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# Theory and Practice of Education for Sustainability: The Case of Secondary Schools in Mauritius

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## About Education for Sustainability

The Brundtland Commission in 1987 defined 'sustainable development' as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.[1] Since that time the definition of 'sustainable development' has expanded to also include the safeguarding of the earth's life-support systems on which the welfare of current and future generations depends (Griggs et al., 2013). Education for Sustainability (EfS), commonly known as Education for Sustainable Development (ESD), is becoming a growing priority across sectors globally, as well as in Mauritius, in order to achieve sustainability. According to UNESCO (2014b, p. 122):

> ESD empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society.

In December 2002, during its fifty-seventh meeting, the United Nations (UN) General Assembly proclaimed the years 2005–14 as the UN Decade of Education for Sustainable Development (DESD) with the emphasis that 'education is an indispensable element for achieving sustainable development'. The UN also

designated UNESCO as the lead agency to promote and implement the Decade. In the recent UN Conference on Small Island Developing States (SIDS) that led to the 'SAMOA Pathway', UNESCO (2014a) emphasized that SIDS Nations are highly vulnerable to the effects of climate change and require ESD to empower communities to make informed decisions for sustainable living rooted in both science and traditional knowledge. In 2013, the thirty-seventh session of the General Conference of UNESCO endorsed the Global Action Programme (GAP) on ESD as the follow-up to the DESD. The GAP aims to generate and scale up concrete actions in ESD to accelerate progress towards sustainable development (UNESCO, 2014b). Education *for* sustainability is commonly mistaken with education *about* sustainability, which is different in aim, scope and impact. Most of the education related to sustainability in Mauritius would fall under the category 'education about sustainability'. This distinction made by Sterling (2002) highlights how we perceive the purpose of education. In education about sustainability it is common to select one of the subject areas, usually sciences, to teach children about sustainability challenges in addition to some sustainability projects that focus on development of environmental awareness – for example, school gardening and reducing waste through zero-waste sensitization campaigns. Although these may be useful starting points to introduce sustainability into schools, it will not address the root causes of our unsustainability through education. This can only be achieved if the mental models underlying those patterns of behaviour that drive our unsustainability are transformed through education and action (O'Brien and Sygna, 2013; Senge, 2012). We can only transform society as referred to by UNESCO if we transform the systems that drive our behaviour, as we will discuss in the next section of this chapter.

EfS has as its primary goal the transformation of the educational systems by: (1) creating a higher vision and goal for education beyond preparation for the labour market; (2) actively supporting the development of key sustainability competencies, including relational competencies, by using the whole curriculum system in an integrated and synergistic way; (3) preparing young people to become engaged citizens and stewards for well-being and ecological sustainability; and (4) empowering young people to develop their unique skills, vision and wisdom to become real innovators for the future and transformational change agents who know how to work with the systems in society for the transformation of society (Smitsman and Deenapanray, 2014; Sterling, 2002; Morin, 1999; Orr, 1992; Bateson, 1972).

## The need for Education for Sustainability

The educational systems of today are geared towards objectives that are often incompatible with the goals outlined by EfS. These goals have been influenced and designed by the dominant socio-economic systems with the purpose of preparing people for a labour market that is consumption based and driven through competition (Sterling, 2002). This raises fundamental questions whether education defined by such systems can deliver the objectives now assigned to it in the transition to EfS, namely, to raise citizens who are ecologically conscious and capable of acting in favour of sustainable development. From this perspective, it should be no surprise that although the quantity of education is increasing, our lack of ecological sustainability is rising in tandem too. As long as learning content and methodologies are designed to keep these extractive socio-economic systems in place we cannot expect education to play a transformative role in our thinking and acting for sustainability (Stone, Barlow and Capra, 2005). EfS requires higher-level goals for that includes learning how to develop our human potential in balance with the natural ecosystems that sustain our life and those of the future generations (Deenapanray, Smitsman and Chung Kim Chung, 2014).

EfS is needed today because we clearly lack the vision, competencies and support systems to achieve sustainable development. Many of the most 'educated nations' have the highest ecological footprints (EFs) in the world with the highest per-capita rates of consumption. As long as we continue to believe that the achievement of well-being and happiness can only be delivered through economic advancement we will end up undermining the very foundation on which this rests, namely, the ecosystems services on which our life depends (Kopnina and Meijers, 2014). EfS aims to empower citizens with the knowledge and competencies for transforming the dominant mental models that undermine our sustainability. This, however, cannot succeed if the educational systems responsible for the implementation of EfS remain outside the boundaries of what needs to change. The behaviour of systems is the result of the structure of systems (Meadows, 2008). In that same way, the behaviour of people is influenced by the structure of the systems they form part of, which includes the purpose, goals, rules of the system and the network of relationships and feedback loops between the elements of the system (Smitsman and Smitsman, 2014). UNESCO declared that 'Education for Sustainable Development allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future' (2014b, p.14). This raises the question regarding the

application of such knowledge, skills, attitude and values if the systems through which we sustain our basic needs are incompatible with these goals. This is further discussed in the section on barriers to implementation of EfS.

