ENGAGING A GRADE SIX TEACHER AND HER STUDENTS IN EDUCATING FOR SUSTAINABILITY: A TEACHER-RESEARCHER COLLABORATIVE STUDY

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BY

CHRISTINA MCDONALD

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University

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Abstract

Engaging a Grade Six Teacher and Her Students in Educating for Sustainability: A Teacher-Researcher Collaborative Study

Educating for Sustainability (EfS) requires a fundamental shift in thinking from an anthropocentric to an eco-centric worldview. EfS requires an ecological approach so that children may develop a way of knowing to live sustainably. To realize these goals, teachers need to understand students' views of human-nature relationships and how these influence curriculum decision-making when adopting the principles of ecology. This study, therefore, focuses on a Grade six teacher who collaborates with the researcher to design an ecology-oriented EfS curriculum. The study also explores her students' views of human-nature relationships and how she translates the intended EfS curriculum into classroom practice.

The study uses an ethnographic design to understand the EfS curriculum development process; phenomenography to identify categories of students' views of human-nature relations and to develop case studies; and an ethnographic design to capture a holistic picture of the classroom culture.

Means of data collection over eight months include: tape recordings of on-going conversations between a teacher and a researcher as they collaboratively develop an EfS curriculum unit; face-to-face individual interviews with the teacher and her students; photo-interviews with students; video- and audio-recordings of classroom observations; and content analysis of documents and artifacts.

The teacher (Rachel) characterizes herself as a "real Enviro Freak" — with an eco-centric human/nature relation. She values practical process-oriented approaches to

teaching and learning. Rachel identifies a number of issues during curriculum development: missing partners for an interdisciplinary approach, time commitments for collaborative effort, previous experience with collaborative work, acknowledgement and support at home, teacher responsibilities, and non-existent EfS curricula. Rachel's support system includes: the school structure in place to implement a n EfS unit, positive working climate with colleagues, her principal's support and her pre-service Early Years education.

Grade six students' views of human/nature relations are: action, life-based intrinsic value experiential appreciation, self-centered, non-reciprocal view, basic need, safekeeping, biocentric, reciprocal, personal, and technical. Two case studies reveal that students develop more sophisticated meanings about the ecocentric world view. While teaching the EfS unit, Rachel displays five character traits: raising student awareness of human/nature relations; interpreting student values and positions; leading students from within; inspiring students by story-telling; and empowering students in making decisions and taking actions. She dissolves the classroom walls and reaches out to the community to bring the EfS unit to life.

The missing link in the EfS curriculum involves the conscious and systematic incorporation of student views and the connection of these views to the principles of ecology. Thus, the study implies that teachers need to learn how to incorporate students' human/nature relations into the curriculum that uses the principles of ecology. For successful teaching, the curriculum needs to adopt a transformative process, which involves, inquiry, reflection, and dialogue within a community of learning.

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CHAPTER ONE

INTRODUCTION

1.1 My Awareness and Learning: Educating for Sustainability

For almost two decades, I watched and listened to over 300 graduate students at the Natural Resources Institute, University of Manitoba, talk research and write about how best to manage natural resources. I often read students' research and sat in on seminars and lectures where students shared their points of view and perspectives on various issues and topics on sustainability. My awareness of sustainability issues and problems became even stronger as I began to think about in what kind of world my children would grow. As a society, what are we leaving for our children and other living things? In the future, would the earth be a healthy place with clean air to breathe, pure water to drink, undisturbed forests, diverse plants and animals, non-depletion of the ozone layer, free from wars and pestilence, jobs for the world's people, a strong economy, and a safe place? What could be done to work towards a healthy world for all living things? If a person's worldview is based on an anthropocentric way of thinking, then decisions and actions are based on what is in the best interest of human beings (probably in the short time frame). On the other hand, if a person's worldview is based on an eco-centric worldview, then decisions and actions are based on what is in the best interests of all living things on the planet. The outcomes obviously are very different, and education might be the key to a fundamental shift in thinking from an anthropocentric to eco-centric worldview in order to live sustainably.

A way to educate for sustainability across the K-12 curriculum might be through holistic teaching or traditional indigenous knowledge because Aboriginal peoples

traditionally do not separate the environment from themselves and their way of life. Everything is taken into consideration as part of a larger system. Every decision given is based on how it would affect the entire system, including people within the system, seven generations from now. This holistic thinking has everything to do with moving towards a healthy world. While reading and writing on ways traditional indigenous knowledge could show everyone the way to a healthy world, I kept hearing, "You're not Aboriginal." "What do you know about traditional indigenous knowledge?" Others mentioned, "Even if you succeed in showing that indigenous knowledge can be used to teach us how to live more sustainably, you will not be taken seriously because you are not Aboriginal. Your views will not be respected." "You will not be credible," others stated.

