't know he is German).
Question: Why did Kavi's father get nervous when looking at the weather report?
Navratri is a Hindu festival that lasts 10 days and 9 nights.
In the state of Gujarat, Navratri is celebrated by dancing Garba.
This year, Navratri started October 1st 2016.
Kavi's father is looking nervous while watching the weather reports.
Because he is aware of the fact that
which lead to
Continuous rain water, various types of wells, river, lake, ponds and puddle are breeding places for mosquitos.
Lena's friend was bitten by a big striped mosquito she had never seen before; a while before she got ill.
Storyline 1 – Lena (14) from Germany
Lena will be visiting Ahmedabad, Gujarat with my parents, her sister Louise and little brother
Ben. I'm very excited about the trip and I've been looking forward to it for months. Lena and I
the second time we visited, on Lena and Louise went out to visit them it would be getting cooler as
and found a nice purple sweater for Louise. Looking at how to wear winter. They went to the H&M
had been made in India. The girls laughed about the fact that the sweater would soon go back to
Know that dengue is common in India and asked if they should buy some mosquito repellent. They
seen how horrible the disease is.
Question: How is Louise's new sweater related to Lena's friend living in?
Rains after the monsoon season prolong the season for mosquitos.
Sometimes, mosquitos get into the boxes in which export goods are transported across the world.
Dengue is a disease that is transmitted to people by mosquitos.
Dengue is transmitted by Aedes mosquitoes. They survive in warm and wet climates.
Gujarat has a tropical wet (monsoon) and and dry (winter) climate.
How are these stories related?
Because of climate change, the weather in Europe is getting warmer and wetter.
Louise's purple H&M sweater was exported from India to Europe this August.
Popular clothing chain H&M uses fabrics produced in India.
On India, Monsoon starts in August
H&M
Other cotton has been processed and made in factories in South Asia, it is shipped to Europe.
Cotton is used to spun into yarn or thread and make soft, breathable textile.
Successfully growing cotton requires a long frost-free period, plenty of sunshine, and a moderate rainfall.
This year's extended monsoon season is due to the shift in the ITCZ, now further north in Gujarat.
Farmers must either choose early harvest, which makes them vulnerable to rain, or wait for rain. If it doesn't rain, the crops will fail.
Often, women are the ones who walk to get water and fire wood.
Global temperature rise is causing the area in which Aedes mosquitoes can survive to grow larger.
If the average temperature of the world rises 2 degrees Celsius, India's summer monsoon is expected to become less predictable
World-wide, climate change is making weather more and often hotter.
Aside from a small dip after the economic crisis of 2008, global trade has been increasing since the 1990s.
Kavi's father has to work all through Navratri, because he is managing one of the party plots.
Before cotton arrives in Gujarat from southern India, it has to be ginned. Gujarat is the state where most cotton ginning is done.
Toya's friend Chayya is not in school.
Toya's friend Chayya lives in a village without a water source.
When water sources dry up, the distance between where people live and where they get their water get larger.
In many parts of India, this years' drought made caused water shortage for crops, livestock or drinking.
Chhaya is visiting wells to fetch water!
She may be suffering from dengue
(Possibilities) Did she know!
Storyline 2 – Toya (14) from village Jamnagar district
Toya lives in a village in the Jamnagar district in Gujarat. Her family earns its money through
farming cotton. Toya's village is very dry and gets little rain. Over the last few years, the rains
have come later and later, and the crops have failed more and more often. Toya's family is very poor.
When Toya came to school this morning, her best friend Chayya was not there. She has not been in
school for a while now. Toya hopes she will come back soon.
Question: Why is Toya's friend Chayya not in school?

ANNEX 3 – INTERVIEW GUIDE

Interview themes:

- Introduction
- Current status of ESD in Ahmedabad and Gujarat.
- Sustainability competences of high school students.
- Role of systems thinking in sustainability competences.

Introduction

Questions:

1. Can you tell me something about your (professional) background? How did you get where you are now?
2. How is your work related to education for sustainable development?
3. Are you involved with sustainability in any other way?
4. What was the first time you heard about ESD?
5. How would you define ESD?
6. When did you start getting involved with ESD? Did you first get involved with education or first with sustainable development?
7. Where would you like to go concerning ESD?

1. Descriptive knowledge on the current status of ESD in Ahmedabad and Gujarat.

Supplemented with: Document analysis, conference data and (non-)participatory observations.

Questions:

1. How would you characterize the current status of ESD in Gujarat as opposed to other states? As opposed to other countries?
2. Do you think there is a difference between ESD in Ahmedabad and in the rest of Gujarat?
3. What difference is there within Ahmedabad?
4. Where would you put the state of ESD in Ahmedabad on a scale between non-existent to structural?
5. To what extent do you see ESD to be integrated into the curriculum?
6. To what extent does ESD in Ahmedabad/Gujarat work on all three dimensions of sustainability? Which themes are most popular among teachers, students?
7. Is there anything else you think I should know about ESD in Ahmedabad/Gujarat?

2. Descriptive knowledge on the sustainability competences desirable for high school students to acquire.

Supplemented with: Literature review and conference data

Questions:

1. What to you is the purpose of ESD?
2. What (knowledge/skills/values) do you think one should have, in order to cope with future and existing sustainability challenges?
3. To what extent do you think these abilities should be acquired through ESD?
4. What learning outcomes do you associate with ESD?
5. How do these connect to the contents of ESD?

6. What does ESD as you encounter it focus on more: input (content) or output (competences)? How strongly does it focus on one over the other?
7. Is there anything else you think I should know about learning outcomes, or competences for ESD?

3. Explanatory knowledge on the role of systems thinking in sustainability competences.

Supplemented with: Literature review and the experiment

Questions:

1. Have you ever come across systems thinking? How?
2. To what extent does this play a role in ESD? How?
3. Would you characterize systems thinking more as a means or a goal of ESD? Why?
4. How do you think systems thinking is linked to the competences we discussed earlier?
5. Is there anything else you want to share when it comes to systems thinking and ESD?

ANNEX 4 – OVERVIEW OF SCHOOL VISITS

1. 19/10/2016 - St. Kabir Drive In Old Branch (DIO)
2. 20/10/2016 - SKUM School
3. 25/10/2016 - Calorx public school
4. 25/10/2016 - H.B. Kapadia New High School
5. 25/10/2016 - H.B. Kapadia IFFCO
6. 28/11/2016 - St. Kabir DIO (try-out pre-measurement and treatment)
7. 29/11/2016 - St. Kabir DIO (try-out post-measurement)
8. 30/11/2016 - St. Kabir Naranpura (NAR) (pre-measurement and treatment)
9. 5/12/2016 - Rachana School (pre-measurement and treatment)
10. 6/12/2016 - St. Kabir NAR (post-measurement)
11. 8/12/2016 - Rachana School (post-measurement)
12. 14/12/2016 - Cosmos Castle International School (CCIS) (pre-measurement and treatment)
13. 15/12/2016 - CCIS (post-measurement)
14. 

ANNEX 5 – FRAGMENTS FIELD WORK DIARY

19-10-16 School visit St. Kabir School (old branch)

Everyone is very welcoming. Harshal introduces me and talks about my experiment. The people from the school seem to think it is okay, if it is only for one time at least. They are very open to the idea, Harshal each time emphasises that he will also go through the official channels, but just want to already see where they are.

Teacher bangs on table, pay attention. Lots of noise from outside [and from the fans, sometimes the kids are hardly audible].

Teacher: one who sets the right example. Interruption with example from teacher

Harshal: Okay lets move on. Teacher: I want to go back to one of the characteristics, zero tolerance of lack of civic sense, respectfully request not to throw things around, you don't have to fight, just ask, or pick up trash if they are not there anymore.

20-10-16 School visit SKUM

[Before the lesson] We looked at the Swachhagraha wall. It was down in a big space where everyone passes through. We came and talked to people, they said wait for 45 minutes. Within 5 minutes the teacher came, asked what was our purpose. They said, you need around 40 students? Okay. Students were taken from classes, rowed up, boys and girls. In the faculty room multiple teachers, also men. Two teachers are talking to us, about what to do, they switch between English and Hindi and then the lady excuses herself for speaking in her mother tongue and not in English, I assure her it's no problem. Harshal asks me about the building structure and if I have ever heard of Foucault. I see what he means, the building looks a lot like a prison. He tells me it was designed this way to be able to have an overview of everywhere. There is one big square in the middle and the four floors of open hallways up. All classrooms open to the opening in the middle. I assumed it must be quite old [turned out later it was only there for 10 years]. Harshal told me about analogy, with George Orwell's 1984, as all the classrooms have CCTV. He looked into one to show me where it was, but couldn't find it. [Later I saw the head master scroll to all of the classrooms when we were having tea] He said that if something is not exactly as it should be, the teachers are held accountable.

[During the lesson] Only 30 minutes we have, children in de kleermakerzit op twee vloerkleden. Male teacher wants to make photo with me in it. Goes quickly. Then start lesson. Making connection performance academic and cleanliness. Changing between Hindi and English. Swachhagraha wall is poster/trailer to your movie. Emphasis on habits, behavioural change. Less loud than the last school. In hallways quite loud, on every floor, noise goes everywhere. Less direct response from the group. Harshal: Come on, you are doing good work, take ownership of it! (The school yesterday took lots of ownership) Leadership: collecting people, take responsibility, take initiative first. Boys talk more than girls, same in last school. One teacher (male) left, other one (female) is very relaxed, closing her eyes. Also with 6&7 standard children.

[After the lesson] After the lesson the teacher asks if I will take tea or coffee. I'm afraid it might be impolite to refuse, so I take tea. We get ushered into the head master's office (with air conditioning) and wait quite some time. Head master seems quite important, big man and there are all the time people coming in to ask things and have him sign things. He looks through the Swachhagraha booklet, says it's very good, good design. He will look through it more in detail and feedback to Harshal. Harshal points me to pictures of the head master and Modi, back when the latter was chief-minister of Gujarat. I ask about the size of the school – 1040 somewhat students – and how long it has been around – ten years. Students are between 3 and 18, apparently it is very common to only have one school like this. Harshal says that sometimes children switch schools in between

(around 12?) and others stay in one school. There are also some schools that only do KG (kindergarten) till 12 or so. While we are waiting for tea, I sometimes try to keep the conversation going and sometimes Harshal or the head master also bring something up, but it is quite awkward. The head master is scrolling through all the CCTV footage in all the classrooms and the hall and the room where the clerks are sitting. Then the tea comes, it's really good (less sugar, more ginger) and the head masters asks about my experiences, the Netherlands and how the school systems compares. We laugh about the way Dutch people plan things, which is apparently ridiculous, haha. The head master agrees that I can do my experiment there or just the test run.

25-10-2016 School visits

School 1: Calorx public school (lesson in the library)

[before class] Harshal discusses people in India largely being driven by emotions. He is going to make a selection of films about India for me to watch. School building looks again like a prison structure.

[during class] Introduction teacher, Harshal introduces me, applause again. Introduction. Why mirror? It's about us, we have to be an example, responsibility. Intro everyone name and standard. It's a little loud in the class room, but quite okay. Standards 8-10? One girls from standard 8 has button 'prefect'. Teacher sits with me and doesn't really give much input. Principal will be changed over the coming time. Harshal: can you tell me any initiative? Cleanings school, girl 9 grade. Cracker campaign, 3 students grade 10 that have already been to CEE (?) → very eager. Introducing book, not a textbook, we don't want to add one more to your bag. Student-centered. In the library, quotes: "teachers open the door, but you must enter by yourself", "the empty vessel makes the greatest sound", "opportunities are never lost, the other person takes them", "planning is everything, the plan is nothing", last one by Eisenhower, but others also by Swami something. New principal coming in, conversation Harshal + teacher on development. P2, why Swachhagraha? Whatever you do, you should not do without purpose. So apparently Harshal was not able to schedule a visit with this school before. Systems: uncleanliness + passing exams. Older students active bit more. P5 what is title? Everyone say at the same time. Once Swachhagraha, always; becomes a habit, set example. The Gandhi term [Satyagraha] and Swachhagraha differences. Girls and boys equally active. Soms in Hindi ook. Harshal asks something in Hindi, girl 9th grade answers in English. Swachhagraha is about the prevention, the Gandhi one about the cure. Attendence list was gotten by one of older students. *Ages for grades*. It's all about changing the habit. *Het is nog steeds wel veel vertellen, wellicht want introductie; hoe gaan de andere lessen eruit zien? Hoe is dit anders van reguliere lessen?* Psychology has proven that it takes at least 21 days to change a habit. Internalising practice to habit. Try this at your home; you will enjoy it. You take the responsibility you own, the responsibility of your school. Harshal: Ownership of what? All kids cleanliness, surrounding, ourselves (based on gestures made by Harshal). Take ownership of your school. I won't go to a student, I go up to a Swachhagraha straight. Swachhagraha wall, after Diwali in detail. P11 Movie, how you choose which? Trailer, poster. When the teacher asked if we wanted to see the children, Harshal said 15-20 minutes. It seems we took a bit more. Teacher left room. Mahabharata, lying on one cabinet. *Different levels?*

[After class] "They are very good students" says teacher. Students smile proud.

School 2: H.B. Kapadia new high school (that school that looked more like a mall from the outside)

10 boys, 6 girls, we get coffee, teacher really wanted us to have snacks as well, because it was the first time she met us. The first time Harshal was here, she was at a teacher training. Quite loud again. Spatious seats though. The kids seem younger than last class. Met principal, teacher and supervisor attend the class. Supervisor: "this is good, together we can and we will". Students paying attention. Seemed like the teacher was telling one girl to smile. Building really doesn't look like a school, more like a shopping building. Apparently quite high-end school. Why crow is there? He is storyteller. Birds like crow help us keep the environment clean. Teacher takes over when Harshal goes to the toilet. Participating more like first school. Questions form the group; 4: zero

tolerance to lack of civic sense. Ownership of surrounding, ownership of your school. Of what to do in public. Tell people when they are doing it wrong. Leadership: person who guides, explains, person who possesses the power. Harshal: one who takes the initiative. You should have a will, be pro-active. The one who waits, waits for the order. *Realise these students have chosen to be in this class themselves, so this will also be a part of how active they are.* Problem-solving, creative ideas. Ask Harshal: do you do the lessons different per class? Harshal told me about businesses with value (Tata as example) and without (Reliance, Adani) This project is funded by Adani, was a personal struggle for Harshal to determine whether he wanted to work on it. Also about secondary school until grade 12, age 16, uniform program, then board exam, then one of three branches: science, commerce, arts. Asking about climate change and consumption. Quite a big step and quite some creativity. You should always connect the things, when you want to overtuig anyone. Telling the story, consumption and climate change. Teacher asks about survey purchasing pattern. Tool for realising how our life is connected to climate change. Teacher medium active.

School 3: H.B. Kapadia school IFFCO

Very active class! Environment is not too loud. Very excited over foreigner being there. They were doing English class before. What's the WhatsApp business? They like the book a lot, all students are very active. They seem a bit younger. Some are already doing the word search. One girl was already checking the answers to the cross word. After Diwali, we talk about the four themes. Teacher getting in, why are you doing this? What is your purpose. Why do you study? Why do you do this? To save your surroundings from waste. Someone (Pramod?) said, when you do such an activity the teacher immediately takes over, is not happening everywhere, but here a bit. She hasn't even seen the book before and already, she is totally owning it. "money waste, food waste, everything waste". Big difference between teachers. Similarity between this one, other HBK and St. Kabir. They don't really have a uniform here, just polo + jeans. One boy not at all. At the bell, everyone runs off. Teacher says: They're exited for upcoming holidays.

28-11-2016 First measurement and exercise – St. Kabir DIO (with Theresa)

Theresa and myself went to St. Kabir DIO to do the test run for the measurement and the exercise. I had already met the teachers once when I went to the school with Harshal, so that was nice. We met with head mistress, then with supervisor, then were directed to the class. There were not 60 students, but 40. Realise that this might just be how it is. Does not have to be a problem, especially because we make the groups from this number, so this wouldn't necessarily mean that the groups are unbalanced. Explaining everything went quite well. We chose not to do the different groups as it would be an unnecessary hassle and focus on perfecting the survey, the mystery and the instructions to give with this. We found that especially the question with the pictures proves difficult to understand for the children and needs to be explained clearly and multiple times. During the exercise, different teachers, the supervisor and the head mistress came by to see how everyone was doing. Afterwards we showed some results to the supervisor and to the head mistress.

29-11-2016 Second measurement – St. Kabir DIO (with Lena)

Went over to St. Kabir DIO for the second measurement. We had to be there at 11.30, so arrived 11.15. We got redirected to the supervisor after talking to the head mistress for a moment. We sat in her office until the class started. Went to the class. Some kids that were there the day before were not there now and some were there that hadn't been there the day before, but there was not too much difference. I thought the kids might find it a bit strange that they had to fill out the same survey again, but after I had explained it was to see the difference and that there was no right or wrong, they did it and did not seem to mind that much. Some of them filled it in quite quickly – probably because they remembered some of the questions. [Reviewing the surveys later, I found that there were actually some differences]. After we completed the surveys, there was still some time left, in which the kids asked questions about the Netherlands and Germany. They asked which language people spoke in the Netherlands, about traffic, about schools in the Netherlands, about how children in schools were.

When they asked whether German/Dutch school children were different in discipline and we decided we shouldn't say too much about the comparative lack of German/Dutch discipline haha.

30-11-2016 First measurement and exercise – St. Kabir NAR (with Lena & Theresa)

We went to St. Kabir NAR, another branch of the school we visited for the test the days before. We were there around 7.40, to start at 8.00. We started a bit late, I think. Also, because there was some confusion about how to divide the groups and who to give which survey. In the end, we decided to do it at random and just give every other kid the systems survey and the others the politics one. The kids were really disciplined and the principal talked about how they should change the world and that the problems that I would be talking about would also play a part in this. There seems to be quite some pressure on the children to do well. Also, when they were filling out the survey, teachers kept saying things like: "less talking, more thinking", "think and write, think and write". The children were very quiet and disciplined. When half of the group could leave, there was some confusion about who was to leave. First the teachers wanted to pick the children that she thought would be good to stay, but this would mess up the sample, so I told her maybe we could just split in half, but then all the girls were sitting on one side, so then we did it horizontally in the middle and that worked. They moved some kids around, so that the ones who hadn't finished would stay/leave, wasn't sure, but thought to just leave it at that. When we broke up into groups the kids were very eager to start and they worked really well. They sat on the floor in 5 groups of 6 and started sorting the cards. Some of the groups got off to a good start, some others had trouble doing the group work and were discussing a lot. Teacher said: "Less arguing, more working". Most of them got quite distracted by the markers at one point, but in the end, we got them to wrap it up. We called the different groups forward and asked them the questions we established earlier. They seemed to be very aware of the answers we were looking for. They understood a lot, got the different connections between the stories and were quite eager to share that too. It was mainly the boys who got up and gave answers to the questions. After we finished the exercise we met two different directors and the head mistress, whom we showed some of the results and what we had been doing.

Theresa:

General Observations First School Visit, 30rd November. A little confusion with the division of the groups. Much influence of teachers in comparison to Monday (with answering questions for the survey, calling upon them to be quiet and also in the group work face telling them to be "quiet and work" - although discussion is obviously something we want to encourage) - I think you could even consider to tell teachers that you don't need them? Inspiring speech at the beginning from that blue-green lady (don't know, what her position was?) - interesting words and focus on how they raise the children to be the change they want to see in the world (#Gandhistyle). Big differences between the groups - reflect upon on which system thinking level kids start (-> can that be seen in the survey? one result is if they do get better - but are there patterns that show how much better?) Why was that one group having so many difficulties? (for one, they seemed to have problems working together, but besides that?) They were pretty straight forward (for two reasons I believe: first because we have shown them the result from Monday and because the stories were already on the sheet. I think that can be ok, especially considering that although they started instantly, we still had to push them pretty much in the end. But it could be that you want more the flowing creativity we had on Monday) Definitely good to ask them more during the group work which common patterns they see between the stories. Maybe next time, if we go the three of us again, let each one look after two/three groups (that way we avoid asking them all the same question trice) In the end: elaborate a bit more on the questions. If there is one student that made the connection climate change, it does not mean that the rest got in the 30 seconds he explained it. Elaborate on these insights. Working atmosphere much better because of group division and floor work (haha yes, I made that joke on purpose). Interesting talk with the teachers afterwards on their awareness of the issues (although they don't even teach social sciences :))

5-12-2016 First measurement and exercise – Rachana School

Went to Rachana School, later heard from Harshal that this is a state board school that was started by a cousin from the director of CEE. We were quite early (like 7.30, class started at 8.00) and all the children were standing in lines in the playground, the assembly I think it was called. The building was nice, very large, dark tiles and dark wood. The architecture reminded me both of CEE (especially after I heard the connection with the director) and of my own high school in the Netherlands. At the gate a boy asks us who we came to meet and brings us to Rati mam. She asks us to wait a bit and then we all go upstairs to a class with benches and tables where about 20 boys are sitting. The teacher goes out to get another approximately 20 boys and we start the survey with only boys in the room. It is less disciplined then the last school (st kabir nar) but still quite good. Some of them are making jokes, but everyone finishes the surveys quite on time. Again, the kids doing the politics survey take less time. Half the class stayed back and half came with us to another classroom, where we did the experiment. The groups were generally quite quick. One group had ordered their pieces within about 10 minutes. Then I talked to them and discussed some possible linkages and said they were doing well. When I walked to another group and looked back, they had cleared their sheet and started all over, haha. The groups here seemed to have more difficulty in knowing what was expected of them when asked to make links/connections. Maybe this could have to do with the fact that they are state board? Does that mean they're not English medium? Or doesn't it? Get some more info on this. We waited a bit longer with giving the markers and first only gave the glue. This (and maybe also the fact there were only boys) made that the children were really thinking more about where to put the papers of text and put less energy in making the chart look pretty. We tried to start earlier with telling them to stop, but the process of starting to tell them to finish and them actually finishing up seems to still take quite long. The de-brief with the found questions worked well. Called different groups forward and asked questions to them and asked for additional answers from the class.

6-12-2016 Second measurement – St. Kabir NAR

Went back to St. Kabir NAR, 8.30 in the morning. Arrive about 15mins early, got directed to the principal, sat with her while waiting for the class to get ready. We discuss about the project CEE does, what the school is working on. Kids of what age are at the school. Again, the school is 3-16, sometimes 18. She asks about where I stay, we talk about how beautiful the CEE campus is, she has also attended the conference. We talk about this. Then it kind of falls silent, someone comes in, she talks to them, I get taken away by supervisor who wasn't there last time. Go into elevator to the same room as last time. Kids are already waiting. Kirti mam seems a bit taken aback from the fact that I want to do the same survey again, but it's fine. The kids also seem to be fine with it. The teachers really make them work hard. "Speak less, work more", "Are you writing new things? Yes? You should write new things!". Asking me: "We ask you for your very honest assessment, what are the children still doing wrong? In which sections can we still make them better?" (paraphrased). Children fill in the surveys, I talk to the teachers. I tell them that in the last class, we took some time after the second measurements to answer some questions about the Netherlands (and then Germany, as Lena was also there). The teachers are immediately enthusiastic and ask me to talk about cleanliness in the Netherlands, the fact that people do not litter etc. Also, about "magic words", because they found that we always said sorry and thank you so much, which made us "pleasant to be around". I tell them about bicycles and that people don't litter that much in the Netherlands. The teachers are trying to get me to judge the way people litter here. They say that if they hear it from a foreigner, it will make more impact. One of the kids asks what I think about Indian traffic sense, everybody laughs. The teachers talk about how, especially on two-wheelers, you should not speed. Then one of the teachers says: If you want to do this, just think of me, I have lost my son like this. Emotional and then the other teacher quickly moves on to something else. Also, they were saying something like, when you graduate your school you must be polite, you must be a symbol of cleanliness, you must be knowledgeable, etc, etc, people must know that there goes a St. Kabirian. Seems to be quite some pressure on the students from the teachers.

ANNEX 6 – SUMMARY LITERATURE REVIEW

Systems thinking is understood to be the ability to connect cause and effect across spatial, temporal, disciplinary and cultural scales.

