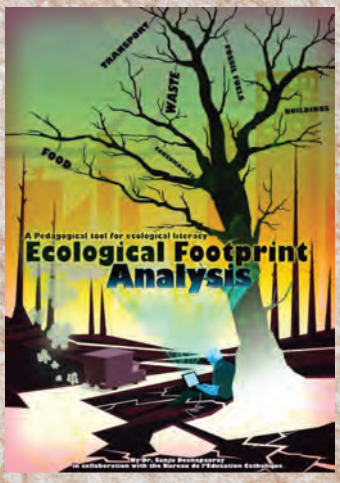
Studies in Applied Pedagogy

Education for Sustainability

The case of Catholic Secondary Schools in Mauritius

Special Edition 2014



ICJM
Institut Cardinal Jean Margéot

Edited by J.Harmon
DEPARTMENT OF APPLIED PEDAGOGY

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Education for Sustainability

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DEPARTMENT OF APPLIED PEDAGOGY

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Postal Address

1, Célicourt Antelme Street, Rose Hill, Republic of Mauritius

Email Address

ap@icjm-mu.com

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Front cover image ‘Ecological Footprint Analysis’ created by Clarisse Guillaume, former student of St Mary’s College, Rose Hill

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    - **Loreto College Curepipe**
    - **St Marys College Rose-Hill**
    - **BPS Fatima College Goodlands**

Gilberte Chung Kim Chung

Director
Bureau de l'Education Catholique

Studies in Applied Pedagogy (SAP)

Number 3, 2014

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EDITOR'S NOTE

The concept of environmental education (EE) has emerged with dominant reductionist programmes and education oriented primarily to the conservation of resources. The Conference in Rio de Janeiro marked a turning point and emphasized the significance of sustainable development in Agenda 21 (UNESCO, 1992). This document calls for a reorientation of EE and introduces the principles of sustainability and the need to apply them to economic, social, cultural and environmental dimensions of human development.

This Special Edition 2014 of *Studies in Applied Pedagogy* on 'Education for Sustainability (EFS): The Case of Catholic Secondary Schools in Mauritius' provides an enriching and thought provoking insight into education through the lens of sustainability with contextualised thinking. Our thanks go to the different contributors namely academics, researchers and practitioners, policy makers, head of schools, teachers and pupils. While we are now in our third year of publication, these contributions give new impetus to *Studies in Applied Pedagogy* whose mission is to provide a forum for critical reflection and action on societal issues related to education. This edition is prefaced by Richard Farell (Emeritus Professor of Neighbourhood Regeneration, Coventry University, and Canon Theologian, Coventry Cathedral, United Kingdom) who provides a theological perspective on education for sustainability. In fact, EFS goes beyond the seemingly neutral discourse of 'waste management', 'rain harvesting' or what could be called the 'green rhetoric'. For Farell, EFS should rather create critical awareness amongst our youth that 'dominant global narratives promoting the freedom of the market and the rights of corporate institutions [...] have to be questioned if heightened inequality, social conflict and environmental destruction are to be reversed and sustainable human flourishing is to be achieved'. This edition is a collection of six papers which present education for sustainability in action.

In 'The Education for Sustainability Charter and BEC commitment', Chung Kim Chung & Smitsman showcase how Catholic secondary schools have made the commitment to Ecological Literacy Development since 2011.

To ensure that Education for Sustainability (EFS) receives the support of the school management and school community, an EFS charter and pledge was created in 2013. The paper provides an overview of the characteristics of the BEC educational system to better understand the context and system impacts of EFS implementation, the BEC management support for EFS, the principles and co-learning process on which the EFS Charter and Pledge rests, and its proposed actions.

In the second paper, Deenapanray, Smitsman, & Chung Kim Chung discuss 'The Philosophical Foundations of the Education for Sustainability Programme'. The authors address critical issues related to the purpose of education in an unsustainable world, raising at the same time the paradoxes of modern education, and show how they are part of the problem. The principles underlying EFS programme, developed by ELIA-Ecological Living In Action (ELIA) in collaboration with the Bureau of Catholic Education (BEC) are discussed. The EFS programme is summarized using a Theory of Change perspective, and provides a normative approach for enabling learning for sustainability.

The third paper is about 'Learning and Development in Ecological Literacy'. This paper offers five keys principles for learning and development based on current scientific understanding of complex adaptive systems. Smitsman & Smitsman foreground that the kind of learning that is promoted through conventional education often lacks the deeper transformative learning that is part of sustainability education. The authors examine the reasons for this and propose integrated solutions for how to change this with reference to Catholic secondary schools in Mauritius.

Fourth, 'The Education for Sustainability Programme' (Smitsman & Deenapanray) provides an overview of the EFS programme and lessons learned since 2011, with an outline of how the EFS programme will unfold over the coming years in the Catholic schools in Mauritius. In 2011, the Catholic secondary schools that are part of the Catholic education network embarked on an extra-curricular programme for Ecological Literacy Development (ELP) developed by ELIA in collaboration with BEC.

In 2013, this evolved into EFS that is being integrated into the curriculum work plan and school activities for three selected pilot schools in Mauritius – Loreto College Curepipe, St Mary's College Rose-Hill and BPS Fatima Goodlands.

Fifth, 'Ecological Footprint as a Tool for Ecological Literacy' is a dual perspective on ecological literacy by teachers and scientific project coordinators involved in the EFS programme. Bangari, Deruisseau, Moossajee (who are teachers at Saint Mary's College), Deenapanray & Smitsman (scientific coordinators in the project) discuss the application of Ecological Footprint Analysis (EFA) at St Mary's College Rose-Hill. While Ecological Footprint (EF) is a powerful pedagogical tool for engaging the school community in place-based education, the authors make the case for EF as a normative tool to highlight and address the ethical dimensions of the consumption of scarce resources.

Finally, 'Messages from the Field – Voices from the EFS pilot schools in Mauritius' take us on a journey into three Catholic secondary schools which act as pilot schools for the implementation of the EFS programme. Students, teachers and management share their stories and experiences of working with the EFS programme over the last three years, and their aspirations for the future. These stories also demonstrate the learning process and transitions that each of the participating organizations has moved through. In fact, I would say that narrative events tend to be one of the best loci for making tacit assumptions and norms more explicit. So, a close reading of these 'voices' demonstrates how EFS brings about individual agency and can sustain social transformation through education.

Jimmy Harmon

Head of Department of Applied Pedagogy

PhD Candidate Language & Education, University of the Western Cape

June 2014

PREFACE

Thank you for the opportunity to contribute this preface to such an interesting and important set of papers about 'education for sustainability'. I would commend the thinking and the practice that is contained in this journal. It will affirm and stimulate inspiring teaching and contribute, if indirectly, to lives lived in the service of God, mankind and this wonderful world.

Whilst this preface is being written about 50 degrees north of the equator and will be read largely by people more than 20 degrees south, we face common challenges about life on earth and its future. To greater or lesser extent we are all complicit in the causes of environmental degradation, ecosystem destruction and climate change. Such understandings of environmental interaction and commitments to sustainability undergird the papers assembled here, for the issues that give rise to our yearning for sustainability are inescapable.

We have been slow to realise what we are doing to this earth. It has taken many years for the discussion to permeate our consciousness. Whilst those scientifically and professionally involved have been researching and publishing for decades it seems that only after the arrival of the new century did the rest of us sit up and take note. Theologians have also been grappling with these matters for years but have failed to communicate the significance of their conclusions about both our responsibilities and God's Kingdom. In a recent investigation of the life of the Cathedral in Coventry, UK, I discovered that the Cathedral sponsored a conference on 'Ecology and Christian Responsibility' as long ago as 1975. One on 'Environmental Reconciliation and the Christian Faith' is planned for September 2015!

Only in the last ten years has the notion of 'sustainability', as a response to these analyses, taken root in the UK. This has been particularly so in the creation of policy for the planning of new development in both cities and the countryside. Homes, offices, distribution depots, shopping malls, leisure complexes, roads, water catchment and infrastructure in general have been assessed in relation to the principles of 'sustainable development'.

This is a development that will provide for the needs of current generations whilst protecting the ability of future generations to meet their own needs. It is development which will respect the presence of wildlife such as bats and newts [in the UK] and which will conserve historic, architectural and natural assets.

That is the theory! Any balanced assessment of the application of such principles reveals confusion over interpretation and conflict between different interests. This is the reality of the social and economic systems in which we live. In the end political decisions are made where interests are traded and where power is exercised, either transparently or not.

'Education for Sustainability' will enable students to appreciate these inherent dilemmas and questions. In particular, there is no escaping the context provided by dominant global narratives promoting the freedom of the market and the rights of corporate institutions. There is a growing sense that these narratives have to be questioned if heightened inequality, social conflict and environmental destruction are to be reversed and sustainable human flourishing is to be achieved.

Pope Francis, in *'Evangelii Gaudium, The Joy of the Gospel'* [2013] makes sharp critical comment about the 'globalisation of indifference' that he sees and seeks to challenge the dominance of economistic, neo-liberal thinking with the Good News of God's Kingdom coming. His argument about the transforming power of the Gospel is broad and has a special place for 'the poor' in evangelisation; it is in this sense that he emphasises social, economic and political sustainability. Ecosystem and environmental sustainability are not the focus of his message but may be threaded into his argument without distortion.

Our approach to sustainability is founded on theological understandings which give value to the incredible world in which we live and which provide the motivation and the challenge to work for a flourishing that is sustainable.

In their book *'Christianity, Climate Change and Sustainable living'*, Nick Spencer and Robert White [2007: London, SPCK] argue that our response should not be one of despair, but of hope. Why?

We have 'hope' because God has created a world that He calls 'very good' [Genesis 1.31]. Despite human failings, God has promised not to give up on His creation [Genesis 8.31]. The Psalmist recognises that 'the earth is the Lord's and everything in it' [Psalm 24.1].

The Apostle Paul recognises that not all is right with God's creation and that it 'waits in eager expectation…. to be liberated from its bondage to decay and brought into the glorious freedom of the children of God' [Romans 8.19-23]. John paints vivid pictures of heaven and earth renewed by God [Revelation 21]. Spencer and White [2007] argue that 'a renewed future creation is not a licence to abandon care for this one. Rather, the opposite is the case: because there is some continuity between this world and the next, because it will be the fulfillment of God the Creator's plans for this universe, there is every incentive to foster and to use the innate underlying goodness and fruitfulness of this material world'.

We have a mandate from God to work and educate for sustainability. Enjoy these papers and be challenged to play your part.

Richard Farnell

Emeritus Professor of Neighbourhood Regeneration, Coventry University, UK

Canon Theologian, Coventry Cathedral, UK

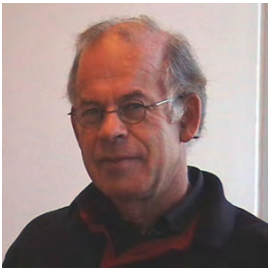
THE CONTRIBUTORS

Gilberte Chung Kim Chung (BA, PGCE, MA, MEdL)

Director of the Bureau de l'Education Catholique (BEC). She has been a teacher, deputy principal and school principal in four Loreto secondary schools as well as a Project Manager/Technical Advisor at the Ministry of Education in the field of Special Education Needs. Since 2007, as the Director of the BEC, she leads a network of 46 primary schools, 18 secondary schools and one technical school.

Prakash (Sanju) N K Deenapanray (BEng (Hons), M.Sc, MBA, PhD)

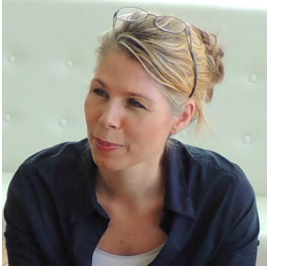
Director of ELIA-Ecological Living In Action and started the Education for Sustainability (EFS) programme in 2011. He supports the programme by providing strategic input and teaching systems thinking, ecological footprint analysis, climate change, and eco-system principles. He is one of the leading sustainability professionals in Mauritius and author of many peer reviewed international journal articles. He is passionate about igniting change for sustainability at all levels of society.



Ad Smitsman (MA, PhD)

Ecological psychologist and researched child development for more than 35 years. Dr. Smitsman retired as associate Professor from the Radboud University of Nijmegen (the Netherlands) in 2009. He is still active as a scientist and acts as resource person for the EFS Programme since 2011; teaching 'Learning and Development' for EFS based on Dynamical Systems Theory. His work has been published in several international journals, handbooks, and presented at international scientific fora around the world.

Anneloes Smitsman (LLM/MA)



Director of ELIA-Ecological Living In Action and is leading the Education for Sustainability (EFS) programme since 2013. She is responsible for the design and facilitation of the programme and provides training in EFS and engagement for sustainability. She has more than 18 years of work experience as a trainer and facilitator. Her skills include ecological literacy, systems thinking, philosophy, law, visioning & dialogue, transformational change, indigenous wisdom, project development, and platform design.

Lucie Leve Hang (B.Ed (Hons), M.Ed)

Deputy Rector of Loreto College Curepipe (LCC) Mauritius. For the last 30 years, she has dedicated herself in providing quality education based on a human-centered approach infused by Christian values. She is acting as a facilitator for the implementation of the Differential Teaching and Learning project in the Loreto Colleges. She is also an EFS Mentor for LCC, providing the critical leadership support for the EFS programme at school level.

Zaahirah Koheallee Hosenbocus (MA)

Head of Department of Chemistry at Loreto College Curepipe (LCC) Mauritius. She has been in charge of the LCC Go Green Club, formerly called the Environment Club, since 2008. She is the EFS Mentor for LCC since 2011. She has done tremendous work to implement the EFS Charter in the LCC educational system and facilitate the change of behaviours of students and teachers to reduce the ecological footprint of LCC.

LCC Go Green Club - Executive Team

The Loreto College Curepipe (LCC) Go Green Club was set up in 2012. It was formerly called the LCC Environment Club. It has members from all forms. The students active co-drivers and co-creators for the EFS activities that are implemented in the school.
The executive members for 2014 are: Urvasi Pauvaday (President), Zainab Khodabux (Vice-President), Kirtisha Hamun (Secretary), Doha Dookhit (Asst. Secretary), Ashwini Dabeedas (P.R.O), Stephanie Yang (Research Coordinator).

Gérard Yu Tim Lun (BE,M.ed.L)

Acting Rector of Saint Mary's College, Rose-Hill since 2012. Gérard Yu Tim Lun has been, over a period of 30 years, closely associated with the college as a young student, an educator, as the Head of French department and Deputy Rector. He firmly believes that education, besides promoting the holistic development of students, should moreover tap on the ability to make youngsters become more eco-conscious. He fully supports the EFS programme and those from within his school who are driving this.

Anamantoo Boni Bangari

Educator at St. Mary's College (SMC) Rose-Hill, Mauritius. He teaches Design & Communication and Technology, Human Values, and Mathematics. He has been an EFS mentor for SMC since 2011. He played a key role in teaching and demonstrating the EFS principles and values at classroom level and with his colleagues. He supports his students to develop their intrinsic values and potential through the teachings of interconnectedness.

Stéphanie Deruisseau

Head of Department of Travel and Tourism at St. Mary's College (SMC) Rose-Hill, Mauritius. She has been an EFS mentor for SMC since 2011. Her valuable contributions to "green" activities organised at school level demonstrate her belief in an education that is oriented towards sustainability. She lives her commitment to EFS by continuously incorporating the EFS principles and practices in her teaching of Travel and Tourism.

Shakeel Moossajee

Educator at St. Mary's College (SMC) Rose-Hill, Mauritius, where he teaches Physics since 2008. He has been an EFS mentor for SMC since 2011. He is responsible for the Environment Protection Club activity classes for form 3 since 2013. He is working hard at bringing a change in the mindset of his students through science projects on sustainability issues.

Sylvestre Larosée (BA, PGCE)

Rector at BPS Fatima College Goodlands, since July 2009. He holds a *'Licence en Lettres Modernes*' and a PGCE. He taught at Prof. B. Bissoondoyal College, Loreto College Mahebourg, and Loreto College Bambous Virieux. He fully supports his team of teachers and students in driving the EFS programme at this school.

Jean Bernard Jacques

English and Social Studies Educator at BPS Fatima in Goodlands, Mauritius, since 2004. He has been an EFS mentor for BPS Fatima since 2011. He played an active role in getting the students and teachers involved in the EFS programme and activities. He implements EFS in his social syllabus in Form 1.

Thyageshwari Katha Padiachy

Educator at BPS Fatima in Goodlands, Mauritius, where she teaches Biology since 2004. She has been an EFS mentor for BPS Fatima since 2011. She is responsible for the component on waste; guiding the students how to collect and measure plastic and paper waste as part of the Ecological Footprint activities of BPS Fatima.

Yasaar Jaumeer

Educator at BPS Fatima in Goodlands, Mauritius, where he teaches Science since 2006. He has been an EFS mentor for BPS Fatima since 2011. He is responsible for the component on transport, resources and utilities. The data collected for this has been crucial for the calculation of the Ecological Footprint of BPS Fatima.

The Education for Sustainability Charter and the BEC Commitment

Gilberte Chung Kim Chung† and Anneloes Smitsman‡

† Bureau of Catholic Education, 1 Célicourt Antelme Street, Rose Hill.

‡ ELIA – Ecological Living In Action, La Gaulette, Mauritius

(Corresponding author: *anneloes@ecolivinginaction.com*)

Abstract

The Catholic secondary schools that are part of the Catholic education network in Mauritius have made the commitment to Ecological Literacy Development since 2011. Initially this started through extra-curricular activities. Since 2013 this commitment is getting embedded into the educational system design and curriculum activities. To ensure that Education for Sustainability (EFS) receives the support of the school management and school community, an EFS charter and pledge was created in 2013. This charter and pledge has been signed by the EFS pilot schools and the Bureau of Catholic Education (BEC) management on 19 February 2014.

This paper provides an overview of the characteristics of the BEC educational system to better understand the context and system impacts of EFS implementation, the BEC management support for EFS, the principles and co-learning process on which the EFS Charter and Pledge rests, and its proposed actions.

Keywords: Education for Sustainability Charter and Pledge; BEC educational system dynamics; BEC commitment to EFS.

1. Introduction

The Education for Sustainability (EFS) programme has been developed by ELIA-Ecological Living In Action (ELIA) in collaboration with the Bureau of Catholic Education (BEC).

The programme started in 2011 for the 18 Catholic secondary schools that are part of the Catholic education network which consists of 10 Diocesan schools, 7 Loreto schools and 1 Filles de Marie school.

The commitment of the BEC to develop capacity within the school system for ecological literacy emerged from the Pastoral letter of Mgr. M. E. Piat, Bishop of Port-Louis (Mauritius), titled "Developing a new art of ecological living". It was highlighted then that ecological responsibility for our planet and the wellbeing of future generations is imperative (Diocese of Port-Louis, 2011). In recognition of the urgency to implement this responsibility, the BEC made the commitment to take a leadership role in preparing students and teachers in their ecological literacy development, and for the schools to model sustainability responsibility in its operations.

This paper provides an overview of the EFS Charter and Pledge, the process for its development, and the implementation in the EFS pilot schools.[1] The paper starts with an overview of the educational system of the BEC network to provide a better understanding for the context of implementation of the EFS principles. The BEC educational system serves as a case study for how to support conventional educational systems in their commitment and transformation to sustainability education.

2. The context – the educational system of the Bureau of Catholic Education (BEC) network

The BEC is the administrative institution of the Diocese of Port-Louis, which elaborates main education policies of the Catholic education sector, coordinates the central administration of 46 primary RCA (Roman Catholic Aided) schools, and coordinates main policy directions of 18 Catholic secondary schools and 1 technical school, in collaboration with congregations present in education, the Loreto Institute, the Filles de Marie Congregation and the Salesians of Don Bosco.

The BEC is a main partner of the Ministry of Education & Human Resources, catering for around 35,000 children and youth in the national education system. This represents an intake capacity of 20% in the primary sector and 12% in the secondary sector. Apart from 2 Loreto primary and 1 Diocesan secondary fee-paying schools, all the other schools operate in the free education system and are grant-in-aid. The schools are open to all the children of the Republic of Mauritius, irrespective of origin, creed or religion.

The education offered is the same as the public education system, which is a 2 (pre-primary) + 6 (primary) + 5 (secondary O levels) + 2 (secondary A levels) system. It is generally highly academic and competitive: at national level, out of 10 children entering pre-school at 3 years old, 7 would pass the national Certificate of Primary Education, 5 would pass the British Cambridge School Certificate for O levels and 3 would leave the education system with the Cambridge Higher School Certificate. The public education system does not offer comparable educational services in all schools, thus the creation of a bottleneck in the admission exercise in the schools perceived as 'star' schools. Private tuition has become a parallel school in both the upper primary and the secondary education system. The pressure exerted by parents and by teachers is also felt in the Catholic education sector, although to a lesser degree, because the schools aim at the integral development of the child and can take initiatives to improve the system.

For the last 160 years or so, Catholic schools have offered and are still offering quality education to all its students, whilst pioneering programs and showing innovation in many aspects; the latest one being the Education for Sustainability programme. Thus, the education project of the Catholic schools in Mauritius encourages "the integral formation of the human person: his academic, artistic, physical, cultural, social, spiritual development, linking family, school, society and the world of work as well as the world of politics, economy, inter-cultures and inter-religions…". In a climate and an environment which are welcoming and which encourage the individual project of the student, the school promotes the personal growth and professional orientation of each student. Each school aims at becoming a school community where all members learn to:

- Respect and protect Planet Earth;
- Love and respect oneself and one another**;**
- Become aware of their own spirituality and of universal values;
- Develop their sense of creativity and initiative;
- Search for truth and social justice;
- Build a world of peace and fraternal harmony;
- Become leaders working for the common good.

Source: Projet Educatif de l'Ecole Catholique, BEC, 2007.

Operating in the public education system as a private partner, the Catholic schools have the same constraints as public schools and it is not always possible to do things differently. The system is still conventional following the post-industrial model: at secondary school level subjects are taught in time-table slots of 35 to 40 minutes, learning is still heavily dependent on prescribed textbooks, and not much time is left for experiential learning and group work, except during activity periods. However, many initiatives have been taken by school leaders and teachers to make learning more interactive and inquiry-based.

2.1 The BEC commitment to the EFS Charter and Pledge

The Pastoral letter 2011 titled "Developing a new art of ecological living', emphasised the need for change in the human person's way of *Being* -'Savoir-Etre' and *Living together* - 'Savoir-Vivre'. As stewards of our Planet Earth, our responsibility as human beings is to take care of it and nurture it for future generations. In order to educate its students in stewardship for Planet Earth, the BEC engaged itself to the formation of school leaders and teachers in schools, so that they could impact on the students and their families, neighbourhood and communities.

This 'ripple effect' strategy was thought to be an effective way of creating awareness and engagement for the necessary changes for sustainability education.

This is also why an Ecological Literacy programme was elaborated in 2011 in collaboration with ELIA, which was implemented in 2011-2012 (Smitsman & Deenapanray, this issue). All the 18 secondary schools in the BEC network were invited to measure their ecological footprint in terms of their consumption (food, consumables, transport, and utilities) and waste production. Students and teachers also learned about the ecological footprint trends in Mauritius: one fact which made a great impact was the realisation that the EF data of 2008[2] showed that if everyone were to live like the average Mauritian in 2008 with footprint of 4.26 gha/person, we would need 2.7 planets to maintain all human activities (Ewing et al., 2010). This means that, on average, Mauritians, and by extension all socio-economic activities carried out in Mauritius, can only maintain their high levels of consumption by appropriating resources from elsewhere (Deenapanray & Leste, 2014).

The students and teachers learned that this raises major ethical questions concerning the fair allocation of resources among members of the family of human beings. This realization was a huge eye-opener for teachers and students to understand why change for sustainability is so important. This also motivated the schools to take actions to reduce their own ecological footprint (Bangari et al., this issue).

The challenge of the school communities was thus to: (i) measure its ecological footprint; (ii) analyse its consumption and waste policies and patterns, and; (iii) create strategies and polices for reducing the EF footprint of the school community on a continuous basis. Out of the 18 schools, 6 schools completed the footprint analysis and initiated some very interesting initiatives. However, the fact that the Ecological Literacy programme was then an extra-curricular activity was detrimental to its sustainability. For further information about the Ecological Footprint project for the schools see Bangari et al. (this issue), and Smitsman and Deenapanray (this issue).

Evaluations took place in 2012 for the way forward. A multi-stakeholder dialogue session for feedback and input was facilitated by ELIA and the BEC with the participation of students, teachers, EFS mentors and school Principals. Proposals were made to: (I) change the name of the programme from *Ecological Literacy* to *Education for Sustainability;* (ii) move the programme from extra-curricular to implementation into the curriculum system, and; (iii) to implement this new programme in 3 pilot schools over period 2013-2018, before implementing it in all the Catholic schools. For full details see Smitsman and Deenapanray (this issue).

2.2 Transformation of the education system as a result of working with the Programme

The positive impacts of the Ecological Literacy programme / Education for Sustainability programme since 2011 for the secondary schools in the BEC network has been as follows:

- All 18 Catholic secondary schools have been exposed to ecological literacy and the fundamentals of sustainability education.
- About 70 teachers have been trained in ecological literacy development, systems thinking, learning and development for sustainability education, and ecological footprint analysis (4 to 5 teachers in each of the 18 secondary schools).
- Each of the 18 schools has an EFS mentor and has participated in the EFS training sessions. 10 EFS mentors of the 3 EFS pilot schools have been receiving in-depth training in the EFS principles and methodologies, including training in systems thinking application, pedagogy for ecological literacy development, ecological footprint analysis, and communication and engagement for EFS.
- Some 12,000 students have been engaged in the programme in one way or another.
- Teachers and students innovated and took initiatives during the EFS activities.The students stated the ‘Eco-Agents’ initiatives to raise awareness and create engagement for sustainability actions at student level, paperless surveys have been developed and are now implemented at school levels, students and teachers are

working together in the separation of waste and application of the 4Rs (reduce, reuse, recycle, repurpose), composting, rainwater harvesting, setting-up of medicinal and vegetable gardens, and more.

- Teaching at school level has become less academic and more experiential with project & action-based research.
- Many new collaborations have formed within and between the Catholic schools.
- Engagement and support for the EFS programme continues to grow with new teachers and students joining.

3. The Education for Sustainability Charter and Pledge

Education for Sustainability (EFS) is a commitment to an educational system that is transformative, value-based and future-oriented. On 19 February 2014 the key stakeholders of the Education for Sustainability (EFS) programme signed the EFS charter and pledge. This charter was created after a broad multi-stakeholder dialogue and visioning process involving the three pilot schools, which took place in September and October 2013.

The pledge was signed on 19 February 2014 by the rectors, teachers, and students of the three pilot schools: Loreto College Curepipe, St Mary's College Rose-Hill and BPS Fatima College in the presence of the Director of the BEC, the Director of ELIA, and the Bishop of Mauritius Mgr Maurice E. Piat. Figure 2 shows the shortened version of the EFS charter and pledge.

Figure 1. EFS Pledge signing ceremony 19 February 2014.

The Education for Sustainability (EFS) Charter

Vision

Our vision is for our School to facilitate value-based education where relationships between people, and between people and the natural world, are central to preparing students to participate in and contribute to a flourishing, equitable and sustainable society in meaningful and empowering ways.

Education for Sustainability (EFS) Principles

1. *All education is education for sustainability*.
2. *Systems thinking & holistic approach to education.*
3. *Experiential learning in and from nature.*
4. *Education in dialogue with place*.
5. *Schools as Learning Communities.*

Mission - to apply and implement the Education for Sustainability (EFS) Vision and Principles by:

- Providing values-based quality education that is transformative and future-oriented.
- Adopting a systems thinking and holistic approach to education.
- Providing a healthy and engaging learning environment, indoors and outdoors, for ecological literacy.
- Measuring and where necessary reducing the ecological footprint of our School.
- Supporting our School to become a Learning Community through partnership and collaboration for EFS.

The Education for Sustainability (EFS) Pledge

1. The school culture

We pledge to create a school culture that facilitates, empowers, and inspires EFS based on the following key values - mutual respect, care, dialogue, openness, integrity, appreciation, and gratitude – by learning together.

2. The school activities

***We pledge to implement the EFS Vision and Mission through the following proposed activities*:**

- School Clubs – with linkages, interconnections and synergies between the various club activities.
- Educational outings and eco-activities for awareness raising and practical application of ecological literacy.
- Yearly eco-retreats – such as camping, and hiking in nature, among others.
- School garden for growing and cooking vegetables, medicinal herbs / plants and for use of school compost.

3. The physical school environment

We pledge to create a school environment that is conducive for EFS by:

- Providing green spaces inside and outside the school building for learning about and from our nature.
- Creating / sustaining a healthy school environment.
- Provision of space(s) within the school premises for the Eco-Club.

4. To measure and reduce the ecological footprint (EF) of the school

We pledge to measure and reduce (where applicable) the EF of our School as an ongoing activity:

- Apply the 4Rs – Reduce, Reuse, Recycle, Repurpose - to reduce waste and enhance resource productivity.
- Sorting of waste, reduction of electricity and water consumption, rainwater harvesting, and adaptation of eco-friendly transport initiatives.