In order to monitor the DESD process, UNESCO (2012) identified specific competencies that need to be developed by educators working with ESD or EfS. These competencies require a very different kind of teacher training than is commonly provided by mainstream educational institutions in Mauritius. The developments of the kind of competencies that are listed by UNESCO require extensive training in systems thinking and coaching. This either requires the support of external trainers with these competencies or demands implementation of such trainings at the tertiary levels where teachers receive their teacher trainings. One cannot assume that teachers are developing these competencies through their standard education and by merely knowing about it. Systems thinking, for example, is a specific scientific methodology with its own tools and processes that cannot be achieved by merely thinking in terms of interconnections (Meadows, 2008; Sterman, 2000).

In *Learning for the future: Competences in Education for Sustainable Development*, the United Nations Economic Commission for Europe (UNECE, 2011, p. 12) Steering Committee on Education for Sustainable Development, mentions that 'audit and assessment as well as monitoring systems for educational institutions should be adapted or developed in order to assess the institution's contribution to sustainable development. Educational institutions should operate according to sustainable development principles as a contribution to ESD and create an enabling environment for the development and practice of the Competences'. Kopnina and Meijers (2014, p. 197), however, argue that if neither the objectives nor the methodology involved for achieving these objectives are critically examined, the evaluation of ESD programmes may lead to questionable outcomes. If the underlying goals for ESD do not address the dominant consumption patterns of society, it will fail to transform the mental models underlying our unsustainability. Sustainable development requires more than the application of renewable technologies and services. It also needs to fundamentally address our relationship with the shared natural resources and ecosystem services and the value we attribute to this (Jackson, 2009). EfS, in order to achieve its objectives of creating ecologically conscious agency, needs to first address our entrapments in a culture of consumer-addiction, and second provide the tools for transforming these addictions into new behaviours for sustainability (Haukeland, 2013, p. 91).

This raises an even more fundamental question, namely, is behaviour driven by competencies or, as system thinkers would argue, by the structure of the system as a result of the goals of the system (Senge, 2012; Meadows, 1999)? If the answer to this question is that competencies alone are not sufficient for changing behaviour, it raises fundamental questions regarding EfS strategies that only target the development of those competencies as outlined by UNESCO. If the answer to the question raised is that behaviour of systems is determined by the structure of systems, it follows that addictive patterns generated by the systems in which people partake require EfS strategies at the structural level of the systems in which education takes place (Smitsman and Smitsman, 2014; Haukeland, 2013; Senge, 2012; Sterling, 2002). These system entrapments that breed consumption addictions form a major barrier according to the stakeholders of the three EfS pilot schools that participated in the research for identifying barriers to the development of EfS competencies and behaviour (Orr, 1992).

## Education for Sustainability in Mauritius

Several initiatives for EfS/ESD have been initiated through the government of Mauritius in the public government school system, the Catholic schools networks (Bureau of Catholic Education (BEC) and Loreto schools network) and some private schools. ELIA-Ecological Living in Action (ELIA) started an EfS programme in collaboration with the BEC[2] in eighteen Catholic secondary schools in 2011. Since 2013, this programme has been mainstreamed in three selected pilot schools, namely St Mary's College Rose-Hill, Loreto College Curepipe and BPS Fatima College Goodlands. The case studies of these three pilot schools will be given towards the end of this chapter. The management for the EfS programme was transferred from ELIA to EARTHwise Centre in July 2015.

### About the Education for Sustainability programme

The EfS programme supports schools to become learning communities for sustainability through a 'learning-by-doing' and 'enquiry based' approach. Representatives from each of the stakeholders (students, teachers, management, non-teaching staff and parents) are engaged throughout the programme for their input and feedback to achieve whole-school support for EfS. Teachers, EfS