Publication	Key notions
OECD DeSeCo (2005) No specific stage of education Spatial Cultural	*Key competencies* <u>Key competencies in three categories:</u> Use tools interactively (e.g. language, technology) Use language, symbols and texts interactively Use knowledge and information interactively Use technology interactively Interact in heterogeneous groups Relate well to others Co-operate, work in teams Manage and resolve conflicts Act autonomously Act within the big picture From and conduct life plans and personal projects Defend and assert rights, interests, limits and needs
	<u>Role of systems thinking:</u> There is no specific mention of systems thinking or of a holistic approach. There is some attention for working across cultural differences and "acting within the big picture" is seen as one of the key competencies, what might be interpreted as a reference to balancing global and local contexts.
De Haan (2006) No specific stage of education Temporal Disciplinary Cultural	*Gestaltungscompetenz or 'shaping competence' e.g. "the specific capacity to act and solve problems".* <u>Key competencies:</u> - Foresighted thinking - Interdisciplinary work - Interdisciplinary learning - Cosmopolitan perception, transcultural understanding and cooperation - Participatory skills - Planning and implementation skills - Capacity for empathy, compassion and solidarity - Competence in (self-)motivation - Distanced reflection on individual and cultural models
	<u>Role of systems thinking:</u> De Haan (2006) does not explicitly mention systems thinking, but does touch upon aspects of it in different competencies. Foresighted thinking is about thinking across temporal scales, the focus on interdisciplinarity suits the cross-dimensional disposition of systems thinking. Cosmopolitan perception resonates with the spatial scales found in the definition of systems thinking used in this research and the distanced reflection on individual and cultural models suits the cultural dimension of systems thinking.

Sipos et al. (2008) Specified to HE Systems thinking/cause and effect Spatial Disciplinary	*Engaging head, hands and heart for transformative sustainability learning (TSL)* Head (cognitive domain; engagement, e.g. through academic study and understanding of sustainability and global citizenship) 1. Cognitive engagement 2. Transdisciplinary curriculum 3. Critical thinking 4. Systems thinking 5. Understanding of sustainability 6. Understanding of global citizenship Hands (psychomotor domain; enactment of theoretical learning through practical skill development and physical labour (e.g. building, painting, planting)) 1. Experiental learning 2. Applied learning 3. Democratic and participatory learning 4. Conflict resolution 5. Collaborative 6. Service learning Heart (affective domain; enablement of values and attitudes to be translated into behaviour, e.g. developing a learning community with individual and group responsibilities) 1. Empowering 2. Creative 3. Fun 4. Values-focused thinking 5. Inclusive 6. Place-based
	Role of systems thinking: Systems thinking is identified to be one of the elements of the cognitive (head) domain of learning. Additionally, learning across disciplines is emphasised in the 'transdisciplinary curriculum', and the spatial aspect is mentioned as 'place-based' learning in the affective (heart) domain.
Wals (2010) Specified to HE, but also talks of other stages of education Spatial Temporal Disciplinary Cultural	*Gestaltswitching and mirroring* Sustainability competence then refers to one's ability to respond to a sustainability challenge with all these Gestalts in mind and to consider the challenge from a range of vantage points. The switching back and forth between different positions requires an awareness of one's own predominant Gestalts and willingness to, at least temporarily, put oneself in another Gestalt on all four dimensions (temporal, disciplinary, spatial and cultural). Competencies: Gestaltswitching Mirroring Coping with uncertainty
	Role of systems thinking: Especially *gestaltswitching* is close to the definition of systems thinking used in this research (the ability to connect cause and effect across spatial, temporal, disciplinary

	and cultural scales). The missing factor in Wals' (2010) conceptualisation is then the systemic component, the emphasis on cause and effect.
Brundiers et al. (2010) Specified to HE Systems thinking/cause and effect Temporal Disciplinary Cultural	*Strategic knowledge cluster, practical knowledge cluster and collaborative cluster* <u>Clusters of key competencies:</u> The strategic knowledge cluster Integrates systemic, anticipatory, normative, and action-oriented competencies, which each include content and methodological knowledge (de Haan, 2006; Grunwald, 2007; Wiek, 2007). The cluster includes competence in analyzing and understanding the status quo (current state) and past developments (history); creating future scenarios and sustainability visions; assessing current, past, and future states against value-laden principles of sustainability; and to developing strategies to move from the current state towards a sustainable future. Important in this cluster is competence in dealing with diversity of opinion, perspective, fact, preference, and strategy The practical knowledge cluster Involves competencies necessary for "linking knowledge and action for sustainable development" to bridge the "knowledge-action gap" (van Kerkhoff and Lebel, 2006). Implementation skills, a critical component of "Gestaltungskompetenz" (implementation competence), require hands-on experience in putting knowledge into practice, and thereby testing the validity and robustness of action-oriented (strategic) knowledge about sustainability transitions and transformations (de Haan, 2006). Experiencing the opportunities in and constraints of various decision-making contexts (e.g. government and business) with respect to sustainability activities is prerequisite to designing and implementing successful sustainability initiatives at any scale. The collaborative cluster Involves competencies necessary to work in teams and in different knowledge communities (de Haan, 2006; Barth et al., 2007; Sipos et al., 2008). This cluster includes competence in engaging with stakeholders[6] establishing consistent vocabularies, and facilitating participatory research and decision making in collaboration with experts from academia, industry, government, and civil society. de Haan (2006) also argues for nurturing empathy and compassion in sustainability education, and is echoed by Barth et al. (2007). The motive for solving sustainability problems stems from a sense of solidarity with people and the natural environment. It is difficult to imagine making the effort necessary to accomplish the goals of sustainability in the absence of that motive.
	<u>Role of systems thinking:</u> Systems thinking can be found in the strategic knowledge cluster. Here, temporal and cultural scales are also mentioned. In the collaborative cluster, there is attention for working across disciplines. There is no explicit mention of spatial differences and working globally/locally.
Mochizuki et al. (2010) Specified to HE Spatial Disciplinary Cultural	*Democratic, deliberative and situated processes* "Any serious call for a truly transformative approach to ESD/EfS, however, require challenging of structural conventions and questioning of the taken-for-granted modernist dualisms (e.g. traditional/modern, individuals/collectivity, academic/vocational) underpinning the modern education system." "Core competences necessary for SD may not be always conceived as universal."

	"If competence is about what we (be it UN organisations, politicians, policymakers, business people or academicians) want university graduates to do what we (and not the students themselves) consider valuable, and if there is no questioning of learners' personal beliefs and whether they really want to do such things, ESD/EfS can be a dogmatic exercise. Given the complex and cross-cutting nature of SD/sustainability, and a lack of consensus on its definition, coupled with diverse conceptualisations of competences and competencies, it is impossible to capture and define the required competences for SD and sustainability." "Instead of quick "check lists" of competences, we need a democratic, deliberative and situated process of first specifying desirable competences (by asking whose needs and desires are being addressed and for what purposes in what kinds of world) and then carefully articulating them in educational programmes. Competences have no meaning unless they are enacted in practice and connected to assessment in a particular context." "[There is a need to overcome] the tendency of the competence-based approach to be preoccupied with specifying competences (while paying insufficient attention to human agency and individual and cultural differences) and neglect the importance of organisational and institutional changes in achieving SD".
	<u>Role of systems thinking:</u> Mochizuki et al. do not specifically speak of systems thinking, however, they do discuss multidisciplinary and the role of cultural differences. Furthermore, a large part of their article is dedicated to the question of universality of ESD competences. In focusing on this, they give a lot of attention to spatial factors, though they do this in the context of defining competences and do not necessarily state that learners should gain this spatial awareness.
Wiek et al. (2011) Specified to HE Systems thinking/cause and effect Temporal Cultural	*Key competencies* "It seems that the field is still in search of over-arching concepts that would relate and integrate sustainability competencies in a meaningful way." Overarching competence (as posed by de Haan): "having the skills, competencies and knowledge to enact changes in economic, ecological and social behaviour, without such changes always being merely a reaction to pre-existing problems" Wiek et al: "We contribute to this convergence with our literature review by creating and applying a common framework of sustainability research and problem solving to define and integrate key competencies in sustainability. - Systems-thinking competence - Anticipatory competence - Normative competence - Strategic competence - Interpersonal competence Integrated sustainability research and problem-solving framework.
	<u>Role of systems thinking:</u> As one of the six key competences, systems thinking plays a large role in the key competences framed by Wiek et al. (2011). A further temporal and cultural focus can

	be found in the anticipatory and interpersonal competence formulated.
Frisk and Larson (2011) No specific stage of education Systems thinking/cause and effect Temporal Cultural	*Competencies and practices for transformative action* Lack of efficacy in sustainability-related educational programs (partly) due to: - faulty assumptions about knowledge automatically leading to action - the information-intensive methods that focus largely on declarative knowledge regarding how environmental systems work. In order to effectively educate for sustainability, alternative forms of knowledge (i.e., procedural, effectiveness, and social knowledge) are essential, as is the consideration of various barriers and motivators for action. Primary purpose is to integrate behaviour change research and sustainability competencies in developing effective educational approaches for transformative actions. Four key sustainability competencies: Systems thinking and understanding of interconnectedness Long-term, foresighted reasoning and strategizing Stakeholder engagement and group collaboration Action-orientation and change-agent skills
	<u>Role of systems thinking:</u> Frisk and Larson specify systems thinking as one out of four key competences and put a temporal and cultural factors in two others. About the importance of systems thinking they say “in order to bring about behavioural change among students and society, people must learn to analyse the consequences of their actions, both intended and unintended, while recognizing the trade-offs now and into the future” (Frisk & Larson, 2011b, p. 7). They connect systems thinking to a temporal component and remark, interestingly: “although understanding the larger system is important, it may actually create a barrier to change as individuals realise that their action alone will not lead to substantive outcomes” (Frisk & Larson, 2011b, p. 7). Interdisciplinarity is mentioned only in the context of systems thinking competence.
UNESCO (2012) No specific stage of education Systems thinking/cause and effect Spatial Temporal Disciplinary Cultural	*Knowledge, local issues, skills, perspectives and values.* Knowledge People need basic knowledge from the natural sciences, social sciences, and humanities to understand: - the principles of sustainable development, - how they can be implemented, - the values involved, and - the ramifications of their implementation. Skills ESD must provide people with the practical skills that will enable them to: - continue learning after they leave school, - to find a sustainable livelihood, and - to live sustainable lives. *Examples of skills* - the ability to communicate effectively both orally and in writing

- the ability to think about systems (both natural and social sciences)
- the ability to think in terms of time – to forecast, to think ahead and to plan
- the ability to think critically
- the ability to use multiple perspectives to understand another person's viewpoint
- the ability to analyse values underlying differing positions
- the capacity to move from awareness to knowledge to action
- the ability to work cooperatively with other people
- the capacity to develop an aesthetic response to the environment and the arts

Local issues

Few of many issues: Agriculture, atmosphere, biodiversity, changing consumption patterns, climate change, deforestation, desertification and drought, fresh water, gender equity, human settlement, indigenous people, land use, oceans, population growth, poverty, protecting and promoting human health, solid and hazardous wastes and sewage.

Perspectives

Perspectives on sustainability are commonly statements that expand upon the principles of sustainable development found in Agenda 21. Principles include, but are not limited to:

- Environmental protection and human-centred development are considered together, not separately.
- There must be a balance and integration of environment, society, and economy.
- States have a right to development, but must respect geographic boundaries.
- Partnerships can achieve more than solitary action.
- Social and environmental problems change through time and have both a history and a future.
- Contemporary global environmental issues are linked and interrelated.
- Systems thinking or a whole-systems approach should be used in problem solving rather than looking at problems in isolation.
- Humans have universal attributes.
- The family is the foundational social unit.
- Local issues must be understood in a global context and we should realize that solutions to local problems can have global consequences.
- Individual consumer decisions and other actions affect and give rise to resource extraction and manufacturing in distant places.
- Differing views should be considered before reaching a decision or judgement.
- Economic values, religious values, and societal values compete for importance as people with different interests and backgrounds interact.
- Technology and science alone cannot solve all of our problems.
- Individuals are global citizens in addition to being citizens of the local community.
- Communities are built for all people regardless of income, ethnicity, status, etc.
- Community and governmental decision-making must include public participation. People whose lives will be affected by decisions must be involved in the process leading to the decisions.
- Transparency and accountability in governmental decision-making are essential.
- The decentralization of governmental decision-making allows people to find solutions that fit local environmental, social, and economic contexts.
- Employing the precautionary principle – taking action to avoid the possibility of serious or irreversible environmental or social harm, especially when scientific knowledge is incomplete or inconclusive – is necessary for the long-term well-being of a community and our planet.

Values

Understanding values (e.g. one's own values, the values of the society one lives in, and the values of others around the world) is an essential part of understanding one's

own and other people's viewpoints.

Role of systems thinking:
Systems thinking is mentioned as the second of a collection of examples of skills. Aside from this, all aspects of systems thinking mentioned in the definition are echoed through the document.

UNECE (2012)

Competences for educators

For educators

Systems thinking/cause and effect
Spatial
Temporal
Disciplinary
Cultural

Learning to know refers to understanding the challenges facing society both locally and globally and the potential role of educators and learners (The educator understands....);
Holistic approach (integrative thinking and practice)
The basics of systems thinking ways in which natural, social and economic systems function and how they may be interrelated.
The interdependent nature of relationships within the present generation and between generations, as well as those between rich and poor and between humans and nature.
Their personal world view and cultural assumtions and seek to understand those of others.
The connection between sustainable futures and the way we think, live and work
Their own thinking and action in relation to sustainable development.
Envisioning change (past, present and future)
The root causes of unsustainable development
That sustainable development is an evolving concept
The urgent need for change from unsustainable practices towards advancing quality of life, equity, solidarity, and environmental sustainability
The importance of problem setting, critical reflection, visioning and creative thinking in planning the future and effecting change.
The importance of preparedness for the unforeseen and a precautionary approach
The importance of scientific evidence in supporting sustainable development.
Achieve transformation (people, pedagogy and education system)
Why there is a need to transform the education systems that support learning
Why there is a need to transform the way we educate/learn Why it is important to prepare learners to meet new challenges
The importance of building on the experience of learners as a basis for transformation
How engagement in real-world issues enhances learning outcomes and helps learners to make a difference in practice

Learning to do refers to developing practical skills and action competence in relation to education for sustainable development (The educator is able to....);
Holistic approach (integrative thinking and practice)
Create opportunities for sharing ideas and experiences from different disciplines/places/cultures/generations without prejudice and preconceptions
Work with different perspectives on dillemmas, issues, tensions and conflicts.
Connect the learner to their local and global spheres of influence
Envisioning change (past, present and future)
Critically assess the processes of change in society and envision sustainable futures
Communicate a sense of urgency for change and inspire hope
Facilitate the evaluation of potential consequences of different decisions and actions
Use the natural, social and built environment, including their own institution, as a context and source of learning
Achieve transformation (people, pedagogy and education system)
Why there is a need to transform the education systems that support learning

	Why there is a need to transform the way we educate/learn Why it is important to prepare learners to meet new challenges The importance of building on the experience of learners as a basis for transformation How engagement in real-world issues enhances learning Learning to live together contributes to the development of partnerships and an appreciation of interdependence, pluralism, mutual understanding and peace (The educator works with others in ways that....); Holistic approach (integrative thinking and practice) Actively engage different groups across generations, cultures, places and disciplines Envisioning change (past, present and future) Facilitate the emergence of new worldviews that address sustainable development Encourage negotiation of alternative futures Achieve transformation (people, pedagogy and education system) Challenge unsustainable practices across educational systems, including at the institutional level Help learners clarify their own and others worldviews through dialogue, and recognize that alternative frameworks exist. Learning to be addresses the development of one's personal attributes and ability to act with greater autonomy, judgement and personal responsibility in relation to sustainable development (The educator is someone who....). Holistic approach (integrative thinking and practice) Is inclusive of different disciplines, cultures and perspectives, including indigenous knowledge and worldviews Envisioning change (past, present and future) Is motivated to make a positive contribution to other people and their social and natural environment, locally and globally Is willing to take considered action even in situations of uncertainty Achieve transformation (people, pedagogy and education system) Is willing to challenge assumptions underlying unsustainable practice Is a facilitator and participant in the learning process Is a critically reflective practitioner Inspires creativity and innovation Engages with learners in ways that build positive relationships
	<u>Role of systems thinking:</u> Systems thinking is seen to be essential for the educator to understand. The specific elements from the definition also come back throughout the competencies.
Rieckmann (2012) Specified to HE Systems thinking/cause and effect Temporal Disciplinary Cultural	*Key competencies* 12 key competences, most important: systemic thinking, anticipatory thinking, critical thinking <u>Competencies:</u> - Competency for systemic thinking and handling of complexity - Competency for anticipatory thinking - Competency for critical thinking - Competency for acting fairly and ecologically - Competency for cooperation in (heterogeneous) group - Competency for participation - Competency for empathy and change of perspective - Competency for interdisciplinary work

- Competency for communication and use of media
- Competency for planning and realising innovative projects
- Competency for evaluation
- Competency for ambiguity and frustration tolerance

"Competencies may be characterised as individual dispositions to self-organisation which include cognitive, affective, volitional (with deliberate intention) and motivational elements; they are an interplay of knowledge, capacities and skills, motives and affective dispositions. Consequently, these components are part of each competency, not having to be regarded independently, but in their interaction."

"Competencies can be advanced: they are acquired during action – on the basis of experience and reflection."

"Key competencies can be understood as transversal, multifunctional and context-overall competencies which are considered to be particularly crucial for implementing societal goals important in a defined normative framework (e.g. sustainability) and which are important for all individuals. […] They rather bear a different, a wider focus, pooling different competency classes and being situated transversely to them; and they comprise different domain-specific competencies and point out the most relevant competency fields"

Role of systems thinking:
The first competence mentioned by Rieckmann is systemic thinking. It is complemented by anticipatory thinking (temporal component) and critical thinking, to form the three most important core capacities. In the larger list of twelve competences, cultural and interdisciplinary factors are added. No explicit mention is made of a spatial understanding of systems thinking.

Hofman (2015)

No specific stage of education

Systems thinking/cause and effect
Temporal

Action competence

The challenge for education is that the students develop an action competence, a competence that provides the individuals with the knowledge of different options and how different choices affect society.

Systems thinking and critical thinking are the basis for developing action competence. To only teach about the effects and consequences can lead to paralysis, but in relation to other aspects of action competence, action becomes motivated.

'What' (descriptions of the effects and consequences of the problem); 'how' (option on change and action strategies); 'why' (perspective on structural reasons); and 'where' (goals and alternative solutions).

Constructive action creates a positive cycle. When the constructive action betters social and ecological climate and develops personal growth and a sense of efficacy within the active person, this leads to feelings of empowerment which, in turn, lead to more environmental and social change.

Role of systems thinking:
The combination of systems thinking and critical thinking is seen to be the basis of developing action competence – the central aspect of ESD for Hofman. Additionally, her conceptualisation of what, how, why and where harbours questions of cause and effect, as well as a temporal notion in coming up with goals and alternative solutions.

OECD - PISA (2016)

No specific stage of education

Systems thinking/cause and effect
Spatial
Disciplinary
Cultural

Global competency for an inclusive world (knowledge and understanding, skills, values and attitudes)

Global competence = the capacity to analyse global and intercultural issues critically and from multiple perspectives, to understand how differences affect perceptions, judgments, and ideas of self and others, and to engage in open, appropriate and effective interactions with others from different backgrounds on the basis of a shared respect for human dignity.

Learning goals:

Knowledge and understanding (knowledge = the body of information that is possessed by an individual, understanding = the comprehension and appreciation of meanings)
- Disciplinary knowledge
- Interdisciplinary knowledge
- Practical knowledge

Global Competence requires knowledge and understanding of global issues as well as intercultural knowledge and understanding.

Skills (skills = the capacity for carrying out a complex and well-organised pattern of either thinking (in the case of a cognitive skill) or behaviour (in the case of a behavioural skill) in order to achieve a particular goal)
- Cognitive and meta-cognitive skills
- Social and emotional skills
- Physical and practical skills

Global Competence requires numerous skills, including the ability to: communicate in more than one language; communicate appropriately and effectively with people from other cultures or countries, comprehend other people's thoughts, beliefs and feelings, and see the world from their perspectives; adjust one's thoughts, feeling or behaviours to fit new contexts and situations; and analyse and think critically in order to scrutinise and appraise information and meanings.

Attitudes and values (Attitude = the overall mind-set which an individual adopts towards an object (e.g. a person, a group, an institution, an issue, a behaviour, a symbol, etc.) and typically consists of four components: a belief or opinion about the object, an emotion or feeling towards the object, an evaluation (either positive or negative) of the object, and a tendency to behave in a particular way towards that object. Value = a general belief that an individual holds about the desirable goals that should be striven for in life; values transcend specific actions and contexts, have a normative prescriptive quality about what ought to be done or thought in different situations, and may be used to guide individuals' attitudes, judgments and actions.)
Globally competent behaviour requires an attitude of openness towards people from other cultures or countries, an attitude of respect for cultural otherness, an attitude of globalmindedness (i.e. that one is a citizen of the world with commitments and obligations towards the planet and towards other people irrespective of their particular cultural or national background), and an attitude of responsibility for one's own actions. In this framework, valuing human dignity and valuing cultural diversity are explicitly included as critical filters through which individuals process information about others' differences and the world, and are key references for critical and informed judgement.

Assessment of the cognitive components in PISA		Self-reported in the PISA student questionnaire
Skills	Knowledge & understanding	Attitudes
- Analytical and critical thinking - Ability to interact respectfully, appropriately and effectively - Empathy - Flexibility	- Knowledge and understanding of global issues - Intercultural knowledge and understanding	- Openness towards people from other cultures - Respect for cultural otherness - Global mindedness - Responsibility
← Components →		
Values		
Global competency		

Role of systems thinking:
Systems thinking is not mentioned as such, but there is attention for cause and effect in the shape of 'analytical and critical thinking'. Throughout the document, the emphasis is on cross-cultural understanding and a global mindset. Interdisciplinarity is mentioned once. There is no mention of thinking across temporal scales.

ANNEX 7 – INTERVIEW TRANSCRIPTS

Interview 1 – Harshal **CEE Ahmedabad**

F: Yes, so yeah, I prepared a few questions, but it is really just to see that whatever comes to mind is very welcome and will be interesting to me and the main themes I want to talk about is the status of ESD Ahmedabad in specific and maybe also Gujarat as a whole a little bit if you know anything about that, about what you think students should learn concerning sustainability, what they should take away, what they need to cope with sustainability challenges in the rest of their lives, and the role of systems thinking in this, all of this. Yeah, that's kind of it.
Ehm, so first I think eh, I would like to know a little bit about your background. So you told me that you studied education, I think?
H: Okay, so, my second master's was in education and that I have completed from the [something 1:09] university in Bangalore. This is a MA of Arts and Education which is different from ME, Master's in Education which is normal master course in education domain my course was different than this traditional MA in a sense, in my course there were, I mean, there was emphasis on two broader domain, first is curriculum and pedagogy and second is school leadership management. So, comparatively they were more expertised domain, compared to traditional MA course. So that was my second master, by first master was in History.
F: Oh
H: Yeah, my bachelor's and master was in History and that was in Pune Univeristy. So that is my educational background.
F: Okay! And straight from here you went to CEE? Is your first job?
H: No no, is my third job, third or fourth you may say. And I'm here since July, so almost since three months.
F: Okay and what have you done before?
H: Before I was working in Surat [also in Gujarat, between Mumbai and Ahmedabad approx.], with public schools. So I used handle 54 schools in Surat, Surat Municipal [something 2. 37] schools more specifically. That programme was focussing on making public school the model school.
F: Okay
H: Ensuring quality learning to students over there that normally come from the dispriveleged background, economically and socially dispriveleged background. So I mean, my role was to conduct the workshop with teachers, headmasters and design the different goals, intervention, which could ensure this quality learning in languages and maths and school processes in those schools. So directly I'm accountable to 15 schools, indirectly I was accountable to 54 schools.
F: Wauw
H: That was in Surat for one year.
F: And that project ended or why did you stop there?
H: No, I left, because I found this CEE opportunity. Because, I mean, I have decided that I should explore three broader domains in my life. First is education, environment and democracy, maybe through the way of education only, I don't know yet. But then the CEE opportunity came in and I thought there could not be a better institution in India to explore the area of environment. So then I joined in the CEE.
F: Cool, nice. And that's so that's three months ago.
H: Three months ago.