5. The school community- Engage, Communicate, Empower

We pledge to empower and support the students to become Eco-Agents and co-drivers of EFS through the following actions and initiatives:

- EFS awareness campaigns using drama, arts, music, games, and eco-challenges.
- School newsletters and social-media for sharing news about EFS initiatives in a way that is student-driven.
- Partnership and collaboration for EFS with those who can support the school in its EFS commitment.

Figure 2. The short version of the Education for Sustainability (EFS) Charter & Pledge.
***Source*:** ELIA-Ecological Living In Action and the BEC, 2014.

3.1 The purpose and process for the creation of the EFS Charter and Pledge

The mission of the EFS programme is for schools to become learning communities and communities of practice for sustainability by embedding the EFS principles in the school system and culture (see Smitsman & Deenapanary, this issue). This is done with the intention that all education becomes education for sustainability (Sterling, 2002). As with all systemic and transformational changes, support conditions need to be created first, and this starts by building relationships with the stakeholders impacted by these changes. It is thanks to the formative years of 2011-2012 that the EFS programme was born towards the end of 2012 (see also the Theory of Change (TOC) model developed for the programme, Deenapanray et al., this issue).

> "*It is important that design should be seen as a continuous learning process rather than a blueprint. There should be a participatory process of modelling which can be carried forward into actual development, management, and evaluation as an on-ing learning process involving all players. This is not a mechanistic exercise, but one that demands imagination and collaboration. Generally, people support change they feel they own, and resist change they feel is externally imposed."* (Sterling, 2002, pp. 81-82).

The EFS school charter and pledge was developed in 2013 in response to what the participating schools needed to deepen and expand their commitment to education for sustainability. It was formed through a collaborative and co-creative process; with input from students, teachers, rectors, and non-teaching staff. The EFS charter has brought together the EFS vision, mission, principles and actions in a coherent framework that can also be used by the schools to evaluate and assess their progress regarding their commitment to EFS.

Furthermore, the EFS charter and pledge acts as a communication tool for explaining to the larger school community what EFS is about and why this matters. For more information about the multi-stakeholder engagement methodologies of the EFS programme see Smitsman and Deenapanray (this issue).

3.2. The EFS Principles

The EFS principles are derived from the philosophy of education and the theories of learning discussed by Deenapanray et al. (this issue), and Smitsman and Smitsman (this issue). They are based on the foundations for ecological literacy as described by David Orr (1992, pp. 90-92) and discussed in Deenapanray et al. (this issue). The foundations for ecological literacy have been translated into five guiding principles for the EFS programme, see Table 1.

It is clear from these principles that EFS is not just about environmental education, it is far more encompassing and transformative than that. The EFS principles for EFS together with the 5 principles for learning and development for ecological literacy (see Smitsman & Smitsman, this issue) form an integrated system through which these guiding principles for sustainability education can become part of the school system and culture.

For further reading about the implementation of the EFS principles we refer to Smitsman and Deenapanray Table 7 (this issue).

Table 1. The Education for Sustainability Principles

EFS Principles	Explanation
1. ***All education is education for sustainability***	The primary reason for education is to guide people to live sustainably on the planet; education for sustainability is based on the thinking that all education needs to prepare people how to contribute to a flourishing, equitable and sustainable society (Sterling, 2002; Deenapanray et al., this issue).
2. ***Systems thinking & holistic approach to education***	Sustainability issues are complex and can only be understood and addressed by using a systemic and holistic approach. Through Systems Thinking we learn to recognize system behavior, hidden connections, interdependence, and networks of relationships. Holistic education values the interconnectedness between academic, physical, emotional, and spiritual development. (Smitsman & Smitsman, this issue; Meadows, 2008; Senge, 2012).
3. ***Experiential learning in and from nature***	Nature provides the teachings of the eco-system principles that sustain all life on our planet. Learning in and from Nature grounds these insights in direct personal experience in a way that opens our minds and hearts to the wonders of Nature, and respect for its intelligence and design (Boven & Morohashi, 2002; Orr, 2004; Stone, Barlow & Capra, 2005; Williams & Dixon, 2013).
4. ***Education in dialogue with place***	By contextualizing learning in dialogue with a place, we learn to develop relationships of care and stewardship for the places in which we live, learn and work. Place-based education grounds us to get in touch with the reality of what is happening around and between us. Through this we start to see and realize our role and response to the sustainability issues that we are part of. This further promotes development and employment of local ecological solutions to these issues (where possible) and in a way that stimulates creative innovative thinking and entrepreneurship (Blewitt, 2006; Moore, 2012).
5. ***Schools as Learning Communities***	The EFS programme supports schools to become learning communities and communities of practice for sustainability. In this way learning for sustainability takes place at every level of the school systems and the EFS principles become embedded within the school system and culture (Senge, 2012).

Source: Authors' elaboration

4. Conclusions

The Education for Sustainability programme following the Ecological Literacy programme in 2011-2012 has mobilised the Catholic secondary schools of the BEC network to embark on the journey of transformative learning for sustainability. Depending on the teachers involved and the school principals, some schools have been transformed, whereas other schools are in progress.

Valuable lessons have been learned and documented over the last three years that has provided much insight regarding the changes and conditions necessary for sustainability education (Smitsman & Deenapanray, this issue).

The co-creation and signing of the EFS charter and pledge in February 2014 has been a major milestone in the accomplishment of the EFS programme.

The coming years will focus on further implementation, monitoring and evaluation of the EFS Charter and its objectives. The BEC is fully committed to Education for Sustainability both in terms of the kind of educational system it promotes, and in terms of its operations and ecological footprint. Many actions have already been taken by the BEC and the EFS pilot schools to demonstrate this commitment and leadership for sustainability education. We are hopeful that the EFS charter and pledge will be taken up by more schools within and beyond the BEC network. Our current sustainability challenges demand that learning for sustainability becomes a priority for all fields of knowledge and across disciplines, through formal and informal education. As was said by one of the teachers and EFS Mentors from St Mary's College Rose Hill:

> *I have joined the 'Education for Sustainability' programme in which I see the missing link to our education system: 'Interconnectedness'. In EFS, the student is the very core of a value-based education meant to develop his/her intrinsic values to give birth to a unique individual who will interconnect harmoniously within the puzzle of existence. 'EFS' is not the responsibility of a government, of a school, of parents or teachers… 'EFS' is an individual choice, a conscious decision that pertains to each and every one of us.*
>
> *I have made my choice. Feel free to make yours, bearing in mind that we are ALL interconnected.*
>
> *Source*: Anamantoo Boni Bangari, 2014.

Notes

1. All the 3 pilot schools are Catholic secondary schools which form part of the BEC network: Loreto College Curepipe (LCC) managed by the Loreto Institute, and two Diocesan colleges: St Mary's College (SMC) in Rose-Hill, and BPS Fatima in Goodlands, Mauritius. LCC is a secondary school for girls, SMC is a secondary school for boys and BPS Fatima is a mixed school for boys and girls.
2. Source: http://www.footprintnetwork.org/images/trends/2012/pdf/2012_mauritius.pdf- accessed 28 May 2014.

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The Philosophical Foundations of the Education for Sustainability Programme

Prakash N K Deenapanray†, Anneloes Smitsman†, and Gilberte Chung Kim Chung‡
† ELIA – Ecological Living In Action, La Gaulette, Mauritius
‡ Bureau of Catholic Education, 1 Celicourt Antelme Street, Rose Hill, Mauritius
(Corresponding author: *sanju@ecolivinginaction.com*)

Abstract

It is widely recognized today that past and current human activities are unsustainable, and sustainable development is now being sought by all countries, be it in rhetoric or purposefully. There is also the consensus that the vocational-type of schooling lacks two key elements for facilitating learning for sustainable development, namely (i) learning to be (le savoir d'être), and (ii) learning to live together (le savoir vivre). These two elements are inherently relational aspects of learning that form the basis of human ecology, that is, the science of relationships and interactions between people and between people and their environment. These essentially external relationships derive their quality from the relationship that one has with oneself – i.e. to be. From this perspective, what is falsely referred as the 'ecological crisis' is more appropriately described as a 'crisis of humanity'.

In this paper, we address critical issues related to the purpose of education in an unsustainable world. In particular, we discuss the paradoxes of modern education, and show how it is part of the problem. The major philosophical orientations for arguing that all education ought to be education for sustainable development are discussed. This paves the way for presenting the principles underlying the Education for Sustainability (EFS) programme, developed by ELIA-Ecological Living In Action (ELIA) in collaboration with the Bureau of Catholic Education (BEC), and the linkages with the other articles published in this issue. The EFS programme is summarized using a Theory of Change perspective, and provides a normative approach for enabling learning for sustainability.

Keywords: Education for sustainability; philosophy of education; paradox of education; Theory of Change.

1. Introduction

There is a generally unquestioned and accepted notion in society that education is a good and desirable thing. In Mauritius, this notion is epitomized by the policy decision to provide free formal education with the aim of facilitating universal access to education.[1] With compulsory education up to the age of 16 years, the outcome is that all the children of the Republic of Mauritius would spend a minimum of 11 years in formal education.[2] Some of us, like the first author of this article who has been schooled for 26 years, spend more time (and financial resources) in formal education. This positive outlook on the enterprise of education is founded on our experiences of its several laudable aims. For instance, education (1) gives people more and better life and career opportunities, (2) helps people make therapeutic use of their leisure time, (3) develops peoples' knowledge and understanding of themselves and the world, (4) encourages people to work together in a spirit of tolerance and mutual kindness, (5) produces more fulfilled, 'rounded', law-abiding people, (6) gives youngsters a broader perspective on life and the world, and (7) helps make the nation more competitive and prosperous (Moore, 2012).

While these objectives may be desirable, they are surely not sufficient for tackling the sustainability issues that we are faced with today.

Worse, as will be discussed in this article, one of the paradoxes of modern education is that while the quantity of education has increased so has the level of unsustainability of human activities. The birth and development of the EFS programme is in direct response to this paradox. But in order to steer the programme to the meaningful end of facilitating ecological sustainability, we need to have a clear idea of what education and learning are for. This leads us to the philosophy of education that is required to achieve this end, and which is the main topic of this article. The clear articulation of the philosophy of education on which the EFS programme is founded will provide guidance on which 'road' will take us to the desirable end of achieving ecological sustainability.

In other words, this philosophy of education will also provide a normative basis for the theory of learning that will be required for achieving ecological sustainability. In addition to shedding light on the corresponding theory of learning, the required pedagogy also emanates from the philosophy of education. Hence, starting from the philosophy of education for ecological sustainability, we arrive at praxis.[3]This cascading approach is also useful in clarifying the different meanings that are usually attributed to the term 'education', and which often lead to the development of educational policies that are confusing in terms of the 'ends' and the 'means' of education. This ambiguity may arise from associating the term 'education' to any one of four things (Frankena, 1965):

1. The *activity of educating* carried on by teachers, schools, and parents (or by oneself),
2. The *process of being educated* (or learning) which goes on in the pupil or child,
3. The *result*, actual or intended of (1) and (2), or
4. The *discipline* or field of enquiry that studies or reflects on (1), (2), and (3) and is taught in schools of education.

Before turning to the philosophy of education and learning principles underpinning the EFS programme, we take a cursory look at linkages between development and education in Mauritius. In particular, the discussion will focus on: (1) the sustainability challenges that Mauritius is confronted with; and (2) a review of the main orientations of education proposed in the Education & Human Resources Strategy Plan 2008 – 2020 (ROM, 2009) and the Maurice Ile Durable Policy, Strategy and Action Plan (ROM, 2013). This article concludes by summarizing the EFS programme from the perspective of Theory of Change.

2. The problem of sustainability

Sustainability, as a desirable goal for societies to achieve, and sustainable development as the process that will lead to that goal, has become the quest of all nations (either in essence or in rhetoric). This can be attributed to the past and current unsustainable patterns of human activities that have reached planetary scale. Mauritius has its own version of sustainable development orientations in the form of Maurice Ile Durable.

The linkages between sustainable development and education are obvious at different (global and national) scales. For instance, the UN Decade of Education for Sustainable Development (2005-2014) seeks to mobilize the educational resources of the world to help create a more sustainable future. Education has been identified as one of the key paths to sustainability. While acknowledging that education alone cannot achieve a more sustainable future, the Decade of Education for Sustainable Development (DESD) has been unequivocal that without education and learning for sustainable development, that goal will not be reached.[4] At the national level, *Education* is one of the 5 pillars on which the MID Policy, Strategy and Action Plan (ROM, 2013) is built.

Since there is a problem for which education is seen to be a solution (or at least part thereof), it will be insightful to investigate the characteristics and scale of this problem.

2.1 Dissonance between socio-economic systems and ecosystems

Human activities mediated by socio-economic exchanges (i.e. market and non-market driven) are unsustainable because socio-economic systems are not designed on the same principles as natural ecosystems.

It is worth here to start with some of the fundamental principles or properties of ecosystems that make them sustainable (this implies leaving out socio-economic impacts). Figure 1 illustrates the dissonance between the functioning of ecosystems and socio-economic systems that are designed by human beings.

Ecosystems have a set of inherent properties such as circular economy, biotic and genetic diversity, thriving on solar energy, and ability to maintain the stock of natural capital, among others, that give rise to emergent properties (an outcome of innovation without design in nature) of self-renewal, self-organization and resilience that are characteristic of a system that can endure and renew itself over time – i.e. sustainable (see for example, Capra, 2002; Marten, 2003; Meadows, 2011). Human beings have designed social and economic systems that are not in consonance with the principles of natural ecosystems. For instance, the conventional economic model is a linear model that is based on maximization and is not a solar economy (Daly & Farley, 2004). Since the socio-economic system is embedded in nature, there is a backlash that leads to the unsustainability of the socio-economic system.By degrading or destroying natural capital, human activities directly undermine the planet's ability to support the socio-economic system.

This is indeed one of the biggest paradoxes of the counterintuitive behavior of human beings, especially since human wellbeing is dependent on the healthy functioning of ecosystems (MEA, 2005).

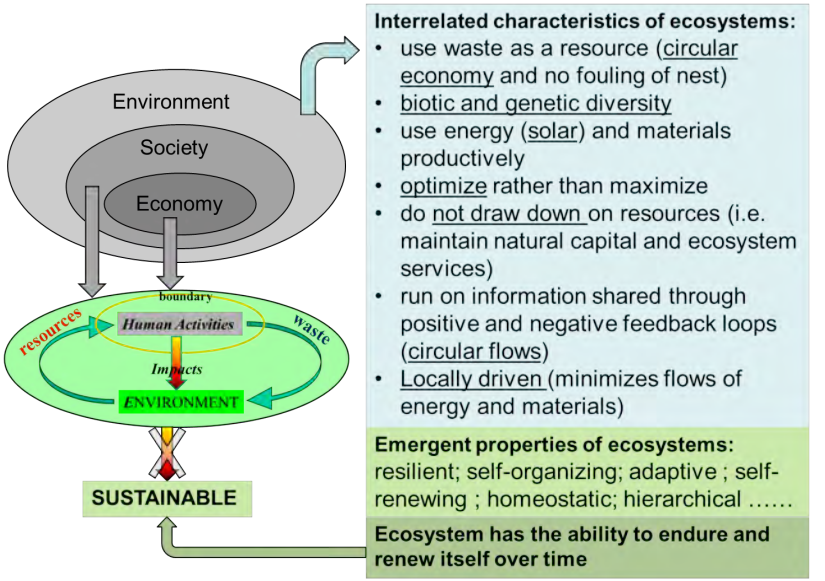

Figure 1. Schematic illustrating the dissonance between ecosystems and socio-economic systems.
Source: Authors' elaboration.

As the overall interactions between society, economy and environment is complex and non-linear, the causes and effects of unsustainable human activities are usually delocalized in time and space – i.e. there are usually delays between cause and effect, and a cause may have an effect elsewhere that is not visible to the agent of the cause (the latter is especially complex in a globalized economy). Achieving sustainability will require aligning socio-economic systems along the principles that underlie natural ecosystems. Following this discussion, it will be useful to highlight some manifestations of unsustainability.

2.2 The manifestations of unsustainability

Unsustainability is manifested through the relationships between human beings and between human beings and the natural environment (biotic and abiotic). Interestingly, the outcomes of these interactions are similar at the global and national levels, albeit the scales are different – i.e. while the scales in terms of magnitude and intensity may be different, the patterns are similar. Because of the lack of space, only a few examples of the manifestations of unsustainability are provided here:

- The Gross World Product (GWP) has increased exponentially between 1950 and 2011 when the total value of goods and services produced worldwide was $77.2 trillion, twice as much as 20 years ago.[5]Amidst the exponential increase, the distribution of wealth has remained highly unequal. At the end of 2010, 0.5% of the world (richest) population appropriated close to 36% of global wealth, whereas the 68% of the world population shared only 4.2% of global wealth. Although less dramatic, the increasing inequity in Mauritius is also a trend. The income ratio of the highest 20% of households to the lowest 20% of households has increased from 6.9 in 2001/02 to 8.8 in 2012. The increase in inequity is revealed by the increase in the gini coefficient[6] from 0.371 in 2001/02 to 0.413 in 2012;[7]
- Fourteen (14) out of twenty four (24) ecosystems – i.e. approximately 60% of the ecosystems studied - vital for human well-being were being degraded or used unsustainably. The scientific evidence is clear that the homeostatic functioning of the planet has been so perturbed by the anthropogenic accumulation of greenhouse gases in the atmosphere that climate change has emerged as arguably the most challenging developmental issue of this century (MEA, 2005). The impact of human activities as the main driver for climate change has literally turned human beings into weather makers (IPCC, 2013). The harmful effects of the degradation of ecosystem services (a) were being borne disproportionately by the poor, (b) were contributing to growing inequities and disparities across groups of people, and (c) were sometimes the principal factor causing poverty and social conflict (MEA, 2005);
- A study calculating EF of nations has shown that humanity is exceeding its ecological limits by 50%. In other words, it now takes the Earth one year and six months to regenerate what we use in a year (WWF, 2012). There are clear indications that EF will continue to increase in the future, driven predominantly by an increase in world population and increasing per capita consumption. In 2008, Mauritius had an EF of 4.55 gha/person, which exceeded the world's biological capacity of 1.68 gha/person. This implies that if every person consumes like the average Mauritian in 2008, we would need 2.7 planets to maintain all human activities. Of greater concern is the fact that Mauritius has an ecological deficit of 3.99 gha/person since its bio-productive capacity was only 0.56 gha/person (Ewing et al., 2010).

This means that, on average, Mauritians, and by extension all socio-economic activities carried out in Mauritius, can only maintain their high levels of consumption by appropriating resources from elsewhere. This raises ethical questions concerning the fair allocation of resources among members of the family of human beings; and

- Finally, a report on the well-being of nations has shown that out of the 180 independent countries that were studied none was ecologically sustainable. The study showed that Mauritius had a double deficit in terms of both its human and ecosystem well-being (Prescott-Allen, 2001).

The studies supporting the above observations do not only reveal that the state of affairs is already bad, but, more alarming of all, that the situation will only get worse in the future. This crisis has been interpreted as a result of the combination of several social traps, namely our flawed understanding of the relationship between the economy and the earth; the propensity to dominate nature using science and technology; any wrong turns in our evolution; or due to sheer human perversity. One of the causes of the crisis of sustainability has to do with the propensity of all industrial societies to grow beyond the limits of natural systems (Orr, 1992).

3. Unsustainability and the paradox of modern education

All of these social traps boil down to the fact that human beings consistently fail to recognise that human well-being is not dissociable from the health and integrity of ecosystems. Fundamentally, the crisis can be explained by the fact that most learning in modern societies is functional, and is oriented towards socialization and vocational goals that take no account of the challenges of sustainability. Education is presently characterized by a number of paradoxes that raise profound questions about its role in creating ecologically aware and responsive citizens. The most significant of these paradoxes is that while the quantity of education is increasing, so is the level of ecological unsustainability.

Although education can be a lever of change for sustainability, it cannot do so in its current form because it is (Sterling, 2002, p. 13):

- still informed by a fundamentally mechanistic worldview, and hence of learning;
- largely ignorant of the sustainability issues that will increasingly affect all aspects of people's lives as the century progresses;
- blind to the rise of ecological thinking which seeks to foster a more integrative awareness of the needs of people and our interrelatedness with our natural environment.

It is obvious from the discussion so far that the unsustainability predicament cannot be solved by the same kind of education that helped create it – i.e. an industrial model of education geared towards economic priorities. So, if education is seen as a lever of change for sustainability, then it will have to be of a different kind altogether. The foundation of sustainability, however defined, will be the clear awareness that our well-being is inseparable from that of nature.

> And, if education does not teach us these things, then what is education for? (Orr, 1992, p. 148).

4. The philosophical foundations of the EFs programme

We now turn to the philosophy of education on which the Education for Sustainability (EFS) programme is founded, and the resulting theories of learning that support this philosophy. The normative approach emanating from this philosophy of education is captured by a set of principles that are applied in the implementation of the EFS programme. The application of these principles is further discussed in Chung Kim Chung and Smitsman, and Smitsman and Deenapanray (this issue).

4.1. The philosophy of education

The fundamental reason for articulating a clear philosophy of education is that there is no education that is valueless or neutral – i.e. any form of education is value-laden, even if the underlying values are not explicitly stated.

In the forward to the Pedagogy of the Oppressed, Richard Shaull states that "(e)ducation either functions as an instrument that is used to facilitate the integration of the younger generation into the logic of the present system and bring about conformity to it, or it becomes the practice of freedom, the means by which men and women deal critically and creatively with reality and discover how to participate in the transformation of the world" (Freire, 1970, p. 16). In its transformative role, education has the ability to result in a paradigm shift, not in rhetoric, but in the sense of Thomas Kuhn (Kuhn, 1965). In contrast, when used to assimilate the younger generation into the logic of the present system, education serves the role of further codifying current unsustainable practices. In this particular role, education becomes part of the problem of sustainability despite all our good intentions.

This is yet another paradox of education (or the system of education), and it is this assimilative character of education that has led Sterling to caution educators and practitioners of the inertia in social systems that prevent or delay the transformation to sustainability to take place (Sterling, 2002, pp. 32-33).

A philosophy of education can be either *analytical* or *normative*. It is normative insofar as it is concerned to propose ends or values for education to promote, principles for it to follow, excellences for it to foster or pedagogies for it to adopt. It is analytical insofar as it is concerned with analyzing or evaluating our thinking about education; more precisely the assumptions we make, the terms we use, the slogans we proclaim, and the theories we formulate (Frankena, 1965, p. 8). The analytical approach has been used to analyze the current policies and strategies of education in Mauritius, which serves as a basis for developing a normative philosophy for the EFS programme.

4.1.1. The policies and strategies of education in Mauritius

Education is one of the five pillars (sectors or issues) that are treated in the MID Policy, Strategy and Action Plan (PSAP)

The MID Vision for education has been formulated in three components (ROM, 2013, p. 4): (1) our educational system promotes the sustainable development of skills, knowledge and values through lifelong learning to ensure the holistic development of the citizen; (2) our formal and informal education systems foster responsible, green and civic values in all age groups to achieve a caring society; and (3) the potential for our human resource is fully tapped to foster social equity along with enhancing economic, political, environmental and cultural well-being. The Vision is laudable since it encompasses positive human development outcomes in terms of 'holistic development', 'citizenship', 'caring society', 'social equity', and human 'well-being' that is multi-dimensional. Although not explicitly stated, it can be inferred that the ideals of 'citizenship' and 'caring society' would also promote values that extend stewardship to the planet and other sentient beings.

However, there appears to be a disconnection between this laudable vision and the policies, strategies and actions that are summarized in Table 1. Except probably for the policy on sustainable lifestyles, the linkages between policies, on the one hand, and strategies and actions, on the other, appear to be weak. Further, there is an assumption that improved access to education and vocational training will support sustainable development, when the above discussion has shown that 'more of the same' is in fact a paradox of education. Yet, another ambiguity is that the Action Plan will be implemented through four priority programmes, namely: Energy; Cleaner, Greener and Pollution Free Mauritius; Green Economy; and Ocean Economy (ROM, 2013, p. xiii). The Green Economy is seen as the primary driver for delivering on the MID education policies, strategies and actions (ROM, 2013, pp. 86-94).

From this analysis, it can be concluded that in the MID logic, education is subordinate to the economy and industry, albeit that these have been qualified with 'green'.

The MID Policy Framework states that "MID policies are not intended to replace or supersede existing policies, but to present new policies or enhance existing ones" (ROM, 2013, p. 32). The word 'new' has been interpreted to mean that any new MID policies are additional to the existing ones. It is in this context that we now turn our attention to the Education & Human Resources Strategy Plan (EHRSP) 2008-2020 that is the main strategic document guiding the education sector. In order to critically evaluate the EHRSP in its sustainability orientations, a methodology has been adopted whereby the frequency of use of the words 'sustainability' or 'sustainable development' is compared with the frequency of use of words belonging to the *industrial age* education like ' employment', 'employability', 'labour', 'vocational', and 'efficiency'.

This approach is justified on the basis that the "individual's thought process is highly influenced by the conceptual categories shared and communicated through the languages of the culture of which the individual is a member" (Bowers, 1995, p. 113). Edward Sapir has decentered the autonomy of individual intelligence by arguing that "language is a guide to social reality... the real world is to a large extent unconsciously built on the language habits of the group" (quoted in Bowers, 1995, p. 113). Table 2 summarizes the count of selected words in order to abstract the philosophy of education underlying the EHRSP.

Table 1. Summary of MID education policies, strategies and actions

MID Education Policies	MID Education Strategies	MID Actions
▪ **Lifelong Learning**: Achieve poverty reduction through improved access to lifelong learning and employment opportunities for all groups. ▪ **Sustainable Lifestyles**: Promote healthy and sustainable lifestyles. ▪ **Natural Disaster and Climate Change Awareness**: Promote critical consciousness with regard to disaster risk reduction, climate change adaptation and mitigation. ▪ **Access to post-secondary education**: Increase access to post-secondary education through multiple pathways.	▪ Improve access to education for students of all ages and groups in and out of school. ▪ Use education and training to raise awareness of, and encourage, healthy life choices for all age groups. ▪ Promote consistency between formal and non-formal education pathways in mainstream and vocational systems. ▪ Encourage the development of family literacy programs. ▪ Develop and mainstream programs to promote environmental literacy at all levels.	▪ Promote MID literacy by undertaking a public awareness campaign publicising quality of life/healthy choices. ▪ Include 'quality of life/healthy choices' in the national curriculum. ▪ Implement the actions identified to support the improved qualifications for green jobs. ▪ Introduce a skills expansion course and certificate, to allow current Technical Extension Officers to become 'MID Extension Officers'. ▪ Improve community understanding of MID and the way it can be adopted in everyday life.

Source: Maurice Ile Durable Policy, Strategy and Action Plan (ROM, 2013, p. xi).

Table 2. Summary of selected words count in the EHRSP

Selected words	Number of times appearing in the EHRSP
sustainable development	6
sustainability	11 • 6 - in relation to training • 4 - in relation to finance • 1 - in relation to social and economic development
environment	31 • 1 – *environmental education* • 7 – environment as a 'milieu' • 2 – in relation to globalisation • 1 – infrastructure • 7 – policy / enabling conditions • 13 – learning environment
economy	75 • 43 – general economy • 32 – knowledge economy
(un)employment	58
employability	16
labour	64
vocational & pre-vocational	55
efficiency	22

Source: Data extracted from EHRSP (ROM, 2009).

It is clear from the results shown in Table 2 that the emphasis for developing quality education in Mauritius is principally driven by the need to enhance labour productivity. This is explicit in the EHRSP where the labour market is depicted as the final boundary in the new structure (i.e. structure proposed by the EHRSP) of the Mauritian education system (ROM, 2009, p. 32). In contrast, the words sustainable development or references to environmental education are barely noticeable. This is not surprising since it is well established that educational reform can seldom escape the prevailing cultural influences characterized in most societies by consumerism (Sterling, 2002). When the person is seen primarily as a productive factor in the economy, the person must also be seen as a consumer.

The person selling his/her labour in exchange for remuneration in an economic growth model ends up spending to reflect individual preferences in consumer markets (Daly and Farley, 2004, pp. 15-35). Education then is limited to the vocational functions of 'learning to know' and 'learning to do' (UNESCO, 1998), as well as playing the role of socializing young minds into the prevailing culture (Freire, 1970, p. 16).

A direct manifestation of this type of education is *unauthentic teaching and learning* (Grenade, 2012) that is characterized by the *banking concept of education* – i.e. education becomes an act of depositing, in which the students are the depositories and the teacher is the depositor (Freire, 1970, p. 53). The characteristics of such a transmissive system of education are summarized in Table 3.

There are other fundamental difficulties regarding the philosophical orientations of the EHRSP that can be gauged from statements such as the *"Vocationalisation" of secondary schooling will be phased in while all attempts will be made to embed a culture of scientific thinking in line with the drive towards sustainable development*." (ROM, 2009, p. 78).