mentors (teachers) and students receive training in systems thinking, ecological literacy, stewardship, learning and development for EfS, dialogue and visioning, EF analysis and climate change among others. The programme was initially developed by ELIA in collaboration with the BEC following a meeting with the bishop[3] of Mauritius Mgr Maurice E. Piat. The programme is open to all schools in Mauritius, also schools that do not form part of the Catholic schools network. The programme was started in 2011 through extracurricular activities and training for teachers in systems thinking, EF analysis, and learning and development for ecological literacy. In 2013, three pilot schools were selected to develop the model for whole-school curriculum implementation of EfS. The learning-by-doing approach allowed critical evaluations in the adaptation and further development of the EfS implementation strategies. This open learning approach has been a key factor for the success of the programme; the evolutionary approach ensured that EfS strategies and trainings developed in response to what was required for the transformation of the systems in which learning took place. Through structured dialogues and multi-stakeholder evaluation sessions using system dynamics tools, the input of the stakeholders revealed the barriers within their educational system that needed to be addressed for sustained EfS implementation to achieve whole-school transformation. An overview of these barriers and the EfS strategies based on Meadows's (1999) twelve intervention points is given later in this chapter.

The EfS programme has gone through three distinct phases. The first phase consisted of an extracurricular project-based approach centred around the EF project (Bangari et al., 2014). The rationale behind the extracurricular approach was simply that intra-curricular implementation was not possible at that time. Relationships and trust had to be developed first. After two years, the green light was given to mainstream EfS in the curriculum in three pilot schools that had demonstrated their commitment and readiness in the preceding phase.

Phase 2 started with the strategy to implement EfS in three key subject areas of the curriculum, namely, sciences, human values and social studies. These subjects were chosen after a systems mapping of synergies, and overlaps between the various subjects of the National Curriculum Framework (Smitsman and Deenapanray, 2014; ROM (Republic of Mauritius), 2009). Teachers of these subject areas were trained, starting with form 1 (i.e. the entry level in a seven-year secondary school cycle) and building up to form 2 and higher forms. The advantage of this strategy was a structured approach to ensure that the three dimensions of sustainability, namely, environment, society and economy, were

brought together in the curriculum. The disadvantage of this approach was based on a too high rotation of teachers from lower to higher forms and the delays accruing in engaging the whole school community. After a year of trialling, this strategy was changed simultaneously to a whole-curriculum approach (i.e. all subjects) and to all forms. On 19 February 2014, the three EfS pilot schools together with the BEC leadership, the bishop of Mauritius Mgr Maurice E. Piat and ELIA-Ecological Living in Action signed the EFS Charter and Pledge, which outlines the vision, mission and principles for EfS. The proposed actions of the EfS pledge came from the schools themselves via a multi-stakeholder dialogue process involving students, teachers, management and non-teaching staff (Chung Kim Chung and Smitsman, 2014).

Phase 3 started in January 2015 with the introduction of new strategies for whole-school curriculum implementation based on extensive multi-stakeholder evaluations that were held in phase 2. These new strategies were created to address simultaneously the various levels of the school system with the aim to create more engagement from students and teachers and provide structural support for the implementation of the EfS objectives. It was decided to create common themes that would change each term. In this way, collaboration between subjects and departments became compulsory and sustainability as an overarching vision ensured that EfS was taken out of the narrow environmental corner to which it is commonly assigned. In the case-study discussion section below, concrete examples are provided for how this was done. The introduction of EfS overarching themes also required allocation from management for structured time within school hours for teachers and heads of department to meet and to discuss how to work together on the common EfS themes. Whereas previously many subjects were taught in silo, lively exchanges now started to build synergies and bridges between subjects to the benefit of students and teachers. It was also decided that the EfS Charter and Pledge that was designed at the start of phase 2 required a higher-level policy implementation in the school system for it to become more effective. Accordingly, the school's code of conduct that is communicated to the parents was updated to include sustainability behaviours that were now expected from all members of the school community. An overview of these strategies can be found in Table 17.1.

The EfS programme also includes the measurement of the EF of the school as part of the school curriculum activities by the students with help from the EfS mentors. Mentors are teachers who have received in-depth training in EfS, including systems thinking and the use of system dynamics tools. The EF

is the calculation of the extent to which human beings' demand of the natural environment's resources stays within or overdoes the capacity of the biosphere to supply goods and services. It reflects our demand on ecosystems for food production, raw materials, energy, housing and waste processing among others and is represented in terms of the area of land required to meet that demand (Wackernagel and Rees, 1996). The EF provides a useful pedagogical tool for making the need for sustainable development concrete and tangible. It brings to light the social (in)justice issues of society's conventional economic models when it becomes clear to which extent natural resources are not fairly appropriated by human beings. The EF data also provide useful feedback to the school community regarding its consumption trends. This is used to evaluate whether certain EfS strategies for reducing waste and consumption are successful and lead to new behaviours for sustainability. The EF calculator has been designed by ELIA and is calibrated for Mauritius (Deenapanray and Leste, 2014). The EF calculator is also adjusted in complexity to align with the abilities of the different ages of the students (Bangari et al., 2014).