F: So mainly you have been working on Swachhagraha?
H: Swachhagraha, so this project is mainly about the cleanliness, there the mission is to create a culture of cleanliness. Specifically in the school, generally in the society. Creating a mission, creating a culture of cleanliness.
F: And this is what you have been working on so far at CEE?
H: Yeah.
F: Okay, ehm, so, then it is pretty clear how your work is related to Education for Sustainable Development. And before, were you involved with sustainability in any other way? Or is it really not only environmental things or do you do other things with that?
H: Like, if you see like in themes of sustainable development, I mean ESD, I mean sorry, in 19 themes of sustainable development. I mean 19 or 17?
F: 17 SDGs

H: Yes, 17 goals are there, quality education is one of the important themes. So in that way I mean, I can say that directly or indirectly my work is contributing to sustainability. I mean last year it was, these children from dispriveledged backgrounds, there this education gives more potential for the [sustainability?]. This year its there is different set of students and school, but you know, I mean in this programme there is almost 2/3rds schools that are city government schools, where you can find students from what should I say, middle class? Low middle class. Mainly from the low middle class. And yeah environment education and education in both ways, you can link with sustainability.
F: Yeah, totally. So ehm, the first time that you came into contact with ESD as a term, Education for Sustainable Development, that was at CEE, or?
H: No, before CEE but because of CEE I say, because I was preparing for the CEE interview and then I was taking down [something 6.55] so I don't know which international treaty it was but it declared this 2015 to 2030 I mean the MDGs got replaced by the SDGs. And then I came to know about education for sustainable development, before that I was not aware of the education for sustainable development, but before that I was aware of the sustainable development goals, but not this education for sustainable development.
F: Okay, ehm, and then, how would you, for you, define education for sustainable development? So what does this entail, as you have experienced it so far.
H: Yeah, so, not precisely I should say, I mean, like I'm a social science enthusiastic person, who aspires to work on social sciences in the school. Eh, when I saw that document of eh, I mean FAO document, I still remember, Food and Agriculture Organisation, they prepared a very nice document about 17 themes and then I realised it sends like a more utilitarian and more practical approach to social science.
F: Yes
H: When you find all themes of social science under the broader umbrella of sustainable development goals, you can find gender, you can find emotional well-being, you can find education, you can find this democracy, something like that, democrating norms or something like that.
F: Strong institutions, yeah.
H: Yeah institutions. Community, traditional knowledge, everything you can find under that broader domain. So I feel that this sustainable development and in particular the education for sustainable development. It is kind of a utilitarian approach towards the social sciences in integration. Because not only social sciences stands for many things, for theory, for many things. And now here, it is a very nice combination. Which is very practical in nature. Because when it comes to social sciences, many people raise the question, what would be its utility. So ESD comes, I mean it brings utility in a very precise way [9.34] those 5,6 themes, just let me open this, yeah just.

F: Okay, and what do you think is, should be the purpose of ESD. So what should, why is it important that children come into contact with these type of…
H: Because I mean, if you see around the society. In every society, there exists problems and promises. But when I see the education system in India, it might be a low income school or a high income school, you will find the emphasis always on science and maths, because those are the topics which parents thing, will increase the employability of their kids. So naturally, they will put the emphasis on science and social science will get the secondary importance. But I feel because, because of this neglection, students are not able to see the root causes of social problems around them. For example take the question of reservation, which in the Western world call it as affirmitve action. In India we call it reservation system, for the socially unpriveledged class.
F: Okay, yeah.
H: And you can find, and there is a reason where there is a reservation system in India, it is because untouchability for a thousand years of section of society is lacking behind in terms of progress and prosperity, so constitution of India has ensured this system of reservation for the educational opportunities, as well as opportunity in employment. But you can see, I mean, what, anger and uneasiness among the middle, upper middle, educated class about this reservation system. And I mean its really strange to see their attitude, but then I think it will be normal for them because education system don't teach the problem of untouchability. Don't teach the problem of why reservation, I mean they don't just connect the problem of untouchability backlog and the reservation system. So it becomes natural for them to express their anger and protest towards this reservation system and then just see the grudges in between two communities start, they start rising. Same about the Hindu-Muslim problem in India. Teacher and textbook, no not textbook. Teachers are shy away to teaching these problems in the classroom. They're just concerned in the getting assignment and the social science in a way is secondary subject for them. So I feel, our education system fails to create a, I mean fails to create the sensibility towards social problems. And **[13.31]** that's why then I hope ESD at least as a new

concept or might be as it sounds glamourous, teacher and education systems would, it would attract the attention of teacher and education system. And then they will touch these issues of gender and well-being, emotional well-being and all the development goals.
F: So really the social side of
H: Yeah, so I'm visualising the scope of ESD from this perspective.
F: Okay, great, thanks. Ehm, so this is the things that students should take away [from ESD] is especially a sensitivity to social issues? You think this is something that students should learn when having ESD? This should be the outcome of ESD or is there
H: Because, like, I mean, as a part of society, you want your society or your nation to be to get sustained for a longer time, with a better life opportunity, better environment, better surrounding, then you should, education should take care of these social tensions, social fractures across the language, gender, [creed?], caste, anything. I mean sustainability not only in terms of natural resources, but sustainability in terms of the social cohesion. It is very much required and a couple of things in ESD also take care of those things, so at least from a social point of view, I can see the scope of ESD, obviously natural point of view, I mean the point of view of resources and nature, that focus has already been assured since the Earth Summit, I mean that was the first time it attract then the attention of the world of the school system. In 1986 it was the time when India for first time put environment education in its curricula. Environment education as a word, it got introduced in 1986 policy. And the 1992 was the year of Earth Summit, when it got pushed, I mean pushed forward. So emphasis and attention towards sustainability is there since 92 about this nature and resources point of view, but as you see as globalisation is taking shape across the world we are facing with new social problems. So social sustainability is one thing I'm looking for. Maybe ESD can be one of the answers.
F: Yes, okay. Well, that really answers my questions I think.
F: Ehm, I have one sort of specific question still on something like this. What do you think – we sort of already touched upon this – but if you would really specifically say that what do you think that people in general, that every person should know, in order to be able to cope with sustainability challenges. So now we've been talking about overcoming social barriers, I guess, to overcome social barriers put up by religion, caste, things like that. So this could be your answer. But really specific, just to have asked it anyway, what skills or values do you thing that, so this is, yeah.
H: Every person or every stakeholder associated with the school or?
F: It's mainly what do you think that children should learn in schools to be able to
H: Children you are talking about, so which values children should look out for?
F: Yeah, knowledge, skills, values is what I called it, but really just what should be the outcome of education in order for them to be able to cope with sustainability issues that are already there and those that are still developing. So it's a very big question and I was already happy with your answer on the social aspect.
H: No, no, I am getting your question I am just trying to I mean I am trying to understand which stakeholder you are looking for, I mean teacher, I mean what knowledge, skills teacher should possess or?
F: No what knowledge or skills children should acquire in their education.
H: Okay, okay, the children, okay, okay. I mean, life skills would be the answer for this question. I mean with the life skill, I mean what should I say. Life skill takes care of all the things I mean problem solving, critical thinking, team work, more importantly. Basically this concept which is that concept of Daniel Goldman, social intelligence. So, life skills takes care of many things, which we can look out for values with ESD, child should develop like empathy. Empathy, then problem solving, critical thinking, team work. The other could be the update, I mean being updated about the changing environment, I mean, changing surrounding I should say.
F: Okay. So to what extent do you feel that this is also seen in the way ESD is told now, do you think these things do they, yeah how do you say this. To what extent do they relate to learning outcomes that are there now for ESD that's being told now, of courses as they are being taught in different schools, do you think this is linked to this as well?
H: No, no, not at all. Because, if you see in India majority of schools and even education system, they just put emphasis on information. Like, if you see the format of [something] assessment, you can see the written text with emphasis on the information only. Which is of normally which is of use for student. So assessment system should be more of quality, which should look out for the assessment of knowledge, skills and attitude students have developed under the ESD and we could have different forms of assessment. Actually, the irony is that all these challenges, Indian educators have recognised all these challenges and in 2005 we have a very revolutionary kind of curriculum, which is called National Curriculum Framework 2005 NCF 2005, which introduce a new system of assessment, which calles CCE, Continuous and Comprehensive Evaluation, where teacher is supposed to mark they do observation on the student in the given format, I mean the academic

performance in the classroom, the things **[22.50]** teacher could observe on the playground or maybe the assembly or the personal skills, so teacher is supposed to mark all of these observations in the format of the CCE, but teachers are seeing it as just a data entry tool and any I mean almost, you can see, many of teachers they are just doing it for the sake of doing it or many of teacher are not doing it at all, CCE. Which is actually required. I mean which could be one of the form of assessment for the ESD. I mean in which you could see the knowledge, skills and attitude in one particular child and then you can design and redesign your pedagogy, your lesson plan, but that purpose got [something] because of the reluctance of the teachers. So you and we can design different assessment system, the key question is: how we are going to change the mindset of teachers.
F: Teachers or also school leaders?
H: Teachers and parents. Because, like, see, 2005 changes in assessment. One was CCE, second change that was introduced was that student does not get failed until 9th standard. I mean school, only 9th and 10th have the exam and then they might if they are not able to perform at par with 9th level or 10, then only they will get failed, because it was seen that like even, before 2005, if students used to score less in one subject, you used to get failed for I mean, the rest of the year you have to repeat all subject, so the rest of the year would go in the bin. So 2005 was big in that schools will not fail the student until 9th standard but instead will design some bridge courses or some alternative mechanism and might be for 9th and 10th student might get failed. But you can see that even this change was not welcomed by the parents and students community. The teachers perceive it in another sense. They put the argument that if exams will not be there, then students will not study. So what will be the purpose. The purpose was different, that students should not have the burdens of the exams, but enjoy studying. But you can see that the difefrentce of opinion between the curriculum maker and the teacher and the parents, so that is something that is the real problem. Which is then should get a system response.
F: And where do you see the school leaders?
H: Pardon?
F: The school leaders or
H: Principals?
F: School principals or the headmasters or, yes. Are they more on the side of the teachers or more on the side of the curriculum makers or is that different per school?
H: They're, I mean, what should I say. You see, I mean in the Indian system, there are I mean two different position at the school leadership level. One is the principal or head master, the other is the school trustees management body. Who takes care of the other things like the management, the record building, the financial management and all those things, and the principal and head masters are normally the administrative head of the schools. So obviously they will be more in sympathy with the teachers, the administrative head. And management body, normally are not so much intrested in this pedagogic approached, I mean they are more interested in the record building, what would be better ways to reach out to the society. For progress to their school and other things. So I mean you can say that the HMs and principals are more in sympathy with the teachers because they don't want this bureaucratic work, the writing and the documentation. The I mean for government and semi-government schools, they are already full of documentation work, because of government implementations, government schemes, so for them, CCE it was like adding to their difficulties already existing over there. So this is the case. But, the CCE, in India, the system is like in NCERT, National Curriculum Education Research and Training [National Committee for Educational Research and Training] it's the board, it's the central board.
F: The NCERT, yes I know.
H: I mean CBSE Central Board Secondary Education, the NCERT is another body. They have their own school around the country and then you have the state board, Gujarat state board, Rajasthan state board, education is the subject which comes in the concurrent list in constitution. So in India, we have three list, central list, state list and concurrent list, where constitution makers, they have classified subject of authority for governments, central government, state government and then there is a concurrent list where governments in mutual agreement should take care of this subject. So education is in concurrent list. So its, it's a delicate position, but normally state board supposed to be aligned with the NCERT. But it's the NCERT have suggested the CCE, but many of state board have not adopted this practice. Or may have adopted in very diluted form. **[30:09]** which is of no meaning. So this is the way, one of the way, how the Indian education system work.
F: So do you think that these type of, I mean this is a different way of assessing those outcomes, learning outcomes. Do you think it also needs a different pedagogy?
H: Pedagogy, yah, yah, 2005 was revolutionary in that sense it introduced very different kind of pedagogy. And teachers were not able just to add up with that pedagogy. And I'll show you some example, so I'll show you

later. Previously you can find books with full of information. Full of content and if you see book 2005 onwards, you will find many pictures which are self-explanatory, cartoons in political science books, then thought provoking questions, then different surveys. So basically they introduced different tools, which teacher is ssupposed to use. And previously teacher was supposed to for the opinion of the students. Okay, this is history, okay, so I mean lets see this Gandhiji has adapted the principles of non-violence and it was correct or not. This teacher used to decide and teacher used to say. Now with this new textbook, teacher and new pedagogy which is called constructivism. Constructivism is what, where you're suppost to construct the opinion based on the experiences of the students, based on the opinion of the students, rather than imposing your own opinion. So, textbook were in alignment with this pedagogy of constructivism, so textbook was not used to support or come up with the argument of what was wrong or right, for example the non-violent method. But it used to come up with different accounts. What revolutionary used to do, what Gandhi used to do, what people used to feel at that time, what was British's opinion about revolution, what was British's opinion about Gandhi? At the same time, some of references from the news paper of that time. And with integration of all of these things, students are supposed to form its opinion. Then your opinion might be different, my opinion might be different but in this way, curriculum maker and the text book, try to ensure that student should be able to form his opinion on the given evidences. They should try to explore any given subject on their own. Before previous 2005, it was to kind of school feeling, teacher used to say and student was to remember. I mean, that was the intention of 2005, but unfortunalty that credo 2005 still continues, until 2015.
F: Yeah, and now there is a disconnect between what is in the textbook and what is being done by teacher.
H: Yeah, yeah. Because I mean teacher find it very difficult to change their mindset, change the old pedagogy, where they used to just read the topic, write it down on the board and then they used to give exercises, assignments, homework and done. So, these are things.
F: Let's see, then I had a question. **[34:20]** Do you think that ESD in Gujarat, is it different than other states in India?
H: I do not have any idea. I mean, you should not see Gujarat and other states variable to see this thing could be different kind of schools, high-income schools, low-income private schools and the government schools. This might be your variable, this might be one variable where you might find the difference. About any subject for that matter, ESD as well.
F: Ah yeah, that was my next question, so that's great. So then Ahmedabad, you would say that, oh do you think also that there is a difference still between Ahmedabad and the rest of Gujarat? Like between big city and..
H: Yeah, but before to response this question. But definitely I should say in Ahmedabad, but if not in Gujarat, you can find at least some awareness in some of high-income school about of this concept of ESD and that is because CEE. I mean CEE have very regular engagement with schools over here and for two times, we have these international conferences in CEE campus, where many of teachers attended. So they know this phrase. I'm doubtful even if high-income school from other metropolitan cities, like Kolkata, Pune, Mumbai, Delhi are aware about these things or not, I am not sure. But because of this particular advantage of having CEE in their city. Ahmedabad schools have comparatively aware of this ESD concept.
F: Okay, this also relates to another question. To what extent do you feel that. I mean Swachhagraha is one project and different projects are done by CEE, to what extent do you think ESD is really only done on a project basis or whether its somehow integrated into the curriculum?
H: Hm, okay, so I mean, it is based on the teachers and principals attitude. In some school I ccan find that teachers and principal is able to integrate it into the curriculum. In one of the schools I have found the teacher to have made the curriculum for the year, not curriculum, schedule for the year, where she has integrated the projects going on in the school, with the existing curriculum from the CBSE and NCERT. So, in some of the schools, teachers are able to do this integration with the curriculum, for some of teachers these are isolated projects. Where they agree with the significance of the project, but might not be able to connect with the ESD.
F: So CEE, I would guess, would prefer the first one?
H: No, we always try our best, that they should look these things in integration to the curriculum. I mean they all follow this NCF 2005 curriculum, and in this curriculum 2005 it's a broader curriculum, where you can fit any of thing at least into one or two things. So it's not outside of the curriculum. For example one of the things in NCF it says school and teacher should be able to develop the aesthetic sense among the students.
F: Aesthetic sense?
H: Aesthetic sense, I mean approach towards beauty in every sense. So here in Swachhagraha its one of the places of the schools that should look very clean. So that's also aesthetic, so you can bring into contact with aesthetics. So, how many teachers have read NCF, are trying to connect it?

F: Have actually read the NCF?
H: Yes. It's a comprehensive document. 120 pages, so you know its definitely in alignment with the NCF, but its up to the teacher if she or him can connect to the curriculum, with the projects.
F: So, I don't know how you are on time, but I think I'm, yeah there's a few other things. Main thing is, so in your work for CEE, or maybe before that, have you ever come across systems thinking? Specifically systems thinking?
H: System thinking in international relation, I've come across, but not this one.
F: Not in this sense. But then looking through documents of CEE, it is already in there, so the idea of connecting the different disciplines, connecting
H: Connecting the dots.
F: Exactly, that's very often coming back. Do you think there are places in the curriculum where students are already learning to think in systems, without necesarilly calling it that?
H: Students are able to connect it. It's I mean what, this is what you are asking?
F: I mean, as the curriculum is now, are there already places are learning to do this, without actually calling it systems thinking. Just connecting different disciplines and different.
H: So, I perceive this question as. So systems thinking would be more broader concept, broader domain. But me, my concern is if students are able to connect whatever learning in their schools to outside. Are they able to connect the curriculum learning, to surrounding outside their school, so that is the area of concern for me. So if you take the environment, or maybe social science. Okay environment, so, I mean not very strongly, but they connect it, at least, normally they would be able to connect it, but I think it is teachers duty, to make this connection very strong and it is like I say, I mean it is teachers attitude and the education system, they discourage this connection. They put focus on the information, [mugging?] up the information, so my wife is teacher and I also go to many of schools. From I mean once you open the platform, I mean, if youre a really good listener, students come up with their own analysis, and they are able to find their own connections, but many of times, teachers are not so flexible. **[42:49]** They don't want to set their class in an interactive way, but just pass on the information from their side only. So I'd just like to share the example, which I encountered yesterday only, in one of my interactions. So you might be aware that some tussle between India and Pakistan is going on these days. And now there is a campaign going on in the India to not use the Chinese goods, social media campaign.
F: Oh yeah, I've heard about that.
H: And because Diwali is approaching, we should not use the Chinese crackers. So yesterday, I was interacting with the students and the topic was air pollution. So we said you should not burn the candle, you should not burn the crackers. And then one girl, she suddenly came to me [43:52] she said that my father has shown me a message on WhatsApp, she said we should not use the Chinese cracker. Because, the Chinese cracker, once they get burned, they produce more carbon monoxide. So, it was strange for me. I mean, they are able to form connections. To crackers to global warming. Then the international relations happens across things like the India and Pakistan and how this is connected to the China. So I asked, why is it that we should not use the Chinese cracker? The fight is in between India and Pakistan. She said no sir, China is supporting Pakistan, so they are able to find the connections. But then I said, take any of crackers, both Indian and Chinese they will produce carbon monoxide. So it is not whether you should use Indian or Chinese cracker, give a thought to you should use the cracker or not. Then they were laughing. So because I made the floor open for interaction, I could get a sense of what was going on in their minds. But like you said, children definitely are capable to make more of these connections, but I am doubtful whether teachers produce the opportunity for students to do this. Basically, education is what, school education is what, how teacher makes opportunity for student to get exposed to different things, to get exposed to learning. But the teacher is so preoccupied with his own knowledge. Then these opportunities are missing, then only you get imposition of knowledge of teacher on student. Then you won't be able to find anything. Connection, creatitvity, anything. So in response to your question, students are capable, but I'm doubtful of the classroom environment and the encouragement they get in the classroom.
F: Okay, and in the curriculum, the new curriculum
H: Curriculum, constructivism all stands for the students experiences. Constructivism is to construct, to construct or build up on the students experiences. So in constructivism it is assumed that every child come up with different learning capabilities, because they comes from very different background. Economic, social, political everything and I mean emotional background. So everybody comes with the, different experiences. So, teacher should build a core concept, based on, those different experiences. So that every student would be able to get that concept in their own context.

F: Yeah, so the curriculum
H: The curriculum made a space, but teacher and education systems have not get this concept of constructivism very well.
F: Okay, I think I'm almost through my questions then. So only, on the concept of systems thinking. Do you think this idea, of being able to connect dots, and to think about how things are changing in temporal, spatial and dimensional scales, so how things connect to global [something], connect to your [something], connects to the environment, do you think that this is sooner a means to ESD? So a way to teach ESD?
H: Yes.
F: Or to be an outcome of ESD, or both? The ability to do things this way.
H: Means or outcome?
F: Or both, or somewhere in between.
H: Most difficult question until now. I mean, this connecting dots, simplifying, generalising this concept, systems thinking to connecting dots. If it's the objective, then naturally, it would be your mean as well. If a teacher is expecting students how local is connected to global, as a concept under globalisation. Then, he is supposed to unfold different dots. How we are connected. For example lets take the example of Ahmedabad, you can find many of people of Ahmedabad in abroad in India, you can find Gujarati and Punjabi people. Many of Gujarati and Punjabi people are abroad in USA and Canada **[49:26]** and UK. So, if they're not able to update themselves. To update the happenings in Europe and the USA, certainly, they will get effected, as we have seen in the economic meltdown in 2008, suprime mortgage crisis, fortunately India was not effected by that, but global recession, you can take. Many Indians are doing jobs over there. And we have this BPO, Business Processing Outsourcing, where we get contracts from America, basically the IT field, which performances depend on the demand from the Western countries. So if you're not able to get this development, and for lets try to connect it to school or education government. In India there was an IT boom, Information Technology boom, where people used to find very high paid jobs in information technology sector. So 2001 onwards, everyone was aspiring to be an IT engineer. And they started taking admissions in the computer engineering colleges. But by 2008 you can see that, I mean the proportion of jobs in IT drastically come down and currently we can find the proportion of jobless people very high in the society. So in this way, I mean the education system should be able to teach. I mean okay, let me think of some simple example. The question was something different, I went somewhere else.
F: Haha, it's okay, it's still interesting
H: Means and outcomes.
F: Yeah, I think you're still talking about that to a certain extent as well though.
H: So, consumption could be one of the example. This is what I use when I go into the schools and speak. So connecting dots does not always mean two regions or the happenings of two regions in the world. Its connecting the issues, and children and peoples roles in these issues. So, I mean education system could connect the climate change and consumption, which is an international issue, not restricted to one of the nations. So here, I mean, education system can play a role. Same is about the terrorism, the war, terrorism, so it should be a mean or outcome, it should be both. Using connecting dot as a mean, ultimately students end up in that mindset of connecting the dots, to see a development from a holistic perspective. So, this means and outcome as well.
F: No that's great. I think my last question is
H: It is actually bad thing when the teacher and professor talks a lot.
F: Haha, it's totally okay, I'm looking forward to all the things you have to say. That's no problem. So I think the last question I have is
H: And the worst thing is I'm both. By qualification professor and by practice I'm teacher.
F: Yeah, great combination, haha.
H: And being a coordinator for 120 schools, I'm a salesman for Swachhagraha.
F: Salesman, professor, teacher, I think it works well together at least. Ehm, but yeah the things that we said the values, the skills, or what did we talk about there, yeah problem-solving, critical thinking, team work, empathy life skills, on a knowledge basis being updated about whats happening in your environment.
H: By environment I mean surrounding.
F: Yes, so do you think this is connected to systems thinking and how? So looking at connecting the dots, is this for instance problem-solving, critical thinking, team work, of course its all related to each other, what role do you think thinking in systems can
H: Its very simple, I mean. Let's take two systems, one is the school system and the system beyond the school. Lets take the example of Swachhagraha, the programme we are doing. So here we are visualising that the state

of students will take the responsibility of problem of uncleanliness in the school. And students will take the initiative, students will take the action, and ultimately they will end up in taking the responsibility in their school and take the responsibility of the problem. So they will develop **[56:10]** this habit of taking the ownership for the faults that they see in their school. So when they develop this habit of taking the ownership, when they go beyond the school, outside the school, naturally they will assume the ownership of problems existing in the greater structure, the greater system.
F: Yes.
H: So in this way, I mean all these things are connected, but you should be able to look at this from this perspective. And school is, after all, a miniature of society. So whatever the approach or practices with the students in the school, that remains for a lifetime. So
F: Once a Swachhagraha, always a Swachhagraha
H: Always a Swachhagraha, yes! Making sure that miniature, system in miniature would get work, would ultimately mean that the greater system will work. This was your question?
F: Yes, definitely, I think so. And also, maybe a little bit more even the role, well that depends if it doesn't necessarily speak to you, then that is also an answer. Whether systems thinking or connecting the dots or thinking in different interactions together, if that would actually, hm, now I'm also getting lost in my own question. This is my first interview, so it's good, I'm starting to see how these questions actually come across, if that also helps to develop things like empathy, or problem-solving, or
H: Yah, empathy is one of the quality which I feel is very important, because India is a very diverse society. Diversity comes up with own promises and problems. Promises are surfacing very visibly, so empathy is something school and education system should work to develop, in very efficient way, then this problem which look like visible, the problems will turn into promises.
F: So the promises are surfacing visibly, what do you mean.
H: Pardon?
F: You said promises were surfacing
H: I said diversity comes with promises as well as problems. So if India is a country of diverse people, obviously we possess different strengths, different skills. But instead of capitalising on that diversity, the fear is that the problem comes up with the diversity, the reservation, I mean the untouchability is one of them, then inequality would be different. The issues based on the caste, the issues based on the language which I have shared. I mean where Mumbai or some of cities experiencing those things. They are surfacing more, in the media, in the public
F: More than the promises?
H: More than the promises. People are, if you see, the discussion on the social media. You will find the discussion on the problems more, rather than on the promises and those are all problems posed by the diversity. So I was saying like empathy would be one of the things schools should develop among the students, which is a great need in a society like India in comparison to maybe other societies in the world.
F: Yeah, okay. **[1:00:48]** Ehm, so then I think my last question is if there is anything more that I should take into account. Looking at ESD in Ahmedabad, at systems thinking, learning outcomes, sustainability competences, just throwing around a few terms.
H: Let's see, we have talked about ESD as a concept, NCF and how we try to bring up some of new ideas. We have also talked about the assessment, we have talked about little bit about the school system, government school, private, elite school. Which domain is missing? We have also talked about the teachers, their attitude. Okay. So now we will go to the root points. To the root cause.
F: Sounds good!
H: If you see the prominent NGOs these days all almost as well as the curriculum makers almost all have identified teacher as a key stakeholder to bring change in the education system. If they want to start any work. I mean they want to work out new framework, new ideas. Teacher is one of the persons in the system where we should take efforts. Where we should concentrate. The prevalent thinking these days the curriculum maker, NGOs, across the India, but if you see the genesis of teachers, I mean the background, who chose this profession? At least in India. So, these are the people, normally, who don't find admissions to other courses. So for the layman, for the normal people, teacher would be the least priority as a career option.
F: Really?
H: Yeah. That was the scenario since '95, 2000 at least in urban and semi-urban area. At least in rural area until 2005 it was the condition that someone by choice wanted to become teacher. But if you see, the urban semi-urban area. See, if you see, see, I will tell you the other development so that you will be able to understand. So in 1992, India's economic gate had opened to the world's economy. Before that we had socialism, the socialist