Table 3. The difference between transmissive and transformative education

TRANSMISSIVE	**TRANSFORMATIVE**
Instructive	**Constructive**
Instrumental	Instrumental / intrinsic
Training	Education
Teaching	Learning (iterative)
Communication (of 'message')	Construction of meaning (*experience-based*)
Interested in behavioural change	Interested in mutual transformation (*and relationships*)
Information – 'one size fits all' (*everyone learns in the same way, learning mostly takes place in the head*)	Local and/or appropriate knowledge important
Control kept at centre	Local ownership
First order change	First and second order change
Product oriented	Process (*and relationship*) oriented
'Problem-solving' – time-bound (*learning mostly takes place in the classroom*)	'Problem-reframing' and iterative change over time (*learning relevant to progress in the world*)
Rigid	Responsive and dynamic
Factual knowledge and skills (*knowledge is inherently fragmented*)	Conceptual understanding and capacity building (*knowledge is meaningful, embodied and whole*)
Imposed	**Participative**
Top-down	Bottom-up (often)
Directed hierarchy	Democratic networks
Expert-led	Everyone may be an expert
Pre-determined outcomes	Open-ended enquiry
Externally inspected & evaluated	Internally evaluated through iterative process, *plus* external support
Time-bound goals	On-going process
Language of deficit and managerialism	Language of appreciation and cooperation
Standardization	*Context-based / innovation – multiple learning styles; e.g. ways of knowing and learning, embodied learning.*

Source: Adapted from Sterling (2002, p.38).

The use of the terms ‘vocationalisation’, ‘scientific thinking’ and ‘sustainable development’ in the same sentence reveals an assumption that these terms are commensurate. It has already been argued that the vocational aspect of education as emphasized in the EHRSP is an integral part of the paradox of education, and this will not be further discussed here. However, the linkages between scientific thinking and sustainable development require more attention because, in juxtaposition to what is assumed in the EHSRP, there is no *a priori* good connection between a culture of scientific thinking and sustainable development. First, being a heritage of the Enlightenment era (Moore, 2012, pp. 47-54), the prevailing culture of scientific thinking is characterized deeply by Cartesian duality with two main impacts (among others), namely: (i) the dissociation of subject from object as manifested by the separation of the human being from nature; and (ii) the accumulation of knowledge through reductionism – i.e. by breaking things into manageable and understandable parts. The outcome is a propensity for human beings to control nature, and a lack of understanding of how whole systems (ecological, social and economic) work (see Figure 1), both of which are antithetical to sustainable development. Second, and as will be further discussed below, educating for sustainability assumes the development of good dispositions in human beings. If some or all of these good dispositions were to be mediated through a culture of scientific thinking, the fundamental problem remains that the distinctions between what would constitute ‘good’ or ‘bad’ science cannot emanate from the field of science itself. What constitutes ‘good’ or ‘bad’ science are the repertory of the social sciences and the humanities that deal with issues like ethics, social justice and peace. This would justify the need for a more liberal or libertarian form of education for achieving sustainability.

Such an orientation is lacking in the EHRSP and the MID Policy, Strategy and Action Plan for education. Within the prevailing educational paradigm, lifelong learning may summarily produce more of the same (quantitatively more but qualitatively the same), and therefore compound the problem of unsustainability. Finally, it is worth mentioning that these cultural biases are not isolated but reflect the norm through the ‘consensus’ that surrounds the EHRSP (ROM, 2009, p. 10).

4.1.2. The normative approach of the EFS programme

The normative approach of the EFS programme derives its raison d’être from the earlier discussions and by recognizing that the prevailing system of education anaesthetizes the minds of students (Chomsky, 2000, p. 4), and that there exists such a thing as an ecology of bad ideas (Bateson, 1972, p. 484). A positive outlook in the EHRSP is that nothing it contains has been carved in stone, and, therefore, immutable. By recognizing the dynamic dimension of education, the EHRSP leaves space for ventilating further changes to the existing system (ROM, 2009, p. 10). It is in this spirit that the elements of the normative approach of the EFS programme that were hinted at in Section 3 are further developed.

The purpose of the EFS programme is to foster desirable dispositions – namely, those belonging to the family which includes teaching, instruction, training, learning, practice, and the like - in all the persons constituting the school community, and principally students and teachers, in order to achieve an ecologically sustainable society (Frankena, 1965, p. 6). To operationalize this approach, both ‘desirable dispositions’ and ‘ecologically sustainable society’ need to be made explicit. Concerning the former, the attitudes, habits, beliefs, and traits that the educative process must shape or bring about should be explained. Since the earlier discussion has made reference to the instrumental view of the human being as a factor in the production of goods, an appropriate starting point is Dewey’s philosophy of education. For Dewey, the ultimate aim of education is not the production of goods but the production of free human beings associated with one another on terms of equality (quoted in Chomsky, 2000, p. 38).

The end of this association of free human beings can be further qualified as generating the common good (Rousseau, 1968, p. 26). However, Rousseau points to the paradox that "[b]y themselves the people always will what is good, but by themselves they do not always discern it. The general will is always rightful, but the judgment which guides it is not always enlightened." (Rousseau, 1968, p. 43). So, an immediate aim of education should be to capacitate persons deal with the inherent tension that exists between the individual and society (Jeffreys, 1971). Another manifestation of this tension is that between the consumer and the citizen. Hence, education ought to give a sense of value of things other than domination (implying social justice and equity in the appropriation of ecosystem services and natural capital) to help create wise citizens of a free community (Bassey, 2010). Further, it is now well-established that human thinking and decision-making may be flawed by cognitive biases (Kahneman, 2011; Dobelli, 2013). Whereas individuals may have the good will to enhance their personal well-being (lest that of the common good), they generally make decisions that undermine their well-being due to a combination of these cognitive biases and broader cultural influences (Kasser, 2002; Layard, 2005;Senge et al., 2012). Education has a role to play in making these biases and contradictions visible, as well as enhancing the good dispositions and practices that will mitigate their effects.

Another way to investigate the idea of good dispositions is to investigate the substantive freedoms that human beings have to value, and which education should foster. The Capabilities Approach (CA) proposes an alternative paradigm for the development of education policies, one which is more concerned with providing children (and individuals in general) with the capabilities necessary to flourish as human beings (Glassman, 2012; Unterhalter, 2013). Amartya Sen has made the compelling case that the key questions we should be asking are to do with how well people are able to function (e.g. live a long life, participate in the community and have a worthwhile job) in any given context. The focus is not so much on the functionings themselves as the freedom or capabilities they have to do so.

Consequently, human development is achieved through the exercise of substantive *freedoms*, which can be classified as (1) political freedoms, (2) economic facilities, (3) social opportunities, (4) transparency guarantees, and (5) protective security (Sen, 1999). It is seen that these freedoms are not limited to the use of resources, which here is covered by 'economic facilities', and include social and psychological dimensions. The role of education is to support individuals develop the capabilities to achieve these substantive freedoms. The focus on freedoms and capabilities should not be construed as being more important than the functionings, since operationalization of the capacity to flourish requires definition of the main functionings. Hence, freedom to function and the functionings are better seen as the two faces of the same coin. Martha Nussbaum (2011, pp. 33-34) has developed the approach further to propose a tentative list of ten Central Capabilities (alternatively good dispositions) that would be worthwhile to pursue, namely: (1) life (ability to live a normal length); bodily health; bodily integrity (e.g. freedom of movement or security against bodily harm); senses, imagination and thought (see Smitsman and Smitsman, this issue); emotions; practical reason; affiliation; other species (ability to live with concern for and in relation to animals, plants, and the world of nature); play (laughter and joy); and control over one's political and material environment.

We now turn our attention to the term 'ecologically sustainable society'. As shown in Figure 1, sustainable development can be conceptually depicted as the nested hierarchy between environment, society and economy. Assuming that the economy is a social construct for the allocation of scarce resources for alternative ends to meet human needs (Daly and Farley, 2004), ecologically sustainable development can be defined as development that enhances human well-being within the ecological limits of the plants (e.g. Holden and Linnerud, 2007).

Human well-being is defined to have both monetary and non-monetary dimensions (Deenapanray, 2006), while ecological limits relate to the biological capacity for ecosystems to deliver the vital services that are necessary to support life on the planet (MEA, 2005).

Since CA can be construed as a theory of development to achieve human well-being, Sen (2013) has recently made the case that sustainability should be seen in terms of sustaining human freedoms and capabilities. The focus on freedom or capability for flourishing should be done with caution in a world of limits. The most striking example would be the freedom to endlessly accumulate material goods at the expense of natural capital. So the vision of capabilities for flourishing should not be treated as a set of disembodied freedoms, but as a range of 'bounded capabilities' to live well within the limits established in relation to the finite nature of ecological resources within which life on earth is possible, and the scale of the increasing global population. A fair and lasting capability for all (not only humans but the entire spectrum of biodiversity) to flourish cannot be isolated from these material conditions. The limits imposed by finite ecological resources and the increasing global population bring in the aspects of intra-generational and inter-generational equity to the vision of development as the capability to flourish and the substantive freedoms that can be enjoyed (Jackson, 2009, pp. 45-46).

The normative philosophy supports two relational aspects of living sustainably, namely (1) learning to be (i.e. *lesavoir d'être*); and (2) to learn to live in a balanced way in society and within our natural environment (i.e. *lesavoir vivre*) (UNESCO, 1998).

4.2. Theories of learning

Every educator operates according to a theory or theories of leaning and within the context of a philosophy of what education should be fundamentally about. Having already discussed the philosophy of education, the theories of education that are most aligned with the EFS programme are now discussed. While learning and development is the subject of the article by Smitsman and Smitsman (this issue), the parallels and complementarity with Vygotsky's and Bruner's theories of learning are made here. These theories of learning promote the transformative education that is summarized in Table 3, and are supportive of the CA by placing the learner squarely at the centre of the learning process.

The main premise of Vygotsky's theory of learning is that learning and teaching are essentially social activities that take place between social actors in socially constructed situations. In these social interactions, teachers do make a difference by facilitating the process of learning through scaffolding. Some of the highlights of Vygotsky's theory of learning that support transformative education are (Moore, 2012, pp. 13-21):

- That learning is an active meaning-making process in which the learning process itself needs to be understood and prioritized. The 'meaningful' learning and concept development has to be distinguished from 'rote' learning;
- That learners may learn in different ways from adults and their adult teachers;
- Children's cognitive development is achieved most effectively by elaborating ideas and understandings in discussion with their teachers and peers (learning through dialogue rather than monologue);
- Children must develop conscious mastery over what they have learned – i.e. the 'conscious' and 'deliberate' learner is one who is able to reflect on what they have learned, and indeed on the language through which their learning is taking place;
- The development of such 'mastery' is not subject-specific and once acquired becomes a tool through which all learning is facilitated and enhanced (i.e. learning become transdisciplinary and systemic).

Despite these attributes, it has to be cautioned that when applied in a conventional system of education, scaffolding may be used as yet another

means to unintentionally reinforce transmissive education.

While building on the work of Vygotsky (and predecessors) Bruner's theory of learning places emphasis on the cultural and economic contexts within which learning takes place. A central element of Bruner's theory of learning is the notion of 'spiraling' that describes the process by which the learner constantly returns to previous learning and understandings in the light of new learning and new experience (Moore, 2012, 21-27). Spiraling implies that learning is not definitive as it continuously unfolds.This theory of learning is commensurate with the notion of lifelong learning (albeit not as a subordinate to the labour market), while fitting the learning requirements for sustainability where no blueprint for achieving it is available. Hence, an adaptive learning process is required (see also Smitsman & Smitsman, this issue). Another important contribution of Bruner's theory of learning is the role and effects of poverty on learning and development. In relation to sustainability education, one is contrived to face the challenges of drawing out the relevance of sustainable development for individuals or communities that are faced with persistent poverty or deprivation, and for whom goals are short range, capabilities restricted, outsiders and the outside are suspect, and beating the system takes the place of using the system (Moore, 2012, p. 23).

4.3. The principles of the EFS programme

The EFS principles that can be derived from the philosophy of education and theories of learning discussed above are summarized in Table 4. They are the foundations for ecological literacy (Orr, 1992, pp. 90-92). These principles have been used to develop an EFS Charter and Pledge (see Chung Kim Chung & Smitsman, this issue).

For education to play a transformative role in steering society towards sustainability, it will need the capacity to create ecologically literate individuals. Such a person will have the knowledge necessary to comprehend interrelatedness, understand how complex systems work, and an attitude of care or stewardship towards the natural world.

The Framework for the UN Decade of Education for Sustainable Development (DESD) International Implementation Scheme mentions that the overall goal of the DESD is to integrate the values inherent in sustainable development into all aspects of learning to encourage changes in behaviour that allow for a more sustainable and just society for all. It also mentions that this will potentially touch on every aspect of life (UNESCO, 2006, p.4).

It is for this reason that the EFS Programme starts with the principle that all education is education for sustainability and aims to integrate the EFS principles, practices, and values into the educational system as part of the curriculum subjects and activities (Smitsman & Deenapanray, this issue).

Table 4. The foundations for Ecological Literacy

Foundations for Ecological Literacy	Further explanations
1. ***A recognition that all education is environmental education***	The primary reason for education is to guide people to live sustainably on the planet; education for sustainability is based on the thinking that all education needs to lead to ecological literacy for sustainability (Sterling, 2002).
2. ***Environmental issues are complex and cannot be understood through a single discipline or department***	Sustainability issues can only be understood by employing a systems or holistic approach, namely by recognizing and understanding that all parts of a system are interrelated through feedback systems. Complex systems behave differently from what our mental models would suggest (Morin, 1999; Meadows, 2011; Senge, 2012).
3. ***Education occurs in part as a dialogue with a place and has the characteristics of good conversation***	Education has to be contextualized (deriving meaning from the place where learning takes place) and should not be merely an abstraction for the learner or practitioner (Blewit, 2006; Bowers, 1995; Moore, 2012).
4. ***The way education occurs is as important as its content***	The ultimate aim of education is to: (1) inspire children to develop their natural potentials; (2) show them how to become stewards of our planetary and human well-being; and (3) guide them how live a meaningful life within the life-sustaining capacity of our planet. The best way to teach children is to show by example. Children are natural modelers - they model and role-play behavior. For this to be successful what is taught needs to lived and practiced by the educational community as a whole. Consequently, all distinctions between teacher and student, between the school and the community, and those between areas of knowledge, are dissolved (Blewit, 2006; Moore, 2012; Bateson, 1972; Fogel, 1993)
5. ***Experience in and of the natural world is an essential part of understanding the environment, and conducive to good thinking***	Abstractions about the natural environment carried out during indoor learning do not have the propensity to alter the ways in which we relate with the natural world and to change our behavior to live sustainably (Boven and Morohashi, 2002; Orr, 2004; Stone, Barlow and Capra, 2005; Williams and Dixon, 2013).
6. ***Education relevant to the challenge of building a sustainable society will enhance the learner's competence with natural systems***	Good thinking proceeds from the friction between reflective thoughts and real problems. The sustainability crisis will bring forth its own demand for ecological literacy as a vital leverage point to steer society towards ecological sustainability (Blewit, 2006; Morin, 1999).

Source: Adapted from Orr (1992).

5. An EFS Theory of Change (TOC)

Given the many paradoxes of modern education, the development of ecological literacy as an outcome through the EFS programme is a challenge. As discussed above, the overall impact of this outcome is to achieve ecological sustainability – i.e. achieving human well-being within the boundaries of ecological systems. The programme requires a clear link between ideas about designing the most appropriate system (taking into consideration the prevailing socio-cultural, political, human and institutional capacity, and financial constraints, among others), and the implementation of actual strategies and action plans to achieve ecological literacy, and ultimately ecological sustainability. Theory-based frameworks provide a useful means to formulate this link clearly, as well as strategic planning, and monitoring and evaluation (INSP, 2005). The lack of clarity about the steps that must be taken to reach a long-term outcome (i.e. impact) not only makes the task of evaluating a complex initiative challenging, but reduces the likelihood that all of the important factors related to the long term goal will be addressed (Anderson, 2004).

A theory of change (TOC) has been articulated to map out the beliefs and assumptions underlying the EFS programme, as well as the delivery strategy that is believed to be critical for producing change (e.g. ecological literacy for sustainability). Theories of change represent beliefs about what is needed by the target population (school community) and what strategies will enable them to meet those needs. They establish a context for considering the connection between a system's mission, strategies and actual outcomes, while creating links between who is being served, the strategies or activities that are being implemented, and the desired outcomes (INSP, 2005, p. 6). This set of connections is depicted in a map known as an *outcomes framework*, which is a graphic representation of the change process as it is understood by the practitioners (Anderson, 2004, p. 3). The outcomes framework is in no way static, and an adaptive learning system must be developed so that the framework is revisited regularly. In as much as the outcomes framework supports change in learning for sustainability, the latter, in turn, imposes changes on the outcomes framework by altering the connections (or strengths) in the system. The use of monitoring and evaluation to achieve adaptive learning is therefore a critical element of the system (see Smitsman & Deenapanray, this issue).

A TOC has been developed (see Table 5) for the EFS programme based on the 'TOC Tool' (INSP, 2005, p.10) through application of the fifteen steps shown in Figure 2.

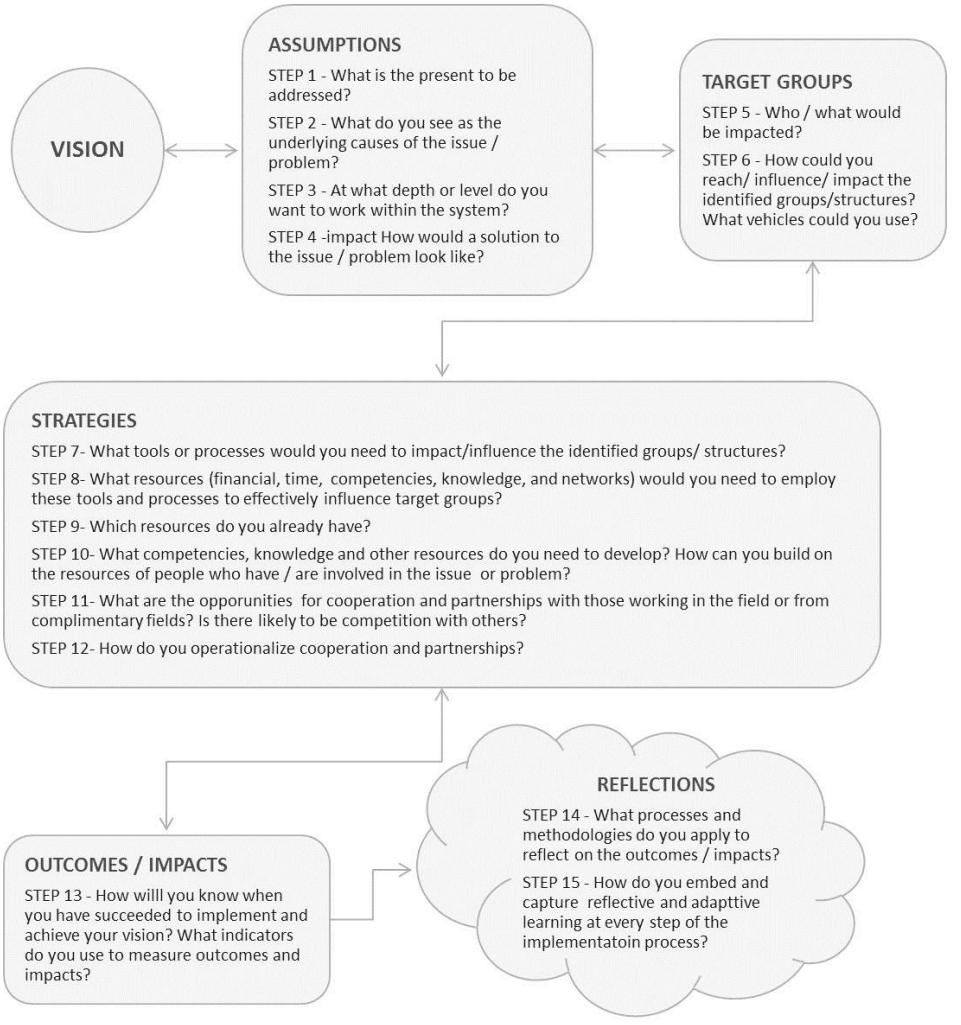

Figure 2. Overview of the Theory of Change (TOC) model
Source: Adapted from INSP (2005, p.10).

Table 5. TOC model applied in the EFS Programme

PROCESS	APPLICATION OF THE 14 STEPS IN THE EFS PROGRAMME
VISION	Our vision is for schools to facilitate value-based education where relationships between people, and between people and the natural world, are central to preparing students to participate in and contribute to a flourishing, equitable and sustainable society in meaningful and empowering ways.
ASSUMPTIONS	
Step 1	System of education does not contribute to competencies vital for sustainable living.
Step 2	Purpose and structure of education + role of human beings in relation to the natural world.
Step 3	Within schools, within networks of schools, in the conventional system of education in Mauritius.
Step 4	Schools that promote and foster education for sustainability + collaboration & research for EFS.
TARGET GROUPS	
Step 5	Students, teachers, non-teaching staff, school + BEC management, parents,
Step 6	collaborators / partners. See Table 7 in Smitsman and Deenapanray (this issue).
STRATEGIES	
Step 7	Learning by doing, multi-stakeholder dialogue, EF calculator, Systems Thinking, EFS Platform & Social Media, Monitoring & Evaluation (M&E) System see Smitsman and Deenapanray (this issue).
Step 8	Training in EFS pedagogy & practices (ELIA + resource persons), EF technical expertise (ELIA), communication & social-media (ELIA + resource persons), knowledge of monitoring & evaluation (ELIA, BEC, schools, universities, and partners), knowledge of school administration, curriculum design, learning styles / pedagogy (BEC, Schools, Universities, Mauritius Institute of Education (MIE)).
	Funding, EFS platform, technical expertise, partnership network.
Step 9	Further EFS research & development, integration of system approach in curriculum design, pedagogy for teaching systems thinking, green building applications, M&E, Eco-camps. The programme builds on the resources that
Step 10	partner organizations and resource persons bring in.
Step 11	Global Coalition for Green Schools, Eco-Schools International, Creative Learning Exchange, Waters Foundation, MIE, Mauritius Research Council (MRC), private sector organizations. Potential competition with Mauritius Coalition for Green Schools and Mauritius Eco-Schools initiative depending on how these are operationalised and the role of ELIA & BEC within these initiatives.
Step 12	Through: EFS collaborative platform; specific EFS projects & EFS research; contributions to conferences/seminars; exchanging lessons learned; supporting similar initiatives.
OUTCOMES Step 13	**Indicators:** (1-3) number of schools, teachers, students involved, and (4) teachers trained (new and total), (5) number of publications + lessons learned, (6) EFS formative and summative assessments of students & teachers, (7) qualitative feedback school community, (8) number of key stakeholders supporting the programme, (9) amount of resources mobilized, (10) extent of media coverage and outreach, (11) degree of EFS engagement (within schools and external), and (12) development of partnership / collaboration networks for EFS. For more information see Smitsman and Deenapanray (this issue).
REFLECTIONS	See development of EFS M&E system (Smitsman and Deenapanray, this issue).
Step 14	See 14 + pedagogy for reflective and adaptive learning is taught to teachers &
Step 15	students as part of the learning and development principles for EFS (Smitsman and Smitsman, this issue).

6. Conclusions

This article has discussed the philosophical foundations of the EFS programme. A normative approach to education has been proposed to foster desirable dispositions through ecological literacy in order to enhance the wellbeing of human beings within the ecological boundaries of the planet. It has also been shown that the current system of education is designed predominantly to produce consumers rather than citizens who are capable of living sustainably. The theories of learning that support the normative approach of the EFS programme have also been discussed. This is important to render the underlying philosophy impactful. In order to operationalize the EFS programme, a Theory of Change has been proposed that is aligned with the normative philosophy and it has been developed based on the corresponding theories of learning. The imperative and motivation for developing the EFS programme is to contribute to the co-creation of a sustainable society and future. The programme aims to empower people with the competencies necessary for co-creating such a future, and to support the formation of communities of practice (schools) for sustainability.

The philosophical foundations of the EFS programme are grounded in the fundamental questions of why education matters, what for, and who it needs to serve.

Notes

1. The case can be made that education is not entirely free since there exists a thriving parallel economy related to the provision of private tuitions. This is not a concern of this paper.
2. The assumption made is that the process of education is initiated at the pre-primary level (at the age of 3 years) and that education is compulsory up to the age of 16 years.
3. Praxis is the process by which a theory, lesson, or skill is enacted, practiced, embodied, or realised. It may also refer to the act of engaging, applying, exercising, realizing, or practicing ideas (http://en.wikipedia.org/wiki/Praxis_(process) – accessed 11 May 2014).
4. Please see: http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/about-us/ - accessed 11 May 2015.
5. Please see: http://www.earth-policy.org/indicators/C53 - accessed 10 January 2014.
6. Gini coefficient = 0 means a perfectly equitable society; Gini coefficient = 1 means a perfectly inequitable society.
7. These indicators are derived from the Household Budget Surveys that are carried out periodically by statistics Mauritius. For more information, please see: http://statsmauritius.gov.mu/English/CensusandSurveys/Pages/Household-Budget-Survey.aspx - accessed 10 January 2014.
8. Please see: http://www.footprintnetwork.org/images/trends/2012/pdf/2012_mauritius.pdf, accessed 4 June 2013.

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Learning and Development for Ecological Literacy

Ad W. Smitsman† and Anneloes Smitsman‡
† Radboud University of Nijmegen, the Netherlands
‡ ELIA – Ecological Living In Action, La Gaulette, Mauritius
(Corresponding author: *a.smitsman@pwo.ru.nl*)

Abstract

Learning and development are key goals of education. The assumptions of learning and development on which we have built our educational systems are often outdated and may lack grounding in current scientific insight related to this topic. This paper offers five keys principles for learning and development based on current scientific understanding of complex adaptive systems. The kind of learning that is promoted through conventional education often lacks the deeper transformative learning that is part of sustainability education. The authors examine the reasons for this and propose integrated solutions for how to change this. Examples are provided for how this has been applied in the Education for Sustainability (EFS) programme for the Catholic secondary schools in Mauritius that are part of the BEC network.

Keywords – Learning and development principles; systems thinking; transformative education; mental models.

1. Introduction

There is a growing consensus around the world that drastic changes are required in the way that we as human beings live, interact, and use our natural environment. The harmful impact of human behavior on our eco-systems raises serious questions about our educational systems. Many of the countries with the highest conventional literacy also have amongst the largest ecological footprint. Ecological literacy development and competencies for sustainable living should be a primary goal of education yet this is rarely the case (see Deenapanray, Smitsman & Chung Kim Chung, this issue; Orr, 2014; Sterling, 2002). Our current educational systems are the legacy of a worldview and system's purpose that was designed in and for the (Western) industrial Age.

Educational systems were formed, initially, to prepare citizens to become rational and responsible economic agents who can contribute to the consumption and fossil-fuel dependent economic and political systems (Sterling, 2002). This view idealizes competition and productivity as a measure for progress and makes this the objective for human development.

Educational systems that were created for this purpose cannot, by their very design and system's purpose, create or foster ecological literacy (Deenapanray et al., this issue). These systems were developed on the basis of mental models that are ignorant of basic eco-system principles for the sustainability of life on Earth. The result of this mechanical way of thinking was a model of schooling governed in an authoritarian manner that was oriented above all else to produce standardized products with the labor input needed for the rapidly growing industrial-age workplace (Senge 2012, p. 31).

2. Traditional views on learning and development.

Theories and discussions about learning and development for education over the last decennia reveal a fragmentized view and lack of attention to the relationship between learning and development. Most of all what is lacking is the vision and understanding of system behaviors, in particular, the capacity of living systems to learn, adapt, and develop. The dominant metaphor is mechanistic and based on information processing.

Absence of an integrated and dynamic understanding of human behavior from a system's perspective has resulted in short-sighted educational policies and educational systems that work contrary to ecological literacy. Debates disregard the interdependence between conditions for learning inside the student (competencies, motivation, prior knowledge and skills, and recently brain locations) and those outside the student (reinforcements, role models, demonstrations, and apprenticeships).

Moreover, conventional educational practices tend to overvalue abstract reasoning and verbal explanation above sensing, and imagination (Moore, 2012). As a consequence, the tacit intuitive understanding of compassion and care developed through relationship through which a deeper self-awareness emerges, gets neglected (Blewitt, 2006) Finally, evaluation and assessment of learning and development of the person remains limited. The focus is on results and targets and not on process, patterns of learning, and development of competencies for sustainability (Smitsman and Deenapanray, this issue).

2.1 World views

The major reason for the one-sided and non-relational conventional perspective of learning and development is the fundamental mechanistic and/or rationalistic worldviews on which these approaches are based. These views assume that complexity can best be understood by cutting the elements or components of a system into pieces and by analyzing each part separately. Understanding of dynamic relationships between elements that form the system, and its behavior, is thus lacking altogether.