A key component of the EfS programme is teacher training in systems thinking and system dynamics. A significant part of the problem of sustainability is people's inability to understand the complex interconnections between the causes and effects of actions and interactions. Systems thinking is the practice of enhancing this understanding of how and why social (society and economy) and ecological systems behave in the ways they do by seeing their component parts (or sub-systems) in the context of relationships with each other and with other systems, rather than in isolation (Sterman, 2000). Systems thinking focuses on cyclical rather than linear cause and effect, and is applicable at any scale of human activities and contexts (Senge, 2012; Meadows, 2008). System dynamics is a method to enhance learning in complex systems as well as learning about complex systems. It was created during the mid-1950s by Professor Jay Forrester of the Massachusetts Institute of Technology (MIT). System Dynamics is grounded in the theory of nonlinear dynamics and feedback control developed in mathematics, physics and engineering. It uses a range of different tools for understanding complex systems. The modelling process is used as a feedback process in the context of ongoing activities of the people in the system, like in this case the learning for sustainability process (Sterman, 2000). Through the EfS programme teachers receive training in systems thinking and the basic tools of system dynamics, such as the drawing of causal loop diagrams (CLDs) and behaviour-over-time graphs to describe trends and patterns. CLDs help teachers and students become aware of the complexity involved in addressing sustainability issues and they reveal the complexity of the worlds that we live

**Table 17.1** EfS focus areas and strategies

| Focus areas within the school system | EfS strategies |
| --- | --- |
| School policy | • EfS Charter and Pledge was developed with and signed by the key stakeholders.EfS Charter and Pledge has been implemented into existing school policies. The school's behavioural code of conduct now includes guidelines for EfS behaviours at school.<br>• The implementation of the national curriculum framework into curriculum activities has been aligned to EfS objectives.<br>• Common EfS themes that change each term are implemented across all curriculum subjects, in all forms, to ensure whole-school EfS implementation. |
| Capacity development | • Training of EfS mentors (teachers) since 2011 in systems thinking, pedagogy for transformational learning, EfS principles, ecosystems, sustainable development, climate change, social justice, ecological economics, visioning and dialogues, values for sustainability, indigenous knowledge systems and stewardship.<br>• Basic EfS training for all teachers in the school, which includes introduction to systems thinking.<br>• Training of EfS student Change Agents (through the school eco-clubs) in systems thinking, EF, social justice, visioning, climate change, sustainability challenges and sustainability values. |
| Student initiatives | • Financial support system for students to initiate EfS projects through the school eco-clubs.<br>• EfS retreats.<br>• EfS school gardens. |
| Multi-stakeholder engagement | • Multi-stakeholder evaluation sessions through which existing EfS strategies are evaluated and new ones are developed.<br>• The EfS funding agencies are invited to key EfS events and do attend some of the EfS training sessions for mentors to learn more about the programme.<br>• Resource persons from the wider community are brought to the schools to extend learning beyond the classroom and the standard learning contents. |
| Communication and outreach | • EfS news, activities and learning outcomes are shared through an online EfS platform with integrated social-media tools.<br>• EfS articles and updates from the schools are shared through school newsletters. |
| Evaluation and acknowledgements | • EfS evaluation is currently implemented in the standard evaluation of the lower forms of the secondary schools.<br>• EfS award and acknowledgement schemes have been developed by the schools to support the students. |

*Source:* Authors' elaboration.

in. It also helps them to become aware of their mental models and where they draw the boundary regarding what they perceive as reality based on their mental model, in comparison to the reality revealed by the system dynamics. Through the CLDs they start to see the unwanted and unintended consequences in decision-making processes by highlighting the factors that are not considered when the boundaries of mental models are set too narrow. CLDs and behaviour-over-time graphs are also used in the programme for brainstorming sessions and for evaluation purposes.

Table 17.2 shows how the EfS programme is aligned with the key focus areas of the UNESCO Global Action Programme on ESD.

## Common barriers in behavioural change for sustainability through EfS

The EfS programme is now in its fifth year. Due to its bottom-up approach of developing a programme for the systems that required these interventions without prior templates, a rich understanding has emerged concerning common barriers for implementing EfS strategies in mainstream educational systems. The aim of the EfS programme is the transformation of the educational systems by aligning the system to a higher-level vision and purpose and building capacity within the school system for the development of sustainability competencies by using the whole curriculum.