economy. And with 1992, 93 we have adopted the policy of liberalisation, privitisation and globalisation where multinational countries started coming to India, so then onwards people started finding more lucrative as well as more diverse job opportunities. So their focus, so till then these teacher colleges were in boom. Everybody wanted to become a teacher because that was ensured, I mean the assured job opportunity till the date, but once the economic gate opened to global market, people started finding different more promising jobs. At the same time, government because of WTO norms, they started decreasing expenditure on education and social costs, you can find this development all over the world. Decreasing the expenditure, so jobs in education also started decreasing. So for these two reasons. Availability of diverse jobs and decreased availability of teaching jobs. People have moved to other career choices. And then onwards, at least in urban and semi-urban areas and then 2005 onwards in rural areas as well, becoming a teachers becomes the last career option. So if you have scored 45% of mark, in your 10^{th} or 12^{th} standard and you do not get application anywhere else, then you become a teacher. And if you score 60 percent marks and if youre not getting the engineer or the medical or the management, then you go for the teacher, that has become the trend in the India. So, teaching is the profession which normally receives comparatively low quality human resources. You should say the so called low quality human resource, academically. Where becomes their last career choice. And expectations of curriculum makers are very high. So you will always find the differences of opinion and ambitions of the teachers and expectations of the curriculum. So this is the root cause. Why it's very difficult to bring a new approach of education like the constructivism or these projects which talk about the behavioural change.
F: And for parents that is then a similar
H: Parents, parents are clearly driven by the market demands. Nobody wants their child to enter into social field or to become a teacher or to own the business, to start a business. They want the safe jobs. So parents ambitions are clearly driven by the market.
F: And so do you see some exceptions, also as we saw the past days, teachers that are very passionate to do something with ESD or are open to do the curriculum in this different way, do you feel they are supported enough? The people who are willing to embrace these developments and the constructivism? Is there space for them to do this?
H: Yes, I mean that was one of the thing which I mean, there should be sufficient support from the educator and the curriculum maker to come up with this idea. This is also the concern area, they have in-service and pre-service training. Pre-service training are the curriculum courses, so bachelor of education or diploma in education, these are pre-service programs, teacher training programs. And in-service programs are like training that they normally receive annually in the months of May and June. So, I mean, the quality of this training programs is also a concern area. **[1.09.00]**
F: Yes, so that annual, that is interesting. I mean it is an opportunity but maybe also. Yes.
H: What should I say, low qualitative human resource is root cause. Unless and until becoming a teacher becomes a passion of many people, the problem will not be solved.
F: Okay. That's a very hopeful message to end with. But thanks a lot at least, I think I have most of the questions, most of the answers. Oh no, I have one more to ask. So, the teachers, they really are most interested in teaching science, math, English, what are the students most enthusiastic about if it wouldn't be for the parents and teachers saying what is important? Also maybe within sustainability?
H: Students are interested about to get the answers of their problems or whatever new things they come across.
F: In their lives
H: Some of which, they come with the age. Might be love, sexuality and might be some of things of career. But education system fails to provide answers to, basically education system fails to provide answers to curiosity of the student. Students are not interested, I mean I feel that, students are not interested particularly in one subject, they are interested in bunch of concepts, but they hardly find answers to these concepts.
F: So this should also be to kindle the curiosity and to
H: Exactly, might be but over the period, might be after schooling for 4, 5 years, might be at 6 or 7 standard, or 8, they start develop interest in particular subjects. Based on the exposure, teaching they receive and the career ambitions developed or imposed by the parents. [laughing] So maybe they have developed interest in particular subject, but by and large I feel that rather than particular subject, interest in bunch of concepts that they got exposed to.
F: That they can relate to
H: Like for example with this **[1.12.13]** Navratri, how this Garba comes into existence. Why this particular form of Garba, why you find animal more on the road more around the area of Ahmedabad and [Sunastra?] I mean the area of Girnar and where you have been than in other part of nation. I mean there other cities as well,

Mumbai, Delhi, but you don't find animal there on the road, but you find them animal on the road in Ahmedabad, why?
F: Why?
H: Why? Teacher is clueless. So I mean, just, if you see the terrain of [Sirastra?] which consists of this [Rajpur?], Girnar, everything, you find that a very less amount of rainfall over there. Which includes Ahmedabad as well. So, since long, I mean since thousand years, since more than thousand years, pastoralism of hearding remains the prevalent profession of people over here. I mean and that is the reason why you can find all the animals over here and there. That is the more fundamental reason. Second, modern reason, is people over here, like some of funda.. the rightist group, they don't allow you to kill the animals, the cow and other animals. They don't allow you to have beef. So once that cow, when she stops giving you milk. People just, what should I say, they just leave the animal there, wherever they find the space, they come on the road. That's the reason.
F: Yes.
H: These are two reason.
F: So this is already connecting the dots.
H: Yeah, it's connecting the dots.
F: So, this is a good ending I think. Thank you so much.
[We discussed a bit still and then Harshal decided there was something I had missed, we recorded a little bit again]
F: So you said
H: In response to your question, like, what would base of values we should look for, education systems should look for creating different opportunities for students, where they can be exposed to this diversity across the world. Particularly when because of the globalisation, internet and social media, the world is coming together. I mean, people are getting exposure to different set of people, their lifestyle, their values. And that's why it becomes necessary that education system should be able to develop different opportunities on school time, which would help students to understand the nature of changing world.
F: Yeah.
H: To respect the people with different value set, different thinking.
F: Yes, that is a good addition I think.
H: So are you are going to write the entire interview?
F: Yes, I think so.
H: Ah, that's so painful.

Interview Ketki Gadre **CEE Ahmedabad**

F: Okay, well first of all, thank you for speaking to me. So, as I already explained before, I am writing my Master's thesis on systems thinking in ESD and as a part of this, I have been interviewing some people within CEE, mainly about what you understand ESD to be, what you think are the main things children should get out of ESD and also, what might be the role of systems thinking. And first of all, I would like to know what is your general background, how you came to work at CEE and what it is that you do here.
K: Okay. So, I'm Ketki and I work with the waste management group here at CEE. My background is a Master's in environmental sciences with a specialisation in pollution control technology. And well before I came to CEE I have worked with various consultancies mainly looking at municipal and industrial solid waste management, so I have been involved with technological interventions and turnkey projects, so right from designing, to making sure it is delivered in time and then also the annual maintenance contract was done. When I came to CEE, I started working on two publications. One publication was trying to compile best practices, what do you call, compendium of best practices in solid waste management by city authorities, so that was one compellation that I did [1.50]
F: For Ahmedabad?
K: It was for an India document. So we shortlisted some 72 entries and then further sub-shortlisted 11, where we actually visited and documented it. And it was submitted to national institute of Urban Affairs. Where ultimately the objective of having this publication was to share it with other municipalities and urban local bodies, so they could take it up. So that was one objective. The next publication I worked on was technological interventions that we can suggest for rural areas in India, mainly looking at solid and liquid waste management. So age-old technologies but how we can re-do them and use them. On a community level and on a household level. Then I started off with a school programme [3.00] which had to do with electronic waste. I came into picture, because I really do not have any experience in education or ESD before that. So what I was required to

do was to research in Ahmedabad, in 120 schools in Ahmedabad, whether they have heard about what electronic waste is. If they have heard about it, if they know what it comprises of and how it should be disposed. When we started off, we made a questionnaire which touched upon all these three aspects. And through the medium of schools, that is through the medium of students, we reached out to 5500 households, and all these people were surveyed and we came to know that almost 50 percent people had not even heard of the term e-waste. And that's when we started off with the strategy of how education and acitivity-based learning can play a role in these children's lives. Because these children actually have a chapter in class 7th and 8th on electronic waste. So they knew what it was, but it had never gone to their homes or to their neighbour's homes. So we decided that they need to be informed, so documentaries were shown to the schools, they were given as resources to the teachers. And they used these resources to use in their smart boards and in their interactive classes. And students also came to know in their secondary research that yes there is something called e-waste and there are already efforts being taken by the urban local body here and that we should contribute to it. They went through an entire cycle of project-based learning wherein they tried to explore what the issue was, they tried to discover or think what they could do about this issue and then ultimately take action. When they themselves research that a lot, efforts have been taken by the urban local body and they have to do something about it, they came to know that you know we can have small collection bins put up in our schools. Right and that is when we started doing collection. There were small bins placed in every school and they were depending upon how the school wanted to do it, there were collection campaigns done ranging from one day, from one week, to one month. Wherein they told the teachers, all the students in their school and of course made sure the message reached to their parents of why having e-waste was important and how we could deal with it. So a collection drive was conducted over almost 18 months in various schools. So it was not done continuously, but bits and pieces, but we tried to cover all the pockets of Ahmedabad, so it had the core city area, it had the suburbs, it had the new commercial area, we've covered schools across the city.
F: That's interesting.
K: And the output if you ask me about this process. Even after the project is over, it is sustainable, because 10% of these schools have retained the practice, of having these collection drives.
F: What percentage?
K: 10 percent.
F: And now, you're working on the Swachhagraha project?
K: Yes.
F: And what is your role in that?
K: The Swachhagraha project is again, again it's on waste management and sanitation practices and making sure that children know how to behave. How to behave when it comes to personal hygiene and how to behave when it comes to using public spaces. Because, here people have the attitude, even if I throw waste, there will be a third person to come and collect it and I really don't have to bother on making sure that it goes into the right bins. So we want to really make sure to address that issue, and we came to the consensus that it is actually the attitude of the people… Because people are aware. They are aware of the fact that waste needs to be segregated, they are also aware that hands need to be washed after using toilet, they know that public spaces need to be clean because when we go there, we feel bad about it. Awareness is there, but it's the attitude. We wanted to work on the attitude and the behavioural change and we thought this was a good opportunity to use schools as a medium to go to the community through them.
F: Okay, so, just from this perspective, from the experiences that you have had with ESD, what would you say is the purpose of ESD as a whole? What is it that you are trying to make students take away from it? Is it only this behavioural change or is it more?
K: It's more. Ultimately, education is a medium and we want to lead it to a sustainable development. Because India is still said to be a developing country and we want to leapfrog towards sustainability and not take the other route that has a lot of errors and re-learning, so we want to leap frog towards sustainable development and I think it can be best done through education and best done through students [9.45]
F: And then, in both projects you mentioned also how students can also be a way of getting to households, is this also do you think this is an inherent part of working with schools
K: I'm sorry can you repeat it?
F: Yeah, I think a lot of people when they talk about ESD to get to students when they're young, because they will carry what they learn with them through their lives. But I have not yet heard anyone say that it is especially interesting because you reach much more people behind the child.
K: Yes, yes, actually, when we are talking to a child, we are actually speaking to four other people. And we make sure that our message is such that the message does reach the family, because we. For example, this is

an activity book that students can bring home. And he's obviously going to show it to his parents to say, you know what, this is an activity book that I got and I'm going to work on it and can you please help me in doing certain things in maybe interviewing our neighbours. So not only the parents, but also the neighbours and community do get involved in it and certainly do get the message of sustainability of sustainable development and how they can be a part of this.
F: Yeah, good, nice. So you obviously first got into contact with sustainable development and then got education into it.
K: Yes.
F: Yes, that is interesting, the people I spoke to before where first education and then got into sustainability. It's the same for me, I also was first sustainability. So I was wondering, when you first got into contact with ESD, did you immediately see a sort of clear definition of the context. Do you think it's more about, as you got into it via sustainable development, do you see that it is really about sustainability, sorry I'm getting kind of lost in my own question. The balance between education and sustainability for you. So some people say it's really all about the methods. So how we are doing something, that needs to be sustainable. Or is it really about the themes, the content that you are talking about? Where is this balance?

K: I think it is about the process. It's about the process and not really the content. Content can be remolded and molded whenever required and however required, but it is ultimately the process, or giving each student the experience of understanding sustainability and going through it. Unless and until a student really goes through the process he will not understand how and why and why it really needs to be done. So I think the process is important.
F: Okay, and what is it then that the student needs to acquire through this process? [12.48]
F: And what is it then that the student needs to require through that process, what are the outcomes that you want the student to get?
K: Ehm, I think it's knowledge, attitude, disposition and behavioural change, ultimately.
F: Okay
K: Because the way we are designing this entire process, whenever we start brainstorming about a project, we think about what we want at the end of the project and we always come to these three to four points that we always want to see that the knowledge has increased of course, because we are giving extra, somehting extra other than what the student is getting through the textbook, so knowledge is definitely there. Attitude, we would definitely want a person who is working with us, to change his attitude towards, if there is wastage of water of throwing the waste in the bin or wether its just towards pets or stray dogs, you know it could be just anything, but the attitude really needs to change, so that is something we are definitely looking for.
F: Okay, so we've been talking about project-based learning.
K: Yeah
F: Okay, to what extent do you think that right now ESD as it's being though in Ahmedabad maybe as a case is it really only happening on a project basis? Or and if so are these project structurally happening throughout a child's education, or is it that some of them never really get any projects and others get a lot?
K: Yeah, eh it depends on the educational boards that the school have, so here we have almost 5 educational boards that run. The international board which we have, definitely has project-based learning incalculated into the curriculum. So students are put through the process of project-based learning day in and out, whether it is CEE project or the textbook curriculum, they go through the entire process of project-based learning. Everything, all these subject are interwoven to each other, so it is not really talking about you know just climate change. It will be about globalisation, it will be about about population explosion, everything coming together so understanding the entire concept and not just one topic. So international boards do take care having project-based learning. The central board, that is the CBSE as known in India and ICSE, are getting there, slowly, but it's just you know, a few projects. It could be through CEE or through their own board or any other medium, but it's happening. While the state board are not really into project-based learning. Some of them do take interest in knowing what it is and how they can effectively use it for their students, but they are still into the campaign mode, of maybe doing some kind of competition or doing an awareness rally or a poster making and that's about it.
F: Okay, so and do you think that this is the way in which students should get into contact with ESD and with sustainability issues, through
K: It could be a start. But just making a poster or taking out a rally, they are not going to understand what the real problem is.
F: No exactly

K: So it could be a start, to make them think, maybe go to the internet, look what ESD is, what are the burning issues that are going on right now and how they can contribute.
F: Exactly, okay great. Let me see, so, I have been looking into the NCF, the curriculum framework and do you think that this document as a whole, does it give space to integrate ESD into the curriculum.
K: I'm not sure about this document.
F: Okay, that's no problem, I've just been reading through it but. Okay let's see, youve been visiting a lot of schools, would you say, is there any sort of overarching description of the teaching styles that you see there? Maybe in the different boards or are there big differences you can see ther?
K: Yeah there is a big difference, so again I will just go back to the educational boards. So international boards are generally the good schools, they have a lot of infrastructure, facilities, as well as learning and exchange opportunities that the students are exposed to. Which means they have smart classes, they have soft boards, they have computers, that they can quickly go online an check, so teachers rely on the age-old teaching methods, that are the text book, as well as they are utilising the new technologies that are coming in. So that's a relief that they are using the presentation they are using the research methodologies and even field work for that matter. They are taken to a lot of field visit, whether it is a factory, manufacturing factory or say a forest, so understanding biodiversity or taking them to a dump site to understand how the city sanitation or the waste management system works. So everything is there, similarly I would say that the CBSE and ICSE do try to do this kind of methodology and they are, in this particular matter, at par with the international board. So they are also using all these new technologies and it's good I would say, but in state board again depending on the vernacular language, the state language, there is a difference between the state run english medium schools and the state run vernacular languages. So the english run schools will still have a component of maybe one or two field visits or they may have computers but not really smart classes or smart boards at their disposal, while in vernacular languages is just the textbook.
F: And the teachers? Their style of teaching? I don't know if you have seen a lot of teaching. Because with the projects it will probably mainly be working with the teachers and not really any
K: What kind of styles if you can mention?
F: Yeah its more about the interaction between the students and the teachers, if there's a lot of distance between them. Or the way if students are made to work in groups a lot or whether they're just listening to what the teacher is saying.
K: Again I think, the same style I will use. International board, ICSE and CBSE board it is both. Sometimes if the teacher is teaching the students have to sit and listen, but at the same time they do have class discussions and group discussions. And they have special classes as well, wherein they take into the seminar hall, or there is a third person coming and visiting them and talking about something. So they are put through you know various kinds of teaching methods. But in the state board it's just the teacher talking and the students listening with few oppotunities to really discuss or speak out.
F: Okay, let me see.
K: Can I take this call?
F: Sure, I will pause it.
[End of Ketki 1]
F: Yeah, yes. Ehm, so I had a question about the different dimensions of sustainability. In an issue like waste management I think they are all there. Social, environmental and economic. Do you see any difference in how students and teachers are looking at the different dimensions? Do you feel social issues are making more impact on the students or that they are more touched by the environmental part of the issue?
K: I don't think so [laughs]
F: No?
K: Or maybe I have not had enough time to interact with both of them together to actually gauge what you are asking, because it is generally when I visit the schools, I meet the teachers I meet the students and I leave. But I have never really had the opportunity to ask them.
F: That is not at all a problem. This is a question I am asking everyone and some people are having a lot of experience with this, others less, that's no problem at all. Then I just had a few questions still on systems thingking and the role of systems thinking in ESD , so would you say that in the project that you are doing now. I think I feel like in a lot of projects that CEE is doing at least, there is already a lot of attention to connecting the dots and how are things related to each other and how can you make connections over different times and space? Do you think this is happening in the projects of CEE? And do you think this is also happening in education they are getting outside of these project?

K: It's happening in a few schools. [00:01:44] for sure. So when we know that a particular school is capable of connecting the dots, we give them more resources and we make sure that we spend more time with them. So, we have chategorised the schools based on their requirements and their ability to really connect these dots. And in this particularly it's they're all schools. So there is going to be a school, a state run school, which is a vernacular medium school, at the same time there is an international board school, so there are schools who are able to connect dots. But there are few who are not able to. And there are few who do not want to. They really do not want to get into the systems thinking. They really want to stick to you know their text book, their school timings and you know thats it.
F: and where do you think that's coming from that
K: I don't know, maybe they just not interested. Not interested about learning something extra.
F: And then the teachers mainly or the school leadership?
K: Yeah, leadership, yes.
F: But they are still interested in CEE projects then or?
K: They would just be interested in doing few activities, like I said they would still be in campaign mode, if there is some competition happening, then they will surely particpate, but if there's an entire process of project-based learning involved, then they will not. So that is why we have categorised the schools. Those that will do the systems thinking, connect the dots and that are really active, whatever is the thing. We are calling them the A-category schools. [00:03:43] Then there is the B-category school, which is a little bit interesested in systems thinking, but not really active, and we have the C-category schools, which is participated in the campaigns and are not at all interested in the systems thinking. So that is how we have categorised and then we decide where we should have our efforts and what kind of efforts from CEE's side should go to these schools and these students
F: Okay, then, this is kind of, do you think systems thinking or connecting the dots, what we've been talking about. There are some different opinions, from people who say it is really a way of doing ESD, to do it by connecting all of these things, and people who say by doing ESD, you get to this, the students have to learn doing doing this through ESD. So it is a goal or a means or is it both? So yeah, what do you think is the role, its kind of vague and I've been trying to make it clearer but I think its just a vague question, but if you have anything to say about this?
K: I think its, again, its the process and ultimately the goal, so both, it cannot be just one thing and its done, it cannot be like that it has to go hand in hand together, so the goal also needs to be there and the process also needs to be there. I don't know if that answers your question?
F: Yeah, I think that's fine. And then my last question, what do you think is the role of systems thinking in the goals of ESD, that we talked about earlier, so that was then developing knowledge, attitudes and behavioural change. So do you think that systems thinking is of added value particularly in developing this?
K: Certainly, yes, it will add a new dimension to ESD.
F: In what way?
K: So ultimately, if we are saying that we want behavioural change, then just the waste management behaviour is not going to help me reach a sustainable development, i need to have the behaviroual change in sanitation, in water, in my attitudes towards the labour class who is working. So behavioural change and systems thinking ultimately reaching to sustainable development.
F: Okay, thank you. Ehm, one more question, just to clarify about the attitutes. Would you say, how would you define these attitudes that students have to acquire. Is this more a way of thinking or is this ehm, values
K: I think it is important because attitude leads to behavioural change. The current behaviour and if acquired, the behavioural change. So it's the most important part, when we are talking about ESD. That is one thing that we need to address.
F: And what type of attitudes are these, that the students need to get or what do they have now that they are not changing their behaviour?
K: As I had mentioned earlier, this is not my job, this is someone else to do it. Or I am to rich, I am too good to be doing something so [something] those are the kind of attitude that students have. [00:07:32]
F: So it's really like in the Swachhagraha book, it's really about taking ownership of
K: Exactly.
F: Okay, I think those are my question. I don't know if you have anything you'd still like to add? If you come up with it later, that is also fine.
K: Sure, I will.
F: Okay, great!
K: I hope I could do justice.