Stymied but not stifled, I researched other ways of knowing and fell upon a "systems" way of knowing (Laszlo, 1972; Senge & Lannon-Kim, 1991) that paralleled the traditional indigenous ways of knowing. The "systems" way of knowing was appealing because sustainability means learning to think in terms of interrelated systems where every part of the system affects every other part of the system over time (past and present). When one part of the system is weakened or damaged, the whole suffers. The systems approach is characterized by ideas of unity, wholeness, relatedness and interaction that are manifested in ecosystems. For example, consider the concept of waste. In an ecosystem, waste from one species is food for another. If we use this principle as a guideline, we would not view our waste as "garbage" to be taken to the landfill site; we would view our waste as a renewable resource thus maintaining the ecosystem in dynamic equilibrium. All ecosystems behave or function according to a set

of principles (see Chapter 2 for details) that are inter-connected, and this web-like structure ultimately determines the sustainability of ecosystems over time.

Ecosystems can be used as models for Educating for Sustainability (EfS) because they are the only known systems that without human intervention has been sustainable for millennia (Capra, 1996). Bowers (1995); Laszlo (1972); Orr (1992/1994); Senge (1990/1991/2000) and Warren (1993) contribute to the eco-centric way of knowing and thinking. Not only can we learn valuable lessons from the structure and function of ecosystems to live sustainably on the planet, but also model ecological principles. In other words, the relationship between the ecological approach and Educating for Sustainability is not just what you teach (using the principles of ecology as guidelines for living sustainably on the planet) but also about modeling appropriate behaviour. This relationship is demonstrated when all members of the learning community (teachers, students, administrators and parents) work together. The principle of relationships within ecosystems is the framework for inquiry and learning and for connecting various disciplines within the Grades 9 and 10 curricula in the Integrated Studies in Systems (ISIS) program in California. Students in the ISIS program complete interdisciplinary projects/research, answer questions such as: "How can we use solar energy/devices to help improve the quality of human life?" Students have an opportunity to present their answers to the community.

Nine theses also revealed sustainable development education from an interdisciplinary ecological perspective (Arenas, 2000; Gavan, 2000; Lauzon, 1995; Lawrence, 1993; Riley, 2000; Samuel, 1991; Williams, 1994; Wismer, 1990; Woods, 1993). Of these, seven studies are American and two are Canadian. Except for two case

studies *Educating for Sustainable Development: A Case study of an Environmental Immersion School* (Samuel, 1991), and *Ecological Education: Schooling, Economics, and Sustainability* (Arenas, 2000), all the other studies are essentially conceptual. Although the conceptual studies lack the essential practical elements, they have much to offer. For example, Riley (2000) articulates an eco-spiritual ethic/praxis for curriculum theory based on the principles of interdependence, justice and ecological sustainability and draws from the work of eco-feminists (Collard, 1989; Macy, 1991a/b; Merchant, 1996; Salleh, 1997; Spretnak, 1997), deep ecologists (Berry, 1988; Devall, 1988; Orr, 1994), and process theorists (Bohm, 1980/1985; Capra, 1996; Davies, 1992; Zukav, 1979/1986). These authors' curriculum theories promise to foster within children a broadened, deepened sense of their connection within the matrix of all living things (Riley, 2000).

1.2 Background to the Problem

Ecologists such as Carson (1962), Leopold (1949), and Muir (1979) contribute to an understanding of sustainable development by revealing the interconnections between the environment, social well-being and economic/political factors and the need for harmony between these factors. Their concerns (and solutions) stem from the exponential growth of the human population and the resulting load this growth places on the natural environment. For example, Leopold's (1949) solutions are to "examine each question in terms of what is ethically and aesthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise" (pp. 224-225). Many authors and scientists during this time period widely espouse the argument that the

world has finite resources and a finite capacity to absorb the ecological burdens that humans may put on it (Borgstrom, 1969; Ehrlich, 1968; Hardin, 1969). They propose solving the world's population problem through a process of development.