Sterling (2002) points out three orders of change. The first order of change is about making adjustments to the existing system. This is simply doing the same as the old but in a slightly more efficient way. The function of this system post-reform is still focused on the vocational aspects which look to produce skilled workers for the information economy and the socialization function which looks at measures to tackle social exclusion. This type of first order of change, whereby conventional boundaries are kept intact and the purpose for education is defined by the socio-economic systems, leaves society's values unexamined. This is what commonly prevails in our societies. Many well-intended EfS projects work at this level and are therefore not considered a threat to the status quo. Transformational change would come from the second order, which seeks to change the educational paradigm. It redesigns the whole system based on more participative values and methods that address the root causes for our unsustainability. This kind of change creates a shift from transmissive to transformative learning as one is made to think about thinking and learn *about* learning. It thus guides both

**Table 17.2** UNESCO GAP priority actions (UNESCO, 2014b) and EfS strategies

| GAP priority actions | EfS strategies in line with GAP priority actions |
|---|---|
| 1. *Advancing policy:*Mainstream ESD into both education and sustainable development policies, to create an enabling environment for ESD and to bring about systemic change | The EfS programme has created a replicable model for EfS implementation into the whole curriculum system with the intention that this can bring to scale across schools in Mauritius and lead to new educational policies for ESD in collaboration with the Ministry of Education. |
| 2. *Transforming learning and training environments:* Integrate sustainability principles into education and training settings | Strategies were created that require collaboration and exchange between subjects and departments through common themes as key conditions for enabling learning environments for EfS. School garden projects and field-trips require learning outside the classroom. |
| 3. *Building capacities of educators and trainers:*Increase the capacities of educators and trainers to more effectively deliver ESD | Training has been conducted for teachers and mentors since 2011 to develop sustainability competencies at whole school level. |
| 4. *Empowering and mobilizing youth:*Multiply ESD actions among youth | Each school has a system of EfS or eco-clubs where students are given responsibilities for driving EfS initiatives at their school. |
| 5. *Accelerating sustainable solutions at local level:*At community level**,** scale up ESD programmes and multi-stakeholder ESD networks | The EfS programme uses a multi-stakeholder model that brings together the programme funders, local communities, NGOs and resources persons to expand learning for sustainability beyond the traditional classroom settings. |

*Source:* Authors' elaboration.

the individual and society as a whole towards a higher level of thinking and builds the competencies for sustainable development. The third order, systemic change, is the ultimate goal of EfS. This kind of change and transformation is characterized by systems that constantly reinvent themselves and are flexible to expanding boundaries.

Through input via multi-stakeholder sessions consisting of EfS mentors and rectors from the three pilot schools, and the EfS programme and BEC managers a systematic mapping out of common barriers has started. The purpose of this exercise is to gain more understanding about the system dynamics and their
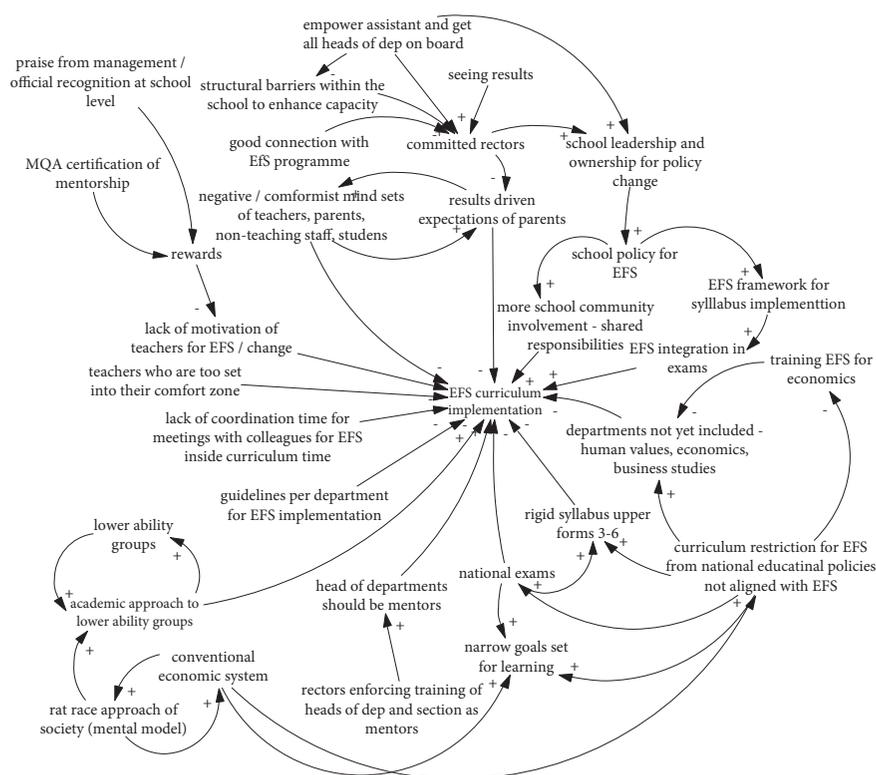
**Figure 17.1** Overview of barriers for EfS curriculum implementation as indicated by stakeholders. *Source:* Authors' elaboration.

impacts on the EfS strategies and the learning process for sustainability. Without this identification of common barriers and possible learning traps it is difficult to achieve the second or third orders of change, as identified by Sterling (2002). The CLD of Figure 17.1 represents how participants viewed barriers regarding the implementation of EfS into their educational system. These data will at a later stage of the research be used for the development of a more comprehensive CLD that will also specify the types of positive and negative feedback loops. The evaluation session took place in December 2014 in Mauritius.