F: Yes! Definitely! It's really nice to hear from different perspectives and it's really adding up so.
[End of recording]

Interview Madhavi Joshi **CEE Ahmedabad**

05:42 F: Okay, and the first time you time joined in, or the first, well I guess the first decade that you were at CEE then ESD was not really a term yet.
M: It wasn't, I joined in '93, so the term ESD, see at that time, when I [more answer]
11:13 F: Why do you think that here, specifically in India, it came up as being social, environmental, and economic at the same time, where in some other contexts, it really was seperate, there was environmental education and then there was -
M: Ehm, well, somehow, I don't know, WWF they also [more answer]
15:30
F: So, something that I have been asking people, I do not necessarily see it here, I've been asking people if they were first in education and then got into the sustainable development part or, but for you it seems that you weren't really doing anything education before?
M: I wasn't doing anything in education.
F: And also not really into sustainability then necessarily?
M: Well, I was into communication research […]
19:19 F: Okay, and within the context of what you've been working on, how would you define ESD then? There seems to be a lot of differences between people who explain it much more as a content of education that you're working with and other people really say it's the process or it is something in between. It's the goal, where youre going or -
M: I think it's both. I think if you look at ESD it is, it says Education FOR Sustainable Development, right so I think it's about the developing both the content. Giving the content in such a way so that people can make critical choices. So that they are able to decide between what would work for them in a particular context. So it is contextual, it is transformative for me, it has to be transformative, it will have to be empowering. So it is not one way, again. It is something that has to be, it evolves. So it's kind of, we have this whole life-long learning as a part of ESD, or any education, it's life-long and it has picked up that life-long from EFA
F: From the?
M: From EFA, what is it called, EFA no? There is a document, there is this whole, again there's a document that used to come every year. And it's focussed on the school education system, it's called EFA.
F: Yeah, I think I, I'm just thinking which is the, what the abbreviation is.
M: Yeah I'm also, eh, education... Education For All!
F: Ahhh yeah of course [both laughing] And that was also a decade, right?
M: Yeah, it was also done in a decade.
F: Yes, education for all, and that also, yeah -
M: So that is where, that is where my understanding would be, it is really connecting all these. And again it makes, it is important that one makes these linkages, it's not just content, I cannot, I don't think just content can change anything. Because you can have very good content, but if you don't take, take your learners thtough a process where they learn how to make linkages, where they learn how to you know use that content to improve their understanding and action. And act as well. That is for me, ESD.
22:15 F: Yes, so then the purpose is the students that, or learners that have gone through ESD, you want to enable them to?
M: Enable them to change and to think differently.
F: Yeah.
M: It's [something] but I think that's what it has to be, otherwise it's not ESD for me.
22:34F: Okay, ehm, so I've been looking into the National Curriculum Framework 2005 and I have a few questions about that. So it seems to give a lot of space, for schools to put ESD into their curriculum, to look more at a constructivist way of learning, to look more at a lot of different things. To what extent do you think this space is being used? At the moment?
M: At schools? I think it depends. [23:12 […]
28:06 F: And do you think the way ESD is happening at schools now, I'm now looking mainly at schools here in Ahmedabad, would you say it has been able to become structural at any schools or is it always really only on one project and then maybe with another project at another time with another class. To what extent have they been able to integrate it into -

M: Some schools have actually […]
33:06 F: Ehm, okay so, with ESD as its happening now, or maybe within CEE, are there certain learning outcomes that are associated with it, very specifically for schools? Like how do schools perceive, what do they think the children will get out of it, for them? Or is it really that they feel they should do something for sustainability?
M: I think it's most of the time, it is negotiated with the school, except with projects, those have specific objectives. For instance, Swachhagraha is a project, so it is, but is also again about, they're both the things, you know, learning objectives in terms of lets say the Swachhagraha, focused learning outcomes behaviour related to cleanliness.
F: Exactly
M: But, also, the other learning objectives that we discuss with the schools and the teachers, and is also for us, it's also about citizenship, so building that citizenship in the child because we feel if that child is able to [something] values which are to do with, related to cleanliness, obviously they are going to then also be looking at other things around them and they will be more careful and more concerned about the environment. So building that concern, also building skills such as leadership skills and better understanding about sustainability, through the way that content is discussed with them. So yeah, those are done. I think the learning objectives are clarified.
34:44 F: Okay. And I have one more question regarding the NCF, or that comes back to the NCF a little bit. At one point the NCF recommends - what is it - a softening of subject boundaries for integrated knowledge and joy of understanding. [Both laugh a little] Do you feel - that sounds really nice -
M: That sounds really nice, yes.
F: So my question is again is this happening? Do you feel that there is yah, you already talked about the structure of the schools and how fit this is.
M: Difficult, it's difficult [35:15 […]] it is, it is, environment education is a subject in the schools, in most of the schools, and so in classes, its taught as a separate subject, so the teachers are, who teach that, they find it difficult to get other teachers involved, so while we, when we do our teacher training is very clear that we don't really that it is not only meant for say a science teacher or a social science teacher, typically she will be the one who will be asked to do this. Or, you know, getting into conversation with organisations like us, on sustainability. These are typically those who will be the teachers, science and social science, most of the time. So, it is still not happening, really, the boundaries are there, and they still are not able to kind of break those. So the integratedness yes if the teacher understands, so she tries to pull in people from, but it is only to the extent of a particular activity. But the way we would like, say the entire institution also engaging with sustainability. Unless we have programs which look at the whole institution approach. So through the kind of programs were right now doing, except for swachhgraha, which is looking at the whole institution approach, of course with the focus on one area, unless we do that, it won't happen. So we need to go to the school with that kind of a broad approach and then look at the systems thinking and then look at the linkages with them, so those exercises need to be done, so some of the programs have done that and very successfully, in [x] for instance, south-Gujarat, Anandshala, Partesh, systems thinking, whole institution approach. […]
But still teachers don't think that way, they only think about their own subject, so still the silos are there. I don't think internationally we have been able to solve this issue.
F: No, no, I don't think so.
M: I have not seen, only very few schools, those who are best practices [laughing] probably, which are actually. No it needs a different structure, it has links with the way a school is structured. I think one of the schools here, Mahatma Gandhi international school, if you get time you have to see that, I think they actually do this, they try to do it at least, there is some space they provide for cross-subject learning and integration. Projects help us do that, actually, so when we are in Paryavaran Mitra or other, we use that as an approach, that is where we use the space to get students to understand that there is a link between maths and physics and these subjects and how do you use skills and knowledge to make, to you know understand sustainability, or find solutions to, so small kind of solutions but then connected to the study in the class, through different subjects. [more on eco-clubs]
40:04 F: Are schools somehow already doing systems thinking?
M: […]41:50
F: So then, judging by this, my next question is, almost final question
M: You finished ha, quickly

F: Almost! What is the relationship between ESD and systems thinking? I think we've been talking about this most of the time. But there is, I've hear people, some say that systems thinking is a way of doing ESD, whereas some say if you do ESD then you end up with systems thinking, this is the goal of ESD or it's something that is a competence almost of ESD. Still it seems to be, even though it's clear that it's very connected. I'm still curious to see what you think, where it is connected in what way.
M: […]
ESD helps in doing ST. It's both. To do an ESD process, you need to know how systems thinking is done.
[quite a long description of a project]
48:09 F: So then, one question back on the earlier outcomes of ESD that we discussed, that was the ability of people to make critical choices and empowering them and giving them context. Do you think systems thinking has a direct role in achieving this? The ability to think in systems?
M: I think it takes some time for people to do that. Because, you know, it has to be done, it's not very simple, noh. As you start thinking, you start getting more and more, deeper into that issue and then the complexity increases. So that's where the problem is, especially with schools and students. One thing is that you're opening a Pandora's Box. That you're getting them to think deeper, but then they also have to understand that there are no simple solutions to all the problems. So again, a good facilitator is required to do something like that. You know to be able to also get them to get deeper into a certain learning process, and it can't be done in one class, for instance. So they need to develop a pedagogy that takes them from say starting to understand to getting into deeper kind of enquiry of the issue. And I think it is, it definitely is an important process and it should be done. But I think it needs training. People need to know how to handle it.
F: Teachers?
M: Ha, facilitators, teachers, I think people need to know how to handle it. Because it is not an activity, because it, that is the danger with this one, or any of these activity-based learning approaches, because this is a very serious tool to be able to reflect. And reflection should become a part of learning. And after doing the systems thinking process, one, that loop, one needs to reflect. Every time. We did it once and then they go back, they do, they actually do, work in the field, come back. And then they sit and reflect. And then we do another systems thinking process, so you know, it has to get into deeper issues and more questions. And that's where the learning and critical thinking process will come. That's how I would look at it.
51:10 F: Yeah, that's interesting. So I think, I've been through, most of them. Ehm, although maybe one question that I haven't, we've sort of touched upon it but maybe to make it just a bit more specific. You think in schools, in your experience, is there more of a focus especially in assessment, more on the information students acquire or more on the skills they acquire? Or the outcomes that are -
M: In the schools presently? On the way it is structured? It is information. It is all the exams, the assessment happens on what information they have. […]

Interview Pramod Sharma **CEE Ahmedabad**

F: Okay so first of all, thank you for answering some of my questions. So as we already spoke about earlier, I'm writing my master's thesis on the role of systems thinking in
[Madhavi comes in, asks something, leaves]
F: The role of systems thinking in developing sustainability competences. And these questions are not all about that, so I'm first would like to know a little bit about your background and experiences within ESD, then I have some questions about ESD in general and in Ahmedabad in specific. And a few questions not so much about ESD and systems thinking. So my first question would be if you could tell something about your background, how you got at CEE and how you -
P: So I've been working with CEE for 13 year, I joined in january 2004, and initially I was looking at one school programme and then I was focussing on the regional office, so the Western region so all the programmes [something]. And since 2010 onwards, started focusing on the handprint programme nationally, so that shift happened in 2010, so then 2012 shifted to the school programmes, where the focus is on action-based projects and project-based learning. So that has been the journey, but within that journey have been involved with many other programmes which are not directly related with school, like urban development, urban issues, rural development, lots of national consultation for reports that has to be submitted to UN systems and other systems on behalf of government of India and all those kinds of things. So, that really gave me a lot of broad understanding and depth and different perspective, because, when you read a document and you find an issue and you think okay good, and then people start interpreting it, doing the [something] and you're like okay this line can mean so many things and how people play with those interpretations and how those things are

important when major policies are designed and what is importance of I mean when a lot of stakeholders, this is coming to your point, when there is a system every stakeholder has his own self-interest involved when you look at a system of stakeholders working together, or I would say interest groups within that system. And, so, that gave me a perspective and then started look at, and also, theoretically when you look at anything it looks different, but when you look at it from a practitioners point of view and the problem that would happen, because when it will be implemented at the grassroots, to what extent the details need to be there and how and what kind of safeguards need to be there and so lots of experience and when luckily, I have been travelling since my childhood, so I've had a very broad perspective of India as such, and during these 12 years also intensively interaction travelled more as a tourist in India. But also now, more or less 7, 8 years internationally. So, kind of broadened my understanding, which we're trying to see how are we trying to bring it into our work with schools.
F: Yeah, very interesting. 04:24 And, right now, the main, so ESD I think, so I was asking other people how ESD is coming back in their work but I think for you its everywhere, pretty much? Because youre also working on the Para pravayaran... Mitra?
P: Paryavaran Mitra.
F: And that is also a project that's only on primary schools? Or also secondary?
P: It's one to eighth, primary 6 to 8. But we have schools which have primary which also have secondary. Our focus is on the pedagogy and the process. But most of our material is designed for class 5th to 9th, I would say. But we've adapted it and taken it to higher classes also and to lower classes also, so we have been able to do it. But our focus is on improving the way the transmission of environment or sustainability issues happens. And how do you, how a teacher becomes a facilitator and lets children experience it. So in a nutshell, it's a transformative approach that we are encouraging and we are prescriptive to some extent and then open ended as to how and what children do. But as a capacity-buidling exercise we need to be prescriptive we need to suggest things you should do and then after 2, 3 years, when the teachers get the hang of it, then they start experimenting within and using that same pedagogy in different context and then you see then they [something] of how they have used it for their science teaching or [something] teaching. And moving on the environment or sustainability. And also, the challenges that how do you move beyond the symbolism associated with environment. So I won't call it lip-service that because all those days and celebrations and short-term actions are also important, but how do you get them to understand a long-term perspective and the importance of children to get engaged. In around a situation and so for that we are now also entering into a lot of partnerships, which are also bringing in a lot of values and different ideas and it also keeps our learning going on. Because the moment to share your perspective and your challenge, so that exchange also happens because otherwise, you become redundant sometimes and nothing new to offer to - [both laughing]
F: Yes
P: But the challenge is that it's a range, there are people who have not done anything in terms of environmental education beyond those environmental days, to schools who are into it, so how do you service and work with such a big range. And the way that we found it is, okay you need to offer a big basket, so teachers can choose and keep that engagement going and keep that interest alive.
F: 07:41 Do you see in this range, do you see differences geographically? So is Gujarat in that sense different from other states in how they are -
P: Yes, yes, yes, yes. You just hide the name of the school and give me a report and I will tell you from what part of India the school it. To that extent we know that.
F: Okay, and is there, is it generalisable on a state level?
P: Because, that is the other thing that happened when I shifted from a regional office, to a national and then we started looking at all the reports, because in the initial phase we werent looking at, we were struggling, how do you motivate schools to share their work with us and then two years, because there was no incentive associated with it, and then in 2012 we realised and started that awards. So, for me, I wasn't [something] about that thing, it was just a way of getting those reports back and see that how our work is being interpreted and get a feedback and those reports are an indication that the most motivated person and the best school is sending you that and that gives you an idea that if the best is doing this work, what the others must be doing. So we find that as we move North from South, it's more, Southern states have taken it seriously, small curriculum week, small project group, as you move North, there is more symbolism, more photo-opportunities, less depth in their work. And so that difference in terms of engagement is visible. And that is also help us that now we know that if you go to that state for teacher training, you know how to pitch it. So same module is pitched on a different level and with a different understanding. But that challenge is only this when we realised and we have negotiated with a lot of [CSR?] on that you need to give us money for teacher training, that is the

only thing that makes a difference. The more we interact with teacher, the more we meet them, the more they will understand what has to be done. 10:04
F: Okay, and within the state here in Gujarat, do you see a difference in the way ESD is taken up here in Ahmedabad and in other places?
P: Yes, yes, the difference is, the schools have done it on their own also and many initiatives have been taken. But what I'm saying is that. What I said, nah, it takes two to three years for a school to really get into project based learning more. And, so, the school which are in our vicinity get more exposure, more interaction, more sharing between them compared to other places, so that difference is visible, that difference is there. And the depth of teacher's understanding is different.
F: And for them of course the distance to conferences that are held here
P: So the schools, the level of engagement, the level of interaction will make a difference.
F: Yeah, of course. Ehm, okay, then, this is still a bit on background, but, coming to CEE, was your experience mainly in education or in environment? When you first started on this or was it, did it coincide?
P: Ehm, my, I am an education person.
F: Education
P: My basic qualification and education is science teacher. So I'm a science teacher, qualified to teach between class six to nine.
F: Okay.
P: And I started as a teacher. Teaching chemistry, because it was a chemistry honours, at class eleven and twelve. Then I moved into management and then came back to a school-based project, where they needed a person with management skills to manage a large project of 1600 schools in a district. I only had two years of work experience and at the age of 26 I was managing 1600 schools with around a team of 150 people at different levels working with the government. So we were placed with the government system and the project was focusing on water, sanitation and hygiene education so that, so there I was able to use my master's in management. So I was doing both management and education, so I like both the fields and I'm not, the other thing I, I came to, by accident I joined CEE. I came for some other interview and then Kartikeya was [something] that [coventry?] and he said okay youre good. [Both laughing] Good for this job.
F: Ah, that's nice.
P: I was just asked to meet a few people at CEE and then everybody said yes, okay you can come and then I chose the CEE western region office and didn't think about - To be frank, I wasnt aware about because I had applied already long back and by the time the application had come, the interview had come, I had completely forgotten about which, what was the job, and I'd never been in Ahmedabad and I thought okay lets take that opportunity and I was sent to join another organisation and I just came to Ahmedabad and I thought okay good campus, good people and I was not aware about CEE on that day also.
F: Haha, well then you must have had a great interview. [Both laughing]
13:50
F: Well, then you must have had a great interview [both laughing] 13:50
P: Haha, I had never heard about the organisation, about its work. On that day only I said okay, okay, after four years with this sector, I need a change now. This organisation because they we [something], but I had never heard about CEE I think, haha.
F: Well, that's a good way to come in somewhere, fresh looks, haha.
P: So, I liked it, the atmosphere and I joined, great [something]
F: Okay so, this was also when you got into contact with ESD then I guess? As a concept?
P: Yes, because I joined in 2004, the decade came in 2005. For environment education, I started in CEE with ESD only, Iwill say that. My entry in the sector happened with the decade.
F: Hm, yeah, okay, so then probably, I was going to ask, what definition you see for ESD, because I've noticed that a lot of people are putting different labels on ESD, so whether its really about content, about process, about -
P: It is everything, for me now its the ability to give you perspective. If I'm a child or a teacher is able to have a perspective and he or she is able to take a decision of is it social issues, the environmental issues, the ecology and is also, taken into the context of culture. Now, I now understand it. It is, is nothing, when you interact or engage, you're immediately able to see whether its lifestyle or [plantation?] or any decision that you take, can you bring it the social perspective, the environmental perspective, ecological perspective, economy perspective and understand that what is the cultural context to it? That for me is ESD. And the moment I say that means that you are giving a competency.
F: Yes.

P: A competency to think.
F: Exactly.
P: So, it's a challenge, I would say, there are so many linkages and understand that, that means that you need a broad exposure to things.
F: And this ability to give a perspective, that is a competency for the teacher as well as the student?
P: Everybody. It's a competency for me. The moment you bring a fresh perspective as you [something] I will, you know, put it into my own framwork.
F: Yeah.
P: So it's for everybody. The process, I also learn, the moment I do a training and somebody challenges me, into or give me a new perspective, because this country is such a diverse country every part will have a different thinking and a perspective on the same thing. And I'm not exposed to all the diverse contexts. So that is what I was discussing with Ketki, today is that if you look at our dustbins also, the CEE dustbins
F: The dustbins, yes.
P: You will never find a roti in it. Have you ever found a roti?
F: No, they go to the dogs yes? [laughs]
P: Whatever, but nobody will throw a roti, but you might find bread, biscuits.
F: Yes, maybe?
P: Or any other food eaten, half-eaten banana or half-eaten thing. But you never find a roti or rice in a dustbin. Just try noticing it. So I was discussing and Ketki was also saying, I have never thought of it in this way. And it's very difficult for any of us to throw that part of our food into a dustbin. We'll try to give it to dog or any animal or anybody.
F: Yeah, it's true, I've noticed it at lunch in the DO everyone is always giving each other rice and roti's, so yeah.
P: Ha, so you never.
F: So why is that?
P: It's the way we are conditions. Because for many it is god, many it's a lot of labour or effort, so everything, that's not a piece of something, so lots of hidden values are there. So for that reason it stops me, I don't think. She [Ketki] a waste manager but she'd never thought. But I was just sitting somewhere and observing some people 18:32 Why that lady just climbed three floors down, came out of the society and put two roti's for, there was no animal around there, but put two roti's on a plate and went back? Why? What makes her do that? She could have just thrown it into the dustbin she has at home.
F: Yeah, that's interesting.
P: So, this is, so where does that, but, she doesn't realise that she is doing it.
F: No, exactly
P: So, education also help her, that why she is doing it. There is an environmental context there, there is a social context there, there is a cultural context there, there is a cultural context there, but how do you give her that ability, or an opportunity to reflect. For me education is reflection, thinking and questioning. Basically, if you are doing the three things, you're learning. So how do you give that, you know, opportunity for - because the moment you start thinking, the way, I enjoy, and teachers enjoy interaction with me is, most of the times, when teacher working with me for three years, now they just, if I ask questions and then I am thinking that I need to change my approach, because I don't answer, and I force them to think, and say that you are thinking, so they are not thinking in the correct way, they interpret it in that way or there are different perspectives to it. So, last time it happened that I was just explaining and then evryone, the room was silent, there was about 70 teachers and nobody responded. 20:14 What, why youre not responding. We are thinking that if we response in this way, what will be you challenge, or how you will challenge us. Haha, because we are thinking about the question that will come after the answer. [laughs]
F: And the next and next
P: Ha, ha, so it's not that we don't know the answer, but we know that you will not accept that answer when we and make us say more and get us into something where we know we will realise that there is no single answer.
F: Exactly
P: And that's a challenge for us. And that is what sustainability is all about, so my job is done, for that group of teachers. Or my challenge is now, how do I keep them engaged. Why did it come again to, say if I say I am there for two hours if anybody wants to come, why do they come? So I have to also, you know, evolve.
F: Yes.

P: So I was thinking sustainable development goals is one perspective to evolve my thinking, but I have to evolve with, so its a complete chain, ah, people they don't know why they are planting a tree, to this level. They now okay, now there are multiple perspectives to the same thing and there a many right answers.
F: Yes.
P: Which, to, its a kind of, and the moment you get that kind of response you are happy and you think okay, there at least made some difference.
F: Yeah, it's, yeah, I think it makes a lot of sense to think about it in that way, that's interesting.
P: So my approach is this. So how do you make people think, reflect and question?
F: And how would you translate that into learning outcomes? In a high school class? What competences or what -
P: High school, like we went to a school [something, 19?] and they were all answering questions and they were two schools, so now, we were discussing me and Ketki, how do you differentiate between two schools. So she said, first school people understood what they were saying, second school they didn't understand what they were saying. Same thing. So I asked her, why do you think so? The first one they had lot of depth in what they were saying and speaking with conviction and were able to give examples and show commitment of why they are doing it. Second one is just greenwash, saying the right words but the moment you start look okay was there a content in those paragraphs or sentences they said, you don't find anything 23:10
F: That's very interesting, yeah.
F: So, so, this is a way we see the [something - learning?] I not know which species this tree or this bird is, but you are able to explain. So I see this bird doing this and probably this means this.
F: Yeah, okay. Ehm, so then something about, I've been looking into the National Curriculum Framework 2005, and it seems that it actually shows a lot of room for ESD to work inside the curriculum.
P: It is there, the sad part is that its being looked at, because those people have not moved beyond environment, so the moment it translates into textbooks, that was my challenge also, when I started my PhD and on what premise I should say that these are the learning outcomes, and how do I say, becaus I completed my PhD on assessment, so why am I doing these things. What are the standards on which I say this person has this much knowledge or attitude or whatever. Regarding to what. So I started looking for the documents that say, okay, this is what we expect. And everywhere I was seeing no nothing was there. And then I spoke to people at NCERT and now what to do. It was not there. They said look at the syllabus, look at the syllabus, so I looked at the syllabus and I realised that there was lot of differences. 24:57 Because, the social sciences textbook reflected sustainability thinking, but from a social side or economic side. The science textbook it was totally lacking. And I went to everyone said why, why this difference, I'm not able to call out everything out related to environment or sustainability from science textbook, but a lot is there for geography textbook, or history textbook or civic. They say those aren't written by scientists, those are written by educators. So science it doesn't matter, in education they're just giving you the right science.
F: The information..
P: The right science. Kind of thing and the application thereof. So one, the word sustainability, in education system, people have started using the word, but don't understand it. The only understanding I would say is that, they use, they have started using sustainability in different, in place of environemnt. But the broader understanding of all of the elements and all this, I dont, I'm still struggling to find people in the system who deal with curriculum and other things, who reflect on it. Yes, they talk about it. But you is ESD? They won't be able to say, but they are doing ESD, I would also say that. If you look at larger purpose of education is to engage with issues of society in presence and future. So you find all those content, but since they don't understand it, they don't draw the linkages or put it as a coherent context.
F: Yah
P: So it is dilluted the moment and by the time it reaches the school, it is again in compartments of syllabus, compartment of subject, compartment of the class, compartment of the chapters, so, it gets divided, again, the systemic thinking that you talk about, you have to then have a very good teacher who is able to draw those connection, instead of focussing on my chapter, on my subjects. It becomes a challenge. So through our projects, we are trying to draw those linkages and now what has happened is also that multi-disciplinary and inter-disciplinary teaching and learning approaches, people are talking about them, especially the good schools they call them, the private schools. So they [something] teachers are starting to sit together that kind of thing, but started, but not understood I would say.
F: 28:01 So what happens there between the NCF that -
P: The NCF didn't translate into textbooks.

F: Okay, so that's okay, so that's the one thing really, that okay that makes sense. Because I was gonna ask, the NCF has this space, if there's a teacher who wants to do this, but something -
P: You need to understand, it didn't reach the teacher. The essence of it. It got lost in. Because there are so many layers, by the time that it reaches the classroom, there are so many layers in between, so the detoriation will happen.
F: And now then a solution is teacher training, rather than trying to get this from policy.
P: Everything, I am an educator, I am a teacher, I know how to convert. So all the content is in the textbook, all the everything is there, it is my capacity to give that to the student, so it ultimately boils down to capacity of the teacher.
F: Yeah, see, and could you say, do you have the idea that in Ahmedabad, just my research is gonna be mainly in Ahmedabad, so is there a predominant teacher style? In schools? Or maybe differences over boards? Or is there a lot of variation?
P: There is no predominant style, there is variation. So it depends on the kind of, you can't say that all the private schools have the same, no, it depends on the school, the management, on the teacher, and how open the school is to new ideas and experimenting with it. And there are, to what extent the teachers are given the freedom to work within the framwork, the syllabus and the textbook and the goals, so lot of externalities are involved.
F: Yeah, of course.
P: But, I would still say that this is changing fast and because the market is also demanding that the children are having a lot of experience.
F: Yeah, so more experience-based?
P: Its not, so the moment the parents start asking for it. So it has happened at one, that a teacher at one school 30:40 who is a parent said, why don't you convince my principal to do this in my school. Or there are parents who's two children are going to two different schools who say she's getting a good experience, so why isn't he getting that kind of thing. But it is still and the other challenge is that schools are overdoing it also I'd say, overdoing it also. So, then so, so, I always say that education is always is muddle or [laughing] its a dirty business. It's like that, ha. So there is nothing, you will always find schools on different levels of the trajectory, but who defines that trajectory youre looking and I am looking from different perspective and school management, so. But yes, they're opening up, schools are challenging and what I saw, after the new curriculum framework 2010, and that is also the Primary reason that we were successful, was that, they are now ready to accept it. Earlier, there were a lot of barriers. So if I approach a school, there is a response, so that is happening.
F: Okay, so yah that is definitely a step forward. And in general would you say that to what extent is ESD able to sort of move beyond only different projects? To what extent is it able to really be a structural factor in the curriculum? Is that happening in some schools, in no schools, or -
P: It is happening. In education, one basic notion is, if you say definitely yes, you can't say that, if you say definitely no, you can't say that. So it s a continuum.
F: Yeah, exactly, so to what extent was the question, haha. But I can see, I guess what you want to know is also what you barely can answer so
P: You can't standardise
F: No, there's no generalisation there.
P: So, whether NCF or ECE, people are doing it, because when you think that this is the right thing to do, they are not waiting for us or any external input. There will be an empowered teacher, and empowered principal who are doing it and then they are fine. So there are schools where we have gone and then sat there for a day or two and okay and now what to do here, because we are all with our set of ideas, so that is a challenge [laughs]
F: But this is something, a goal, when you start visiting a school, the idea is to move beyond this different projects that are happening and really to make it strucutral.
P: Nee, nee, projects are just the means, they are paying my time, they are paying my costs to reach them, so they, its like, it has been a long, so for me, I'm very clear and my team is very clear and that is what I have invested into the training and capacity-building here, that don't look at schools from a project lense, look at from a very broader perspective and we have to deliver whatever outcome and output are required for a project, but don't loose the focus on the larger context [something] So that, if you just focus on projects, then next project and next project, and that is one of the challenges that I now, I'm rude with teachers. Oh we did water project for two years, don't you have something else? And I say oh, so you're not taking mathematics this year? You're not teaching science this year? You're not teaching English this year? 34:57

P: Okay, we will do it. [laughs]
F: Yes, that is interesting.
P: So that is now how I will do it, so now I have some grey [points at hair], so now I can afford it. So are you, you're done with you're maths?
F: Because you've done it for two year [laughing]
P: So that is the second stage 35:22 You are making them understand that it's not a hobby, or its your or my kind of thing. It has to happen, it has to be done with all the seriousness that we treat other subjects, you are challenged and you get bored by doing it again and again, but you need to think that every year the children change, you are only the same person and the problem is that you are doing it. Let the children do it
F: Exactly, yeah
P: So, that, so, I use rudeness as one of my tools.
F: [both laughing] thats also a nice statement. I think, if it works, why not. So I have one that kind of suits to this, one time back to the NCF 2005, it states at one point that it recommends the softening of subject boundaries, of integrating knowledge and getting more joy of understanding. And that sounds beautiful, I was -
P: Nah, the moment you then say okay, now we will have classes, and then you say we will have syllabus, and then we will have subject, syllabus, textbooks and the textbooks will have chapters.
F: You lose that.
P: That's difficult to do. And then in class 7 there will be a biology teacher, a chemistry teacher, so you're not able integrate science, what are you talking about integrating subjects.
F: Yes, yeah exactly.
P: There is a physics teacher in class 7, there is a chemistry teacher in class 7, there is a biology teacher in class 7, that kind of experiences of specialisations on that level.
F: Isolated within the school
P: Within and you're getting specialisation kind of.
F: Yeah, an there's -
P: Specialisation only happens in 11th and 12th, but the schools are doing it.
F: And on the basis of, and the textbooks? Is there any like within the different textbooks that are being designed, is there any connections between?