Learning content then becomes abstract symbolic knowledge of individual pieces, rather than relational, process and context-based experiential knowing. By default, there is little or no place in these views for acknowledgement of intuitive sensory based processes of *knowing* characteristic for certain ages (young children) and tasks (for instance, physical and artistic activities and social communication).

The mechanistic and rationalistic tenets of current educational systems have also impacted deeply on how the student-teacher relationship is conceived, and consequently how this relationship is valued within the larger system of education. The role of the student is degraded to become a recipient for information and knowledge that is transmitted and sent by the teacher (Sterling, 2002). Curriculum design in such a system formalizes these assumptions and packages *what* needs to be taught and *when.* Standard mechanical testing procedures assess mostly cognitive abilities of the student. Only limited aspects of learning are measured by traditional tests, mainly its outcomes. The larger process of learning that includes development of new capabilities underlying leaning are hardly acknowledged at all (Moore, 2012). This standardization of information-packaging further alienates students from their process of learning. Love for learning and development as a holistic process cannot be fostered through mechanistic and standardized educational policies (see for more information Deenapanray et al., this issue).

This conventional learning through prescribed instruction via controlled relationship is in stark contrast to what stimulates learning of infants and toddlers in the first years of life. This period brings tremendous learning and development that perhaps outweighs what occurs in later years at school. The most important lesson for educators at early age is not to impose the interaction on the child but to co-construct it *with* the child (Fogel, 1993).

3. A systems approach to learning and development

The system's approach to learning and development we propose differs in important respects from traditional cognitive theories that currently dominate the field of education. System ideas have inspired cognitive psychologists in the field of education for many years. For instance, Piaget (1952, 1954) conceived children's growing cognitive abilities or intelligence as developing cognitive *systems*. The system's approach we propose, however, entails a different kind of system than the traditional closed systems of cognitive theories.

The foundation for our approach is based on scientific studies of behavior of complex adaptive systems (see e.g. Goldfield, 1995; Kelso, 1995; Meadows, 2008; Thelen & Smith, 1994). These type of systems have the capacity to self-organize and consequently to change and adapt by learning and development. The discipline of systems thinking that we refer to is based on the study of these kinds of systems. The closed systems that are referred to in traditional educational theories are systems with networks that are not designed for change and adaptation.

"According to the systems view of life, the spontaneous emergence of order and the dynamics of structural coupling, which results in the continual structural changes that are characteristic of all living systems are the basic phenomena underlying the process of learning." (Capra, 2002, p.88). Changes occur for a system's internal relationships, as well as for the system's relationships with its surrounding environment. These changes set the stage for learning *how* to adapt existing capabilities to new tasks that the system achieves, which forms the basis for development of new capabilities (see Figure 1). This reflection on capacity for learning and development as emerging from the system's self-organizing dynamics is altogether absent in traditional cognitive theories.

The systems view has inspired developmental psychologists over the past 30 years (Adolph, & Berger, 2006; Fogel, 1993; Gibson & Pick, 2000; Heft, 2001, Smitsman & Corbetta, 2010), to thoroughly investigate how young children's capabilities to act and communicate develop in continuous interaction with their social and physical surroundings. In addition, inspired by James Gibson's (1979) work on ecological perception, and Eleanor Gibson's work on perceptual development (Gibson & Pick, 2000), researchers have investigated how the process of learning and development gets fueled by children's growing capability to sense internal and external relationships with the systems they mobilize for interaction and communication purposes. By exploring a system's internal and external dynamics by sensing and attuning[1] their activities to the system dynamics (which involves sensory and motor activities), children learn to regulate their relationships and attain their goals. We base our perspective on this research. From this research we like to highlight five principles as fundamental for learning and development, with application to learning and development for ecological literacy.

1. *Learning by being part of the world* - Learning takes place in the world and is continuous; it starts before birth and people continue to learn until the end of their life.
2. *Mobilization of capabilities for new tasks and solutions* - Learning begins by mobilizing existing capabilities and experientially adapting them to accomplish changed tasks and task-demands when meeting real life challenges.
3. *Sustaining and enhancing our learning potential* - Our learning potential increases when; (a) freeing degrees of freedom that are available in the capabilities that are selected for performing tasks[2]; (b) creating more variety for (physical) tasks; e.g. patterns of movements have to become more variable and less rigid; and (c) liberating our thinking from rigid mental models that are held by constrictive belief systems and assumptions. By liberating our thinking and assumptions, we create new opportunities for exploration and hence development.
4. *Learning through feedback systems by attuning our activities to the system dynamics* - Learning is directed at attuning activities to information that arises from within the system, and between the systems that people engage with, as part of the tasks they accomplish.
5. *Learning from and for the future* - Learning and development is naturally future oriented, people have an intrinsic tendency to reach for what has not yet been accomplished and to strive for what is just beyond our reach. This is done by mobilizing current capabilities for new tasks and solutions.

Learning for a sustainable future by learning how futures emerge, are formed and sustained is a key component of education for sustainability.

Some of these principles, like principle 1, may sound trivial or obvious, yet are easily overlooked and not readily acknowledged when it comes to educational practices. Other principles, like 2 and 3, may sound counterintuitive. For instance, existing capabilities may be insufficiently developed to accomplish a new task successfully, but they may nevertheless be useful to start the process of learning. With respect to principle 3, variation and increasing degrees of freedom initially leads to errors, but later to results that are more robust and flexible. It is fundamental to the process of learning, but runs against the belief that learning progresses by limiting degrees of freedom to avoid errors, as is commonly found in educational systems that believe in strict discipline, clear rules, precise copying, and prescribed routines.[3]

3.1 Learning by being part of the world

We easily associate learning with formal education, but forget that most learning takes place outside the realm of formal education and continues for life. Learning even starts before birth. Babies in the womb learn to discriminate their mother's voice and simple song melodies (see Burnham & Mattock, 2010). Before the start of formal education an enormous amount of physical, cognitive and social learning occurs from daily interactions; such as learning to manipulate objects, walk, enumerate, make comparisons and choices, and socially engage with other people.

The accomplishments of learning before children attend school perhaps even outreaches that of learning that occurs in later years of formal education. Conventional formal educational systems of many contemporary societies place too little importance on the role of informal learning. Learning and development through informal education, especially the kind of learning and development that takes place in the first three years of life sets the stage for and supports formal education in many respects. Thorough study of early childhood has also provided and expanded tremendously our insight of what human development and learning entails, and how it is accomplished (see the Wiley-Blackwell handbook of infant development, 2010).

Learning and development are intricately linked to millions of daily interactions and experiences. This fundamental fact is easily overlooked when one confines learning to formal education and the acquisition of abstract knowledge and mental skills for solving theoretical problems separate from lived experience. Widening our scope to include learning from our daily interactions sheds light on important aspects of learning and development that may otherwise remain hidden. Firstly, every living being is part of the natural world. This relationship does not get created by learning to act and developing the capabilities to do so. Rather, our intrinsic relationship as part of the natural world is given and forms the basis and motivation for learning and development. By being alive we are in relationship with the natural world that sustains us, and in order to stay alive we continue to regulate and further develop this relationship (see Merleau Ponty, 2002). We are born with an enormous potential that results from billions of years of evolution, driven by the creative exchange and interactions between countless other species, organisms, and agents (see, Gottlieb, 1997). However, we are not born ready-made; we have a lot of growing and development to do before we can take care of ourselves. Taking advantage of our evolutionary potentials requires that we continue to learn and develop new potentials on the basis of what is available today.

Secondly, we easily attribute a privileged status to the brain with respect to our theoretical and practical understanding of the world and ourselves. But when we consider daily achievements and their tight interconnectedness with the world, we must acknowledge that brains do not and cannot function separately.

For even the simplest accomplishment, they form a system with the whole body including the physical capability of limbs to move and the capability of senses to sense and get attuned to upcoming patterns of stimulation by movement of limbs.

In every action, the relationship with the world penetrates the whole system: brain, movement apparatus and senses; the latter two form the interfaces with the world, but none has a privileged status.

To illustrate this, interconnectedness can be experienced by sensing the dynamics that arise when one opens the eyes, changes the gaze and moves around. Changing bodily postures and positions with respect to the world brings objects that were out of sight into sight (and vice versa) resulting in a continuous interchange of foreground and background.

The interconnection of different subsystems within the body, and between the body and the world, appears also in the way we sense the world differently as a result of physical changes, such as bodily growth. For instance, as children grow and learn to crawl and walk, chairs can climb-on-ables. Openings that were earlier used as crawl-through-gateways now lose their meaning as the child grows older. We may recall these some of these early childhood experiences. In other words, the way a child experiences its environment is very different from an adult. Infants learn to reach, crawl and walk in the first years of their life on the basis of a growing visual awareness of changes in (visually) sensed relationships with the world that occur as a consequence of changes in physical capabilities, such as the capability to stand upright on both legs, whether or not supported by a chair or sofa. This growing awareness guides their discovery for how to use the new capability to regulate the relationships that arise when reaching, crawling and walking. This process is cyclical and moves through several developmental stages. Awareness of current relationships with the world motivates and guides learning how to control the body to regulate the awareness and achieve new results. Improved control and developed new capabilities of the body sets the stage to engage new and a more differentiated awareness and control (see Smitsman & Corbetta, 2010). A good example of this is the delight children have when desired objects finally come in reach as they grow taller.

The ability to open the water tap by themselves when tall enough can enable children to brush their own teeth, get water without needing to ask for help, which may subsequently give rise to a whole new experience of self and environment.

3.2 Mobilization of capabilities for new tasks and solutions

To survive, live and thrive in the world, learning is an imperative from birth onwards. At birth, and also during childhood the need for learning is self-evident, since capabilities to act and socially interact are still limited. The demand for learning remains throughout life. Research of the past 30 years about early childhood development has provided many new inspiring insights (see Thelen & Smith, 1994; Smitsman & Corbetta, 2010; von Hofsten, 2007; Meltzoff & Willamson, 2010; Sacks, 1989; Gibson, 1979; Reed, 1996).

This research has explored in depth how do young children achieve the task of learning and development. The answer seems by mobilizing *existing capabilities* and coordinating them in different ways for finding new solutions. Young children use whatever capabilities they have to their availability, even for sometimes unconventional purposes. We will use the insights from this research to describe the processes of learning and development. Our assumptions are that: (i) the processes of learning and development stay the same throughout life, only what is learned changes; and (ii) educators can benefit from understanding these learning processes to better facilitate learning and development of their students. Figure 1 illustrates how the learning process unfolds.

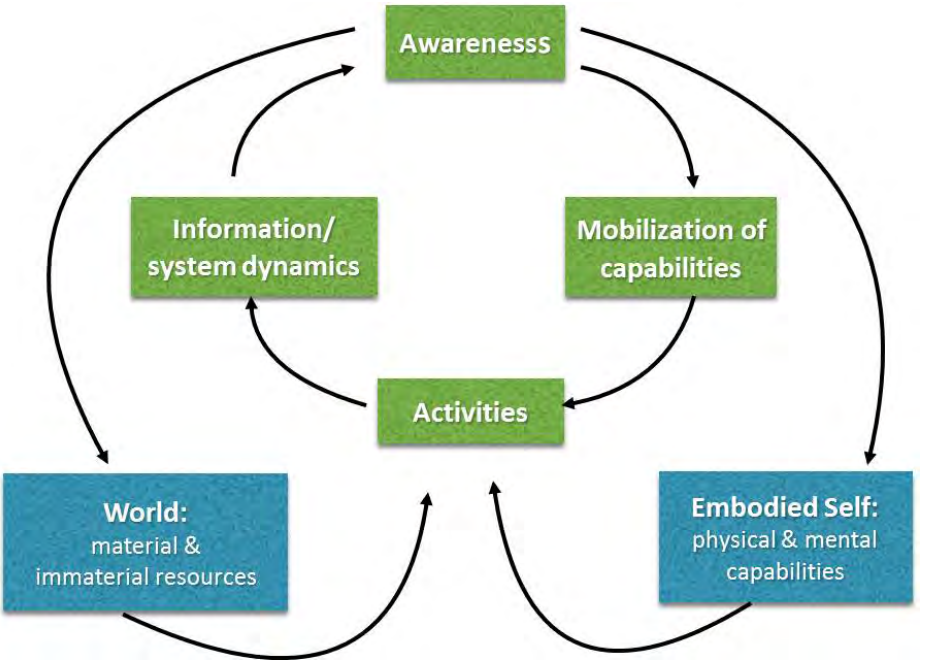

Figure 1: The cycle of learning (the inner cycle of awareness, mobilization of capabilities, activities, and information) embedded in the larger cycle of development (Embodied Self & World).
Source: Authors' elaboration.

Figure 1 shows the cycle of learning as a change in the state of awareness, and how this state is influenced and regulated by: (i) mobilization of capabilities, (ii) activities, and (iii) information or feedback. This is also called the *inner cycle of learning*. Awareness of the Embodied Self (the box on the right) and the World (the box on the left) feeds the cycle of learning via the Activities (shown via the outer loops in Figure 1). In the process of feeding the learning cycle, the Embodied Self and the World also get changed by the cycle of learning in a complementary way. These later changes we call development. Thus development involves both the Embodied Self as well as the World. This complementarity we can see, for instance, in the way that changes in social media technologies led to demands for new capabilities, and how these new social media capabilities further influenced development of new social media technologies. This in turn also influenced and changed the way people are relating with each other and the world in which they live. Not all changes in development lead to ecological literacy; increased social interaction through technologically facilitated virtual worlds may also contribute to a sense of growing disconnection from the Natural World and real life contact with people (Buckingham, 2008). Thus, changes that occur for the Embodied Self as a result of learning imply a changed World to live in and vice versa. Our experience of the world changes and expands as a result of the development of new capabilities and shrinks as a result of a loss of capabilities.

Capabilities vary between persons; from young infants' capability to flex and extend limbs, to later developing capabilities to walk, jump and dance, to the use of language, arithmetic, cell phones, and integrated thinking, to name a few.

Every person, even atypical developing children, have some capabilities on which learning and the development of new ones can be build. Capabilities form an action repertoire that gradually, but at different paces, expand and get more differentiated

when children grow up. This repertoire is physical as well as mental. The development of mental capabilities arises on the basis of physical abilities, starting at about the end of the first year of life, and is fundamentally embodied (see Damasio, 2010). Thus brain functioning is not separate from body functioning, instead it forms an integral part of it. The same applies to resources and tasks that the world entails. These can be physical, such as the opportunities to use all kind of sit-upon-ables (such as chairs) and immaterial or symbolic (such as symbolic systems for communication).

Let us now turn back to the inner cycle of learning itself, and especially the interconnection between: (i) awareness, (ii) mobilization of capabilities, (iii) activities, and (iv) information or feedback. Learning involves a state of awareness that is directed at and fed by the Embodied self and the World simultaneously. For instance, a child's discovery of her emerging capability to speak gets accompanied and fed by her discovery of an understanding parent who is willing to listen patiently and vice versa. When we move on to the other elements in the cycle of learning (Figure 1), we see that awareness as a state cannot exist without employment of capabilities to generate activities that feed this state.

These activities feed awareness by generating dynamics that entail information for acting. Children learn to attune their sensing abilities to these dynamics to become aware of the world in which they are acting, and through this receive feedback about themselves as the acting agent. As a consequence of this cyclical process our learning 'how to act' gets more differentiated, capabilities change, and new ones develop (see also Merleau Ponty, 2002, for philosophical underpinnings of this proposition).

The cycle of learning and development, and in particular this aspect of co-development between Embodied Self and World, may clarify the kind of capabilities that are important to develop for ecological literacy. For many people ecological literacy is seen as something new, and for some even contrary to the kinds of developments that are asked for from the world in which they grow up. For many students it makes more sense to learn technological and economic competencies in order to earn a living in an increasingly competitive global economy, than developing ecological literacy. It is useful to remember that our current ecological crisis is not a crisis of our Natural World; it is a crisis in how we relate with each other and our Natural World (Deenapanray et al., this issue). In the same way that young children will use whatever they have available at their stage of development to explore and meet new challenges (Adolph & Berger, 2006; Smitsman & Corbetta, 2010; Fogel, 1993; Lock & Zukow-Goldring, 2010), we need to remind students that ecological literacy is not so much a new capability as much as it is a creative realignment and repurposing of their capabilities for a (new) task and shared vision: the sustainable development of our society.

3.3 Sustaining and enhancing our learning potential

When infants begin reaching for objects at the age of 3-4 months their movements are coordinated, but also jerky. Initially, they may stretch both arms, whereas one arm leads the reach. The whole body is involved in the task, but the different limbs do not work together smoothly yet for reaching successfully. The coordination that exists stems partly from so called neonatal behavioral patterns, partly from the way activation of one limb affects other limbs, and vice versa. How do infants learn to reach more smoothly for an object? And how do children learn to adapt coordination of their movements to different locations and objects? What do they learn over months of practice and thousands of attempts before achieving the 'desired' results around 6 - 7 months of age? Such questions do not specifically apply to infants' learning and development only. They are relevant for every novice who tries to use available capabilities in new ways and for new tasks.

Children do not learn reaching by dividing their action in separate units: velocity, distance, location, and so on. Neither do they solve mathematical equations for integrating these units into a coherent solution. On the contrary, they do a much smarter thing: they learn to sense changes in relationships and how to vary their actions accordingly. More specifically, they become aware of the current state: the flapping dynamics of the hand that fails the target of the reach. They also become aware of a desired future state: a hand that moves more smoothly towards the target and can grasp it. Moreover, they also learn to sense the variables that can transform the current dynamics of the reach into the desired future state: less or more forceful activation of the arm, less or more stiffening of muscles, refining direction and so on (Thelen & Smith, 1994). Children learn to achieve all this, thanks to the freedom they gained for exploring reaching and the changes that occurred for the state of the reaching system through hundreds of attempts. Diversifying activities produces a growing awareness of future states in relation to current states, which provides information about the gap between current reality and future desired states or outcomes. Through this growing awareness children also learn how to bridge the gap between current reality and future desired states, and they learn how to keep these states of awareness active in different tasks. This learning process is the same for an infant who learns to reach as for a student who learns to solve mathematical equations. In both cases learning is grounded in a growing awareness of how to achieve the desired future states and outcomes. Conscious teachers can sense the state of awareness of their students when performing tasks. Facilitation of learning is essentially about *guiding the awareness* of the students, and encouraging students to explore the change of awareness that emerges as they vary their activities: “how does this feel, look, taste…; imagine, what could happen next; try this, and see what happens”, and so on.

Freedom of exploration of cooperation between existing capabilities in new and different ways is of utmost importance for learning and development. When freedom of exploration diminishes learning also slows down, and may even stop. On the other hand, when freedom for exploration is too large it can destabilize the system, which can also affect the capacity for learning.

We generally see little progress initially when a new system has just formed, because creation of freedom for exploration can easily perturb the system. After the system becomes more stable the span of exploration increases and consequently learning increases.

The reader may have experienced this when, for instance, learning to drive a car. Capabilities such as looking around, manually turning a wheel and handling gears while controlling pedals by feet are all available when one starts driving for the first time. But put together into the new system of car driving, visual exploration narrows down; arms, hands, and legs stiffen in the attempt to control the steering-wheel, gear, and pedals. After the new capabilities for driving the car are more fully formed, properly linked and integrated, the combinations of capabilities start to work together as an integrated system. We then no longer need to focus on each capability separately and at this stage a new awareness emerges. This new awareness enables us to free some of our attention that was previously focused on how to control the gas pedal and breaks, to now look around and get a sense of the experience of driving. This state of awareness enables us to be fully present as well as forward looking at the same time.

To conclude everyone would agree that a major result of learning is an increase in skilfulness. When referring to skilfulness, however, one often forgets that it is not absence of errors, but flexibility in capabilities that results in robustness of learning. This entails variability in performance and arises by freedom of exploration. In eco-systems this is the principle of co-operative diversity leading to resilience of the system. Flexibility should also be actively designed for in the educational systems. This can be done by challenging students to creatively employ current capabilities to work on sustainability solutions in new and innovative ways.

It will be further strengthened when they also are 'allowed' to fail, make mistakes and discover for themselves what works and what does not work. If only success is rewarded and 'failure' is shamed, children will stop exploring and start performing for approval. When children mobilize existing capabilities into a new system to accomplish a new task, failures initially precede successes. It may take hundreds of failed attempts, over weeks and months before successes arise.

3.4 Learning through feedback systems by attuning activities to the variables that change system dynamics

Feedback is essential information for learning and development. In systems thinking, feedback means any reciprocal flow of influence. In this way every influence is *both* cause and effect since nothing is ever influenced in just one direction.

There are two distinct types of feedback processes: reinforcing (or amplifying) feedback processes and balancing (or stabilizing) feedback processes (Senge, 2006, pp 74-79). These different types of feedback processes are essential for learning to take place. It provides us with the necessary information for knowing/sensing whether to change, continue, modify, balance, diminish or vary our activities for desired results. Amplification can work to promote and accelerate growth, but can also contribute to the breakdown of a system by accelerating decline. When unhealthy patterns become amplified it can lead to breakdown, when positive results become amplified it can generate more motivation for learning. Balancing (or stabilizing) feedback processes are essential for learning new capabilities. In the initial stages of new learning there is increased instability, if this instability is not stabilized at some stage to consolidate the learning, breakdown in learning can result. For example, balancing feedback for students can help them to integrate and apply what they have learned and prevent information overload. It can also be a clear signal that the student needs rest and time for reflection. It is essential that educators are aware of these different feedback systems and their role and purpose for learning and development. Feedback from the student can provide teachers with the necessary information for knowing what to share, how and when to aid the students in their learning. Feedback from the teachers can provide students with the necessary information about their learning progress, and especially when this feedback provides information about quality and quantitative aspect of their learning activities (see also Meadows, 2008, for more information about systems thinking).

We discussed earlier the importance of information generation for learning by active exploration of how to accomplish a task (see Figure1). Ecological psychologists and developmental psychologists (for a review see Smitsman & Corbetta, 2010) have studied the generation of information in leaning and development (see Michaels et al., 2008). We will not dwell on this research, because that would be beyond the scope of this article. However, two points are worth noticing. Firstly, the common concept of 'information' does not agree with what we mean by 'information' as described in the model of Figure 1. Messages, instructions, articles, pictures, movies, and even the environment and the body are not information. Rather, they form conditions for the emergence of information. Information first arises in the relation between an active receiver of stimulation (e.g. the student) and the source of the stimulation. Active in this case entails more than translating (decoding), it also involves listening, looking around, touching, reading, walking, communicating by words and gestures, and so on.

Secondly, for teaching this means that teachers are not simply passing on information, instead they organize conditions for the emergence of information. This means that teaching should not solely be directed at *what* needs to be taught and learned, but also *how* learning can be facilitated by designing tasks, and set-ups that evoke appropriate activities for learning. In the EFS programme this is emphasized through experiential learning methodologies and learning in dialogue with place in and from Nature (Smitsman and Deenapanray, this issue).

These activities involve attentive observation, careful listening, reading and using systems thinking for working on a problem, as well as undertaking certain activities that may initially appear not to bring information for the tasks at hand. From developmental research we can learn that children learn and develop through the information they generate, challenged by the tasks and settings they get engaged in.

When we start to observe children, we can see a lot of spontaneous activity and exploration that may at times appear to have no purpose whatsoever. As we continue our observation we can see how children from these perceived random activities actually attune their actions for information that will finally lead to success and stabilization of the success. This is in sharp contrast to conventional formal education, where students are rarely provided with the freedom to undertake activities that may initially not appear purposeful to the competencies that are to be mastered. This is why in the EFS programme so much emphasis is placed on the right linking and collaboration/synergies between subjects and curriculum activities. Initially it may appear as if learning mathematics and learning music has nothing much in common, yet studies have actually shown how playing Bach and Mozart can directly contribute to better math results.

Coming back to our earlier point about feedback systems; in conventional education students are not asked to provide or generate feedback for their learning progress. Instead, students are being evaluated and judged according to tests and assessments that may not even involve any relationship between the one assessing and the one assessed. In the absence of the student's own participation in her/his learning evaluation, the student does not receive the kind of feedback needed to stimulate further learning. In such a system students mostly learn how to generate expected results and outcomes, but are not engaged to learn *how to learn* or develop their learning potential (see also Smitsman & Deenapanray, this issue).

Finally, there is one more aspect of information feedback that we like to draw attention to, and that is the role of information feedback for selecting appropriate tasks for learning.

It is important that the teacher is aware of the capabilities of the students, and understands the type of activities and conditions the student requires to support her/his further learning and development. Matching capabilities with the right kind of tasks for using these capabilities can make all the difference between empowering or frustrating learning experiences. For the sake of simplicity, we confined the system of teaching to the dyadic relationship of teacher and student. However, it actually involves other components, which feedback on the process, some more directly (other students, in the classroom, the classroom climate), others more indirectly (collogue teachers, management, etc.). In reality, teaching and learning encompasses the whole school community, hence the analogy of 'Schools as Learning Communities'.[4] In summary, education systems that foster learning and development enables information creation and feedback from dynamic interactions between the elements of the whole system (Meadows, 2008). Information feedback can accelerate and balance activity in the system and gets generated through the interactions and interconnections between the elements of a system (e.g. teachers, students, caretakers, management, non-teaching staff). Top-down information transmission and feedback does not stimulate development. Experiential learning and active participation from students in their evaluation and learning processes forms an essential component of education for sustainability.

3.5 Learning from and for the future

Learning would be blind without a sense of future states that can be acquired, or awareness of what becoming more skillful and knowledgeable entails. This requires a sense of direction or a sense as to whether current activities will contribute to become more skillful and knowledgeable, or not. One may wonder what drives children over and over again to initiate new challenges for which existing capabilities are insufficient, unless they organize them in different ways. The answer cannot solely be found in the experience of past successes, since development proceeds as a result of many

failed attempts. There has to be more that motivates learning and development; like the emerging awareness of a dawning future and the desire to manifest that future. This desire gets further fed by the growing clarity that results from relentless efforts for achieving what this future might entail and how it can be made manifest (see also discussions about Senge's five disciplines, and especially discipline 1 'Self Mastery' in Senge et al, 2012). This sense of future emerges at the horizon of current capabilities, and is brought closer by modifying these into new capabilities for accomplishing this future state. Vygotsky (1978) has put forward a similar notion in his theory of the zone of proximal development, and pointed to significance of this zone for children's development (see Reed & Bril, 1996). The creation of a future has also been beautifully phrased by the Spanish poet Antonio Machado in the first phrases of his poem Wanderer (1979):

"Wanderer, your footsteps are the road, and nothing more;
wanderer, there is no road, the road is made by walking.
By walking one makes the road, and upon glancing back
one sees the path that will never be trod again.
Wanderer, there is no road. Only wakes upon the sea."

Awareness of an emerging possible future, grounded in a sense of growing expertise that is fed by current activities forms the primary motivation in every learning task. The time in which children are currently growing up with growing uncertainty about our future makes learning for sustainability even more important. Sustain-ability requires that we learn how to adapt to climate change, how to develop resilience in the face of growing scarcity of vital resources, and this requires that we increase our learning potential in ways we never had to do before. Learning for sustainability is learning to think in entirely new ways and this requires a major transformation of our educational systems and society in general. If the purpose of education is to prepare students to live a meaningful life and contribute to the world in positive ways, then education needs to prepare students for the future that they may inherit as a result of past and current actions. Without this context of understanding our sustainability challenges, student will not know what choices can contribute to their and other people's wellbeing, now and for the future (Deenapanray et al., this issue). Learning how to sustain and enhance their learning potential will further support students to learn how to meet challenges as opportunities for further growth in awareness, care, compassion, resourcefulness and skillfulness.

In this way education can instill in students a sense of *active hope* as co-creators for the future we all desire. Active Hope is about becoming active participants in co-creating what we hope for (Macy & Johnstone, 2012). The tasks ahead of us are tremendous and it is easy for people to feel overwhelmed or believe that they cannot change the future. Education for sustainability prepares students how to respond pro-actively to changes that are coming that are beyond their influence, whilst showing all the little ways that they can help shape the future in their local context.

When students learn how to creatively employ existing capabilities in new combinations, and for new and different tasks, this will directly stimulate the kind of change in thinking and approach that is so essential in learning for sustainability. Our existing capabilities form the basis for further learning and development. With our current capabilities we can learn how to create different future outcomes, once we free our capabilities from the mental models through which those developed. [5]

4. Dynamic Systems and their futures

Learning and development form self-organizing non-linear feedback systems. Such systems are inherently unpredictable. You cannot make a complex system do what you want it to do. But, although their future can't be predicted, it can be envisioned and brought into being through care (Meadows, 2005, pp. 194-195). Yet, in contrast to this fact, people have designed educational systems precisely to control future outcomes – e.g. to ensure that all students who pass through the system attain similar knowledge

and skills that can be applied to tasks suited for jobs that society has designed on the basis of past and current economic systems. This shift from attempting to control the future to learning how to bring this into being is an incredibly important transformation in thinking about education, one that is at the forefront of education for sustainability. Through training in systems thinking, teachers and students can learn to listen to what the system tells us and discover how its properties and our values can work together to bring forth something much better than could be produced by our will alone (Meadows, 2005, p.195). This shifts the focus from blame, judgment, expectation and disappointment, to one of curiosity, openness to the learning and development of students and teachers, and a willingness to discover and explore the various potentials that the system dynamics afford for.