The barriers that were identified as shown in Figure 17.1 were further analysed by using the twelve leverage points of Donella Meadows. Leverage points are places within a complex system where a small shift in one thing can produce big changes in everything (Meadows, 1999, p. 1). This is summarized in Table 17.3 in descending order of importance, number 1 being the strongest leverage point. By contrasting the identified barriers against the twelve leverage points a better

understanding can be obtained for how to develop a strategic whole system approach for EfS implementation. Experience in the EfS pilot schools has shown that each strategy only works if this is embedded within a larger integrated approach for systemic transformation. Strategies that are designed in isolation of the systems that require change commonly fail to produce transformative results. The same can be said for a single-strategy approach that is dominant in many sustainability projects characterized by the model 'education about sustainability'.

## Summary of results of the case studies of the EfS pilot schools in Mauritius

Three Catholic secondary schools have participated in the EfS programme since 2011: Loreto College Curepipe, St Mary's College Rose-Hill and BPS Fatima College Goodlands. Since 2013 they have become the pilot schools for EfS implementation in the whole curriculum and transformation of their school system through the EfS strategies. These schools are open to all the children irrespective of origin, creed or religion. The education that is offered is the same as the public education system. It is generally highly academic and competitive; at national level, out of ten children entering pre-school at three years old, five would pass the British Cambridge School Certificate for zero levels and three would leave the education system with the Cambridge Higher School Certificate. The Catholic focus of the schools is aimed at the integral development of the child, and school leadership can take initiatives for the innovation of their systems (Chung Kim Chung and Smitsman, 2014, p. 9).

One of the most noticeable changes that have occurred since the implementation of the phase 3 EfS strategies is the increase in levels of engagement across the school community of students and teachers. Before, the EfS implementation was mostly driven by a small group of mentors, whereas now all teachers started to work together for common goals through the introduced EfS common themes. The themes for 2015 are: term 1 'Water', term 2 'Soil & Food' and term 3 'Energy'. CLDs were used in brainstorming sessions to bring forth the student's own interpretation of the importance of the theme they are working with and how this links to all the different dimensions of human activity and our impacts on the planet. As observed by one of the EfS research interns the advantage of working with these system dynamics tools linked to holistic themes is the increase in level of reflective and creative thinking:

**Table 17.3** Leverage points and strategies to address common system barriers for EfS implementation

| Meadows's leverage points | Barriers identified | Interventions and strategies applied | Impact |
|---|---|---|---|
| 1. The power to transcend paradigms | Culture and mindset of victim-hood, blame, colonization heritage, consumer addictions and traps | Creation of an empowering and safe learning environment via mentoring and coaching of teachers based on mutual respect, equanimity and transformative communication practices | Effective, but it takes time and continuous support. Long-term approach through small groups, difficult at large scale |
| 2. The mindset or paradigm out of which the system – its goals, structure, rules, delays, parameters – arises | Modern socio-economic paradigm (consumption driven), colonial mindset (slave-master relationships), postcolonial mindset (inferiority complex, imitation, corruption, using materialism for sociopolitical gains) | Use of systems thinking and tools to make visible the mental models underlying the consumer addictions and traps and how these mental models are inherited and sustained by the dominant cultures. Applied within the context of an empowering learning environment | Effective medium to long term. This only works if a safe and empowering environment is put in place at the same time |
| 3. The goals of the system | Defined by dominant socio-economic system (market-driven interests) | EfS Charter and Pledge has been created for the schools to take the standard goal of education to a higher level aligned with sustainability objectives, in such a way that this enabled creation of new school policies for EfS. | Effective if part of an integrated approach that ensures implementation at school policy level and teacher training |
| 4. The power to add, change, evolve or self-organize system structure | Top-down hierarchical power structures, control from the top, negative repercussions for challenging power | New school policies were created that gave more power to teachers, mentors and students to initiate and collaborate linked back to the EfS Charter and Pledge | Effective if top management and leadership is on board |
| 5. The rules of the system | Have been created to support the dominant socio-economic system. Purpose of education as preparation for the labour market | EfS Charter and Pledge led to new code of conduct for sustainability behaviours at whole school level, implemented mentor and champion system for sharing of responsibilities | Effective if applied at the same time with transformation of organizational culture |