P: Who will do it? I remember when the environment education was first made compulsory and we were all supporting the state government and the education board in the way with the textbooks, so I was invited as an expert to one of the meetings and [something] kind of thing. So there were 12 chapters would be written and there were 14 college professors writing this textbook. And then they realised that the chapters had lots of overlaps.
F: They had lots of overlaps.
P: Lots of overlaps. So, the chairman, these two people are writing, the same content has been covered, the same thing has been talked about both of them in the same textbook. They say how do I know that he has written it, how do I know that he has covered it? So I know that that part is important so I also include, and I also know that that part is important so I also include it. But that, that's the challenge.
F: Yeah and in essence its not a problem if it is in both, as long as you can then connect it to-
P: Ha. So this is how. It's not India, it's most of the places its.
F: Yeah, okay. [both laughing] Then I think my main question that I still have are on the role of systems thinking in ESD as that is happening here. So, is there, in your experience, I feel that in CEE projects, that I have seen so far, there is already quite a lot of attention for connecting different dots and -
P: That is how we now have learned and evolved ourselves. Doing that. We try to draw connections, can't do a thing in isolation.
F: No, and do you feel that in other parts the curriculum this is also happening within schools?
P: Yes it is happening, this kind of thing. But still its happening inc- I won't say, people are trying to do it, and its now an integral part of the way we work.
F: Okay, for CEE.
P: For CEE 40:00 And the other thing is that now I realise that this time this organisation has come prepared to, after working with FEE for 2, 3 years and then internationally, realised that -
F: FEE?
P: Foundation for Environmental Education
F: Ah yeah.

P: Is that we are one of the few countries and few organisations that work with curriculum.
F: With the c-, okay.
P: Others design their own curriculum, but we start with that one. Our first question is what is there in the text. And then we start trying to standard it or do it in a better way or assessment or whatever. Most of the people have their own content design and then go to the school, so it might not directly fit to. So that is the biggest difference that I find between CEE and other organisations.
F: Within India
P: Within India, globally also. I don't know if you realise that also or not.
F: Yeah, I think, I can see, I think that is one of the things that I talked about in my introduction, that it's especially a lot of adjectival education, they are just coming with one topic and pushing that on a school without thinking about a way it can fit into -
P: But we started [something]
F: Exactly
P: The first question is, what is there in the textbook. Because the moment, the reason I think it also happened is, we wanted to be in the classroom, but there was not place in the classroom. It was first extra-curricular, then it became co-curricular, then it went into clubs more and then it became compulsary.
F: Then it became?
P: Compulsary subject. So that journey, because when you're outside of the school, we are thinking how do we answer the classroom and we found that this is the way. So from the beginning [laughing] So from the beginning, it became the way of working.
F: So, more general question, what do ou see as the relationship between ESD and systems thinking? We've already touched on this.
P: I think I answered that. 42:24
P: I think I answered that. 42:24
: I think so too, so that's good. And then, the last one is, the learning outcomes or the competences, the ESD competences. I would say personally, that I think systems thinking is one of them, but also a means to getting there -P: I think systems thinking, I would say is an outcome of many competencies, and I think we had that discussion
F: Yeah
P: For example when a person is not able to think critically, how is that person wil think in systems. So it's, there are prerequisite skills before systems thinking, so you can see systems thinking as a competency. Because, yes, it will reflect as a competency, but it requires many other competencies to be able to do it.
F: Yes, yeah, and the thing is -
P: And you might not get the direct example, but you may say that I mean assess okay child is able to draw linkages, or is able to, I gave you many examples, if that person is able to do all those things, then systems thinking is a competency kind of thing. For example I gave you that lady coming out and giving her food to, leaving her food. And she doesn't know about systems thinking, or she doesn't think about compentency or ESD, but she is practicing
F: She's a part of it, yeah. And the thing is, what I was thinking about was, there is such a, ehm, like, a sort of sense of place that you want students to develop, knowing where they are in the world and how they connect -
P: No, that is one, world, but at what level. I was designing a training program last week for class one and two teachers. So what is global for a class one or two child? Radius of five kilometers, six kilometers?
F: Yeah, maybe, I think that already quite far.
P: Or the place that -
F: Yes, no, the first day I went to high school, I got lost because it was so far out of my own area [both laughing] so, yeah definitely
P: So what is global? What is world. And global and world from which perspective? political boundaries, geographical boundaries?
F: Yeah, no, definitely, my question though was -
P: That is still a, what do you say, global perspective, Gujarat, thinking of water and its investment to ensure that the quality of forest in Madya Pradash. Is a global or a local thing? Because the water starts there and it ends there, so for them this is the system.
F: Yes, yeah! But that is a system.
P: Ha, but that is India, that is just 200 kilometers.
F: Yes, but as soon as that water is being used to water cotton plantations and then -

P: Ha, but the economics of it and that kind of thing, the cotton is one part of it. But the complete agriculture, rinking water and, you're dependent on Madya Pradesh, one state.
F: Yes.
P: Ha, and if there is a conflict and how do you resolve it, you understanding that your water comes from that state. So that's global -
F: That's about sense of place yes - [both talking at the same time]
P: That's global! That's global for a child in a school
F: Definitely.
P: Realising that Sabermati doesn't have its water, have global water, is a global thing for me.
F: And this is where I would say, but that might be a difference in perspective, that systems thinking is a way of getting to that notion, where is - I have water here and that water is not just water that is here, it came from somewhere, where did it come from, why did it come from there? And in that sense, I would say that systems is also a means to get to this awareness, this global awareness or glocal awareness or whatever of your own place within you're environment.
P: No, one you are talking about systems thinking, in terms of spatial
F: Yes.
P: Spatial kind of thing, I am thinking of systems thinking in terms of cause and effect. So systems thinking for me is also the ability to think of any issue in terms of cause and effect 46:49 You can get gender perspective or a migrant perspective, anything, why its happening, that kind of thing, so moving beyond the spatial understanding of it. Systemic, so connecting spatial parts of the earth is one way of looking at it.
F: Yeah, no, exactly, so between dimensions.
P: Ha, so you're looking it from, when you're looking from that is a long debate we have had in 2010 is that, the moment people started understanding ESD and then they were interacting too much with people with social background, it was so I would say charming or sexy to say oooh gender is more important, or a child safety or nutrition and all those things started attracting many of our colleagues and then I used to challenge them that you are getting into other shoes that you don't know how to wear. We're all looking at the same elephant from a different angle and don't loose your place, because then, who will talk about environment? Everybody is, every social thing, is so attractive. Poverty, marginalised, hunger, gender, women, child, malnutrition, death. So everybody gets drawn to it. Saving a tiger, saving a tree, abstract, water cycle, abstract, who will talk about this perspective?
F: Yeah, but then isn't it, isn't it the most valuable thing to be able to connect them to each other have the people who are interested in gender -
P: Who will connect it? That is the project I did in SEWA [Self-Employed Women's Association], when after one year, we had to close that project. After two years. We had to close it, without completion. And after six months the lady who was the coordinator, said now I am realising that to what actually, to what extent my vision is. Because the one thing that we are thought at SEWA is that if you are earn your [solid?] income.
F: If you are what?
P: Earn, if your liveli - if a woman earn and brings money at home and she's able to meet her needs, all the problems are solved. So for us everything is that, but now, because I said okay there are a lot of gaps in the way you are implementing the projects and you're only looking at it from one perspective and you're not looking at the sustainability of the resource, how it will happen and all those things and you're only looking at how much you are able to earn, so you just concentrate on your own mode.
F: Yeah sure.
P: So you're not looking at it from that kind of thing and for you, you don't understand it. I was very, again rude, to make them understand at that point, but I'm sorry, they didn't understand it. We had to close that project.
F: Yes, but then still I feel that that would be exactly where systemic thinking is a competency -
P: Yes, but, yes systemic thinking but they need to be 50:13, but you, you need to be, for that reason I go back to the other discussion we had, I need to understand the content of it. They are expert on women, the livelihood or other issues on women in the society, we are expert on the dependence of those people on natural resources or resources and help them with whatever expertise, help, make them link- I mean because they're rag pickers, but they don't understand waste management if I say kind of thing and we know how we can maximise this. They are only looking from, okay I can answer this much from this, but they might be doing the wrong thing.
F: But do you think that -
P: They exposing them from what issues kind of thing, but you have to look at it from environmental perspective.

F: Yeah, okay
P: So then, they're expert of the social part, their kind of thing, only related to the economic. So they don't talk about environment then.
F: But do you think that if the knowledge is there, that the links are automatically made?
P: We don't assume, and I don't assuming, I've stopped assuming. The more grey hairs I have, there's nothing automatic. Because, you need a skill, you need to have the content. You're conditioned to think in a way, because she's admitted, the manager, because I have been working with SEWA for 15, 20 years and one thing that I have now been totally conditioned or trained to think in that only way that the only way that the world can change is that women earns -
F: Yes.
P: And she's able to meet her needs. So for me that's the only way of thinking I know, I understand, I work and now, the moment they said to me they opened up to. But before then, the project was only for money.
F: Yes, yeah exactly. No it's, but, I think that, in my own experience, what I found is that you can have all, you can know about the different things, but for me systems thinking started as a certain curiosity, which I think comes before necarily, or that's a compentence I think you can develop, I think without - [talking at the same time]
P: You might, but again I'm coming to the example, you might be practicing it, but it's important to realise is.
F: Yah, okay. So this is - And, that is -
P: No like it is systems thinking, thinking has to be there, there is no thinking. Systems are in place, because you work in a certain way, you know, in a society that if you get are [working?] for two hours you what kind of thing will be there. 52:52
P: No like it is systems thinking, thinking has to be there, there is no thinking. Systems are in place, because you work in a certain way, you know, in a society that if you get are water for two hours you what kind of thing will be there. 52:52 You know that okay when the bottle is not there, you know Narmada water has not come. Today. So you know Narmada water comes from Madya Pradesh, because you go for your vacations that kind of thing, but you are not thinking, you know all the systems.
F: But you are not seeing it as a system?
P: You're not thinking.
F: And this seeing it as a system?
P: It's the same debate I had, now I'm realising it ha, I'm now thinking, the same thing when you say okay, when you say environmental education, we have been focusing more on environment, but without good educaiton processes, you cannot have good environment. And when you look at this environment education, people are not, people are not expert on education, they are expert on environment. And that's the challenge. We've done three rounds of recruitment, I have not been able to find people who can work with school systems. They're not strong in education. We're able to attract people who are good at environment and then we have to train them into communication and education part of it.
F: And the other way around?
P: No, they're not able to do that.
F: No people that come in -
P: Who are education expert, who can train into environment, no. We don't attract them.
F: And why is that?
P: I don't know. Wheve never been able to figure it out.
F: Hm, that's interesting. Yeah.
P: Yeah, it can be a problem in systems thinking, because you don't realise that how this career is also in education. A core education person, if a person comes to see, what that person will do. We're not able to visualise. Because I remember one last interviews, when there was teacher-teacher educator, who was teacher at one other colleges you know cities then [Ahmedabad?]. And we are said, what are you teacher, okay and how do you teach, she said okay this is the concept we [something] teachers, we just [something] students, and then okay we will help, okay if students started asking questions, normally has [something] asked. And then help her as a teacher, to think to find her [senses?], and then her comment after 10 minutes: now I understand how to teach. And she has been teaching for ten years in a university. So that's the problem, because nobody has helped her to reflect and telling her or given a new perspective. The system is there, but the thinking. How do you see system thinking, because system is in itself an area, and thinking is in itself education. How do you look at, when you combine, it has to have the elements of both and equally strong. And what, so, if you look at the documents of UNEP, you will find the same problem. 56:08 UNEP only looks at systems thinking from the environment perspective, the sustainability perspective.

F: Yeah exactly because -
P: They don't talk about -
F: They don't talk about it as an ability to do something, but rather as -
P: Ha, they say the whole institution approach and everything, but when you say whole institution approach you say okay, you take the protection of women as, is there one of the indicators? No we didn't look at it. Okay, sanitation all those kind of? No, we didn't look at it. Only looked at it from the electricity perspective, the biodiversity perspective and the energy perspective. Water perspective. So, when you say systems thinking, you have to bring all those elements into it.
F: Yeah, that's something to, yeah.
P: Ha, because I was reading, in India, we talk about rapes, and all those kind of things, equally it is a big problem in [US?] cities, many of them. Kind of thing. So how do you? It's a common problem, a common issue. So how do you, so which, I actually, I have to see a document where they say that as an indicator?
F: They say what as an indicator?
P: Okay the safety of women.
F: Okay, yes. For, yah. Yeah, for me I think also, what. Ehm. I can see how systems thinking is an outcome of different things, and, but I feel, that it's also driving a lot of things. The moment that it is acquired. That you have this skill. And even though it's not gonna be one thing like, okay now I can do it and now I'm done, not at all. But the first time that you get into contact with seeing things in this way, looking holistically at factors, you're still not going to be able to do it in a whole lot of other instances, but I do feel that being able or experiencing, looking at something in that way, is also driving other competences.
P: Nee, but it's also lot of exposure [something]. The key word that you here use is experiencing. The more you experience, the more you are able to do it. Kind of thing, so how do you create the opportunity for children to experience it. The more you do it, otherwise, is your new [something], how to, how many criterias you can bring to your thinking process.
F: Yeah. How many different perspectives. Okay. Yeah, then I think I've got most of my question answered. I there anything else? Sorry, that's actually my last question, is there anything else that you think I should.
P: No, no, you can always ask, because 59:23 [end of recording]

Interview Partesh Pandya **CEE Ahmedabad**

F: So I'm doing my Master's thesis research in systems thinking as a competence for Education in Sustainable Development. I have a few questions. I think the main themes that I have questions around are your background and the way you are involved with ESD, a few question more on the education part of it, on ESD in general and a few more on systems thinking. But its mainly a structure just to tick it off, if there's anything else you think would be interesting for me, I would also be very happy to hear that. So, my first question is, what exactly is your background professionally, what do you work on in CEE and how did you get to that place.
P: Okay, so I am Partesh, I am working with CEE, I am looking after for one of the regional cells, CEE West. The CEE is working in 7 different zones of the country, or maybe you can say that the country is as a part of our implementation strategy is divided in 7 zones, North, East, West, South, Central, North-East, etcetera. West region of the country.
F: Okay
P: So this is CEE West and I am coordinating that team
F: Okay and what have you done before this?
P: Before CEE or before the post?
F: Before CEE and before the post, just what is your background?
P: I'm master in education MEds and my technical subject is physics, so I'm a student of physics. I work with a few organisations, before CEE, one of them is a state institute NCERT, which Bijoy has already menationed, I was there for two years, 16 years back.
F: That's interesting
P: So since 16 years I'm here in CEE
F: Okay, so then it's somehow clear how ESD would be a part of your work here. But can you tell me a little bit more on how you are working on education for sustainable development? Within your post at CEE?
P: See, mainly our team and me are, if you are asking me how I'm working with the ESD, so my main task and work is regarding the team development and the concept developtment and the ideas development and the ideas or the model that we are developing or implementing or trying out is for the sustainability, so for example, im giving an example, if they want to work with a school, with the primary education, we are closely

going to work with teachers and school management committees because if we can work with them, processes are strengthened and once processes get strengthened, it might be sustained. If you directly work with the students of course we can change the students approach and attitude in their own life. But the process, when we are talking about the process and the sustainable process in the school, there's also very much important to work with the teachers and the school management committee if we strenghten them or we can work with them. So that is the one thing, the approaches, as far is approach is concerned. Second thing is that when implementing any kind of idea or things, basic fundamental plan is to start with visualisation, as an approach, any implementation, without visualisation were not doing, visualisation is with the stakeholders, for example if you want to work with school, then the school teachers, the school management committee and the students all sit together, plan for 2 years and upcoming 2 years, what we are going to do and based on that plan we are implementing. If you are working with community we are working with the same procedure. All the stakeholders are sitting together, visualising their own development plan and based on that we are working there. So sometimes its quite difficult, because if you ask me the activities, this might be different one project from one project, one task form other task, on school from one school are little difference. But yes, they all sit together, them find their goals and then they are doing it.
F: So do you have some example of ideas that have been implemented.
P: Yes, of course, one of the project we have is called Anand Shala [spelling it out] Anand mean joy, shala means school. The joy for school, under that we are sitting with the principal [something] member, visualising that, visualising in two different area, the software and the hardware. When we are talking about the software, might be teaching methodology, teaching approaches of the the teachers, the content etcetera is also covered, the involvement of [something] members. When we are talking about the hard ware, sanitation, drinking water facilities, and other things are also a part of that. So they all plan, identify okay good, our teachers are very commited, but maybe the mathematic might be the performace is not acoording to what they want, so maybe the teachers know about the mathematic, [00:07:52] but once they deliver the mathematic there is a mismatch, because of their students are not getting enough of support or not the improvement what you want, for that the real requirement of the teachers capacity buidling, like that.
[Phone rings]
Ah this phone will take another ten minutes.
F: That's okay, I can wait.
P: Okay, you can work here. Because I already called them.
[End recording Partesh1]
[Start recording Partesh2]
F: Okay, well let me see, where were we. I was wondering, when was the first time you came into contact with Education for Sustainable Development? Was that already at the NCERT?
P: 2007
F: And in what way? How did that happen?
P: I was at [something at the time] and then the CEE. Actually in 2004 even, there was a conference here on DESD, Decade for Education for Sustainable Development. At that time when we were working here in the team for that conference. We all sit together and decided to read some of the material. So, we could collect many materials, [something] lots of material. And there, in a place outside of the campus, with all team members, we did a three day reading workshop.
F: Wow
P: So that's how we know ESD. 2004
F: Okay, and since then it has grown
P: And then, on 2004 it was rather ESD understanding. It was quite one of the new subject. One of the subject, trying to understand what it mean and how the people are thinking and how it is connected with our subject and area. But over a period of time, practising ESD, all what we are practising whether it is ESD or not, it is critical thinking. It come out, progressing.
F: Okay. And when you were working at the [NCERT/GCERT?], you were working on environmental issues as well or just education?
P: Actually at that time, I was coordinating a project. And that project was trying out a technology, about teacher training through sattelite and I was coordinating subject specific area. So there are area, science, hard maths and teacher educators. So the way of working is totally different. [00:02:42]
F: Yes. So I was wondering in so the definition of ESD and the purpose of ESD I think has changed a lot since 2004 or at least there's been some nuanced changes and what would you, how would you say, what is the

purpose of education for sustainable development as you understand it, why should children learn this, what do they have to come out with?
P: Why student have to learn? ESD?
F: Yes, so it's a very big question, but I'm asking everyone
P: Eh, no, I want to understand from you even. Is it really ESD as a subject?
F: No, I mean
P: So for me, ESD not a subject.
F: No.
P: And it's not that one has to learn ESD, its maybe an approach. So whatever they are doing, it's supposed to be, the process is passed through ESD. So the process should be ESD, the learning process. So changing the norms might be your norms and my norms is might be difference. So understanding each of us is more important rather than what is true. So, the approach of learning, instead of what? How.
F: Hm, yeah.
P: So if I'm saying that. What is true. What is Sunday? What is Sunday? Maybe you say Sunday means holiday? Might be the other person will say Sunday is prayer day in the church? So, which one is the right? Instead of talking that what is Sunday, how Sunday is. I'm not teaching ESD, so I don't think ESD you can teach.
F: So it's a way of teaching?
P: So, ha [Yes in Hindi] it's fine. I'm not sure, but
F: Yeah, but I'm interested in getting different views
P: yeah but if you're asking me how you should teach and why you should teach ESD to the student. Then no, we are not teaching to the students. Of course, we are discussing with teachers, because they are actually the delivering mechanism.
F: So ESD is something teachers do, rather than something students do.
P: No, sorry, it's not a question of do, for do yes for everyone. But if you are asking for why teaching? It is not necessary to teach ESD to students. But it is necessary the way we are teaching the process, it should be ESD, with students.
F: Okay and what are then the main characteristics?
P: So it's not a content.
F: No exactly, that is another question coming up
P: But I answered that
F: No exactly, that is great. So in that sense, just to summarise, ESD is really about how you are talking about whatever things and not necessarily a body of content that you should talk about, so it's not about the information, but it's about the way you bring it across, yeah okay. Okay, so
P: How many questions you have?
F: Well, a few, but this is all very small, this is. So the current, I have been looking into the, especially into the National Curriculum Framework and it seems that there is quite a lot of room for interpretation and quite a lot of flexibility to bring ESD practices into education. Is this also how you see it? And do you think that this is happening?
P: Both. Both yes.
F: Both yes, okay, so in what ways do you think that the national curriculum framework, do think it has changed the way schools are doing this? Or what has been the impact of that document?
P: See, things are get changed, keep changing even. So yes, there is a potential to change the things through National Curriculum Framework NCF 2005, but it was to document the [pair?] in 2005 or, and, and that document, after a decade, 10 years, a first one has to revisit. Because, still there is room [00:08:05] to rethink an integration of the subjects perhaps our system is still folowwing the subject specific areas. rather than the life skill specific areas.
F: Yes.
P: Might be one of the life skills is the require mathemetical skills and the same life skill is require linguistic skills, so might be life skill is important, of the subject, because it is the are following the subject. In the end of the day they are going to measure subject. And then theyre measuring the subject, oh lots of things are a part of that, exam, marks, everything. If I'm working or practising ESD, rather than exams, rather than marks, more learners that if I'm students, so it is not necessary what I know and what I did not. The important is that, who am I, what is my quality, based on my quality, what's my [something] in the future, rather than, if I'm, if this is the curriculum, and I would ask something, whether you know this or not, it's based on my choice
F: yes.