If education is to play a transformative role in society its purpose will also be to help bring about a different future. The following principles may be useful to keep in mind to better understand this process for transformation to sustainable futures: i) awareness of a future state needs to be brought to life, and be kept alive by current activities; ii) current activities need to stay embedded in the awareness of future state(s) that are wanted and not drift away from them, and iii) current activities need to feed the awareness of future states in ways that both the awareness of what can be reached as well the awareness of what needs to be done become more differentiated. This later principle encompasses the planning of activities.

The principles above apply to the whole educational system. Good teachers are aware of these principles and will guide their students to take advantage of the feedback systems that create different system behaviors and thus different future outcomes. This includes knowing what information to introduce when, e.g. when to keep something at the horizon and when to bring it closer for further analysis and more direct experience.

Bringing students to the horizons of their understanding will challenge them to stretch their thinking beyond current understanding. Teaching should stimulate forward looking learning over short as well as longer distances in time and space. As said by Theobald (1999, p. 173): "*Learning results from challenge. There will be few positive changes so long as schooling remains homogeneous, bland and boring. Education, like life, should be exiting, surprising and fun. Positive development occurs as people have experiences with the unexpected. The vital skill is to stretch students and to challenge them to do a little more than they feel capable of managing, not only intellectually, but in many other ways*. "

5. Conclusions

The 5 principles for learning and development discussed in this paper support to better understand from a system's perspective how to facilitate learning and foster development of students in such a way that this leads to ecological literacy:

1. *Learning by being part of the world.*
2. *Mobilization of capabilities for new tasks and solutions*
3. *Sustaining and enhancing our learning potential*
4. *Learning through feedback systems by attuning our activities to the system dynamics*
5. *Learning from and for the future*

These learning and development principles align well with the principles for education for sustainability (see Smitsman and Deenapanray, this issue): (i) All education is education for sustainability; (ii) Systems thinking & holistic approach to education; (iii) Experiential learning in and from nature; (iv) Education in dialogue with place; and (v) Schools as Learning Communities. Ecological literacy implies a broad understanding of how people and their societies relate to each other and to natural systems, and how they might do so sustainably (Orr 1992, p.92). This presumes both an awareness of the interrelatedness of life and knowledge of how the world works as a dynamic system. This kind of literacy cannot be developed by solely learning about sustainability issues and principles.

It requires a more fundamental shift in the way learning is facilitated and the role of the learner in its journey towards ecological literacy. Learning about nature and learning from nature are not the same. This also supports a more holistic understanding of what drives and influences behavior. Teachers who participate in the EFS trainings receive training for how to apply these learning and development principles in the classroom (Smitsman & Deenapanray, this issue). Students are bombarded by so much information on a daily basis without a deeper context for meaning and understanding of interconnectedness.

Many students complain that they do not know how to choose between all the options presented to them because they cannot oversee cause and effect over time without considering the larger system dynamics within which these choices take place. Education for sustainability is future oriented education. It is in this ongoing cycle of learning and development generated through interactions (experiential learning) and interconnections (relationships) that a sense of future and a path to this future can emerge from present reality as a lived experience.

This ability of learning how to make visible the often hidden connections between events and factors of influence, and the ability to stay attuned to the information that is generated through feedback systems in the forms of pattern, flow, and process is vital for the development of ecological literacy. The above principles provide guidance on how to embed this in the facilitation of education and systems design for education. To better understand how education inspired by these 5 principles can contribute the development of ecological literacy, we have to go back the schematic of Figure 1 - the cycle of learning. This Figure shows how the cycle of learning is embedded in the larger cycle of world and tasks on the one hand, and capabilities on the other hand, both described as resources. Existing resources on both sides provide input and feedback for the cycle of learning and evolve as a result of the cycle of learning. This cycle further shows that the world, tasks and capabilities one becomes aware of arise as a result of the information feedback that is created through the activities that take place in the process of learning. This demonstrates beautifully why placed-based education and learning in and from Nature is so essential for ecological literacy development and cannot be taught artificially and without direct experience of Nature and living systems.

Notes

1. Attuning in this context is a technical term in psychology used to describe' being aware of and being response to another'.
2. Degrees of freedom relate to the variation that, in principle, is available for performing activities. This is discussed in more detail in section 3.3.
3. In this case, variation in tasks by opening the degrees of freedom in the learning system is done gradually and with awareness of the right degrees of freedom for developing resilience by enhancing flexibility in the learning.
4. This is principle 5 of the Education for Sustainability principles (see Smitsman and Deenapanray, this issue).
5. If, for instance, a student has only learned mathematics to solve mathematical equations and is not stimulated to apply this capability for different tasks and contexts, it will be difficult for this student to employ this capability for co-creating different future outcomes.

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The Education for Sustainability Programme

Anneloes Smitsman and Prakash N K Deenapanray
† ELIA – Ecological Living In Action, La Gaulette, Mauritius
(Corresponding author: *anneloes@ecolivinginaction.com*)

Abstract

In 2011 the Catholic secondary schools that are part of the Catholic education network embarked on an extra-curricular programme for Ecological Literacy Development (ELP) developed by ELIA-Ecological Living In Action (ELIA) in collaboration with the Bureau of Catholic Education (BEC). In 2013, this evolved into the Education for Sustainability programme (EFS) that is being integrated into the curriculum work plan and school activities for three selected pilot schools in Mauritius – Loreto College Curepipe, St Mary's College Rose-Hill and BPS Fatima Goodlands. This paper provides an overview of the EFS programme and lessons learned since 2011, with an outline of how the EFS programme will unfold over the coming years in the Catholic schools in Mauritius.

Keywords: Education for Sustainability programme; EFS pilot schools; ecological literacy for sustainability.

1. Introduction

The Education for Sustainability (EFS) programme is developed and facilitated by ELIA-Ecological Living In Action (ELIA) in collaboration with the BEC to support (conventional) educational systems to become learning organizations and communities of practice for sustainability. The main objectives of the EFS programme are:

1. Implementation and mainstreaming of Education for Sustainability principles and practices in educational systems, starting with schools.
2. Setting-up a collaborative platform for sharing best practices for promoting EFS among all relevant stakeholders, such as government schools, private schools, NGOs focused on education, stakeholders from the green building movement for development of green schools, and for attracting collaboration with key institutions for sustainability education regionally and internationally.

The EFS programme was initially developed as an extra-curricular project in 2011 for the 18 Catholic secondary schools that are part of the BEC network.

Since 2013, and after review of the initial phase, the programme is being mainstreamed into the school curriculum system in three selected pilot secondary schools in Mauritius - Loreto College Curepipe (LCC), St Mary's College (SMC) Rose-Hill and BPS Fatima Goodlands. Through the EFS programme, the capacity of the pilot schools is being developed with the aim of replication in the other secondary and primary Catholic schools in Mauritius. The programme is also available to other schools outside the BEC network wishing to join in. As has been discussed by Deenapanray, Smitsman and Chung Kim Chung (this issue), most of the current and conventional educational systems do not foster ecological literacy for sustainability. In contrast, schools often contribute to the problem of unsustainability by failing to support teachers and students to develop the necessary competencies for contributing to sustainability solutions.

EFS competencies include, among others: integrated thinking (or systems thinking), pattern recognition, understanding of eco-system principles and their applications in human activities and social organizations, sustainability stewardship and relationship, reflective and creative thinking, and the capacity to envision and dream a sustainable society and future.

The EFS programme has been designed to address the gap between 'what education needs to be for' and 'the current reality of what education is contributing to'. When the programme started in 2011, it was developed in response to the appeal of Mgr. M. E. Piat, Bishop of Port-Louis (Mauritius) to link religious practice with ecological responsibilities. In his Pastoral letter titled "Developing a new art of ecological living",Mgr. Piat highlighted that ecological responsibility for our planet and the wellbeing of future generations is imperative.

He recommended that the Catholic educational institutions need to take a leadership role to prepare students in their ecological literacy development and capacity to act on these ecological responsibilities (Diocese of Port-Louis, 2011).[1] This is how ELIA and the BEC developed a partnership to support the achievement of this commitment.

In February 2011, permission was granted by the management of the 18 Catholic secondary schools to introduce ecological literacy development through extra-curricular projects and teacher training. The programme started with an Ecological Footprint Analysis (EFA) project and teacher training in systems thinking, learning and development for ecological literacy, and ecological living practices. At the end of 2012, and on the basis of an evaluation exercise with inputs from all relevant stakeholders, the programme was redesigned to achieve more impact and renewed engagement and support from the school communities. Some of the decisions emanating from this review were: (i) permission was granted to continue the programme within the curriculum system; (ii) the name changed from Ecological Literacy to Education for Sustainability; (iii) three pilot schools were selected from the 18 Catholic secondary schools to implement the revised EFS programme, and; (iv) the EFS Charter and Pledge was created and signed by the EFS pilot schools and the BEC management to signify the commitment to Education for Sustainability. Section 2 provides a more detailed overview of the evolution and development of the EFS programme into its current form.

2. The evolution and development of the EFS programme from 2011-2014

When the programme started in February 2011 extra-curricular activities and training were the only options. By providing a soft introduction to ecological literacy development in this form, changes could be introduced gently without too much resistance. The initial goal of the (Ecological Literacy Programme) ELP was to: "*Enhance the competencies of educators, students and practitioners in addressing sustainability issues through experiential learning*."

The objectives of ELP were to:

1. Use Ecological Footprint Analysis (EFA) as a tool to quantify the footprint of school activities through a co-learning practice between teachers and students; and
2. Train teachers to employ a systems approach so that creative and integrated actions can be found and applied.

ELP started with the Ecological Footprint Analysis (EFA) in the schools. All the 18 secondary schools in the BEC network were invited to measure their ecological footprint in terms of their consumption (food, consumables, transport, and utilities) and waste production. Each school was provided a customized Ecological Footprint (EF) calculator for Mauritius designed by ELIA together with training in EFA. As an example of EFA at St Mary's College Rose-Hill, please see Bangari et al. (this issue). As students and teachers measured the EF of schools and learned about the growing EF of Mauritius, it became clear why learning for sustainable development is essential. Teacher

trainings were carried out in systems thinking (including system archetypes and mental models), ecological living practices, and learning and development for ecological literacy. The latter was facilitated by Prof Smitsman (retired developmental psychologist from the Radboud University of Nijmegen). These trainings were attended by selected teachers (also known as 'mentors') and coordinators from the 18 secondary schools.

About 50 teachers were trained over this period and approximately 10,000 students were involved either directly or indirectly in the programme between 2011 and 2012. For a summary of the lessons that emerged from this period please see Table 5 in Section 2.4.

2.1. Evaluation of ELP in 2012

In May 2012, ELIA facilitated a multi-stakeholder evaluation and dialogue session to review the ELP and to chart out the way forward. After 14 months of programme implementation it became clear that several challenges needed to be addressed if the programme were to continue and achieve its objectives. Many of the teachers involved complained about the heavy workload that was added to their already busy schedules. The lack of whole school support for the ELP initiatives was also reported as an obstacle. The evaluation through multi-stakeholder dialogue was designed to find out what were the underlying causes for these experiences and outcomes. The key questions that the evaluation sought to answer were:

1. How could it be ensured that ecological literacy and learning for sustainability becomes a priority for the system of education and not marginalized to a class about environmental education?
2. By which design would teachers and students be able to carry out their commitments to programme with support and engagement from the school system of the larger school community?
3. How could the programme achieve more impact in the system of education and enhance the experience of learning for sustainability
4. for all members of the school community?
5. How could the programme contribute to the necessary transformation of the dynamics of the school and the educational systems?, and
6. How could the programme support schools to become learning organizations and communities of learning and practice for sustainability?

For the evaluation, each of the 18 Catholic secondary schools was asked to send 2 students, 1 mentor and the school Director or Deputy Director. The stakeholders were divided into 6 groups of between 9 to 10 persons, and each focus group was mixed with respect to the type of stakeholder (student, mentor or management) and school representation. Two questions were put to each group in order to guide conversations about the philosophical foundation and value propositions of education, and to assess the attitudes about and understanding of ecological literacy.

In combination, the questions revealed to what extent 'ecological literacy' was seen as important and as an integral part of the 'purpose of education'.

Q1. What is the purpose of education?

Q2. What are the key actions for ecological literacy?

2.2 Feedback and outcomes

The different aspects of 'purpose of education' given in Table 1 do not follow any order of priority, and do present varying degrees of overlap. The overlaps have been maintained to better capture the nuances in the participants' responses.

Table 1. Consolidated results for Q1 on the purpose of education

Index	Purpose of education
1	To contribute to the overall development of a fully-accomplished, and happy person (academic, moral, physical, spiritual, ecological)
2	To develop a sense of belonging to a community and the planet (social relationships &respect for others; être bien en soi-même; emotional intelligence)
3	*Avoir un système pour que l'enfant réussisse sa vie* (to find your way in life) avant de réussir dans la vie – a system for the child to find himself/herself and to succeed in life
4	Help child to develop his/her talents (academic and non-academic capabilities), and to make use of them afterwards (for autonomy)
5	To socialize and succeed in life (have a place in society; status-role; money)
6	To seek knowledge (learn consequences of human action and learn the 'why' and 'how' of things)
7	Transmission and sharing of knowledge, experiences and values (to pass one heritage and inspire others)
8	Acquisition of skills

Source: Extracted from group discussions.

Table 2 shows the consolidated answers to Q2. The order of the actions is not prioritized.[2]

Table 2. Consolidated results for Q2 on actions to achieve ecological literacy

Index	Actions for ecological literacy
1	*Comprendre le sens même du mot* 'ecological literacy' – to understand the meaning of the words/of the concept 'ecological literacy'
2	Introduction of ecology in existing curriculum and subjects & introduce new subjects like agriculture/gardening
3	Learning by doing / experiential learning (especially learning in nature; by doing outdoor activities like gardening and discovering natural sites of Mauritius)
4	Review of teaching techniques (Use of multi-media (modern technology) in teaching and interactions & not just talk and chalk)
5	Exchanges between secondary and primary schools
6	Engage in long-term green activities (review lifestyle; rationalize use of resources; car-pooling; applying 3Rs in waste management etc …)
7	Better relationship between students and teachers
8	Develop intrinsic motivation

Source: Extracted from group discussions.

In order for the actions (see Table 2) to be effective in achieving the purpose of education (see Table 1), several enabling factors have been extracted from the focus group discussions. The enabling factors form the set of resources and conditions within which the actions are implemented and the stakeholders operate.

The enabling factors are listed in Table 3. It is pointed out that the list of enabling factors may not be exhaustive since they are an indirect outcome of the brainstorming process – i.e. no question was directly put to the participants to probe the enabling conditions and resources required specifically to implement ecological literacy and to achieve the purpose of education drawn out in Table 1.

Table 3. Overview of enabling factors

Index	Enabling factors
1	Learning must be fun (e.g. use of games)
2	Ecological literacy starts at home
3	Need proper infrastructure (not specified)
4	Must start from early childhood (pre-primary / primary levels)
5	Introduce 'environment' as an examinable subject

Source: Extracted from group discussions.

The feedback and input from participants through the evaluation and dialogue session revealed that the following key issues needed to be addressed for the redesign and further implementation of the programme:

1. The 'purpose of education' generated by the participants are fully aligned with the objectives of the Ecological Literacy Programme, yet many participants had not grasped that ecological literacy answered to the deeper purpose of education;
2. Participants voiced difficulties in understanding the concept of 'ecological literacy' when answering Q2, while their understanding of the purpose of education showed otherwise. This paradox seems to be rooted in a misunderstanding of the word 'ecological' (or of the word 'ecology'), since it is clear that the understanding of the vision of 'ecological literacy' is already acquired;
3. Experiential learning, such as provided by the Ecological Footprint Analysis (EFA), needs to be reinforced by scaling up the application of EFA, and through other activities like more contact with nature and further development of relational skills. Further, the learning (and the process of learning) should be fun;
4. Use of methodologies other than 'chalk and talk' should be promoted (e.g. games and multi-media);
5. Creative ways must be found to introduce the concepts associated with 'ecological literacy' in the existing curriculum;
6. Since 'talents' are multi-dimensional, 'methodologies' (point 4) and 'creative ways' (point 5) should foster learning and enquiry across multiple dimensions (all senses, abilities [academic and non-academic], imagination and multiple intelligences) and across the curriculum;
7. There is a need to investigate ways to bridge the gaps between secondary-primary-pre-primary.

2.3. Moving forward

Based on the above recommendations, changes were made to the programme. Table 4 compares and contrasts the initial (2011-2012) and revised (2013-2018) ELP. The revised ELP is now known as the Education for Sustainability (EFS) programme.

Table 4. Programme Developments 2011-2018

Period	Name of Programme	Implementation	Activities	Trainings	Schools
2011-2012	Ecological Literacy (ELP)	Extra-curricular	• Ecological Footprint Analysis (EFA) • EFA competition between schools	• EFA • Systems Thinking • Learning & Development principles for EL • Ecoliving practices	18 Catholic secondary schools part of the BEC network
2013-2018	Education for Sustainability (EFS)	Within the curriculum system of the schools: • *Three subjects: Sciences, Social Studies, and Human Values – synergy* • *Activity Clubs* • *Eco-Student clubs*	• EFA • Eco Challenge competitions • School gardens • Eco-Clubs • Eco-retreats • EFS campaigns • Sustainability Awareness days	• EFA • Systems Thinking • Learning & Development principles for EFS • EFS Charter implementation • Stewardship & Peace education • Communication & social media • EFS Teacher training	• Curriculum implementation in 3 pilot schools: LCC, SMC, BPS Fatima • Linked-in learning opportunities for the other Catholic schools (primary & secondary)

Source: Authors' elaboration.

To implement the programme, each pilot school has identified teachers who are willing to act as EFS mentors. These mentors are being trained to teach other teachers in the basics of EFS. The mentors also receive training on engagement and communication for EFS. A key objective of the learning-by-doing capacity building approach is for the pilot schools to run the EFS programme without external support by 2019 at the latest.

2.4. Lessons learned

The implementation of the ELP over the period 2011-2012 provided many valuable lessons. The approach taken was to make the most of the openings that the system provided to introduce ecological literacy development via a 'learning-by-doing' and project-based approach. As with many things new or different, resistance did arise in schools from teachers and management to different degrees. This was particularly acute in persons who are not intrinsically convinced about the need for sustainability education, and reluctant to make the behavioural changes that were identified through the EF measurements.

Table 5 provides a summary of the main lessons learned and how they have been addressed in the redesigned EFS programme.

Table 5. Overview of issues, lessons learned, and implementation in 2013-2018

Main Issues	Lessons learned	Implementation
A. *Time pressure and multitude of tasks; students & teachers are working with tight school curriculum and private tuition, which makes it difficult to introduce something new.*	1. Find ways to implement EFS as part of the curriculum to ensure that EFS activities and training take place within school hours as much as possible. 2. Demonstrate how EFS competencies support and enhance the development of conventional competencies. 3. Work with the curriculum subjects as much as possible, avoiding adding new course content.	• Since 2013 EFS is implemented in three subject areas – Sciences, Social Studies and Human Values • Since 2014 Ecological Footprint Analysis is conducted as part of ActivityClasses and is broken down in different levels, starting with Form 1 in 2014, Forms 1 & 2 in 2015, Forms 1,2, and 3 in 2016 up to Form 5 in 2018. • During EFS trainings, teachers are invited to provide examples and case-studies of their deliverables and challenges. EFS competencies like systems thinking is then offered in support of those deliverables. Pedagogy for EFS is provided to support student engagement and improve student-teacher relationships.
B. *Difficulty in getting other members of the school community involved (fellow teachers, students), support from non-teaching staff) in the Ecological Footprint Teams on the basis of only interest and commitment.*	1. Interest and voluntary commitments to EFS alone are insufficient to develop continuity of learning for sustainability over time. 2. Involvement on the basis of interest and commitment alone does not lead to embedding of the EFS principles in the system of education.	• EFS participation is compulsory since 2013 for the EFS pilot schools. • Since 2013, training and support is given to the three pilot schools to embed the EFS principles and practices in the school system and create synergies between the curriculum subjects. • Since 2014, Ecological Footprint activities for teachers and students of the selected subjects and Activity Classes are part of the curriculum activities and are thus compulsory. • Extra-curricular activities through Eco-Student Clubs remain possible for those who like to go beyond the school requirements. These students and teachers are supported to help drive, mentor and catalyse changes for sustainability within the school system and community.

C. Lack of engagement and support from other staff members and students who were not directly involved in the EFS activities.	1. When changes and new competencies are introduced as extra-curricular it marginalizes the priorities for these changes and new competencies. 2. The structure of extra-curricular activities limits communication and system engagement of support from other stakeholders within the system. 3. Those who do not share similar interests and convictions find it hard to understand why priority is given to the development of these new competencies. 4. Those who are not directly involved and observe how much extra time is demanded for involvement maybe reluctant to support out of fear that support may lead to requests of their involvement.	• See implementation of A & B for the change from extra-curricular to implementation within the curriculum work plan. • An EFS Charter and Pledge was developed in 2013 and signed on 19 February 2014 by the 3 pilot schools and the leadership of the BEC. This sent a clear message to the larger school community about the importance that was given to transformation of the educational system to achieve EFS. • Communication strategies have been created and are being implemented in each of the pilot schools to explain the EFS Charter and Pledge to the entire school community. • EFS case-studies and best practices from the pilot schools are shared through the EFS platform and EFS social media. This news sharing and positive feedback and acknowledgement from local and international community stimulates further commitment and engagement.
D. Resistance to change	1. People are reluctant to change their habits and patterns if they do not observe personal and professional benefits from these changes. 2. People are reluctant to change their behaviour if this upsets their deeper belief systems and securities in life. 3. People are reluctant to embrace change of something new unless they understand and accept the deeper meaning and purpose for these changes. 4. People feel uncomfortable with too many changes at the same time; one step at a time in a way that leads to ownership of these changes tends to give better results.	• The EFS programme has secured support at the highest level of the school leadership for changes resulting from implementation of the EFS principles and practices. • Training in System Thinking to safely reveal and expand mental models supports the deeper changes in personal convictions and helps transform barriers to learning for sustainability. • Training in climate change, sustainability challenges, and Ecological Footprint provide a compelling framework of meaning, purpose and relevance for the necessary changes. This also reminds participants that these changes are required from everybody in society. • The context of change is embedded in real life examples and experiences to ensure that participants can personally relate with the changes required. • The deeper changes within the system have been prepared through training of mentors over three years to drive the changes on the ground.

E. Involvement of parents and the Parent Teachers' Association (PTA).	1. Due to limited time availability of EFS trainers, the large size and scope of the programme, and by prioritizing on meetings with teachers over parents it has been challenging to have direct contact with parents and PTAs.	• In 2014 emphasis is placed on the EFS schools to communicate the EFS programme to the parents via school newsletters and sharing of the EFS platform. • EFS mentors in each of the pilot schools are asked to involve the PTAs of their school to ensure that parents understand the changes at school and support their children's ecoliteracy at home.
F. Engagement of students & teachers via online learning platform and social-media.	1. Many teachers and students lack the technological and social media skills and means for participating through online platforms. 2. Many students and teachers are shy or reluctant to share their opinions and feedback online when they feel unsure about the extent of their own literacy of sustainability issues. 3. It is difficult to get people to voluntarily adopt new habits of communication unless there is an immediate need and incentive.	• In 2011, an online learning platform was created as part of the BEC website. This was not very successful due to lack of participation from stakeholders and the platform became dormant. • In 2014, a new platform has been created with full social-media integration and online forums and registered under the name of the programme on its own domain and server. • Since 2013, training is given to the EFS mentors on how to use social media and technology to communicate their work and create engagement of others from the school community. • Training of students in social media and computer technology for participation in the online EFS platform is provided as part of the curriculum activities in the Computer + Communication & Media Clubs. • Engagement on the EFS platform by stakeholders outside the school community is provided to help boost online conversations and reduce barriers to communicating. • EFS teaching and sustainability awareness resources are provided through the EFS platform and social media networks to encourage teachers and students to go online to access and apply these resources in their work with students.

Source: Authors' elaboration.

3. The Education for Sustainability (EFS) programme 2013-2018

The integration of the EFS programme into the school curriculum and school system is ground-breaking in Mauritius. Between September and October 2013, ELIA together with the EFS pilot schools developed an EFS Charter and Pledge that outlines the vision, mission, principles and actions for education for sustainability. These principles are based on David Orr's foundations for ecological literacy (Orr, 1992, pp. 90-92; Deenapanray et al., this issue, Table 4). The EFS principles are:

1. *All education is education for sustainability.*
2. *Systems thinking & holistic approach to education.*
3. *Experiential learning in and from nature.*
4. *Education in dialogue with place.*
5. *Schools as Learning Communities.*

On 19 February 2014, the 3 pilot schools together with the BEC Leadership, Mgr Maurice E. Piat (Bishop of Mauritius), and ELIA-Ecological Living In Action signed the EFS Charter & Pledge. The contents of the EFS Charter and Pledge emanate from the school communities via multi-stakeholder dialogues involving students, teachers, school management, and non-teaching staff. For more information about the EFS Charter and principles see Chung Kim Chung and Smitsman, and Deenapanray et al. (this issue).

3.1. The formal context of education in Mauritius

In order to better understand the Mauritius context for the EFS programme, we provide a brief overview here of the government's strategic commitments to educational reform and the direction it proposes education should provide for. The educational systems in Mauritius consist of public, private and semi-private educational institutions. The public institutions are largely based on the French and English educational models, inherited from the colonial systems that were in place until Mauritius gained independence in 1968. As Chung Kim Chung and Smitsman discussed (this issue), the educational system in Mauritius (and this is also the system for the EFS pilot schools) is still conventional. It follows the post-industrial model: at secondary school level subjects are taught in time-table slots of 40 minutes, learning is still heavily dependent on prescribed textbooks, and not much time is left for experiential learning and group work, except during activity periods. However, initiatives are starting to make learning more interactive and enquiry-based. Gradually, more emphasis is placed on development of competencies via project-based learning and by building bridges between curriculum subjects (MIE, 2009).

As Deenapanray et al. (this issue) have discussed, the Education & Human Resources Strategy 2008 – 2020 mentions that: "*It is today recognized that the ultimate objective of any educational enterprise is to improve student achievement so that individuals may fulfil their personal aspirations for a sound, value-based lifestyle and also become positive contributing members of society. This requires new systems, structures, tools and knowledge. But more than anything else, the culture of the education and training system must be realigned: the focus should now shift from access – which is today a reality – to quality and relevance.*" (ROM, 2009, p. 12)

The EFS programme addresses the quality and relevance of education by responding to the deeper question of 'education for what purpose'. Furthermore, the EFS programme empowers teachers and students with the knowledge and understanding that 'fulfilling personal aspirations for a sound and value-based lifestyle' within the context of socio-economic systems that require major reforms to achieve sustainable development goals is challenging at best. Indeed new systems, structures, tools and knowledge are required, and this requires also a change in the 'process for change'.[3] This includes the transformation of the mental models on which the previous systems rested.

The government's Education and Human Resources Strategy Plan (EHRSP) mentions: "*Greater attention will be paid to curriculum development and review as a regular activity of the Ministry so as to respond to emerging and future needs of the economy and society. "Vocationalisation" of secondary schooling will be phased in while all attempts will be made to embed a culture of scientific thinking in line with the drive towards sustainable development*." (EHRSP, 2009, p.74)

Scientific thinking does not necessarily provide the framework and thought leadership for ecological literacy for sustainability (Deenapanray et al.; Smitsman & Smitsman, this issue). It only does so when it has a strong foundation in Systems Thinking and the theory of adaptive complex systems. Moreover, as UNESCO has pointed out, Education for Sustainable Development (ESD) needs more than scientific thinking, and should in fact also include learning from indigenous knowledge systems and oral traditions (see Boven & Morohashi, 2002). Moreover, the literature on ecological literacy showcases again and again, that it is not a culture of scientific thinking alone that will lead to ecological literacy for sustainability. Instead it is integrated thinking, holistic thinking, development of care and compassion, reflective thinking, creativity & arts, and most of all the ability to learn from our natural environment and each other through deep appreciation of our interconnectedness that results in ecological literacy.

The process for change is critical to the outcomes of change. If the process for change is facilitated through the same dynamics and consciousness that led to the need for change, transformation will not occur.

In the National Curriculum Framework Secondary (NCFS) it is mentioned: "*(i) That teaching and learning processes be oriented for optimal cross-disciplinarity in the Lower Secondary levels (Forms I to III) in a bid to equip the learner with the broadest perspective of knowledge. Notwithstanding the specifics of subject disciplines, bridges need to be built with other disciplines to equip the learner with the bigger comprehensive pictures of reality to ensure the validity and currency of learning; and (ii) That the curriculum be holistic and provides for the overall, wholesome development of the individual in his/her physical, social, emotional, intellectual, aesthetic and moral dimensions,*" (MIE, 2009, p. 14). The EFS programme, as can be seen in the sections below, contributes in many aspects to the implementation of these NCFS guidelines and objectives. The EFS programme provides schools with the process, pedagogy, and methodologies for creating an educational system that acts as a learning community of practice for sustainability through holistic and transformative education.