| | | | |
|---|---|---|---|
| 6. The structure of information flows | (1) Feedback loops are missing about consumption patterns and (2) feedback loops are missing about positive impacts of sustainability behaviours | (1) EF calculation of the school conducted by the students to show data, patterns and trends about consumption patterns and (2) acknowledgement and reward mechanisms were created, including communication of positive EfS results to wider community via social-media and EfS newsletters | (1) Effective for expanding and transforming the mental models; (2) helps to create and sustain engagement for EfS actions/changes and for attracting funding resources |
| 7. The gain around driving positive feedback loops | Elite of the best performers gets rewarded by the system, as such promoting competition – success to the successful loops | Incorporation of assessment for EfS knowledge and competencies in standard tests. Implementation of continuous evaluation project-based linked to EfS | Effective, but takes time and structural changes. Often not possible at final exams if set by Cambridge |
| 8. The strength of negative feedback loops, relative to the impacts they are trying to correct against | Students have little power or input to influence learning contents and tasks, lack of structural affordances in the system that enable cooperative and integrated learning within and between subjects and fields | Creation of EfS student clubs that coordinate with EfS mentors for student input into EfS projects and learning tasks. Management support to allow time within curriculum hours for coordination between heads of department for EfS implementation and time for EfS mentors to meet and coordinate | Very effective, creates more engagement, changes the culture of the system and balances out the success to the successful loops that drive competition |
| 9. The length of delays, relative to the rate of system change | Lack of communication between departments, lack of national policy adaptation to ESD requirements, lack of acknowledgement/rewards for new EfS behaviours | Creation of common EfS themes per term that require implementation across all subjects ensures communication and coordination which reduces the delays. Acknowledgement of student EfS activities end of term reduces the delays and creates positive reinforcement | Very effective – it changes the system at the structural level and in the feedback loop system. After these strategies, much more engagement, collaboration and whole system integration |

**Table 17.3** Continued

| Meadows's leverage points | Barriers identified | Interventions and strategies applied | Impact |
|---|---|---|---|
| 10. The structure of material stocks and flows | School buildings unfit for EfS objectives, lack of infrastructure for nature-based learning, high dependency of fossil-fuel based resources | Through CSR funding green building adjustments and school garden projects have been financed. Through the EfS Charter zero-waste strategies to reduce fossil-fuel dependency have been incorporated in the schools | Effective to create congruency between vision and objectives. The risk, however, is that too much emphasis is put on environmental factors, which can shift focus away from larger embedding into the whole curriculum and educational system |
| 11. The sizes of buffers and other stabilizing stocks, relative to their flows | Lack of EfS funding sources, constraints in educational budgets, lack of EfS resources for teacher trainings | EfS funding schemes have been created to create more resources for EfS implementation and enlarge educational budgets of the schools beyond existing means | Effective as long as someone is driving this at the level of the EfS programme. It requires a large amount of time to maintain financial sustainability of the programme |
| 12. Constants, parameters, numbers | Size of classrooms, teacher – student ratio, standard Cambridge exam requirements | At the structural level of the system, size of classroom and Cambridge exam requirements, etc. could not be changed. However, implementation of EfS projects and pedagogy required exchange and collaboration between classes and allowed for creating different teams and mixtures of abilities and backgrounds. This had an impact on changing the parameter settings for teaching | Effective for building bridges between subjects and promoting higher-level thinking when this is combined with systems thinking tools and methodologies. This only creates impact when it is part of larger strategies for systems transformation that result in new combinations |

*Source*: Authors' elaboration.

> Since they were told to think, reason and share what they think affect or pertains to the theme of water, they will better understand the map of interconnectedness that they were taught in class as they themselves came up with it. It was not just another diagram to memorize from a textbook written by a stranger. This was the product of their own thinking process, and it was an exercise that expanded their mental models without being explicitly told to do so. That's the beauty in this approach – it is so subtle in its maneuver that the child is independently developing a more open mental model without making it seem like a task that is being externally imposed upon them. (Kritika Treebhoohun, EfS research intern)

In order to create structural changes, which refer to Meadows leverage points 4, 6 and 8 (Table 17.3), a new policy was created in the schools that enabled the student councils of each year group (form) to meet to coordinate how they want to work with the assigned theme. The same was done for the heads of department in each of the pilot schools. The rectors of the schools allocated time and space within school hours for meetings with the mentors to better coordinate the EfS implementation through the common themes in each of the subjects and fields. The result is that a learning community for EfS could now emerge through a shared vision and application beyond what had been agreed to formally through the EfS Charter and Pledge.