P: As a curriculum provider. Rather than that, this is not my curriculum, my curriculum is Floor, my curriculum is that, what Floor is, how she is, so for that, instead of giving something, we are discussing a generic something. So yes for that, still there is room where we can improve in NCF
F: And you think NCF could even put that more into the curriculum framework. That should get a bigger role in the curriculum framework? Or do you think its already in NCF but it should be implemented more.
P: See, many gaps, NCF itself it needs to improve. thats one thing. But based on the NCF all the provinces or the states, they are preparing their textbooks and their curriculums, that is also not 100% reflection of the NCF is there in the textbook or the curriculum.
F: Yes
P: So there is another gap. So maybe this is the NCF [draws], its might be look like this, but it is supposed to look like this. So that's a gap. But based on this, if I'm developing something, it might be this.
F: Yes
P: So when were talking what the largest scale and the area, Its not being reflected here. So I'm not saying that this is not enough. I'm not saying this is not enough. I think there should be many things
F: On different bases
P: Yes. Sometimes I also think we need a big big big NCF curriculum, why don't we put some bullet points. Teachers should know what Floor is, that's it. That's my curriculum.
F: Yes. Yeah, that sounds, haha. Ehm, one of the things that I found in the [In the and they have to just sit there for one second?] is the softening subject boundaries, that that is recommended in order for children to get a taste of integrated knowledge and the joy of understanding. And I'm wondering to what extent this is happening, because I have been visiting some schools and
P: Clear boundaries!
F: Yes, very clear
P: Even more clear boundaries, and that is something, integration of subjects is still not happening. And NCF that is written there in NCF, there is no boundary, but the way it is being developed, itself, one is de[something] the curriculum out of it, or a textbook out of it. It will be based on subject. Because if I'm saying, you dont have the boundary of this room, then it's fine, then what else it should be? [00:13:04] In this area, the NCF is unclear or might be that it does not say anything.
F: Yes
P: Its not saying anything, and we say this is a guideline, thats why I'm still following the subject. At least if it is a guideline, it is a guideline, so no subject, but what.
F: Okay, so it is giving no alternaternative?
P: Yes
F: Ja, okay, so then just to few point that are still here. Ehm, sorry, do you feel that the current, the way of teaching, that is being practised right now, do you have, is there, can you generalise the way of teaching happening now, or do you think there is a lot of differences between schools, between city and other areas, do you think there are some, some more general things to be said about this or do you think it is totally?
P: Very interesting question and I also sometimes feeling all this things all sort of questions in the daily life, doesn't exist.
F: No
P: The questions it doesnt exist. Why? I'm living in a rural area. In a small tiny village, you can't belief only 300 population. Very small, every evening I'm going there, every morning I am coming here. When I'm interacting with the small kids, in the village, their fathers are the farmers, basically the farm labourers and they have a small piece of land, they are doing farming. So when I'm interacting with them they don't care what they're teaching in the schools. Why because their connection with the schools is not for the livelihood. Not for the livelihood. And most of the [parcel?] of the school, they are mainly working for the farming or farm labouring, and then in the city area, where the parents don't have any option for the livelihoods rather than doing some job or something. They're insisting their student supposed to be taught, supposed to be do something and learn, pass marks and everything, so when I'm comparing these two. So both are almost doing same things for the livelihood, for the livelihood, for their livelihood is farm and it's a sure livelihood, so they are not caring what their kids are getting, and their livelihood is based on their marks and the grade they are getting, that's why they're very much concerned about what their kids are getting. So both concerns is about the livelihood. So not the schools, or the parents, or even teachers, or even systems are even talking about what's the life skills. And what are requirements, so both are very much concerned with the livelihood.
F: yeah, that's interesting

P: So when we are, when we are look back, I was discussing with some 18 or young people, they're actually software engineering with one of the big software company here in India and I was just talking, they're all less than 30. What their background and where, from where they get their primary education. Half of them, they get their primary education from [00:17:26] the government school, so it doesn't make a difference if they get their primary education from government school, from private school, from rural area. So it doesn't make a difference. But it makes a difference is there are categorally asked its going back to their home. So what is the father telling it, what is the mother telling it. Do they care if you do your homework or not. So the concern is regarding livelihood, is more effective. Or more is [shell?] quite bigger than the other.
F: Okay
P: So it is not the question whether its a city or urban. But yes what is the assure. You and I can connect when we go to the data. When we see Gujarat, the province or state where you are right now. Turn out from primary education to college 15 year of education, 12% people are finishing their 15 year education graduation.
F: What percent?
P: 12, one-two.
F: 12 okay and in comparison to other states?
P: In Bihar, comparatively the poorest state. The literacy rate is 65 percent, here comparatively is 77 percent, but in Bihar the 14% people are finishing their graduation.
F: Okay so..
P: Yes it is right, why, might be the nature of the state, the area. We are here in this area, the Western part of the country, might be we are people mainly engaged with the business.
F: Yes Ive heard this yes
P: Yes and I also feel also when I was younger, I was studying in a grade, 12 something. When I was 16, 17 years old, I started to earn something, then I never ask for money to my father.
F: Yes you started to earn
P: so thats the kind of entrepreneurship, to stay here for the local people
F: Yes thats interesting
P: so its not necessary for them to finish their graduation, but before that they start
F: and entrepreneurship
P: entrepreneurship, so also its depends on the culture, very difficult or might be a different opinion.
F: Yes. So the life skills we were talking about, can you give some examples of these skills.
P: This is a making process, conflict resolution, when we're in a society no, all these things are very important. Today if I want to give a vote, to electing some people vote, V-O-T-E, vote election
F: Oh yes
P: what do you say?
F: Yeah, vote.
P: This might be a difference in pronunciation. Vote, not vote
F: We say vote
P: Vote, okay sorry
F: No its okay!
P: Many time, people are voting what their elders are saying, but the thing is quite important that they hold their own opinion. So being an opinistic people from a society is more important rather than the subject what theyre. So when you are talking me the lifeskills so this is a making ability. Maybe they have their own opinion. [Pen wasn't working, Partesh offered me a pen, but it was working again]
F: Yeah its working again [00:21:25]
P: Having an opinion, conflict-resolution, every day the lakhs of thousands of millions of police case are there in our court.
F: Police case?
P: Police case in the country. If next ten year, there isnt any single application, police case is filed, then also, the court cannot finish the backlog. So there is a huge number. So for solve these, we require conflict-resolution. Sit together, what's the problem, tell me, lets sit together thats required and education supposed to be supposed to be take care of these many things this is very much important to build a good society rather and to build good community.
F: Interesting, so in that sense life skills are about how to interact in a societal context and how to
P: And this is why ESD is more important
F: Because what is the role of ESD in achieving that

P: And that is what I'm saying right, when I'm in the schools asking them what to build, after two years, what your school will look like? They sit together, they plan, they implement, there might be even conflict, but because of that, there is an opportunity, the school board will discuss. A two year process, will provide an opportunity, to think holistically.
F: Ah yeah, that's really interesting. So I think I'm almost there
P: You can tick all
F: Sorry?
P: You can tick all
F: Oh haha [I had been ticking off the topics covered] Yes, I wasn't ticking anymore, I was only listening. I was wondering, oh yeah, so we were talking about multiple gaps, how do you think, is there in earlier conversations I've heard there's also a big gap of, between what teachers are doing and or how to phrase this clearly. The way that teaching is happening and ESD that this is not matching at this moment, so that there is a big gap in between teachers that do not see the added value maybe of these life skills but are very focused on the livelihood rather than and how do you see this and how do you see this to be overcome?
P: Instead of giving clearcut textbook, give them, no you will decide what to teach. Actually we want this kind of society. Might be instead of the objective, lets give some output. Lets discuss outcome and output. If I want to teach about the mathematic, then my objective is to teach the mathematic. Rather then that, if I say that, can I develop the critical, analytical ability in the students.
F: More competence-based
P: More competence-based. For that, if I teach mathematic, is fine, but I take all the students [something, something, something] find out the how much [something] we are [something] how we can do this, discuss, what is the amount of waste we are producing, that each area is more concentrated. All these things are critically required to discuss. If I implement a project within a month, or maybe a two-month project, it's comprised of mathematic, but it also linked my mathematic skill, with my daily life. Rather than [something] my daily life is very much connected with mathemetic. What we are trying. Mathematic is connected to [something], my life is connected to mathematic, so we have to talk about life. If there is a connection, I have to identify that connection, if it is not, not needed.
[phone ringing]
F: Go ahead.
[End of recording]
[Beginning of recording Partesh3]
F: Ehm, the main things, just about systems thinking. So my research, what I'm trying to do is seeing what the role of systems thinking is in developing ESD competences. So maybe more related to the life skills. Ehm, so my question is really, do you think at this time in secondary education here in Ahmedabad, are, is systems thinking already happening without maybe necessarily calling it this, but is there already an incentive for teachers to think about connecting different dots to each other?
[Partesh makes gestures to suggest a negative answer]
F: Not at all.
P: There is a lots of things [something] and as far as secondary education is concerned. As far as primary education is concerned, yes, there are things, I mean it is happening. But as far as secondary education is concerned, when we are converting the education system from primary to secondary, the objective of the education is a bit changes. The objective in primary education is basic, the fundamental education, but when we are entering into the secondary education, then the [something] in-depth education is started. And when we are talking about the in-depth, it's also leading to vocationalism, my livelihood, many things, so might be person to person is different, so sometimes rather than approaching collectively, very individualistic approach is there. So a lots of things to improve.
F: Okay, so then my last question, what role do you think systems thinking or connecting the dots or thinking on spatial scales or temporal scales, what role does that have in achieving these life-skills that we discussed earlier. So is it one of the lifeskills that you should develop or is it something that can help you develop these lifeskills. So this is maybe a bit, or both. If the question is clear.
[Guy comes to ask for tea or coffee, lots of talk on tea and coffee]
F: Ehm, so yeah, that was the last one, so what is the relationship between life skills and systems thinking, is systems thinking one of the life skills or is it something that can help you develop these.
P: Systems thinking ehm, is it a life skill? Or.... through the life skills, system thinking... attitude? can be developed, can be improved?
F: Okay

P: So might be that life skill is tool for systems thinking?
F: Okay, so
P: A bit near tool, what I thinking, I'm not exactly, tool. Tool is a very physical thing, but life skill is maybe, [ways?] of systems thinking. Systems thinking is very much of internal things. So over a period of time if I did systems thinking, a person can build inside or outside, in something different way. Systemically thinking process. But the life skill will definitely build such attitude. In that way, yes it's a tool.
F: And the other way around?
P: An ingredient? Ingredient?
F: Life skill for systems thinking or the other way around?
P: No, no, no, life skill as an ingredient for systems thinking? I'm not sure.
F: And maybe the other way around as well?
P: Systems thinking as an ingredient for the life skill?
F: Yes
P: Ehm... No. Systems thinking, life skill is basically, accordingly me, is a fundamental things, is essential, but that things leads to develop the systems thinking.
F: So by being able to vocalise your
[More coffee talk]
F: So just to clarify, the systems thinking, or life skills, systems thinking would then be one of multiple possible outcomes of developing life skills.
P: No, no, no, no. [scribbles on paper] I can draw this square, because I have basics of life skill. What I want to say is. Life skill is basically important, to systems thinking. Draw, you can remove draw. Draw is one idea. Its not a question of drawing. But if I have a life skill. For example, I'm giving another example. Ehm, because I mainly work with the kids. One kids is draw this and this. [draws a circle with a few random smaller circles in it] Ehm, as a teacher, if I have a good life skill in me, then I will ask the student: Oh, very good, what have you drawn? And the kids will tell me, Okay? do you know what I draw? Tell me, can you guess? I say no, I can't guess. Can you tell me? Then the kid they say, oh, this is a person. And who eat lots of sweet balls.
F: Oh yes, I've seen those.
P: So, system thinking, system is there, accordingly me, first I have to accept that what he draw is right. Second thing, is maybe he want to communicate but he or she must have his or her own ideas to communicate, but I don't want to understand that what he drew, but i want to understand how he or she is communicating, so that system. But how come this system is in-built in myself. Through my life-skills. So that life skill is very much important, systemic thinking. So that is what I want to say, now either way this way, that way, you can decide.
F: Okay, so maybe there is one last one, the really last one, is then still about these life skills, so what makes one thing, when is something a life skill? Just to clarify for me, so if something is a life skill when?
P: No. Something?
F: When is something a life skill
P: No
F: So we've talked about, there is a collection of
P: See its a very, very. Because life skill is not that one, two, three like that
F: Exactly
P: So how can I answer that, some being process, some being and then okay I have good life skills and then I can stop learning
F: No thats not how it works, but thats what I was hoping to
P: So always improving, ongoing ongoing, till my death
F: Exactly, so its something, its not tangible in that sense
P: Not tangible, no
F: Okay that was what I was trying to. Okay! Then is there anything else you think I should take into consideration anything else I should look into?
P: You can come at any time, for a coffee.
F: Yes, next time I will not have a lot of coffee before, than I can have a cup of coffee.
[more coffee talk]

Interview Rajeswari Gorana **CEE Ahmedabad**

F: Yes, okay, so first of all, thank you for answering some of my questions. I'm doing my - I don't know what Bijoy told you already - but I'll just give you a short summary.

R: Nothing, he just told me, she's in DO and she would like to talk to you.
F: Ah okay, well that's true.
[Writing name down and explaining about the project]
F: I'm researching the role of systems thinking in developing sustainability competences. Very broad, but still, so at this moment, I've been talking to different people within CEE, just to hear what the current practices are on ESD especially and then with a little bit of a focus on in what way systems thinking, or connecting the dots or working through different disciplines is already happening. And in this light, I have a few questions, first a little bit about your background and what you do within CEE, and then about ESD more in general, about ESD how its happening here in Ahmedabad, because I'm focusing my research on schools here and then a few questions going into the relationship between ESD and systems thinking. And in general is there is anything it reminds you of I'm very curious to find out anything in that sense, so there is no fixed structure. So anything that pops to mind is also interesting.
R: Just talk.
F: Yeah. Okay, so my first question really is if you can tell me something about your background, how you ended up at CEE and -
R: Ehm, I've done my Master's in Environmental Sciences, but I also have a degree in teaching. Which is a Bachelor's of Education. So that's why I applied for a job here, because it is a environmental education, so I had both qualifications. I got through and I got into the organisation and I think you know, they analysed the abilities and they assigned me to this job, to this particular group called Children's Media Unit (CMU) and what Children's Media Unit does is, to develop learner support material.
F: Okay.
R: You know on themes related to environment and sustainability and it also writes, what we call instructional material, so it is meant to be used by someone who is trying to communicate environment and sustainability concepts. So that person could be a teacher, could be an educator working in a formal or non-formal set-up, could be a trainer, in any situation. So the material is just not information-based material alone, but is also instruction-based material. So there will be instruction that, let we say, if you have to do, explain about climate change, then you are supposed to set up an experiment, you have to talk to your class, introduce it, have a discussion, so that is the nature of the material that we do. While that is the chief way of communicating, we also do lots of other materials, for instance we do games, because at the core, it is learning that is important for us. So how do the groups that we want to interact learn. So does a child learn better with a game? Then we develop a game. Similarly if it is, let us say, an adult who is trying to help a young learner, will a website help? Or if it is something to be distributed among large numbers and still be communicated, will a poster help?
F: That's interesting.
R: And so we are trying to get, what is a good way to communicate and engage the learner. We try to understand the needs and develop the material. So books are just, you know a part of it, but we also try and do as much variety as possible.
F: That's interesting.
R: Yeah, that is about me and how I ended up here.
F: And when did you start working here?
R: In the year 2002.
F: Okay. And before that, did you have any other jobs, or?
R: Yes, I was teaching, in a school. For secondary level students. So I just to teach chemistry and biology.
F: Okay, nice. And do you remember why you wanted to switch from education, why did you do the Master's in Environment?
R: You know the way in India, the way we look at things in India is, one you look for a well-paid job, that is one. And the second thing is when everyone would look, if you have some interesting studying and environmental sciences, you did some education, you will try and see where you can find a position that will suit your training. And in that sense the CEE job was perfect for me.
F: Yeah, exactly, sounds like it.
R: And it was also, ehm, I would say paying well, for the time that I joined. In a teaching position you will teach and you will teach till a certain level and here you do different things. When I came, I didn't know what exactly I would be doing. Because it seems like an educational institution, the name, I mean the name is Centre for Environment Education. So maybe I thought they make me go to schools and do something. I came with a compeltely, without knowing what it does. Yes, I looked up the website, but I didn't understand much, the way it was presented. But anyway, let me give it a shot, I came here, I did and I got cleared and when I saw the offer

letter I thought it was a good amount. And I thought, I should come and join. So it was not purely I'd say, to do something in environment education. No, I came, I discovered, I liked and I stayed.
F: Yeah [both laughing] that's good though! And what do you do like on a daily basis? What have you -
R: For instance, our projects are you know to do with learning support material.
F: Yeah, and actually also writing the content.
R: Yes, so it involves a lot of being at breast with what can be a suitable content that fits under environment education and education for sustainable development. So you'll have to say, okay, if youre looking at culture, these are very important when youre looking at ESD. So in a way, were also scanning the content, you know, is it just trees and animals or is it much more than that? Are we looking at, not just the traditional components of pollution, but also you know like those concepts which are emerging. So say for instance climate change was totally new concept in India. We hear about climate change when I did my Bachelors and Masters, there was one whole section on climate change, so yeah I understood the science very well, you know the multilateral environmental agreement, the UNFCCC was not well know, we knew that there was something like that, but it was not well known, now its a political instrument, so everyone knows about it. We talked about it but we didn't know what. For instance when coming to CEE also there was not much discussion on climate change, we still talked about EE, ESD, things like that. But you know around 2005-6, we realised that you know climate change needs to be communicated, and then it was here in this group that we thought you know we should sell immediately something to teachers, which tells them briefly the science of it, what will be the impact and you know, what can one do. So that was the thinking for us. So we developed a small booklet and of course, we found a funder, and he printed about one lakh copies [100.000] but is was a very small book, based on what we read, so that this group could do when it understood climate change in all its seriousness, which should, and to be able to communicate that science to the teacher. Because you know, the minute you say atmospheric sciences, the minute you say complicated terms, the teacher will say, no, no, no. So how do you do it in a way that the teacher says, okay, if I teach geography I certainly can talk about green house gasses, or I can talk about polar caps melting. So the teacher should feel comfortable and we had to do that, so that is one example. So we were already into the process of developing climate change material in 2006, by the time the Nobel was announced for the IPCC we had very good material already here, made for the teachers.
F: Yeah, that's interesting.
R: So similarly, this book, just right now, were working on transport issues. We're trying to understand what it means to, you know, to look at transportation in a city situation and how to communicate that to teachers and school. So how do schools look at the way its own students come to the school, what is the carbon footprint, how can we encourage non-moterised transport, how can we focus on walking. How can we communicate this aspect that transportation is not only convenience, it also has certain implications.
F: Yeah, exactly.
R: So just right now, we're working on that, so probably you know one, as in as a person or as a group that is developing learning material, you should be scanning the horizon, to see what is happening, look for those topics and issues that need to be communicated, then of course use your expertise to understand the learner, education, so you should be thinking about, what are my learner characteristics, should I use an experiment, should I use a role-play, should I simply use the news paper or should I run a debate? So you should learn, you should also look at your learners' situation and your learners' capability. So your one foot is in education and one in sustainability, so you have to put these together and -
F: That's interesting. So when you started here, was this the first time you came into contact with ESD as a concept?
R: You know when I joined, I joined in 2002.
F: Yah, so there was not that much -
R: So we heard about sustainable development as a definition from the report -
F: Ah, Bruntlandt
R: Yeah, the Bruntlandt commission report. And in India, Indira Gandhi.
F: Okay, yeah.

R: She was the only head of state to have participated in the Stockholm Conference.
F: In? In the Stockhold conference.
R: Yeah, in '71. So that was when she told that you know, in a poverty situation, you can't address environment, because your living situation is important, you cannot say, don't cut trees or you know, because with poverty. She made this very important observation, that if you don't address poverty, you can't address environment. So, as students, we read all this, we know, we understood, but SD was not really big in that sense

and ESD was certainly not at that time. But, you know, by 2004, we understood that SD was gaining coinage, that it was being used more and more. So there were discussion within the organisation that we should use sustainable development, so there were many initial rounds of discussions. Many felt that you know what we call EE in India, is already ESD. Because you know when you're talking about water, you are already talking about who accesses water, what is the water going to do for a farmer, how does it affect your health, so already ther was an interface that had the environmental, the social, the economical and the cultural aspects included. So many people at that time, I was a new joinee, argued that what is this new term, we are doing EE perfectly and EE for us involves everything, what is being defined as sustainable development is a very Western concept, you know, we already have it. So there were discussion like that. But by 2004 we got to know that the United Nations was trying to -
F: The decade
R: Declare the decade of education for sustainable development. That is when, in spite of huge debates and arguments, we realised, we need to now articulate environmental education in SD terms. Even if you try and gravitate towards environment, you should be able to have some social, some economic element built into it. Without that, you know, you are only focusing on one pillar. So it was easy for us, it was an organic transition for people working at CEE. We were already looking at the social, the cultural. Maybe because we are a country where, I think many people are in touch with the environment. Many people know what it means not to have access to water -
F: Yeah, exactly
R: So also,
F: So the sustainability issues are also very -
R: Yeah, the sustainability on the face. So you cannot go to, let us say an NGO and talk about water as if you talk about say water. You should be able to talk about much more than that. So the transition of course was very smooth, but we realised that you know. How do we communicate ESD. There was an international conference at the beginning of the decade and by then the draft implementation plan was in place.
F: Of the decade?
R: Yeah. Then it talked about many aspects, many strategies, like use ICT, learner is important, prepare teachers, develop the curriculum... You know, make it multi[something], you know the learning should happen from more sources and not only education. 16:04 All that we were in a way knowing, we understood it. So the transition was smooth, for us the major shift was, our jargon changed
F: Okay, yeah.
R: You know, what we were always traditionally calling environmental education, now we were consiously calling ESD. So yeah. I think that is how I landed into ESD. So from 2002 to 4 there was not really much, but after 2004 it became really, and once into the decade you know, the terms were used in conjoined fashion. The people used EE and ESD.
F: And now, how would you define ESD? Is that still for you the same as EE or?
R: Ehm, I can go back to this understanding. The way CEE works and the way EE works for a country like India, you know majority of the population, you know in touch with the nature, many basic necessities are still at the reach, whether it is water, transportation free from pollution, you know. So they're all there, so in a way, I would go back saying, for me they're not distinct. I could use EE and still be knowing that I am doing ESD. But I could communicate as ESD, because obviously it will have taken environmental themes into it. So like every CEE person, I will say that EE and ESD are almost same for me. So, yeah.
F: And would you say it's more about the content that youre teaching or the way that youre doing it? ESD?
R: You know, again here, there's an angle to it 18:12 Content of course plays a very important part, but CEE as an organisation always believed that learning has to be context specific. You should take your immediate environment into consideration, that, you should use an approach that engages the learner. So it is not about a set of facts or information being given to a learner, but you know, facilitating the learning process in such a way that the learner itself describes that a tree is a home for many insects. Or for instance, that you know, wasting water means wasting electricity. So it is one thing to tell someone that if you're wasting water, you are wasting electricity and it is another thing to make someone do something and realise it. So, CEE, because it believes that you should do an active learning approach, that you should take the context into account, that you should also appreciate that the learner himself has some knowledge and experience in it. Building that into the learning process is important. So, I guess, for us ESD is both about content and about the processes. Having said that, I will say that we haven't actually stretched the concept of ESD to something like citizenship education, or I would say the development is not being pushed to that level. So, yes there are, ESD thinking has to be widened, it needs to certainly include what do I do, what can I contribute, how do I act as an individual, as

a collective entity for a global cause or let's say for a wider cause. 20:31 We certainly say that the standard ways of looking at [something] waste, resources, those are already there. But they're not [something] in the umbrella of the citizenship concept, so yeah, I mean.
F: Yeah, I think that answers the - Good. So I've been looking into the National Curriculum Framework 2005, and it seems to be quite flexible towards the integration of different topics into the curriculum and also a new way of teaching and I was wondering, is there in your opinion, is there room in the NCF 2005 to integrate ESD into the curriculum?
R: Again, a difficult question. The curriculum framework is a very very intention document. The curriculum framework only guides the one who makes the syllabus, you know the framework, and the person who writes the text book. So you know, you can always suspect if all the good intention of the curriculum framework, if it actually translates into 22:05
F: Practice?
R: Into even those systems, you know
F: Ah, even into the layers?
R: Into let us say, designing the syllabus, designing the text books, and then finally for the teacher to be able to, you know, translate it in the way it is envisioned in the curriculum framework.
F: Yeah, if that's connected
R: :I have a feeling much of it is lost in translation, you know when it moves from one step to the other, but I wouldn't only say that it is lost in translation, becuase it is removed with so many steps, but also because of so many other challenges. That in India, much of the learning is centrered around textbook and the textbook is a shared resource for the teacher and the learner. So the teacher uses the textbook and the student also uses the same textbook. So an adult and a learner, both are using the same resource.
F: So it's not that there is also a sort of... Ah, that is interesting.
R: Yeah, and the other thing is that you know, exams are an important part of India's education system. And usually, now there is a little change, but usually end of the year there is an examination and the child has to past before he gets promoted. Not at all levels, before the 5th standard there is no examination. But after fifth, you have to essentially clear that examination, before you can move to the next one. So it has over the years become very convenient for the school system, to ensure that all the learning is actually derived from the textbook.
F: Yeah, in order to be able to -
R: Clear the, for the teacher to manage the time. So what happens is, the textbook is given, the lessons are taught, children are supposed to learn those lessons, at the end, there will be a test based on the lessons and at the end, you clear and you go. Now, in a situation like this, if you want to translate a very intentional document like NCF, which says we should follow constructivism, we should invite elders, you know, we should look at different abilities in a class - it is not possible. It is not possible.
F: No, not in that context.
R: Not possible. That is, so you know, it is there in the system, but the system cannot deliver, because the systems work in a certain way. The other thing is, teacher preparation is also very poor. It is done in a way, let us say, there is no ambillical chord between National Council of Educational Research and Training, National Council of Teacher Education, the boards which actually operate the schools, like the Central Board for Secondary Education, so there are no chords, they are all individual entities, seperated, they function in their own spaces, and somehow they expect that all of it should actually go down to the school level. So, there is issue. In the ways things operate in India, so teacher preparation is another weak link in all of this. And of course there's a lot of structural challenges, like you know there are a lot of first generation learners, classrooms are overcrowded, you know, and that there are not enough resources in a school, not enough textbook, so that are also the issues. So all these also play a part in how a good document cannot actually be translated into -

F: Yeah, exactly.
R: It doesn't make a difference to a child actually.
F: No.
R: No, it doesn't work. 26:14
F: Okay, yah, that makes sense. So, would you say, in your experience, I don't know if this is very applicable to what you are doing right now, but that there is somehow a predominant teaching style in India and what does that look like?