3.2. The EFS programme components

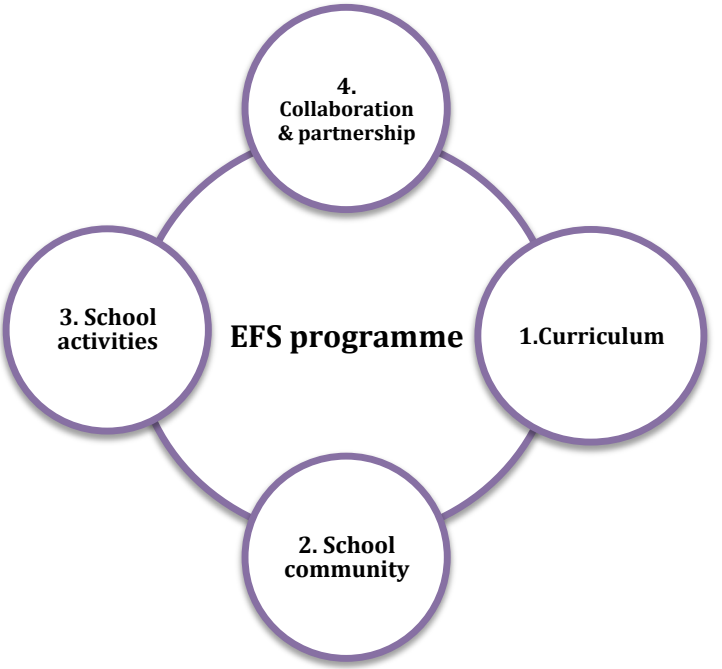

Figure 3. EFS Programme Components
Source: Authors' elaboration

The EFS programme works as an interconnected system that helps develop synergies between, curriculum, school community, school activities and collaborators and partner organizations, and in such a way that this brings the EFS principles into practice through the whole school system (see Figure 1). By enhancing the connectivity of the system and creating shared learning opportunities; learning for and about sustainability becomes meaningful. As said by Blewit: *"All learning really becomes meaningful when there is some resonance with the everyday lifeworld of the learner. We tend to translate abstractions into concrete examples before they are felt and make any sense – global warming with baling out the basement, for example. Resonance is therefore essential if learning is to become a key constitutive element of any transformative process leading to a more sustainable future."* (Blewit, 2006, p.10).

3.2.1. Curriculum integration

One of the main issues with the way conventional educational systems teach curriculum subjects is the lack of connection and synergy between subject areas. It is for this reason that the National Curriculum Framework for schools in Mauritius recommends building of bridges with other disciplines and between subjects (MIE, 2009). In addition, another problem with conventional education is the lack of connection between what is taught and what is meaningful for the learner (Sterling, 2002; Blewitt, 2006). Furthermore, educational systems designed to prepare students to participate in a highly competitive global market economy provides little incentives for learning and teaching through collaboration and teamwork. Systems thinking shows that the structure of a system gives rise to its behaviour (Meadows, 2008).

Hence, the EFS programme aims to create positive impact at the structure of the educational system in schools by introducing into the structure the right incentives for collaboration, synergy, exchange and co-learning between students, teachers, non-teaching staff and management. This directly impacts on the ways that curriculum subjects and activities are taught and facilitated.

To implement the objective of building bridges and enhance collaboration between disciplines, the EFS programme chose three subjects for implementing EFS competencies.[4] In order to know which subjects to choose, a system's map was created that revealed the linkages between the learning objectives for each subject. Figure 4 shows a part of the systems map of the lower secondary subjects that was used in 2012 for making the decision to use Sciences, Social Studies, and Human Values as the main focus areas for EFS implementation.[5]

The School Clubs form part of the Activities classes, and are also used for achieving the objectives of EFS. One of the pilot schools, namely St Mary's College (SMC) Rose Hill, developed an innovative rotational model for their nine different

Clubs through which the EFS principles have been implemented to achieve two objectives: (1) creating synergy and collaboration between the Clubs in such a way that all activities contribute to ecological competencies for sustainability; and (2) promoting experiential learning opportunities through Club projects that provide the hands-on-experience for competencies for sustainability (see Table 6 below).

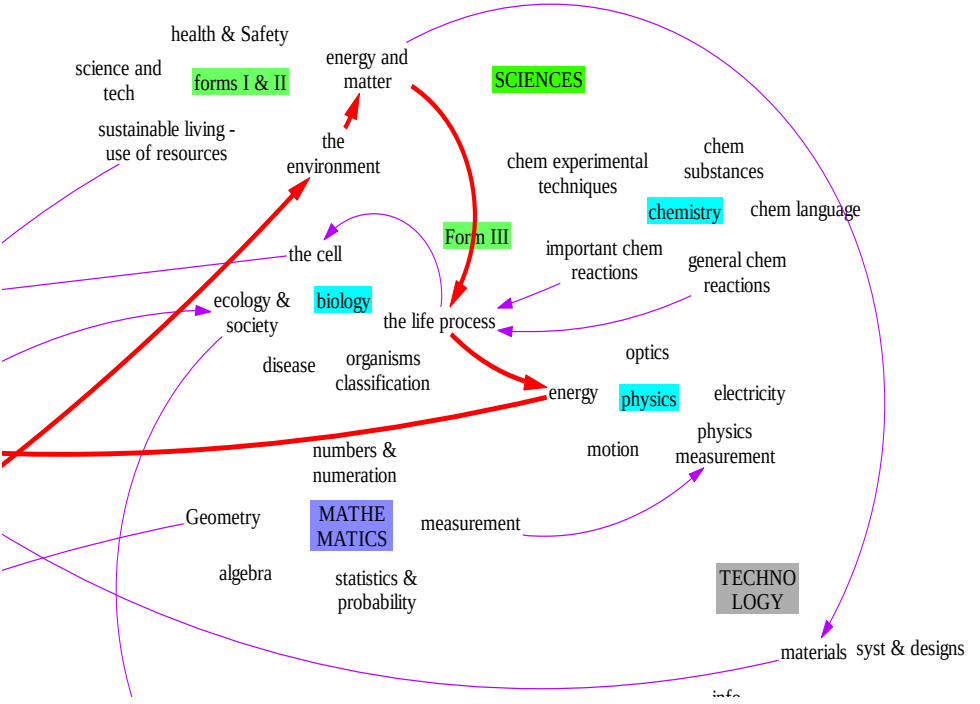

Figure 4. A section of the systems map of the national lower secondary curriculum subjects
Source: Authors' elaboration

Table 6. Examples of EFS implementation in SMC Activity Curriculum Activity Clubs

SMC - Curriculum Activity Clubs	Objectives
Environment Protection club	• Create awareness about environmental issues. • Develop an attitude of curiosity and care for Nature. • Develop projects using the 4 R's concept to protect and improve our natural environment
Botany and Farming club	• Promote interest and engagement for nature conservation and animal welfare. • Development of basic skills for plant cultivation, composting, and permaculture. • Learn about the medicinal and endemic plants of Mauritius.
Cooks club	• Develop basic skills for cookery and appreciation of locally grown food. • Cook from the School Garden to share and promote social awareness.
Media club	• Develop social-media, writing and photography skills. • Provide the school with a (mini) Club newspaper and to share updates from the School campaigns on eco-social issues. • Document and share news about the other Clubs through social-media and School newsletters.

Source: St Mary's College Rose Hill, Curriculum Activity Clubs – Rotational Model.

For example, in the Botany Club students are growing the vegetables provided for the Cooking Club, which is documented through the Media Club and supported by the Botany & Environment Club with composting, rainwater harvesting, etc. Through the Science Club, the Ecological Footprint Analysis (EFA) of the school is carried out and monitored, which again provides feedback to the other Clubs in terms of the behaviours and practices that contribute to sustainable development, and those that do not. Permaculture classes will start in the third term of 2014 to provide further knowledge and understanding of eco-system design principles and to further support the cultivation of healthy organic vegetables and medicinal plants.

All teachers of the three subject areas and the EFS mentors are trained in systems thinking, pedagogy (learning and development principles) for EFS, and stewardship for sustainability. EFA is carried out by the EFS mentors and coordinating teachers of Sciences and selected students from the Environment Clubs. Permaculture training will be provided to the Botany and Environment Clubs for composting and school gardening.

3.2.2. The school community

Principle 5 of the EFS Charter and Pledge outlines (see Chung Kim Chung & Smitsman, this issue):

> ***Schools as Learning Communities***– *The EFS programme supports schools to become Learning Communities and Communities of Practice for sustainability.*
>
> *In this way learning for sustainability takes place at every level of the school systems and the EFS principles become embedded within the school system and culture.*

The EFS programme supports schools to become a Learning Community for sustainability in the following ways. Representatives of the various school stakeholders (management, teaching and non-teaching staff, and students) are chosen to participate and endorse the programme to achieve whole school support for the programme. Pedagogical methodologies are shared with the schools that focus on facilitation of learning, rather than transmission of information (see Deenapanray et al., this issue, Table 3). Also, this demonstrates that learning for sustainability takes place at every level in the school system and is not limited to the classroom, or just for one category of stakeholders, namely students (see also Senge, 2012).

The Ecological Footprint (EF) project that is part of the curriculum activities requires engagement and collaboration between students, teachers, and non-teaching staff (see Bangari et al., this issue). The EFS pilot schools have all made the commitment to monitor and where necessary reduce their EF, which was formalized when they signed the EFS Charter and Pledge on 19 February 2014. To achieve this all members of the school community need to work together in sorting waste, reducing usage of paper and plastic, and by composting organic waste. By working together to bring into practice the commitments made, schools are further supported to become Learning Communities of Practice for Sustainable Living (Williams & Dixon, 2013). Table 7 below further highlights how the EFS principles are applied and their impacts on the four components of the EFS programme – Curriculum, School Community, School Activities, and Collaboration & Partnership with support organizations.

3.2.3 School activities

The EFS programme caters for activities that are part of the curriculum and those that are extra-curricular. For example, the Ecological Footprint (EF) is measured and evaluated by the students with support from the teachers as part of the curriculum activities. The EFA is gradually scaled up in terms of its measurement scope starting with Form 1(waste), then Form 2 (consumables, and transport, buildings & utilities, and then From3 (food). The EFA is discussed in more details by Bangari et al. (this issue).

Extra-curricular activities that will also form part of EFS are, for example, yearly Eco-retreats that are organized by the pilot school to support students to learn from Nature and develop an attitude of stewardship for our Natural world through real-life experiences. The pilot schools are also using their school open-days and international awareness days for sharing their Eco-campaigns with the broader public. The Eco-Clubs or Environment Clubs of the pilot schools consist of students from all the different age groups, where students take an active role in creating awareness and engagement activities for sustainability. The students of many of these Clubs also engage in collaborative projects and initiatives with other schools committed to sustainable development and with the Maurice Ile Durable (MID) Clubs. The primary aim of the MID Clubs initiated by the government of Mauritius is to harmonise existing Environment Clubs in schools and align them together towards the MID project.[6]

Table 7. Implementation and impact of EFS principles in the school system

EFS Principles	Curriculum	School Activities	School Community	Collaboration & Partnership
1. ***All education is education for sustainability***	EFS addresses the purpose of education and uses all existing subjects to align with this purpose.	Curriculum and extra-curriculum activities form part of the same objectives for EFS.	The dynamics and structure of the school community form part of the educational experiences of students, and are addressed where changes are needed.	Collaboration and partnerships with support organizations locally, nationally and internationally provide co-learning & co-creative opportunities.
2. ***Systems thinking & holistic approach to education***	Creating bridges and synergies between subject areas and learner central facilitation of education.	Creation of synergies between Club Activities+ integrated design for school projects.	Systems thinking is used to intuit and assess which system structures & dynamics of the school community require transformation.	Systems mapping is used to carefully select support organizations and partnerships that help build the larger eco-system environment for EFS.
3. ***Experiential learning in and from nature***	Taking the curriculum out of the classroom and bringing Nature into the classroom.	School activities are designed to provide these experiential learning opportunities for students & teachers.	The whole school community is engaged to join in the learning process for EFS. Through EFA, students encourage their parents to also reduce their EF at home.	Collaboration with Nature conservation NGOs, integrated farms and Natural Park & Wildlife institutions extend opportunities to schools for learning in and from Nature.
4. ***Education in dialogue with place***	By making EFA part of the curriculum activities students and teachers learn about sustainable development in dialogue with their learning environment, e.g. their school.	School activities are designed to help students see the importance of application of SD principles in their own local context, while recognizing global patterns.	By learning from all members who form part of the school community, learning becomes more grounded in local reality and the school community as a whole becomes part of the dialogue with place.	Support organizations & partnership are selected to (safely) introduce students to the social, economic, and environmental realities of their local context, to apply what they have learned at School.
5. ***Schools as Learning Communities***	Through EFS the traditional dichotomy between teacher and student falls away, and teacher and student learn to work together in a project-based way that fosters schools to become learning communities.	By demonstrating how the school as a whole is committed to SD, students learn that these activities do not exist in isolation but have direct positive value for society and our future.	EFS supports the school community to become a learning community for sustainability, where learning for sustainability takes place at every level of the system and continues to develop, deepen and expand over time.	By embedding the learning community principles into the partnership practices it sets up a different quality and purpose of relationship with those outside the school system.

Source: Authors' elaboration.

3.2.4 Collaboration & partnership

Collaboration and partnership is actively encouraged within the school community and in relationship with others in society. This section deals with the aspect of collaboration and partnership with support organizations and individuals from outside the formal school system. Since the start of the programme in 2011, ELIA has brought in expertise from professionals (overseas and in Mauritius) who provide support to the programme. For example, Prof Smitsman provided training to the EFS mentors and selected teachers in learning and development principles. His many years of research in early childhood development from a dynamical systems perspective supported teachers to gain a more fundamental understanding of the process of learning, and the necessary conditions for the development required for ecological literacy.

The programme further encourages the pilot schools to seek partnership and collaboration with organizations that provide project-based learning opportunities for students. Especially with organizations and people that can help to increase opportunities for 'learning in and from Nature'. ELIA is in contact with the Green Building Council in Mauritius (GBCM), which is part of the Global Coalition for Green Schools, to support the schools with the green building aspects of sustainability education. In some of the pilot schools more shaded areas need to be created, especially around the vegetable garden where outdoor learning takes place. These garden shading projects will be designed together with the students under supervision of the Green Building experts to ensure that enhancement of the physical school environment can also provide project-based learning opportunities for the students.

3.3. Stakeholder engagement methodology

Stakeholder engagement for feedback, evaluation, input and co-ownership in the programme is vital for the success of this programme. Stakeholders of the school include amongst others; students, teachers, parents, non-teaching staff, management, partners & collaborators, funders, and local communities impacted by the school activities. ELIA applied the following principles that form the methodology for stakeholder engagement in the EFS programme.[7]

1. Ensure commitment and engagement from school management and the appropriate decision-makers at the highest level, from the very start of the programme.
2. Create engagement and obtain inputs from all stakeholders who are part of the school community for adaptive learning through the iterative process of design, implementation, monitoring, evaluation and documentation of the EFS programme.
3. Use visioning and dialogue sessions for assessing shared purposes, creating commitment and engagement, and to receive input from all the stakeholders. This ensures future-orientation and facilitates a rich exchange between all the different stakeholders in a way that contributes to co-learning and co-creation for EFS.
4. Apply a 'Learning by doing' methodology to remove possible barriers to EFS and remain adaptive, flexible and responsive to the realities on the ground.
5. Measure and evaluate results of the EFS programme in each of the 3 pilot Schools, including ongoing measurements of the Ecological Footprint of the schools. As the EFS programme seeks closer integration in the existing lower secondary curriculum framework, evaluation will be complemented with conventional means. Students are supported in their self-evaluation of EFS competencies (please see Section 4 for more details).
6. Partnership and collaboration to exchange with experts of similar and complementary fields to further enrich the EFS programme and share lessons-learned and best practices to enhance programme visibility and secure more commitment to EFS in Mauritius.
7. Communicate and share the results of the EFS programme through school Newsletters, social-media technologies and the official EFS platforms, peer-reviewed journal articles, online publications and participation in

conferences. This also supports the other Catholic schools that are part of the BEC network to learn from and with the pilot schools.

3.4. Pedagogy for ecological literacy development

The conventional educational system, which also applies to the EFS pilots schools, have long favored and endorsed a top-down approach for learning and development. Through the EFS programme teachers learn key principles for experiential learning and how to provide the necessary learning conditions for fostering EFS competencies. These competencies include the ability to sense, imagine and think in terms of pattern, connectedness, process, flow and interdependence. This is in sharp contrast to conventional education where students are taught to shut down their sensory and intuitive abilities, even before they enter secondary education. Tasks and assignments in conventional education are designed to stimulate analytic thought capable of dissecting information.

Teachers are trained in the key learning and development principles for EFS: (i) l*earning by being part of the world*; (ii) m*obilization of capabilities for new tasks and solutions; (iii) sustaining and enhancing our learning potential*; (iv) l*earning through feedback systems by attuning our activities to the system dynamics*; and (v) l*earning from and for the future*. For a detailed discussion of these principles see Smitsman and Smitsman (this issue).

4. Evaluation and assessment

Evaluation and assessment is generally used to: measure learning, assess progress of a programme or policy, improve the quality of a programme, enhance accountability to stakeholders, communicate results and build up a body of evidence (Delgado, 2007). Evaluation and assessment in relation to the EFS programme has two dimensions: (1) with respect to the programme implementation and for ongoing improvements. This includes evaluation of EFS competencies for students and teachers as a result of the EFS interventions; and (2) with respect to EFS contributions to conventional educational evaluations and assessments of students.

4.1. Programme evaluation and assessment

The EFS programme has been evaluated in the following ways: feedback and dialogue sessions with stakeholders, interviews with EFS mentors and management, presentations by the schools, and questionnaires. Section 2 of this article provided many examples of the above. A two year research programme is currently being developed as part of the EFS programme in collaboration with relevant educational institutions and universities in Mauritius and overseas. The purpose of this research is to assess the impacts of the EFS programme on transformation of conventional educational systems. This research will also contribute to the further development of an EFS Monitoring and Evaluation System (MES) based on the Theory of Change (TOC) model that is explained in Deenapanray et al.(this issue).

4.2 Evaluation and assessment of students

Most of the conventional educational systems in Mauritius do not actively involve students to join in the assessment of their own learning process. In general, students are assessed on the basis of standard tests and scored for their performance, which is used for further selecting who can study where or to study what subjects. The aspiration of many parents in Mauritius is for their children to have the opportunity to study overseas. Those who have the best results in their final exams get the best opportunities for scholarships.

The shortage of scholarships for studying overseas and the increasing pressures for students to excel may partially explain the creation of a highly competitive and what is often referred to as an ‘elitist’ educational system in Mauritius (Mauritius Times, 2014).

In such a system there is little place for students to evaluate their learning process and reflect on their learning potential, other than when this is directly results oriented.

As Smitsman and Smitsman discussed (this issue), the opportunity for self-assessment is essential in EFS. Early childhood development studies have shown that young children themselves generate information about their progress by actively exploring and attending to the system dynamics of their activities. We can extend this principle to EFS by making students and teachers more sensitive to the 5 principles of learning and development, and in particular the dynamics or information that their activities generate. Comparison of the 5 principles and current assessment strategies reveals that there is a large gap between what is required when assessment is directed to the learning process itself (the 5 principles), and current methodologies that only assess the outcomes of learning (literacy, numeracy and factual knowledge). ELIA is currently conducting research on this gap with the view to developing processes and tools to bridge it. EFS will also make use of some of the standard assessment methods to test EFS competencies, through for example use of questionnaires and multiple-choice tests. Yet, beyond these methods of assessment there is something more fundamental that we like to draw attention to and that is the effect of evaluation and assessment on the motivation for learning. In conventional education evaluation and assessment serve the primary purpose of providing feedback to the system about student progress and performance for the set targets that need to be achieved. In EFS, assessment and evaluation serves also the purpose of providing feedback to the student to further stimulate learning and development for EFS, and in a way that enhances the learning potential of the student – i.e. developing the learning ability to learn. This can only be achieved by creating the conditions for students to generate information feedback about their competencies by actively exploring the dynamics of learning. For example, learning about a forest through text-book knowledge and exams is entirely different from walking through a forest and receiving direct feedback from the forest about the degree of our ecological literacy.

When we feel that we make progress and intuit how we can stabilize our progress we get motivated to move forward and learn more. Self-assessment frameworks are in development as part of the EFS programme to support students to reflect on their own learning process and progress.

5. Conclusions

The EFS programme has been the first of its kind in Mauritius. Increasingly more schools in Mauritius (at all levels) are recognising the need to ‘green their school’. Classes about environmental awareness and sustainable development are introduced more and more, even at primary level. Students are learning how to keep their environment clean, how to reduce and recycle plastic and paper, and how to take care of our planet. These classes are usually taught as themes within curriculum subjects or else through extra-curriculum activities. Education for sustainability goes much further, however, by also addressing the system dynamics of educational systems at different levels (curriculum, management, teacher-student relationship, student-student relationship, and finally student and learning tasks).

The EFS approach reveals whether the purpose, structure and behaviour of the educational system are aligned with the systems objectives regarding education for sustainability. In this approach, the relationships that form part of the experience of learning for sustainability are just as important (if not more) as the content that is taught. For example, teaching about environment and sustainable development through teacher-student relationships that are hierarchical and discourage reflective creative thinking will not be able to foster competencies for EFS.

The authors are hopeful that the EFS programme for schools in Mauritius will be able to significantly contribute to the kind of transformation in thinking, mind-set, attitude and relationship that everybody seems to refer to when reflecting on the changes needed for a sustainable society and future. The programme is still in its infancy and much more is to be learned, explored, evaluated and researched. Most importantly, the programme receives broad support from the stakeholders in the pilot schools and increasingly more interest from other sustainability education initiatives. In the end, the people on the ground are the persons who make all the difference and full acknowledgement goes to the EFS mentors with support of their school leadership and the Director of the BEC who are aligning heads, hearts and hands to make this work. It is appropriate to conclude this article with this quote from Buckminster Fuller: "*You never change anything by fighting the existing. To change something, build a new model and make the existing obsolete.*"

Notes

1. It may be useful to know that the Catholic schools in Mauritius also provide education to non-Christian children and are not enforcing their religious views on the students. The schools are open to any student from any background.
2. It is interesting to observe that the recommended actions for ecological literacy reflect the basic learning and development principles as outlined by Smitsman and Smitsman (this issue). In order to achieve understanding of the concept of ecological literacy (action 1), activities through learning by doing (action 3) and transformative learning relationships (action 4 and 7) are required.
3. See the Theory of Change (TOC) discussed by Deenapanray et al. (this issue).
4. Ideally, it would have been recommended to work with more than three subjects. For practical reasons, however, regarding time-availability of teachers three subjects were selected to start with.
5. The subject 'Human Values' is not part of the National Curriculum of Mauritius, but is part of the BEC curriculum. This systems map was carried out on the basis of the National Curriculum Framework for secondary schools in the Lower Secondary classes in Mauritius. Human Values was chosen as the third subject area for implementing the EFS principles and practices for the important role it plays to support children in developing the necessary values for ecological literacy and planetary stewardship.
6. The MID policy is the official government strategy and action plan to promote the sustainable development of Mauritius. It also functions as the long-term vision of the government for making Mauritius a sustainable island. See the MID website for more information – www.mid.mu
7. It is noted that parents were not directly engaged for their feedback and input in these beginning phases of the programme. Provisions are currently made in the programme to involve parents for their feedback and input over period 2014-2018.

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Ecological Footprint as a Tool for Ecological Literacy

Anamantoo Boni Bangari†, Stephanie Deruisseau†, Shakeel Moossajee†, Prakash N K Deenapanray‡, and Anneloes Smitsman‡

† St Mary's College, Ambrose Street, Rose Hill;

‡ ELIA – Ecological Living In Action, La Gaulette, Mauritius

(Corresponding author: *sanju@ecolivinginaction.com*)

Abstract

One of the key objectives of ecological literacy is to promote a better awareness and understanding of the impacts of human activities on other human beings and the broader environment. Quite often, the impacts of human activities, such as the consumption of resources and the generation of wastes, are invisible because the effects of these activities are delocalized in space and time. This hidden attribute of human impacts makes it more difficult for human beings to take corrective actions to remedy any detrimental consequences of their impacts. While consumption and waste generation are mediated predominantly through the market (or economic) process, the ensuing impacts are also environmental and social. In this paper, we will discuss the application of Ecological Footprint Analysis (EFA) at St Mary's College Rose-Hill (Mauritius) to quantify the environmental impacts of school activities. While EF is a powerful pedagogical tool for engaging the school community in place-based education, this article will also discuss the use of EF as a normative tool to highlight and address the ethical dimensions of the consumption of scarce resources and the release of wastes in public good sinks that have increasingly less assimilation capacity. The paper will further discuss briefly the lessons learned in applying EF analysis in the Catholic secondary schools that are part of the network of the Bureau of Catholic Education (BEC).

Keywords: Ecological Footprint Analysis (EFS) of EFS schools; EFA as a pedagogical tool for Ecological Literacy.

1. Introduction

There has recently been a worldwide increasing interest in Ecological Footprint Analysis (EFA) for educational purposes among schools and non- governmental organizations (Gottlieb, Vigoda-Gadot, Haim, and Kissinger, 2011). EFA is also an integral part of the Education for Sustainability (EFS) programme (Smitsman & Deenapanray, this issue). The EFS programme started in 2011 for the 18 Catholic secondary schools of the BEC network.

When the programme started in 2011 it was called the Ecological Literacy Programme (ELP) and focused on the Ecological Footprint calculations of the secondary schools as extra-curriculum activity together with training in Systems Thinking and Pedagogy for Ecological Literacy. In 2013 the programme renamed 'Education for Sustainability', and it became part of the curriculum objectives and activities with implementation in three pilot secondary schools. From the 18 secondary schools invited to participate in the Ecological Footprint (EF) project, 6 schools became actively involved and submitted comprehensive EFA reports that summarized their EF and proposed actions to reduce the EF of their school. This article presents the results of the EFA for St Mary's College (SMC), Rose-Hill, Mauritius. St Mary's College is a Catholic secondary school for boys and was founded in 1955. The school caters for around 1028 students and joined the EFS Programme in 2011. Since 2013, it is one of the three pilot schools for the EFS programme.

The EF concept was developed by Mathis Wackernagel and William Rees at the University of British Columbia in the early 1990's. EFA was designed to represent human consumption of biological resources and generation of wastes in terms of appropriated ecosystem area, which could then be compared to the biosphere's productive capacity in a given year (Ewing et al., 2010). 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.

Using a defined methodology, it is hence possible to assess the footprint of individuals, schools, organizations, countries or even the whole planet. A common indicator used is the number of hectares of land that one requires to sustain one's way of living. With the rising population and an increasing pressure on the production of goods to satisfy our growingly sophisticated lifestyle, this area of land has kept growing. Another common representation of an individual ecological footprint is through the number of planets Earth that would be required to sustain one's average consumption. This assumes that if all persons on earth have the same lifestyle or consumption patterns it would then require on average a given number of planets. As we have only one planet, any figure beyond 1 implies that our consumption is unsustainable (Deenapanray & Leste, 2014).

2. Ecological Footprint Analysis as a Pedagogical tool for EFS

EFA provides an excellent pedagogical tool for making concrete to people why sustainable development matters when discussing present and future wellbeing and the role of education. It also provides a tangible framework to bring to light the many ethical dimensions involved in sustainable development, such as intergenerational equity, distributive justice, and carrying capacity and population growth. Addressing these issues from a sustainability perspective provides teaching opportunities for interdisciplinary bridging of subjects and can link scientific concepts to social issues. Furthermore, the concept of ecological deficit (or ecological overshoot) can be presented to the learner in the simple form of two land areas: one for what we are demanding and one for what the planet can deliver (Lautensach, 2009, p.159). Even very young learners will understand that if people want more than what can be provided for and can be sustained, it can lead to conflict.

EFA also provides valuable opportunities for implementing the following EFS principles (Chung Kim Chung & Smitsman, this issue): (i) systems thinking & holistic approach to education (principle 2); (ii) experiential learning in and from nature (principle 3); (iii) education in dialogue with place (principle 4); and (iv) schools as learning communities (principle 5).

By measuring the EF of the school students and teachers learn to work as a team supported by the larger school community for data collection. Together, they also review critically the behaviours prevailing among the different stakeholders forming the school community that generate the measured EF. Students and teacher learn to apply sustainability principles in a real life context and they learn to employ systems thinking to reveal the (hidden) connections between EF measurements and behavioural patterns. Through the trainings on systems thinking, teachers and students learn that relationships between members of an ecological community are nonlinear, involving multiple interdependent feedback loops. Quite often, 'causes' and 'impacts' are delocalized (i.e. take place in geographically distant places) and 'impacts' are delayed (i.e. take place at a distant point in time even when the causes and effects take place in the same place). By first understanding the behaviour of systems, actions can then be designed for reducing the EF of the school in ways that take into account possible consequences and impacts of these actions in other places of the system and over time. However, it is also pointed out that schools exhibiting relatively low footprints may not necessarily be sustainable.