The creative and visual communication of the students working with the common themes showcased that students could comprehend that an issue like 'Water' has many different dimensions, ranging from the most basic 'health and food security' to the more spiritual as the womb of Life. These creative and visual expressions are communicated in the form of posters, collective eco-boards for updating the entire school community, paintings, collages, short films, poetry, sculptures and décor objects. During term 1 and the theme 'Water' many villages in Mauritius suffered from flooding due to severe rainfall. These real-life issues were incorporated in working with the theme 'Water' to create a more meaningful connection between what is happening in the environment and how it is directly impacting their community. Parents were engaged and kept informed via the Parent Committee and have responded positively in the new direction the school is committing itself to. The school's code of conduct was updated by aligning this with the EfS Charter and Pledge. Accordingly, new sustainability behaviours were added and emphasized to sustain the implementation of behaviours for sustainability. Furthermore, students have been given responsibilities for monitoring and providing feedback to management as eco prefects.

In one of the schools the mathematics teacher made a real effort to make learning more interactive in his classroom by using systems thinking as a guideline coupled with ecological literacy. Students were asked to explore and collect data about water consumption and compare the price of bottled water in their region (local shops and supermarkets). The students then had to analyse their water consumption household bills to calculate their domestic water consumption and how much it costs them at home. They were asked to explore how they could reduce the consumption of water and reduce their personal cost as well as the cost for the environment. In one of the human values classes students worked around the slogan 'Religion Divides, Water Unites', to learn about the concept of global citizenship and how this demands fair allocation and sharing of our planetary resources. By working around this slogan students learnt about stewardship and development of care as key sustainability competencies. This assisted the students in experiencing the heart of sustainability and how development of care for nature in itself reconnects us with nature inside and around us. Care for nature thus grounds us in our own humanity and brings us back to values, aspirations and practices that unite and form the basis for developing sustainable communities (Boven and Morohashi, 2002; Morin, 1999; Bateson, 1972).

## Conclusions

EfS can provide schools with the opportunity to innovate and transform their systems. In order to live up to this opportunity a systemic long-term approach is required together with the facilitation of a higher-level vision about the purpose for education. If the aim is that education should prepare citizens to become conscious co-creators of their societies and future, it follows that a whole different set of competencies need to be developed than is currently the case in mainstream education. One of the most common remarks people make when discussing transformation for sustainability is that the mindsets need to change. Everybody seems to mention this as the magic key, without ever providing any understanding of *how* the mind becomes set, to *what* and *why* it remains set in those parameters. One of the things that shamans and systems thinkers have in common is that they both know how to work with the invisible systems that set the parameters for what manifests in our world though patterns, behaviours and feedback loops. Competencies for sustainability require understanding and comprehension of the short-term and longer-term impacts of human behaviour across dimensions, fields, spaces and places. By the time these impacts are visible, in terms of ecosystem

collapse and species extinction, it is often too late and the damage irreversible. If students can learn to pre-empt these impacts and prevent such damage by changing their behaviour and adopting new behaviours aligned with sustainable development, the world will truly start transforming. We are very far removed from that reality and there are many traps and addictions that will need to be brought into the daylight and addressed through a transformative learning approach.

The main lessons learnt from the pilot schools through the EfS programme is that learning is relational and the first step is the development of trust by building a learning community. By embarking on this new journey through EfS we will be met by dragons, monsters and all kinds of signs that may discourage. People around us may say it is too much, too difficult, it won't change anything. This is common for any quest in life, and as always, the treasure is found by meeting the challenges and transforming the barriers. During the past years, the pilot schools met many challenges and they too felt like giving up. But they did not, they were supported to move through this by understanding that those who are innovators and creators of new systems will have to create the pathways that do not yet exist. By embracing this uncertainty at the same time as being open to explore and apply different kinds of strategies, confidence is built in the process of learning itself. This then becomes the greatest resource of the school for progressing further. The pilot schools have undergone many transformations since they started and they are continuing their learning for sustainability as a community approach. They have now reached a stage of maturity that even without the EfS programme and external facilitators they will be able to sustain their commitments on their own and together in a community of learners. By sharing their lessons learnt they pass on the fruits of learning, as this is the way nature shares and sustains itself.

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2   In July 2016, the Bureau de l'Education Catholique (BEC) has changed its name and is now known as the Service Diocésain de l'Education Catholique where co-author Dr Gilberte Chung Kim Chung is the Executive Director.

3   In November 2016, Bishop Mgr Maurice E. Piat was nominated Cardinal by Pope Francis.

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