R: It's textbook based, for one. If whatever is there in the textbook is certainly taught in the classroom, it's textbook based. And the other thing is that, the relationship in the classroom is the teacher knows everything and the teacher will tell us somehting, we learn something new, so there is a hierarchy. The teacher will know, the teacher will teach, we will learn, and then, you know, we go to the next level. This is the fixed notion and this is also the standard practice. So the notion is that the teacher should be able to tell us everything. The teacher has answers for everything and the teacher cannot go wrong. And the other thing is, if you know the textbook, you can clear that. So if I can read the lessons in between a [something] very well, I can go to the next thing. So that is the predominant style, even today, and that works just not in the school, it also works like that in homes.
F: Okay, that's interesting.
R: So at home, the treat will, the format followed is exactly like that. So let's say, if I will help my daughter learn, I will depend on the textbook, and the other thing is that there is, I tell her that you have to learn about trees today, so were looking at trees, we are looking at the textbook. Probably, I will not make an effort to take her out and show her ten trees and ask her whatever you want, she will not [know how to?]. I have a daughter who is in first standard and she learns in the class, when I come and try to teach, being from CEE, I come and try to teach you should [something], she says no, that is wrong. What my teacher says is right. And what my friends says, I'm going to say the same thing. So you know, you're bound by the [something], so even when I try and teach her, I know that my daughter gets into anxiety, my mother is teaching me something new and if my teacher will ask and I will say something, my teacher will say this is not right. 28:49 She's just in first standard, but she's already experiencing that.
F: That is very - what age is she?
R: She will be six.
F: And already feeling this.
R: Yah, totally socialised into it, so I had to go to the school and talk to the teacher. In one of the particular activities, she had to tell how she spends the time during the day. So I told her, you can't say you go back home from school, you should say you go to a creche. And then you spend some time in the creche and then you go back home with your parents. She was not willing to say that. She said, no I will not say that. She learnt it, she agreed, when I said, do you agree to this, she said, yeah that is what I do every day. But why won't you say it when you are in front of a classroom, she says no no, that is wrong, my teacher told me something else. So that is how, it is.
F: Okay, wow, yeah so that is very -
R: So even, so many times even parents obide by the system. They also follow the same practices.
F: Yeah, but if you get the feedback from the exams that you need to know exactly what is in the textbook, then it's at one point, you are going to live in that structure.
R: Yeah, yeah I think you know, in schools in India, they are also in a hurry. They want to teach too many subjects they want to finish too many concepts and move on to the next one, and there is a whole lot of crowding in the curriculum, you know my daughter is learning about transportation, about food, about her own self, about her family, about joint family, about her nuclear family, about I don't know, all shapes, colours, arithmetic, so I think there's also a lot of overcrowding. So actually there is no space where a teacher can actually teach things on a leisurely pace, so there is an issue with that.
F: Okay, let me see, and do you think, no I think we already somehow answered this, but what should be changed in this [something] in order for ESD to be taught in the way that it should be taught? 30:59
R: I think there should be a structural change. The systemic change should actually see how all those people who are actually preparing teachers, preparing text books, preparing syllabus, understand and internalise ESD. It's not a body of knowledge in that sense, that okay if I talk about this, then it is ESD. No, it is, you know, it is values, it is you know, it takes, it is application of science, it is analysing social issues, it is looking at the economic value, the function of economics in let us say, in the way we manage things. It's also contextualising learning in relation to culture. So it's, in itself, ESD is a very complex topic. So, that needs to be understood by all the actors in the system. And then you have to, you know, see how do you want to do it in an infused way, do you want to integrate it? Do you want to you know treat it as a subject or as an area that you can introduce to the learner. And then, be able to assess about it. Assessment is very important, without assessment, you don't know where you are going. If you do it all [something], it needs a lot of will and it's a huge systemic challenge because the number of schools, teachers, learners, languages. Environmental context and environmental problems are immense for India. So you cannot do in a single shot. Let us say if you had to introduce computers, you could very well do it. You can say, you learn this and it is done. You speak, you are in the area which has no water, nothing. But ESD cannot be done so easily, It needs lots of learning and

unlearning on many many levels. It needs to be seen both as a content and as a process. So for that it is a humongeous task. And even that in a large country, where governance structures are not clear, there is a lot of system inertia. If you had to introduce let us say, one subject in the school system in India, you have to look at who is the teacher, who writes the textbooks, how do you prepare the exams, how is the time in the school, ha you know? How does, how will you teach it, so nobody I think is having the energy to do that, so they say whatever is happening is happening, so that is - But, traditionally, while that is the way to do it formally, there have been many creative experiments, the way it has been done. So, one route has been that you know, you use the co-curricular approach, you do projects, you form clubs, you know, or you use camping, there have been initiatives and CEE is the best example. All of school-based activities or activities that involve teachers, somehow try to bring this into the system.
F: Yeah, as an addition to the curriculum. 34:55
R: You know, now it no more [something], because the Supreme Court ruling says that EE is compulsary, so we are no more outside the classroom. We are inside the classroom. But you know, we tell the teacher that you can make space, you can make time, you can add value, we'll tell that. The system support is not the way it should be. In written it is there, you know, EE is compulsary, but if you analyse how is it done, you will find that actually there is little or nothing except a couple of words you know you should cut pollution, you should, so it is a lip-service. So its not in its true sense there. So, some experiments have already been there, we do the NGC, we should do the environmental orientation, the school education program, where we tried to support local NGOs to go to schools and do assignments on environmental issues and engage the learners. That was a scheme of Ministry of Human Resource development, so there are bright and brilliant examples of how it has been addressed, so maybe if you cannot change the entire system, you can do things like this. So probably at a small scale, at a state level, at a district level, something like this happens.
F: So in that sense, right now, would you say ESD is mainly project-based, so not necessarily - is it in some schools also really structurally into the curriculum, or is that really -
R: Ehm, you know the way the [NCERT] which is the [fixed?] body looking at teacher training and textbook preparation, it has taken a stand based on the imput coming from the federal units, the states, that every state has taken its own stance, so some say we do it in an infused way, so if you look at the English textbook, probably there will be a poem on, let us say, for instance a flowering tree and they will say: that is environment for us. Probably there will be a lesson in Geography which talks about lets say El Nino effect and climate change and they say that is environment for us. Or they will do social studies, and say a particular civilisation perished because they did not take care of the environment, and then they say see tha tis environment for us. So you can easily say, because it infused, you don't know what. But if you really ask, how differently do you do this lesson?
F: From before
R: Do you talk about climate change in real sense, do you talk about multi-lateral agreements, do you know that people are struggling to come to negotiation, the teacher say no that is not [our topic?]. So it is still science based, text based kind of teaching. So while it is, it is a good thing that is compulsary, the bad thing is that you can sweep everything under it
F: Yeah exactly
R: And say that it is, under the carpet and say, oh yeah we're doing very well.
F: So do you think when discussing for instance, in history, a civilisation that has perished and verything, are teachers saying in the classroom that this is an example of sustainability, this is something you can connect to, growing population that we talked about in geography or that you can connect to biodivesity?
R: They might be making links because you know, we all are understanding some things, there's a common understanding. As I told you, when I studied climate change, I studied as how o-zone layer, climate change, water pollution, you know, it ;s like all topics were on this level. But now I know that climate change is here and water is here. 38:37 So teachers might be using, but whether they make connections, population, Ahmedabad, water pollution, water deficit, no. There is no time for the teacher to, so I wonder if that happens.
F: Okay, so then I had a question, so what learning outcomes do you think are the most important for ESD as a whole, so what competencies or what outcomes are really - we talked about assessment before, so how-
R: The very important - if you ask me personally - because everything that you do in the classroom with your learner, needs to be planned. You're doing this for an outcome and you want the learner to move from point A to point B. And this is very very important. And essentially for ESD, I think competences play a very important role. Because you know, If you have developed a competency, you can see that the knowledge, the information, has been combined with my behaviour, and I am able to act. And that is the outcome that actually ESD should take us to. So for me competencies are really really important as what I say as a target for the

teacher or whoever is preparing the learning. And the learning objective is equally important, because that is how it is derived how I do things, or why I should do it. These two are really important, but they're not there in so well written, or very neatly articulated in our education system. `
F: So what would be competences that come to mind? For you? Specific ones?
R: You know, for me, the competencies would be leadership skills, citizenship skills, to be able to synthesize information and act in a particular way. You know, to be able to communicate, you know, there are many of course, value and judgment, there are many and these are essential.
F: And what, what are, just if we look at leadership skills for instance, what would be learning outcomes, that are connected to such a -
R: Such a skill, to develop such a competency. You know, if I were to take one learning objective would be [lots of pauses] let say in the case of transportation, if I were able to say or if the learning objective is to understand the whole of motorised and non-motorised transportation in a city, what does it mean. For me if I can learn about those. Having learnt that, I know that if I make my choice 42:43 whether, if at all there is a choice. One that I understand, that there is a choice. Only that motorised transport is not the choice. That there is a non-moterised option as well. So I know that this particular objective iss actually going to make me pre-disposed to make me understand that I will not say that you will do it. Because I know that my daughter learnt and came bback and said I understood this and why don't we walk, I think twice, if I can. But still, that my daughter came to me and asked, is for me going to be important. So for instance when we tell her, that divider in the road has to be of certain hight, because that is when you can actually climb on it and climb of, so now whenever we see one, she says, this is not a good road, she says.
F: Ah yeah, that's nice.
R: So, I know that you know, if I do a particular thing with a particular objective, it can actually by a channel for buidling a competency.
F: And they can come back in that sense and become more internalised, yeah. Ehm, okay so then I think my questions that I have left are on systems thinking, that is the last part that I wanted to talk about, so just going back to the National Curriculum Framework one more time, it recommends - at one point - the softening of subject boundaries for integrated knowledge and the joy of understanding. Do you feel that any of this is happening? The softening of subject boundaries?
R: Ehm, in, if you ask me to comment on the avarages, how it happens in schools, it is not there.
F: No, in avarage it is not.
: No, but if you go to schools that are like very modern and that do not work around textbooks and the same teacher teaches more than one subjects than probably it is possible. But now, the way it is, the space and time assigned to a particular subject, so there is no scope for two teachers to be standing in front of the same class and -
F: Okay
R: So you ccan not expect, let us say geography teacher and history teacher, to be together and talking. So the softening part becomes very difficult, because really I cannot step into history.
F: No exactly. And do you think that outside of the actual classroom these teachers have space to communicate?
R: No they have not. Because there is no space, let us see, I went and spoke to a geography teacher as a history teacher, but then, having spoken, I will not know what peiod we will get, so the system is rigid. 45:37
F: No exactly.
R: The system is rigid, you know. You cannot say, we really did it together, now we want to do. So but, where in the class if between 9 and 4, where can we both go and do something, there is no such thing. I can go and do one and she can go and do one things there, I can go on Wednesday, but here is no place where we can both do the class together. So if you are really creative then you take the teacher and she talks but by then the teacher has something else to do. Let us say, if I am a history teacher, and there is a geography class, I can do. But I need to time to do my correction and to go over my plan, so I cannot be overly enthusiastic and say oh I'll go with you. Then who gives me the time to do the rest of the work. So, there are spacial and temporal limitation, so you can't, both of you can't be in the same place at the same time, because you're required to do something else somewhere. And time-wise also it is not possible., because I can only teach seven periods in a week, and i cannot teach more than that. So there are spatial and temporal issues there are space issues, I mean if you go to the classrooms, the classrooms are really enclosed spaces, and only one class sits there and learns. So even the way buildings are built is.
F: Yeah, I've been seeing this, the circular buildings, with the yeah
R: So there is no, physically it is not possible, mentally it is not possible. I mean, structures are not there.

F: Exactly
R: If you put a CEE person, then they will do everything. But we are already doing so much that we can do everything anywhere, but then we also do it in such a loose way that if somebody asks can you assess this learner, we are like ahhhh. We can do the magic show, but if somebody asks, can the magic be repeated with a child, we are not sure. Because the learning also has to be quite focused. You know, you go and do something with the children, come back and that is fine. But the child has to be able to, you have to be able to evaluate the child and the child has to be able to demonstrate certain things. Now, we don't take it to that end. [Yeah, why not?] Because we are not in that sense, professional teachers, we don't have the worry of a 5th standard child having to complete all of these, so by the time the child goes to 6th standard, the child has to know that the atmosphere is made up of this many gasses, some of them are greenhouse, some of them are essential for life forms, so that is the focus, so you do it completely and put the child in the [something]. But if we went, we would do so many things and the child might like that, but at the end, we are not sure whether the child has learned that particular fact, so that he should be able in the next round that desperation and foto-synthesis are conjoined. Or that -
F: So you think this should also be aligned more? Or is this just the way it is at this point?
R: Aligned in the sense?
F: Ah, that what CEE could maybe be more aligned to what is going to be assessed at the end or fit more to what is being done in the curriculum at that point?
R: Well, we need, if were looking at learning, you need to take it to the end, so you have to make sure that the child has learnt it, that particular objective has been achieved, and that the skill has been integrated.
F: So that's more project-based learning in the long run?
R: Yeah, you need to do that. For instance, we do a lot of activities is water. But if I'd ask the child to write, let's say, an experience of living in Ahmedabad. And what role water play, if he's not able to write, then you know, it's not, it hasnt made a change. So whether we are able to do it. Especially, because CEE can only do certain things, we are not formally the people in education sector, we come form environment sector and we want to change the system. But if you want to work in the system, you should only teach, but also see if it has mattered. For the learning.
F: Yeah. And this is not happening now, you think?
R: It cannot happen, because we are outside actors.
F: Yeah, so there is no real way to -
R: Assess. So that is why you know, some school programmes where you go and interact with teachers and children, maybe it has made a difference, but you know it is a costly thing. If CEE goes and you know it has to meet, it requires money, it requires personnell, so you know that there is already a system where there is a teacher, there is a textbook, there is evaluation, there is learner and you're still putting more money, more effort into it. Then it is happening. But you know, then you have challenges of scale, you can only do it in ten schools and not -
F: Okay. That's good. Ehm, so then, I think my last questions are really on systems thinking. In your experience that you have had here, I think in the projects I've seen from CEE, there's already a lot of connecting of different dots, there is a lot of attention of how does this sector connect to this, do you think that in schools, right now, also happening? Outside of these project? Do you think that there already are places where students are made to think in systems even if its not being called systems thinking but - 51:43
R: Mmm, I cannot really comment on this, because I have not gone to a school in a long time. But I can comment to the extent that you know when we, these times we are analysing the textbooks a lot. So when we analyse the textbooks, we find that, one that the complexity doesn't increase with the age.
F: Okay.
R: And the other thing is there is no continuity. If you talk about, atmospheric gasses today, tomorrow you should be able to talk about the Green house Gasses, and in the third level you should be able to talk about impact of global green house gasses on water cycle. So you need to improve the complexity. You know these are not there. One if there is a continuity, or if there is an increase in complexity, you can bring systems thinking. See there is the greenhouse gas, there is water, there is farming, there is farmer drought. If you do it in 5th standard, then don't do it in sixth, then do it in 7th, then there isn't -
F: Yeah
R: then there is an issue, so, well, if it is written in a textbook, if it is written in a lesson that you know climate change has all these things, then people will understand wow, you know, because the global ice caps are melting, we have a change in temperature in the sea currents and then because of that, we have more you know, cyclones and then because we have more cyclones we have more you know water, because there is

flooding there is crop destruction, because there is crop destruction there is farm suicides, if it is written in the lesson as text, I can read it, I can make out, because my age is. But I really don't know if there is a question asked in the geography lesson, that will make me go to the economics lesson to see how it is, I don't know.
F: Okay, well thats still an interesting answer. Ehm, okay then on the role of ESD, my last to questions, so what do you think is the relationship between ESD and systems thinking. So yeah, even only -
R: Yeah, I am a great believer in systems thinking. So you are asking the wrong person, who is already been converted. I feel that it has to be taught in that way. Taught and learned and communicated in that way, because otherwise, you know how is it different from computer sciences or how is it different from algebra. You know in algebra, if you understand this, you can perform a function. But here, how do you tell them that mosquito breeding, rains in september, my driving a car, that you know, that we are in a city, all these are connected. Who tells them. Or for instance if I plan something for the school system, I should know, who is my teacher, what are the obligations that she has, who defined what she teaches? You know, I should understand all of these. Either when I'm planning, or when I want to communicate ESD, you know systems thinking is very critical and unless you show the whole picture, or you show the numerous dots, or otherwise it becomes road learning and you can care about things, but if I dont know why a school has absentees due to dengue, if I cannot connect that then you know.
F: yeah, it adds a lot of value the moment you can do that.
R: Yeah but systems thinking is really really 55:43 important, because our lessons are very simplistic, very simple. So you really don't know why there should be something like this, so if the geography lesson says that if there are rains in september, then there will be crop loss and you stop there, then that is simplifying facts, which don't have any meaning.
F: You loose a lot of meaning
R: Yeah it doesnt have any meaning, so you will just learn that floods, crop destruction have many more implications.
F: Yah it is really interesting this is the topic I'm designing or I'm using the mystery method from teaching through geography and I want to do an experiment using this in schools here in Ahmedabad. 56:29 And to test the -
R: You know Thomas Hoffmann?
F: Yeah, I've talked to him
R: Ah did you? Yeah, he's a dear friend of mine.
F: Yeah, I've talked to him in September, at the conference.
R: Ah, so he developed two of those mystery activities, and he showed to me and then I told him I would like to develop one with him.
F: This is really nice, because I did one on tigers
[More talk on experiment; about the Garba and economic loss; and book on ESD in the region]
F: 58:44 Okay, then the last question would be what, oh yeah, still on the relationship between ESD and systems thinking. I've been talking to more people around and there seems to be some people who say that systems thinking is really a means to do ESD, as you were also saying, whereas other also say it's a goal of ESD, so when you do ESD, you should come out with the ability to think in systems, and also the idea that systems thinking might be a driver towards the goals of ESD or the competences you want to development. And what do you think, how?
R: I would agree to all the three. Becasue maybe in the initial stage, you have to know what systems thinking is, so you have ereally explain by giving examples. So that way, youre talking about a particular way of looking at things or its a means. But once having introduced that, you should be able to see how you actually examine certain cases while using this. So that is again another level of skill and finally that you should be able to see, to take action or to look in the larger perspective of real life situations in the systems concept. So I would agree with all of the three. In the way it is. It's a goal, its a process and its also a clear objective in a way of realising ESD. All would fit for me, I mean if you ask me.
F: Ehm, and then, to specify to what we discussed earlier, was the leadership skills and citizen skills as competencies to be developed when you are doing ESD. Do you think that systems thinking plays a role in developìng these?
R: Very much. Very much. I mean if you were to ask me to assess my own work. If I dont look at , I mean I wouldnt use terms out of systems thinking, I mean I would say it was a feedback loop or 01:00:46 whether it is, I wouldn't use those words. But when I actually want to explain a concept or when I want my learner to understand certain thing. I will make sure that the complexity is there. And that, there in certain ways the dynamics of that system are responsible for what we are trying to observe. So for me, I am a fond believer, so I

would say that, I would evaluate my work on systems, if I looked at something and it is missing, I would say, wow, that's not good work. So I wouldnt use simple statements like if there is rain in February, then we will have floods. I will say why there are rains in february.
F: Oh there's a peacock [there was a peacock standing in front of the window; both laugh] Okay. I think, then I went through my questions, so I don't know if you think there is anything else I should still.
R: It is nice. So you go back and what do you do? You develop your thesis or you write something?
[Talk about further thesis process]
Sanskriti madam, CEE central regional office; introduced systems thinking - Pune office
Sateesh (something) also. --> Wrote textbooks, CEE central regional office

ANNEX 8 – 'RELATING TO PICTURES' PERCENTAGES

The percentages of the different groups mentioning each term for the two exercises:

	Traffic jam					
	Group 1 pre	Group 2 pre	Group 1 post	Group 2 post	Group 3 post	Group 4 post
Climate change	73,7	58,6	86,8	69	77,4	60,6
Animal welfare	2,6	6,9	7,9	13,8	6,5	12,1
Money loss	31,6	34,5	60,5	51,7	58,1	54,5
Pollution	97,4	96,6	94,7	96,6	90,3	90,9
Biodiversity	15,8	27,6	7,9	24,1	12,9	9,1
Transport	81,6	75,9	89,5	89,7	93,5	87,9
River	0	0	0	0	0	3
War	0	10,3	2,6	17,2	16,1	12,1
CO2	84,2	69	81,6	65,5	87,1	81,8
Water scarcity	5,3	6,9	0	3,4	3,2	9,1
Hygiene	21,1	13,8	21,1	24,1	29	15,2
Health	71,1	55,2	68,4	75,9	61,3	63,6
Peace	15,8	20,7	18,4	41,4	22,6	15,2
Sunlight	13,2	13,8	18,4	13,8	19,4	21,2
Gender	0	3,4	0	3,4	0	3
Poverty	18,4	17,2	15,8	17,2	16,1	21,2
Education	0	6,9	0	20,7	3,2	9,1
Consumption	26,3	34,5	55,3	44,8	29	42,4
Resources	39,5	48,3	60,5	58,6	54,6	60,6
Inequality	2,6	6,9	0	6,9	9,7	6,1
Energy use	71,1	79,3	84,2	79,3	80,6	60,6
Time loss	81,6	75,9	92,1	79,3	93,5	81,8
Urbanisation	26,3	17,2	34,2	24,1	25,8	27,3
Global warming	81,6	79,3	94,7	79,3	87,1	90,9

	Cow and litter					
	Group 1 pre	Group 2 pre	Group 1 post	Group 2 post	Group 3 post	Group 4 post
Climate change	44,7	51,7	50	44,8	41,9	39,4
Animal welfare	50	55,2	68,4	65,5	77,4	51,5
Money loss	15,8	6,9	21,1	13,8	22,6	24,2
Pollution	97,4	82,8	97,4	82,8	96,8	87,9
Biodiversity	42,1	55,2	55,3	44,8	48,4	54,5
Transport	13,2	17,2	10,5	17,2	25,8	12,1
River	5,3	10,3	10,5	13,8	19,4	15,2
War	0	3,4	2,6	3,4	0	6,1
CO2	21,1	34,5	31,6	24,1	38,7	42,4
Water scarcity	5,3	10,3	2,6	13,8	12,9	9,1
Hygiene	78,9	79,3	76,3	72,4	67,7	75,8
Health	78,9	93,1	84,2	93,1	90,3	84,8
Peace	2,6	6,9	2,6	10,3	0	3
Sunlight	15,8	17,2	13,2	13,8	9,7	9,1
Gender	0	0	0	0	3,2	0
Poverty	39,5	44,8	42,1	37,9	29	51,5
Education	2,6	13,8	7,9	13,8	6,5	12,1
Consumption	31,6	27,6	34,2	37,9	16,1	39,4
Resources	39,5	44,8	34,2	48,3	32,3	36,4
Inequality	2,6	0	5,3	0	12,9	9,1
Energy use	7,9	6,9	15,8	10,3	6,5	12,1
Time loss	13,2	20,7	7,9	6,9	6,5	12,1
Urbanisation	28,9	31	28,9	20,7	25,8	24,2
Global warming	57,9	75,9	71,1	62,1	67,7	54,5