They may be so from an environmental perspective but not from a social perspective since persons constituting the school community may be deprived of their basic needs. So, one dimension of EFA in the EFS programme is to carry out a comparative analysis of school footprints to reveal the socio-economic drivers of EF among schools. The immediate aim though is to carry out longitudinal assessments of EFA in each school.

The pedagogical versatility of EFA through the use of enquiry-based learning and learning-by-doing is shown in Figure 1. The 5 E's learning cycle is an instructional model based on the constructivist approach to learning, which says that learners build or construct new ideas on top of their old ideas. By going through the learning cycle students synthesize new understanding from prior learning and new information. The constructivist approach is aligned with the concept of spiralling that is discussed by Deenapanray, Smitsman and Chung Kim Chung (this issue).

The teaching moments afforded by EFA are many and may be found in courses across the disciplines. The mirroring effects are the numerous learning opportunities that are afforded by EFA as listed in Table 1. It is also pointed out that EFA lends itself to the pedagogies of mixed abilities[1] that is being implemented by the BEC, as well as those of multiple intelligences (Gardner, 1993) while noting the social and cultural determinants of learning and education.

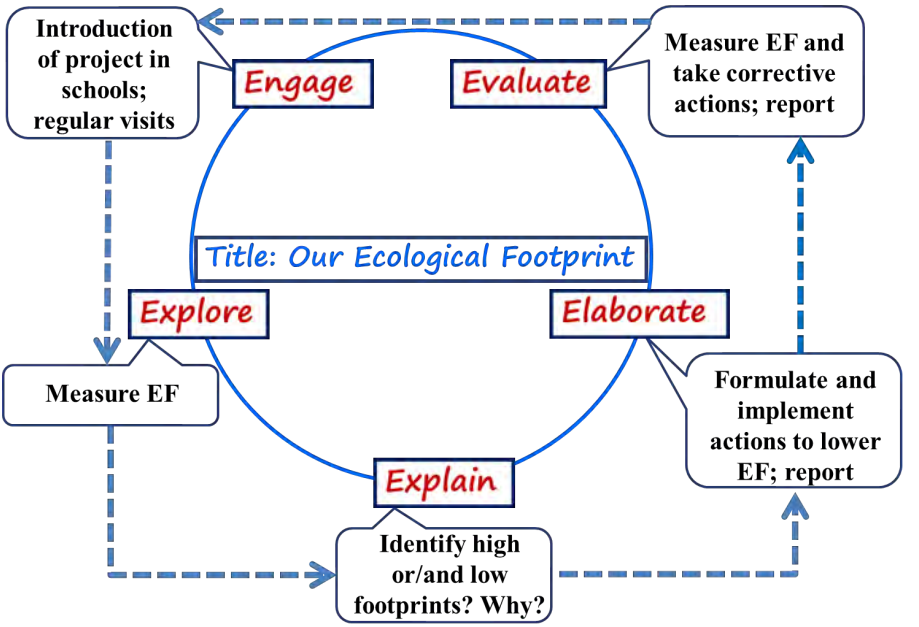

Figure 1. The Learning Cycle of Ecological Footprint Analysis at school.
Source: Authors' elaboration.

Table 1. Overview of learning opportunities through EFA

EF learning opportunities	Further explanations
Making the invisible visible (systems thinking)	The environmental impacts of many of our consumption patterns are not immediately obvious, ecological footprints encourage investigation and discussion of these processes and thus afford many opportunities to consider more fully the human impacts on the natural world.
Ecological literacy (systems thinking; reflexivity)	EF calculations can give us a window into the ecological processes on which our society depends. It makes concrete the principles of sustainable development and shows which patterns of human activity are sustainable and those that are not. It also helps students to comprehend the consequences of unsustainable production, consumption and waste and its implications for future generations.
Social literacy (systems thinking)	Examining EF provides essential information about the development of social systems – political, economic, and cultural – that shape human consumption and production. This will give students chances to achieve greater social literacy by learning such things as population demographics, consumption trends, economic development models, and policy priorities.
Lifestyle choices (constructivism and systems thinking; reflexivity)	EF calculators provide feedback mechanism to students about the impacts of lifestyle patterns and behaviours. This can open the door to discussion about personal consumption patterns and expectations around the linkages between economic development and happiness / wellbeing.
Environmental history (experiential learning)	As EF calculations are conducted over time, we may have more accurate assessments of cumulative impacts and thus have a clearer sense of how human society has shaped the natural world, and vice versa.
Inequality (critical and systems thinking; reflexivity)	EF calculations compared over individuals, groups, or entire nations can provide a basis for wide-ranging discussions of inequality in resource use and waste, as well as the cultural, political, and economic systems that structure them.
Future directions (creative thinking; reflexivity)	EF provides a comprehensive tool for exploring the deeper questions what is needed to co-create as sustainable future. This helps students prepare for their future role and responsibility in society's commitments to the shift to sustainable development.

Source: Adapted from The Centre for Teaching, 2014.

Consumption in this method is classified into five main categories, namely; food, housing, transportation, consumer goods, and services. *Land and land-use* is split into 8 main categories – land appropriated by fossil energy use, built up areas, gardens, crop land, pasture, managed forest, untouched forests and non-productive areas. The method takes into account the size of the population and consumption data for each land use category (Wackernagel and Rees, 1996).

According to the Wackernagel-Rees method, a nation's consumption level is estimated as follows: Consumption = Production + Imports – Exports [$EF_C = EF_P + EF_I - EF_E$]. Land area utilized by each consumption category then has to be determined for each land use category, which is done by dividing each land use category by a relevant global average yield so as to obtain the land area. By using a global average yield, comparison of footprints among different countries is thus possible and meaningful. The land appropriated for energy consumption is worked out differently and takes into account five main energy types; i.e. gas fossil, liquid fossil, solid fossil, firewood and hydropower. The amount of energy land is calculated by estimating the amount of forest plantation that can absorb CO_2 emissions associated with the fossil fuels. Correction is also made for the sequestration of CO_2 emissions by oceans as well as for trade - i.e. exports and imports. In addition to the above, each category of land is multiplied by an 'equivalence factor' as the different categories of land do have varying biological productivity levels. For benchmarking purposes among countries or regions or even smaller communities or organisations, the EF can be expressed in per capita terms by dividing the total Consumption by the population size (Deenapanray & Leste, 2014).

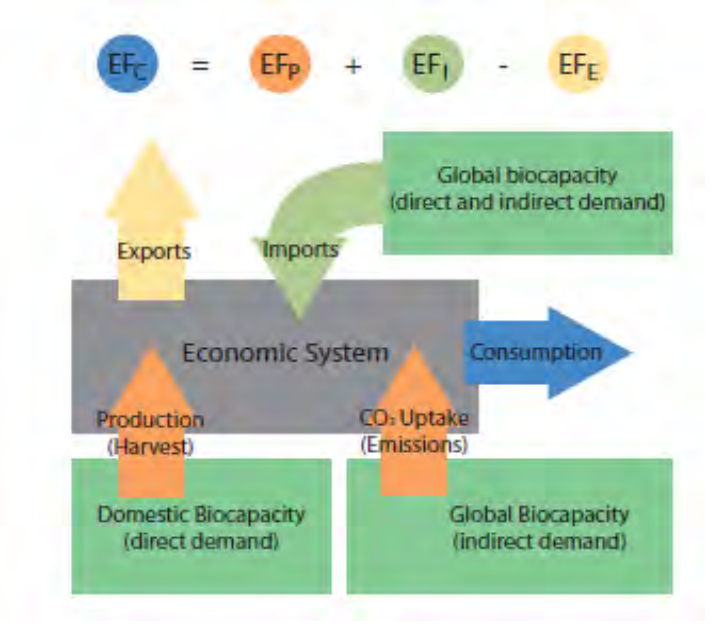

Figure 2. The Wackernagel-Rees method
Source: Ecological Footprint Atlas 2010

3.1. The EFA Methodology applied by St Mary's College, Rose-Hill, Mauritius for data collection

EFA was carried out solely for school activities - i.e. the school perimeter was the boundary for the analysis. The EF calculator that has been used by the Catholic secondary schools that participated in the EF project was designed by ELIA and customized for Mauritius (Deenapanray & Leste, 2014). This calculator was developed on the basis of the Wackernagel-Rees method. The EF calculator covers the consumption categories: food, consumable, buildings, utilities and transport, and it accounts for waste generated. The six types of land that are accounted for are: fossil fuel land; crop land; grazing land; built-up land; forest land; and sea land. To conduct the EFA at St. Mary's College, a small group of 22 pupils was selected by the 3 EFS mentors. The mentors together with the 22 pupils constituted the EF Team (EFT). In order to achieve meaningful results within the time constraints at school, it was decided by the mentors and the trainer (PNKD) that a sample of 16% of the student population would be considered for EFA. One hundred and sixty eight (168) students were chosen randomly from 1028 students using the students' list obtained from the school administration.

This sample was chosen from Forms 2, 3, 4 and Lower 6 classes in order not to disrupt the students of Form 5 and Upper 6 who were concentrating on their SC and HSC exams, respectively. Since the staff included only 96 persons, a larger sample representing 50% of the employees was chosen. The employees list obtained from the administration was taken as source document to choose the sample. The choice of the students was done mathematically in an objective attempt to eliminate bias. Thus, in some forms, from students' list ranging from 1 to 40, students listed at even intervals were selected e.g. (position 2: 1st student name, position 4: 2nd student name, position 6: 3rd student name, etc..), whilst on other lists students listed at odd intervals were chosen, e.g. (position 1: 1st student name, position 3: 2nd student name, position 5: 3rd student name, etc.). The choice of odd or even was voted by the team of 22 students during a meeting when the project was launched at school. An important point to note is the mixed composition by grade (or form) of each group. Next, the EFT was the split into 4 groups each corresponding to one of the four categories for EFA data collection, namely: Food, Transport and Utilities, Waste, and Consumables. The four categories followed the way in which the ELIA's EF calculator is customized. All data collection was performed by the students under the supervision of the mentors. All the equipment and facilities required for collection of data were put at the disposal of the students by the administration.

The EF mentors received training in EFA and systems thinking, together with the EF mentors of the other Catholic secondary schools that participated in the project. Further resources for EFA were shared through an E-learning platform accessible to all the Catholic secondary schools who were participating in this EF project. Throughout the project much emphasis was laid upon communication via presentations, interviews and school meetings. The aim was to engage the most important stakeholders (students, teachers, non-teaching staff) of the school community and to keep everybody informed about the progress and outcomes of the project. The EFS mentors also presented the project in the morning assembly, inviting active participation and support from all members of the school community. Updates and outcomes were communicated via the school notice boards and verbally. Regular work sessions were organised weekly, where the students worked in groups as defined.

4. Results and discussions

The EFA shows that for the year of 2011 St Mary's College had an overall EF of 650 hectare (Figure 3), which translates into a per capita footprint of about 0.84 Ha/person. It is pointed out that this value is a partial footprint because it covers only the consumption and waste generation patterns related to school activities. So the total footprint of any individual constituting the school community will be larger than this value because of all other consumptions and waste generation that take place outside the school (e.g. weekends, holidays, and after

school activities). While noting that this footprint is the partial average footprint for a person in the school community, it is nevertheless informative to contrast it to the average footprint of a Mauritian that was 4.55 ha in 2008 (Ewing et al., 2010), or to the equitably shared footprint value of 1.68 ha/person. The latter corresponds to the equitable distribution of the bio-productive capacity of the planet among all human beings. A detailed comparative analysis of these results will require further analyses that are beyond the scope of this article. The results of these detailed analyses will be published elsewhere.

The highest EF component was food with an EF of 567 ha. The other components were comparatively low, with consumables having an EF of 34 ha, followed by transport with an EF of 32 ha, and waste with an EF of 7 ha as shown in Figures 3, 4 and 5, respectively.

However, some anomalies like some unexplained peaks in the postage or water consumption were also observed after analysis and their possible causes were determined. Analysis of the results showed that the category that scored the highest footprint is the consumable category. This may be due to the large mass of paper that is consumed each year by the students in the form of books and copybooks. Although the footprint for the consumable category is high, the footprint for wastes is strangely low. The results (Figure 5) show that students are the biggest consumers of fruits and vegetables. This is shown by an average of 75.78% of student's population who consume fruits and vegetables per year.

A	B	C	D	E	F	G	H	I
Total School Ecological Footprint	CO_2 Land	Crop Land	Grazing Land	Forest Land	Built-up Land	Sea Land	Total EF	Units
Waste	2	-	-	5	1	-	**7**	ha
Consumables	6	7	-	19	2	-	**34**	ha
Utilities	3	-	-	-	0	-	**3**	ha
Transport	**10**	-	-	-	**2**	-	**32**	ha
Buildings	**0**	-	-	-	**5**	-	**5**	ha
Services	**1**	-	-	-	**1**	-	**1**	ha
Food	**215**	**236**	**83**	-	-	**33**	**567**	ha
Grand Total	**237**	**243**	**83**	**24**	**10**	**33**	**650**	ha

Figure 3. Summary of EF results of St Mary's College in 2011
Source: St Mary's College, 2012

A	B	C	D	E	F	G	H	I
	CO_2 Land	Crop Land	Grazing Land	Forest Land	Built-up Land	Sea Land	Total EF	Units
Paper	1	-	-	5	0	-	6	ha
Aluminum	-	-	-	-	-	-	-	ha
Steel, Other Metal	-	-	-	-	-	-	-	ha
Glass	-	-	-	-	-	-	-	ha
Plastic	1	-	-	-	0	-	2	ha
Waste Total	2	-	-	5	1	-	7	ha
Clothes, Fabric - Cotton	1	7	-	-	0	-	8	ha
Clothes, Fabric - Wool	-	-	-	-	-	-	-	ha
Clothes, Fabric - Synthetic	1	-	-	-	0	-	1	ha
Leather-Based Products e.g. Shoes	-	-	-	-	-	-	-	ha
Paper-Based Products e.g. Books	3	-	-	19	1	-	23	ha
Metal-Based Products e.g. Tools	-	-	-	-	-	-	-	ha
Plastic-Based Products e.g. Stationa	1	-	-	-	0	-	1	ha
Wood-Based Products e.g. Furniture	-	-	-	-	-	-	-	ha
Electrical Equipment	-	-	-	-	-	-	-	ha
Glassware, Porcelain	-	-	-	-	-	-	-	ha
Medicinal Products	-	-	-	-	-	-	-	ha
Hygiene and Cleaning Products	1	-	-	-	0	-	1	ha
Cigarettes	-	-	-	-	-	-	-	ha
Consumables Total	6	7	-	19	2	-	34	ha
Electricity	3	-	-	-	0	-	3	ha
Bottled Natural Gas	0	-	-	-	-	-	0	ha
Water	-	-	-	-	-	-	-	ha
Utilities Total	3	-	-	-	0	-	3	ha
Car Travel (gasoline)	10	-	-	-	2	-	**11**	ha
Bus Travel (diesel)	16	-	-	-	1	-	**17**	ha
Motorcycle Travel (gasoline)	3	-	-	-	1	-	**4**	ha
Transport Total	**10**	-	-	-	**2**	-	**32**	ha
School Buildings	0	-	-	-	-	-	**0**	ha
Total School Land	-	-	-	-	5	-	**5**	ha

Figure 4. The EFA of St Mary's College in 2011
Source: St Mary's College, 2012

The teaching staffs are placed second with an average of 15.18% of the total consumption and the non-teaching staff making an average of 9.4% of the total, again per year. There are many reasons that can explain this pattern, just to name a few: families are more and more conscious to eating healthily. There is, however, an important gap between the consumption patterns in between the students and the staff, independently whether they are teaching or non-teaching staffs. A possible reason can be that parents tend to give more attention to the veggies intake of their children but paradoxically choose readymade foods for when it comes to their own consumptions.

Student, teaching staff and non-teaching staff were grouped and analysed separately in an attempt to find out the impact of the economical background of people on their mode of transport. Results show that two main factors affect the mode of transport of people; economic background and distance. Those people living within a range of 1.5km from the school prefer to walk. Very few students and/or teachers use a bike to come to school.

An interesting point to observe is that only 5% of the students come to school by bike or walking although 52% of them live within 5km of the school. A survey will need to be done to understand the reason behind this unwillingness to walk and/or travel by bike. Staffs with an average income mostly use a motorbike as mode of transport. Those enjoying a better economical background opt for a car as means of transport. It is good to highlight that 49% of the teachers use a car as compared to 20% for the non-teaching staff. The most common mode of transport is by far the bus.

A	B	C	D	E	F	G	H	I
	CO_2 Land	Crop Land	Grazing Land	Forest Land	Built-up Land	Sea Land	Total EF	Units
Buildings Total	**0**	-	-	-	**5**	-	**5**	ha
Postage	0	-	-	-	0	-	**0**	ha
Telephone	1	-	-	-	1	-	**1**	ha
Services Total	**1**	-	-	-	**1**	-	**1**	ha
Fruit, Vegetables	1	2	-	-	-	-	**4**	ha
Bread	188	208	-	-	-	-	**396**	ha
Rice, Cereals, Noodles	0	1	-	-	-	-	**1**	ha
Beans	-	-	-	-	-	-	-	ha
Milk, Yoghurt	1	-	12	-	-	-	**13**	ha
Ice Cream	-	-	-	-	-	-	-	ha
Cheese, Butter	0	-	7	-	-	-	**7**	ha
Eggs	0	0	-	-	-	-	**0**	ha
Pork	3	2	-	-	-	-	**5**	ha
Chicken, Turkey	5	9	-	-	-	-	**14**	ha
Beef	4	-	56	-	-	-	**60**	ha
Mutton, Goat	0	-	8	-	-	-	**9**	ha
Fish	4	-	-	-	-	33	**37**	ha
Fruit Juice, Wine	-	-	-	-	-	-	-	ha
Sugar	0	0	-	-	-	-	**0**	ha
Solid Vegetable Oil/Fat	-	-	-	-	-	-	-	ha
Liquid Vegetable Oil	-	-	-	-	-	-	-	ha
Tea, Coffee	8	14	-	-	-	-	**22**	ha
Food Total	**215**	**236**	**83**	-	-	**33**	**567**	ha
Grand Total	237	243	83	24	10	33	650	ha

Figure 5. The EFA of St Mary's College in 2011
Source: St Mary's College, 2012

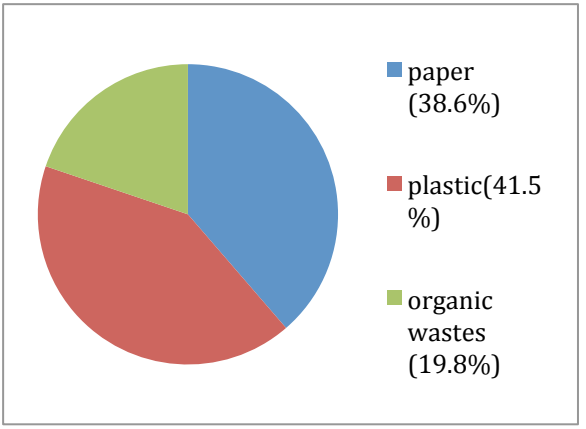

Figure 6. The proportion of waste produced by type
Source: St Mary's College, 2012

This shows an anomaly because no recycling of wastes was done at that time for school waste. It was expected that the footprint for waste would have been comparable to the consumables, since consumption patterns generated waste. One possible explanation is that not all waste items like toilet paper, copybooks and textbooks go to the school bins, some waste was de-localised. That is, the waste stream generated from the consumption of paper in the form of books and copybooks fall outside the school boundary. It was also noted that almost the same amounts of paper and plastic waste were produced yearly (although plastic wastes are in a slightly greater proportion over daily collection). The following actions were proposed on the basis of the EFA for reducing the EF of St Mary's College:

1) Encourage students to sell their old textbooks in good conditions to the college and this will be sold back to new students at reduced price. This will reduce consumption of paper.

2) Prescribe books that are both textbooks and workbooks to reduce the consumption of paper as copybooks.

3) Encourage student to reuse their plastic bottles and plastic wrap several times instead of using them only once and throwing them in the bin after usage. This will reduce plastic waste.

4) Markers used by teacher could be refilled with special ink to be used again instead of buying new markers.

5) Paper and plastic waste can be separated in appropriate bins and send for recycling when a considerable amount has been collected.

5. Lessons learned

The EFA is a valuable pedagogical tool to establish a baseline of consumption and waste generation against which future Ecological Footprints will be benchmarked. It also enables the school to become conscious of the actual level of resources being used at St. Mary's College and to identify which items and patterns increase the EF. This supports the school to choose actions that will help bring consumption levels back to sustainable limits.

The following pertinent lessons were learned:

- Overall, it was not an easy task to gather all the necessary data and to implement the EF project in the school in 2011-2012, when this was done as extra-curricular activity. The EF team met resistance from school staff and the students who were reluctant to engage in the project.The EFT engaged in several communication strategies to overcome this resistance, namely: notices were affixed in public areas of the school and a brief presentation of the project was delivered during the morning assembly to engage the school community on this new journey of learning for sustainability; the management of St Mary's College made arrangements on a regular basis for free periods where important issues with regards to the project could be discussed.
- Surveys were carried out anonymously, yet many respondents were hesitant to disclose their consumption behaviours as they perceived their food habits as being individual rather than a reflection of the society as a whole. To address this, communication strategies such as workshops, talks and exhibitions were identified for the near future to further sensitise everyone to this cause. The collection of information for the food category was undertaken by the students but most of the weighing activities were undertaken by the mentor mainly due to a lack of time or for convenience.
- Team leaders could have been elected within each sub-team where these students can act as rapporteurs and be empowered to better coordinate the tasks that are to be completed. Another important aspect for the further success of EFA at schools is more effective communication with the school staff and students. Involving students in the EFA project has shown to be effective as a dynamic approach for helping to sensitize students to the issues related to his environment.
- Finally, the EFA showed that many low cost solutions can be implemented to reduce the ecological impact of St Mary's College.

Since 2013 provisions have been made in the EFS programme for EFA to continue as part of the school curriculum activities, which has come into effect since 2014 for the EFS pilot schools. Evaluations in 2013 and 2014 have shown that much of the work that was carried out by the EF teams in 2011 - 2012 has contributed to the deeper changes in behaviour for sustainability. The outcome of the EFA in 2011 indicated effective ways to lower the EF of St Mary's College, which has been implemented in the years that followed (see also Lee Hon Chong, this issue).

6. Conclusions

For education to play a transformative role in steering society towards sustainability, it will need the capacity to create ecologically literate individuals (Deenapanray et al., this issue). EFA provides an effective pedagogical tool for ecological literacy development of students and teachers at school. By analyzing school activities in the measure of biologically productive area necessary to support current consumption patterns (given prevailing technical and economic processes)the school community can become aware of its contributions to sustainable development. The EFA also provides an effective tool for ongoing monitoring and evaluation regarding the school's commitment to the implementation of the EFS Charter and Pledge that was signed in February 2014. Through the EFS Pledge, the EFS pilot schools have promised to take actions where necessary to reduce their EF (Chung Kim Chung & Smitsman, this issue).

At St Mary's College we are committed to the ongoing change in mental attitude and behaviour necessary for sustainability. The attitude towards change for sustainability is not "*what can others do for us*"; instead it is "*what can we do for ourselves*". It is in the minds of people that the wind of change must first start to blow. It is our commitment to pave the way towards this new mental disposition. Much progress has been achieved and many more lessons are yet to be learned.

Notes

1. Please see: http://www.bec-mauritius.org/courses/appliedpedagogy/17, accessed 27 May 2014.

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Messages from the Field – Voices from the EFS pilot schools in Mauritius

Jerry Lee Hon Chong†, Lucie Leve Hang†, Zaahirah Koheallee Hosenbocus†, Urvasi Pauvaday†, Gérard Yu Tim Lun ‡, Anamantoo Boni Bangari‡, Stephanie Deruisseau‡, Shakeel Moossajee‡, Sylvestre Larosée††, Jean Bernard Jacques††, Yasaar Jaumeer††, and Katha Padiachy Thyageshwari††

† Loreto College Curepipe, Mauritius

‡ St Mary's College, Rose Hill, Mauritius

†† Bon et Perpetuel Secours (BPS) Fatima College, Goodlands, Mauritius

(Correspondence: *contact the schools*)

Abstract

Through this article the reader is taken on a journey into three Catholic secondary schools that are part of the Bureau of Catholic Education (BEC) Network and act as pilot schools for the implementation of the Education for Sustainability (EFS) programme. Students, teachers and management share their stories and experiences of working with the EFS programme over the last three years, and their aspirations for the future. These stories also demonstrate the learning process and transitions that each of the participating organizations have moved through. Many valuable lessons can be extracted from this feedback that will further be implemented as the programme progresses over the coming years.

Capturing and integrating these feedbacks in the further planning process and implementation forms an integral part of the adaptive learning approach of the EFS Programme. The sharing of stories also supports the participants of the programme to evaluate their own learning and progress and provides valuable time and space for reflection.

Keywords – reflections on the EFS programme; pilot schools; stories of change for sustainability through education.

1. Introduction

The Education for Sustainability Programme, designed and facilitated by ELIA-Ecological Living In Action (ELIA) in collaboration with the BEC, is implemented in the Catholic secondary schools of Mauritius. The schools that have provided narratives for this article first joined the programme in 2011, when it was implemented through extra-curricular activities and trainings. In 2013, the programme was able to move forward as part of the curriculum system and three pilot schools were selected for further implementation. These schools are: Loreto College Curepipe (LCC), St Mary's College (SMC) in Rose-Hill, and BPS Fatima in Goodlands, Mauritius (see Smitsman & Deenapanray, this issue).

2. Loreto College Curepipe

Loreto College Curepipe (LCC) is a Loreto Catholic secondary school for girls in Mauritius. The school was founded in 1870 by the Loreto sisters who also manage 6 other colleges on the island. Today LCC caters for over 800 students. LCC joined the EFS Programme in 2011 and has been acting as a pilot school for the programme since 2013. LCC has an active student-led Eco-Club called 'LCC Go Green Club', where students are playing a key role in driving the EFS programme within the school. The stories and progress reported below are from the LCC Go Green Club, the EFS mentors, and the LCC Rector.

2.2. Progress report from the EFS Mentors

The following report is written by Zaahirah Koheallee Hosenbocus and Lucie Leve Hang. Mrs Hosenbocus is Head of Department of Chemistry at LCC and EFS Mentor for LCC since 2011. Mrs Leve Hang is the Deputy Rector of LCC and EFS Mentor since 2011

Loreto College Curepipe (LCC) - The Go Green Student Club

To all students, the term sustainability has come to mean the actions of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological sustainability and balance. We need to find ways to reduce pollution, for example less plastic should be used due to its inability to biodegrade. Therefore to attain the objective of having a sustainable environment, our school has initiated sustainability activities to help everyone understand the danger humanity is facing by not honouring our planet, and to encourage them to contribute to our quest for a clean and healthy environment. The fact that the Ecological Footprint project has been implemented in our school helps to raise the consciousness of most of us on what is happening to our world. An issue which we once thought had nothing to do with us has become one of our main problems today. We all feel concerned about what is happening to our natural environment and we now believe that it is our duty to gradually fix the harm that has been done and is being done by humanity over many years; or at least to reduce it as much as possible.

Sensitisation programs have been set up to make us aware that if our eco-systems suffer and collapse, then we will also suffer and die along with it. Therefore, by taking even small steps great things can be achieved in the end. Together a whole team of LCC girls have taken the initiative to help in realising the EFS programme. Videos and slideshows are passed to increase the student's and teacher's awareness about the 'critical' position our planet and we are in. The conferences we attend indeed help to show us the path to sustaining a healthy environment. We are fully guided and are made aware of all the possible activities which may be undertaken to reduce pollution or to reduce wastage. We have learnt many things due to the programme and we are trying to get everyone to put into practice the necessary ecological habits.

Activities such as upcycling, composting, rain harvesting, and recycling are being done during activity classes. A kitchen garden and a nursery garden have been set up and we are taking care of them. Competitions, which were also organised last year to motivate us students, taught us about the wonderful dresses one could make out of plastic or other recycled materials. Each class has been offered a plant to look after and there is an eco prefect to assure the cleanliness of their respective classrooms. In this way we can ensure that Loreto College of Curepipe will remain green and clean and it is one step towards 'saving the planet' that we are all taking together.

Written by Urvasi Pauvaday – President 2014 LCC Go Green Club

Many people talk about sustainable living or "Maurice Ile Durable" as a great way to help the planet and its inhabitants, but for most people, it is just a vague concept. First of all, we believe that we need to be aware of a number of ongoing green facts that may guide us. These facts must lead to changes in our everyday actions. With some thinking and planning we can take small steps each day towards a greener planet so that we can live more sustainably. Our aim and commitment at Loreto College Curepipe (LCC) is to guide our students to live peacefully and sustainably on our planet; to help them build a healthy future where ecological literacy becomes embedded in their everyday activities. Our motto is : *''Reussir sa vie avant de reussir dans la vie.''*

2.2.1. LCC Education for Sustainability Actions

Taking time to recycle is one of the simplest steps towards sustainability that anybody can start immediately. Discarded trash does not magically disappear. It goes to landfills and takes years to break down. Taking time to separate trash into recyclables and biodegradables can be very important and make a real difference.

In 2012, during the first term, we introduced the students to the concept of Ecological Footprint Analysis. The objective was to collect data for four different categories and to calculate the footprint—impact on the environment. For both the mentors and students of the program, the concept was initially vague but we started collecting plastic bottles and ended up with 150 which we stored in the attic. We contacted the firms Powerplastic and Mission Verte (unfortunately they never came for collection, and that is now being addressed through the EFS programme).

We also completed the collection of data for the FOOD category. To be more ecological we decided to stop printing 100 questionnaires and instead view those via an overhead projector. We selected students of all levels and during their activity classes they gathered the data for the EF analysis. Due to lack of time and human resources, we could not make the EF for the remaining two categories. Now that EF has become embedded within the curriculum activities, we no longer have to gather those data outside school hours, which will make it a lot easier to continue to measure and improve our Ecological Footprint.

At the end of 2013, we had a small informal meeting with the EFS mentors and the teaching as well as non-teaching staff, to discuss how to move forward in 2014. From this meeting we formulated the following objectives for 2014:

- Launching of the LCC GO GREEN CLUB with our logo (designed by Mrs. BASSET);
- Setting up of an executive team;
- Eco-agents for each Form;
- Campaigns on recycling;
- Separation of waste after school hours on Tuesdays and Fridays by the Form 5 and Upper 6 Eco Agents (under the supervision of Mr. Dinesh);
- Celebration of important international days;
- Conference on global warming (AIESEC);
- Gardening initiative by AREU;
- Rain harvesting.


LCC Go Green Club – Executive Members

We completed most of our objectives but the main problem we faced was to get people into the habit of separation of waste in the staffroom as well as in the yard. Even though clear labels were tagged on different bins, it remained a BIG CHALLENGE. During the year the Eco Agents were very active on the ground; they painted the flower pots to beautify the school entrance. As part of the program, we try to talk to other departments in order to sensitize their students in their own field.

The works of some departments are as follows:

- The home-economics department – after each cooking class the girls went to throw their organic waste in the compost bin;
- The Fashion & Art department did the upcycling with their students;
- For the sports day the costumes of the mascots were made using old newspapers and plastic bags;
- The Science department included the programme in the curriculum. Some of the work done included explaining the chapter of MATTER outside the classroom. This provides more space and learning was made through experience rather than through books;
- The P.E department uses the empty yogurt containers to make ice;
- The Accounting department included a question related to ecological literacy during the second term examination;
- Recycling and Re-use of papers—all question papers are recycled at the end of year. The administrative staff used papers from old diaries or old photocopy papers to make new copies when necessary. If not, most communication goes through mail. We have also introduced the student diary to reduce the use of paper.

Eco-point

The EFS sensitization program

- The Form 2 and Form 3 students came up with the **ECO Games**, which are now played in the activity classes. Through games the concept was better understood.
- **Science competition at MGSS Nouvelle France** which chose the idea of upcyling and presented dresses made up of old newspaper and plastic bag. They did not win the competition but since the idea was an original and innovative one, they were awarded a prize by the Minister of Foreign Affairs Hon. Arvind Boollel.

MGSS Competition 2013

For the year 2014, our objectives are:

- Introduction of ECO POINTS for separation of waste;
- Setting up of nursery garden by the Prevoc Year 3 students;
- Medicinal garden;
- Kitchen garden for the Food & Nutrition classes;
- A plant for each class;
- Eco thoughts;
- Campaigns and competition—reduce the use of PET bottles;
- Compost competition;
- Celebration of important international days – World Water Day, World Earth day, World Environment Day, and World Food Day;
- Initiation into Education for Sustainability of LCC Junior School.

Our aim is to inculcate these values into our small neighbours. We started with the donation of plants and the ecopoint to show how to separate trash. We have planned a 15 minute video on sustainability. Global impact is built on local as well as everyone's actions. Sustainable Living is a great way to maintain a healthy global ecology.

By making small changes in our lifestyle, we too can make a GLOBAL IMPACT.

We thank the rector Mr Lee, the deputy rector Mrs. Leve Hang, Mr Dinesh, the teaching, non-teaching and administrative staff and all members of the Club for all their ideas, help and support.

2.3. The management

Loreto College Curepipe (LCC) - Management

EFS started in LCC after the wakeup call of the bishop, Mgr. M. Piat in his "lettre pastorale" three years ago. We took note of his concern for our sick planet and the urgency of the situation. We responded to it although it did not immediately win the support of the staff, teaching and non-teaching. Thanks to the wholehearted dedication of a handful of teachers, we decided to embark on this noble project. At the same time, in line with the government's decision to implement the MID concept, we thought it was our duty to do our share, however insignificant it may be. Actually, LCC has always had at heart the promotion of a better environment and hence, participating in such a project was our own way of putting words into action. Besides, we are well aware that the best agents of change are the children, to whom we have to bestow a better world. The first meetings were not very conclusive and we did not have the backing of the whole school community. Without the undaunting perseverance and unfailing support of Mrs. Z. Hossenbocus and her team as well as Mrs L. Leve Hang, the deputy rector, we could have never reached such heights today.

The first small and tottering steps of yesterday have now become major and conspicuous strides in our march towards a better environment. The regular sensitisation programmes and talks as well as exhibitions or debates have borne their fruits. Today we can say, without the least doubt, a major battle has been won though aware there is still a long way to go. But we are comforted to know that we are on the right track. Indeed, the unflinching support of the EFS team is highly appreciated. We have seen many projects taking shape and with time, materialised. Among the notable achievements, we may mention:

- *Rainwater harvesting with the sponsoring of Currimjee Foundation. We have already noted a marked decrease in our water consumption and bills.*
- *The 3 R's concept put to effect. Regular recycling of question papers. Refilling of white board markers. Recycling of used batteries.*
- *Toilets equipped with water- saving devices.*
- *Use of economy saving lamps.*
- *Selective littering and composting.*
- *No paper waste forms part of the school culture; only necessary emails are printed on rough paper and communication via email is encouraged.*

Our LCC Go Green club has initiated several projects and is growing stronger than ever. This year's initiative has been to embark the LCC Junior school in the project with an awareness campaign of the importance of separation of waste and by offering one plant for each classroom. Humbly, we know that our contribution to a better environment may be only a drop of water in the vast ocean, but we are confident this will have ripple effects in the long run. We have noted a significant change in the mindset of our pupils and staff, more committed to this just and laudable cause, worth fighting for. Together, we can heal our sick planet.

Written by Jerry Lee Hon Chong – Rector of LCC

3. St Mary's College, Rose Hill

St Mary's College (SMC) in Rose-Hill is a Catholic secondary school part of the BEC network for boys in Mauritius. SMC was founded in 1955 and caters for around 1026 students. SMC joined the EFS Programme in 2011 and has been acting as pilot school for the programme since 2013. St Mary's College has developed a unique rotational club activity model, through which the EFS principles are applied to create synergy and collaboration between the club activities.

3.1 Reflections from the EFS Mentors

Green Marians Club – Nature Camp

St Mary's College - EFS Mentors

I joined the "Education for Sustainability" programme in January 2012 not knowing exactly the kind of adventure that was waiting for me. Participating in this programme changed my perspective as I came to realize how respect for the natural environment is in fact respect for oneself. I was gradually becoming closer to my inner self and to others' feelings.

As I am responsible for the food component at school, I am involved in the education of adolescents on the importance of having good eating habits for their health and well-being. This makes me grow a sense of fulfilment as I meet these students at an important stage of their lives where they start to take responsibility for their food choices.

My challenges initially were mainly related to the choice of food that I thought would be worth taking into consideration in the Ecological Footprint Analysis. I had to be objective, bearing in mind the variables such as the cultural backgrounds, religious beliefs, and socio-economic factors, which influence the food habits of my colleagues, and our students. However, time is not enough when we are deeply engaged in following a direction: as a result of our actual educational system, we as educators tend to confine teaching to mostly what is examinable rather than broadening it to other aspects of life. Therefore, whenever it is possible, I try to relate chapters of the subject being taught to concrete ways of living sustainably. I am used to taking my Travel and Tourism students to "green" sites, where they get in touch with nature through seemingly insignificant situations such as feeling the sun on their skin, hearing the wind blow through the trees or feeling the smell of moist soil walking down the paths.

I hope that these experiences make them more aware of the importance of nature and act as a trigger to live more responsibly.

Finally, I believe that although schools actively participate in inculcating ecological consciousness into kids, authorities and, commercial and non-commercial organisations should also be participating in this cause. Sensitisation campaigns, allocation of funds and communication programmes just as those being done for other social problems that affect our community at large should be extended to ecological issues as well.

Written by Stephanie Deruisseau - Head of Department of Travel and Tourism & EFS Mentor

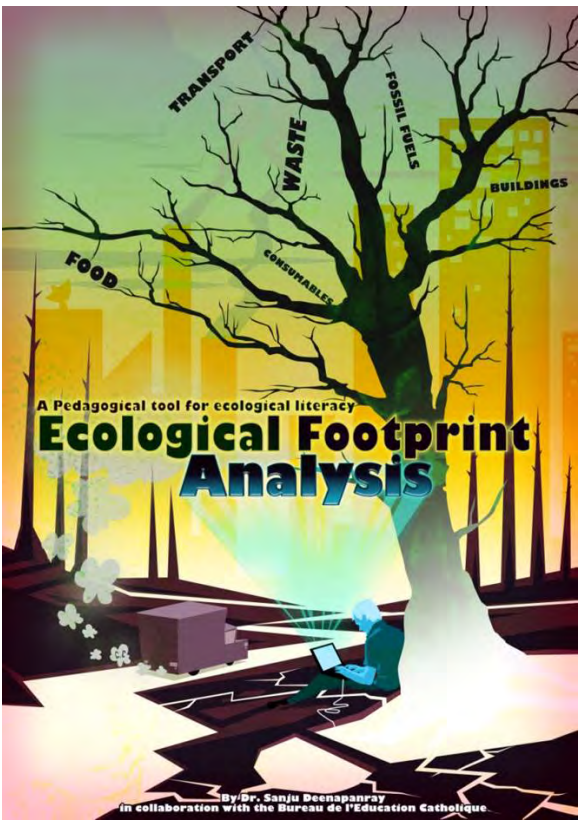
St Mary's College - EFS Mentors

In the EF analysis, waste was one of the easiest components to measure. We had placed separate bins for sorting out of waste at strategic locations at schools. Although we had tags on the bins for each category of waste, I was surprised to notice that students did not respect the tags and had thrown all the waste in the same bin.

The students working on the EF calculation and myself had to sort out the waste in the appropriate bins before weighing. As a remedy to this situation, we had to arouse the awareness and concern of everyone about the project in the morning assembly. However I was surprised to see that some students still threw all their waste in the same bin. Although we had gloves provided, initially it was difficult for us to sort out the waste because of the organic remains like food but gradually my team of students got used to it and strangely they started to find it amusing. For the consumable category we had design a questionnaire to access the consumption level of the different categories of materials used at school. Some of the students in the team found it boring to compile all the data but others found it interesting. For me one striking result was the high consumption of paper at our college.

Written by Shakeel Moossajee – Physics Educator & EFS Mentor

St Mary's College – Botany & Farming Student Club



Ecological Footprint book cover SMC – EF Arts competition
Source: Clarisse Guillaume – former SMC student

St Mary's College - EFS Mentors

*The English verb "educate" derives from Latin infinitive mood "ēducāre"(1st.conjugation) which is the intensive form of the verb "educĕre" (3rd.conjugation) originally meaning "**to draw out**". Searching the Internet for the definition of the word '**Education**', I came across this: "the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life."*
Unless I am mistaken, it would seem that we have drifted away from the very purpose of Education! Whilst most educational institutions are busy imparting secular knowledge to millions of students worldwide, what about our innate potentials that remain latent in us and without which we cannot be a wholesome being?

*'Education for Sustainability', EFS, is in my experience the programme that has imbedded the missing link of the educational puzzle. In EFS, '**the student**' is the very core of a value-based education meant to develop his intrinsic values and relate him to other people and his environment. Based on a systems thinking approach that is infused in educational activities, the student progressively gets to feel his interrelatedness with all that surrounds him. His notion of being a fragmented entity of the world is soon re-established into his realisation of being a primordial link in all worldly matters and the ecological balance. He becomes more responsible in his actions once he gets to realise their implications.*

Working with the students in the EFS programme has made me realise that sustainability can only be achieved in education if all subjects are interrelated and their overall outcome caters for the development of the student at the physical, emotional, mental and spiritual levels. Being a Design and Technology teacher, I have the possibility of relating applied Mathematics, Physics, Art, Socio-Economic and Cultural factors to Design processes. But this relationship would be incomplete if I failed to mention the impact of each Design process on our planet, be it in terms of the depletion of our natural resources or its impact on the environment. Somehow, my exposure to learning from nature and in nature through the EFS programme inspires and challenges me as a teacher to always look for ways and means to relate the academic to the natural world, for the benefit and development of my students.

The transition has started at our school community level, embarking officially through a pledge, the manager, the rector, teaching and non-teaching staff along with students, to pave the way towards EFS. We are conscious that without everybody on board, the programme will not be sustainable. Parents, the community, the population are also key players for the success of the programme. Our greatest challenge will be to inspire many more through our work to change their mindset and join hands with us.

So far, our work has been acclaimed by many local schools and St. Mary's College (R.Hill) will soon be on the TV highlights through a documentary on EFS on the national channel. I am confident that whatever is being done, together with this publication will positively contribute to the success of the EFS programme.

Written by Anamantoo Boni Bangari - Educator in Design & Communication and Technology, Human Values, and Mathematics & EFS Mentor

3.2 The Management

St Mary's College - Management

My relationship with the St. Mary's College started when I was still a young student, joining form one, many years back. I never thought then, that this love story would be a turn point in my life and that I would be the captain on board, as the acting rector, years later. I grew up as a teenager at the College, matured as a teacher there and later took up the responsibility of leading a team of committed staff towards what I believe is the future of Education. Over the years, I have witnessed the development of the College and experienced the inevitable transition in Education under the constraint of an ever demanding and speeding lifestyle, enhanced by technological outbursts. Being a lighthouse that marks dangerous and hazardous coastlines whilst showing the way to safer shores is not sustainable anymore! As such, any rigid structure that seldom adapts to our dynamic needs soon becomes obsolete.

As a rector, realising this fact is primordial to allow oneself to be ever in line with evolution. This is a prerequisite to adapt to our students' specific requirements and better monitor their development, in the same way as remote lighthouses have paved the way to a more adequate and centered modern electronic navigational system. My management has evolved along that line as I can witness the limitation of a top down management style. We are not in the army with soldiers to escort to a battlefront. On the contrary, we are catalysts of peace and harmony. I believe in a management style which is at the very core of development; a management that accompanies and supports each student and staff towards self fulfillment. Sustainable development is not the ownership of the rector, nor the teachers or parents. It is the inspiration of the whole school community working together towards a shared goal.

In that sense, I have given the opportunity to a dedicated staff, administrative, teaching and non-teaching, supported by parents, to put in place various interlinked systems in which I am personally involved. The academic, the sports, the leisure, the spiritual; all co-existing in synergy with the motivation of integral development through an atmosphere of freedom of expression and respect…Configuring, financing and monitoring the upholding structure that sustains and promotes awareness whilst giving the impetus to my staff is my daily challenge. My endeavour to instigate a vision of interconnectedness through activities that relate the students to the realities and complexities of our present world has culminated in various achievements which the school community is proud of.

Today, St. Mary's College is one of the three pilot schools which are leading the way in the 'Education for Sustainability' programme. We have our own mini botanical garden with rare endemic and medicinal plants. We have a rain harvesting system that we use for irrigation in our garden. We have solar panels that supply us partly with a renewable and non-polluting source of electricity. We have regular segregation of wastes enabling us to collect organic wastes for composting that we equally use in our garden. We have intercultural and science exchanges with some schools of Rodrigues, through our Green Star Award programme, launched in 2011. Those are some of the realizations of our students, our staff and supporting parents working together through a well structured system of activities which reinforces academic development. These are the outcome of calculating our 'Ecological Footprint Analysis' in 2012.

We are now moving into another phase of our development. We are having additional classes constructed in response to increasing demands in Education. This was an opportunity to ensure with the architect that optimum use of sun light and cross ventilation became an asset that would further curtail our energy consumption. I have many dreams which keep motivating me to ever strive for the benefit of one and all in the school community; a paperless school, online capture and sharing of data via intranet. Communication with parents, through our school web platform that is expected to gradually eliminate the use of report books. Self-sufficiency in electricity and water needs. But all these would be insignificant and irrelevant if our students are not the ones who would beneficiate the most out of it. After all, are they not the future of our country?

I am thankful that life has endowed me with the possibility to be a steward of change in our transition towards 'Education for Sustainability'. I am confident that together we will make Sustainability become infused in our culture of Education and Living.

Written by Gérard Yu Tim Lun - Acting Rector St Mary's College, Rose Hill

4. BPS Fatima Goodlands

BPS Fatima in Goodlands is a Catholic secondary school part of the BEC network for boys and girls in Mauritius. BPS Fatima was founded in 2002 and caters for about 460 students. BPS Fatima joined the EFS Programme in 2011 and has been acting as pilot school for the programme since 2013.

BPS Fatima Goodlands

4.1. Reflections and feedback from the EFS Mentors

The following report written by Jean Bernard Jacques, Yasaar Jaumeer, and Katha Padiachy Thyageshwari – Teachers & EFS Mentors of BPS Fatima.

4.1.1. Why Sustainability?

As education is the act of imparting and acquiring general knowledge, developing the power of reasoning and judgment, and also preparing oneself for the future, it is at school that we should urgently raise the awareness of present and future generations about the fact that the planetary sustainability for human life is being threatened and this will impact on the whole of mankind.

Forty years ago in the world summit on sustainable development, in Stockholm, the world leaders agreed on the urgent need to respond to the problem of environmental deterioration. Some twenty years ago, in Rio de Janeiro, the leaders reiterated their wish to go forward on the protection of the environment which would also lead to social and economic development.

In Johannesburg in 2002 the world leaders committed themselves to building a humane, equitable and caring global society cognisant of the need for human dignity and sustainable development. Words are important but actions are of utmost importance.

The United Nations launched the decade of Education for Sustainable Development back in 2004 and in line with that the pastoral letter of 2011 of the Bishop of Port-Louis set a new era in the Catholic Confessional schooling and education was chosen to be 'the' essential tool for achieving sustainable development.

We say that '*all education is education for sustainability*' which means all education should promote the vision of interdisciplinary thinking and systems thinking, which acknowledges complexities, looking for links and synergies to find solutions to problems and most of all problems which can lead to the extinction of mankind. Not thinking about ecology today, not making decision and acting on them today, Mankind may have the same destiny as that of the Dinosaur and the 'Mamouth' in the centuries to come.

Economic, social and also cultural development and sustainability all are linked to environmental and ecological sustainability. This is what we want our students today to know about, to think about and to act about. If mankind needs to be saved, we need a 180 degree shift in paradigm and mindset, which should be in the present and future generations of students. It is they who have the talents and energies needed to go for green thinking for renewable energy and for the protection of our blue planet.

Flash rains, flash floods, sea level rise, global warming all are linked to climate change, adding to that the near extinction of animals such as the polar bear or the Siberia tiger, all these are painful proofs that nature is rebelling against us and through education we can help to put things right again. It will take time, years and decades, but the actions should start today, or it will be too late.

4.1.2. BPS Fatima and the Education for Sustainability Programme

Education for sustainability sets a new dimension to 21st century education. School is a dynamic institution; it is the cradle of new ideas and new paradigms. The EFS programme is the milestone for a better future for Mauritian people and the 'UN decade of Education' has been the keystone of education towards bringing in synergy between mankind and nature. We teachers at BPS Fatima are fully committed to the EFS programme.

We have been on board since 2011. Initially, we were five teachers and we were tasked to sensitise our pupils and colleagues concerning the impact of human activities on our environment. We also had the opportunity to implement the first phase of the project, the Ecological Footprint Analysis of our school. We collected data for all the four areas of this study, namely, transport utilities, waste, consumables and food.

Sorting of waste

4.1.3. Development, challenges, achievements and support

During the course of the programme, we witnessed that the pupils were becoming more conscious of the materials they were using. They were making a conscious effort towards sustainability. For example, they collected plastic bottles to throw them in the appropriate bins and they used boxes or cloth for their food instead of using plastic covers. It was also noticed that through the concept of protecting our environment, a care-culture was being integrated in the course of the development of the students. A shift from 'do not care attitude' towards 'responsible actions' on the part of the pupils was the biggest achievement of this project. However, it cannot be ignored that the students also have another environment, other than that of school. Hence, it is important to have the support of the parents to ensure that the culture of sustainability is promoted at home as well.

We also came across numerous hurdles, among which the lack of time, partly due to the fact that the first phase of the project from 2011-2013 was not yet integrated into the curriculum activities. Talks were organised in order to commit everybody to making use of the appropriate bins for each type of materials (plastic, paper and organic waste). This waste was collected at the end of the day for measurement purposes. The other data concerning food and clothing were collected using a sample size of 70 pupils. The data for building, transport and utilities were collected by a teacher in the team. The results revealed quite a lot about the footprint of the school. It was clear that something needed to be done. The school decided to implement some measures as soon as possible.

The management, in collaboration with the Diocese of Port- Louis, speeded up the photovoltaic project. Endemic trees were planted. The agricultural department started to do composting of waste. During science classes, pupils were acquainted with measures that could be taken in order to help reduce our footprint. For example, pupils were asked to switch off the light and fans when they were not necessary. So, in a way, we were looking to change the mindset. Fortunately, the project gained acceptance and everybody started to look for ways to

change our relationship with the (school) environment.

Some of the initial ideas have not yet been implemented. For instance, the management is keen to invest in a system of rain water collection. We are glad to know that this new phase of the EFS programme from 2014-2018 will take care of these and other aspects. As can be seen here, the members of BPS Fatima have adopted the philosophy of sustainable development and are imparting this philosophy to the students through projects and eco-awareness and action campaigns. The environment club set up this year at school is surely one big step towards Ecological Sustainability.

Education for Sustainability gives a new drive to our educational approach and a new hope for tomorrow's world.

Photo Voltaic panels on the roof of the school

Eco-outing with the students of BPS Fatima

Students working in the school garden

4.2. The management

BPS Fatima, Goodlands - Management

Man has been entrusted with the responsibility of looking over and protecting Mother Nature. These days we are witnessing lots of national calamities due to climate change. The flash flood that hit our tiny island on 30th March 2013 and the casualties are still vivid in our minds. In other parts of the world, natural calamities due to climate change hit almost every continent. Scientists have been shouting on roof tops that Man has to protect Nature.

Man's activities are destroying the forests, poisoning our seas, polluting the air and jeopardizing his future. It seems that Man is embarking on an irreversible enterprise that will bring but havoc to us and all.

Ecologists have been pressing for urgent measures to protect our environment. A lot of damage has already been caused to Nature. Pop star Michael Jackson has urged humanity to heal the world. Many governmental and non-governmental organizations are involved in campaigns of sensitization for the protection of the environment and they are launching plans and projects to save the world.

Some years back we were involved in the project whereby we had to calculate the ecological footprint of Man on Nature. We are now trying to go a little further; we are implementing on a pilot basis, the project 'Education for Sustainability' whereby we are sensitizing our students to empower them. That project involves the whole community of BPS Fatima College – teaching staff, non-teaching staff and students. Through EFS we want our students to be aware of the role that they will have to play to care for Nature. We have been given a planet from our fathers and we have to hand it over to the future generations, they too have to hand it over to generations to come. Education is a means of empowering our students. As EFS is integrated in the Curriculum, this will facilitate to some extent the task of empowering our students.

We are not only introducing EFS in our Curriculum, we have also installed Photovoltaic plates to produce solar energy since June 2013; we have an endemic garden that we are trying to enrich with other endemic plants and we are also contemplating the idea of harvesting rainwater to be used to water our gardens.

Actually we are faced with the challenges of implementing the EFS project. Everyone must be motivated not only at the beginning but also throughout the implementation of the project until each and every student is imbued with values that mould his beliefs and actions that transform him into a caring agent of Nature.

Written by Mr Sylvestre Larosée - Rector BPS Fatima, Goodlands

5. Conclusions

The stories presented here in this article, from the pilot schools, provide a valuable window for a better understanding of how students, teachers and school management see the priorities of education for sustainability. It also reveals where they experience the challenges, how they view the benefits and why it matters to them to become the drivers for these changes towards a sustainable society and future and through education. It can be observed from the narratives and feedback that most of the participants in the EFS programme are engaged in a professional as well as personal capacity.

Their own convictions regarding the changes that are needed in society and the role education should play towards this, are a major contributor to the success that they have been able to achieve in their school over the last years. Many of the participants believe in the principles and practices of sustainability education and are committed to the deeper changes in the educational system. It also testifies how the EFS programme is in many ways revitalising the heart and purpose of education by responding to the deeper question of 'education for what purpose' (see also Deenapanray, Smitsman & Chung Kim Chung, this issue). As said by one of the EFS mentors from St Mary's College Rose-Hill:

> "*In EFS, the student is the very core of a value-based education meant to develop his/her intrinsic values to give birth to a unique individual who will interconnect harmoniously within the puzzle of existence. 'EFS' is not the responsibility of a government, of a school, of parents or teachers… 'EFS' is an individual choice, a conscious decision that pertains to each and every one of us. I have made my choice. Feel free to make yours, bearing in mind that we are ALL interconnected*."

Source: Anamantoo Boni Bangari, April 2014.

The stories also reveal that most of the emphasis in the initial stages of the programme has been on the concrete tangible environmental actions, which can easily be measured and evaluated. Sustainability education, as is discussed in earlier articles of this journal, is not just about development of environmental literacy. It is quite common for ecological literacy to be brought down to development of environmental consciousness and green habits. Ecological literacy, however, goes much further and starts with the principles of life that demonstrate how we are all interconnected and part of the Web of Life. In general, the relational aspect of ecological literacy is less talked about in feedback from teachers and students, although this forms the foundation for the kind of learning and development that leads to ecological literacy (see also Smitsman & Smitsman, this issue). It is encouraging, however, to see how in some of the stories presented here the relational dimensions of sustainability are brought forward.

The narratives from the field, presented here, reveal a beautiful progression for how changes for sustainability were introduced and later implemented in the schools. An overall pattern that can be observed from these narratives is that people needed a concrete experience or understanding of the larger context, in order to engage with and accept the changes introduced through EFS. As was described in one of the narratives, reduction of consumption and waste was initially met with resistance by members of the school community (in particular teachers who were not participating directly in the programme). Then as more people started to see the purpose and benefits of these new behaviours, a ripple effect resulted through which many more people engaged and came to support the changes. The ecological footprint calculations of the schools ensured that the learning for sustainability remained grounded in local reality and invoked a collaborative and multi-disciplinary approach (see Bangari et al., this issue; Smitsman & Deenapanray et al., this issue). The people who have been driving these changes on the ground are critical to the success and sustainability of the EFS programme.

Perhaps the success factor of education for sustainability is that it brings back into clear perspective that learning needs to be purposeful, transformative and meaningful in the most personal as well as the wider context of what education needs to prepare for, and contribute to.

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EDITOR'S NOTE

The concept of environmental education (EE) has emerged with dominant reductionist programmes and education oriented primarily to the conservation of resources. The Conference in Rio de Janeiro marked a turning point and emphasized the significance of sustainable development in Agenda 21 (UNESCO, 1992). This document calls for a reorientation of EE and introduces the principles of sustainability and the need to apply them to economic, social, cultural and environmental dimensions of human development.

This Special Edition 2014 of Studies in Applied Pedagogy on 'Education for Sustainability (EFS): The Case of Catholic Secondary Schools in Mauritius' provides an enriching and thought provoking insight into education through the lens of sustainability with contextualised thinking.

Our thanks go to the different contributors namely academics, researchers and practitioners, policy makers, head of schools, teachers and pupils.

While we are now in our third year of publication, these contributions give new impetus to Studies in Applied Pedagogy whose mission is to provide a forum for critical reflection and action on societal issues related to education.

This edition is prefaced by Richard Farell (Emeritus Professor of Neighbourhood Regeneration, Coventry University, and Canon Theologian, Coventry Cathedral, United Kingdom) who provides a theological perspective on education for sustainability.

Jimmy Harmon
Head of Department of Applied Pedagogy
PhD Candidate, Department of Language and Education
University of the Western Cape (UWC)

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