The last three decades have seen many conferences, reports and declarations concerning the environment and development. Reports such as *Global Tomorrow Coalition* (1991/1989); *Global 2000* (2000); and *World Conservation Strategy (*1980) stress the need for adopting sustainable development concepts in global issues and recognizing the unsustainable policies and actions of nations. For example, the discussion of environmental problems by delegates from 113 countries attending the United Nations Stockholm Conference on the Environment *Only One Earth* resulted in The Stockholm Declaration and Action Plan (1972), which highlights 109 recommendations for action in areas related to the conservation of natural resources, education, human settlements, and pollution at the national and international levels. The Stockholm meeting also created the United Nations Environment Program. Several United Nations conferences focusing on such themes as water, climate, science and technology, air and water pollution, and women continued to occur between 1974-1981.

In 1983, the United Nations General Assembly appointed an independent commission, the World Commission on Environment and Development (WCED), "to re-examine the critical issues of environment and development, to formulate innovative, concrete and realistic action proposals to deal with them, to strengthen international co-operation on environment and development, to assess and propose new forms of co-operation that can break out of existing patterns and influence policies and events in the direction of needed change, and to raise the level of understanding and commitment to

action on the part of individuals, voluntary organizations, businesses, institutes and governments" (WCED, 1987, p. 356).

From 1983 to 1987, the WCED undertook research and conducted public hearings to explore global solutions to problems caused by environmental degradation. The Commission was confident that it was possible to build a future that was more prosperous, more just, and more secure (p. 356). The Commission report, *Our Common Future*, was presented to the UN General Assembly in 1987 and concluded that the world was facing a serious threat brought on by unsustainable development. This report captured the world's attention and became a highly influential document. The Report emphasized the links between problems of growth, technology, environment and economics and offered the solution – sustainable development – "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. v). Central ideas contained in the report include sustainability as what the global human population should strive toward and development as the process (not an event) of change required to attain sustainability.

Almost a decade later, the United Nations voted to hold a world conference on Environment and Development (Earth Summit) in Rio de Janeiro in June 1992. Representatives from 178 countries, along with 117 heads of state met to discuss the relationship between the environment and the economy. The Conference produced an 800-page report entitled *Agenda 21* (Sitarz, 1993), which discusses future sustainable development initiatives. One of the key reference points for the advancement and implementation of sustainable development through education is contained in *Agenda 21*'s chapter thirty-six, *Promoting Education, Training and Pubic Awareness:*

(a) *Education*, including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. While basic education provides the underpinning for any environmental and development education, the latter needs to be incorporated as an essential part of learning. Both formal and non-formal education is indispensable to changing people's attitudes so that they have the capacity to assess and address their sustainable development concerns. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviours consistent with sustainable development and for effective public participation in decision-making. To be effective, environment and development education should deal with the dynamics of both the physical/biological and socio-economic environment and human (which may include spiritual) development, should be integrated into all disciplines, and should employ formal and non-formal methods and effective means of communication.

(b) Governments should strive to update or prepare strategies aimed at integrating environment and development as a cross-cutting issue into education at all levels within the next three years. This should be done in cooperation with all sectors of society. The strategies should set out policies and activities, and identify needs, cost, means and schedules for the implementation, evaluation and review. A thorough review of curricula should be undertaken to ensure a multidisciplinary approach, with environment and development issues and their socio-cultural and demographic aspects and linkages. Due respect should be given to community-defined needs and diverse knowledge systems, including science, cultural and social sensitivities.

c) Countries are encouraged to set up national advisory environmental education coordinating bodies or round tables representative of various environmental, developmental, educational, gender and other interests, including non-governmental organizations, to encourage partnerships, help mobilize resources, and provide a source of information and focal point for international ties. These bodies would help mobilize and facilitate different population groups and communities to assess their own needs and to develop the necessary skills to create and implement their own environment and development initiatives (Sitarz, 1992, p. 7).

Mandated in April 1996 to ensure the follow up of *Agenda 21,* the 52 member countries of the United Nations Commission on Sustainable Development recommended: 1) the development of an international strategic alliance among United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Environmental Program (UNEP), the World Bank, United Nations Development Program (UNDP), United Nations Children's Fund (UNICEF), World Health Organization (WHO) and international Non-

Government Organizations such as World Wildlife Fund, The World Conservation Union (IUCN) and others, and 2) the development and implementation of a work plan.

The Commission on Sustainable Development (CSD) recommended that a Work Programme be developed with the following objectives:

- Develop a broad international alliance, taking into account past experience and promoting networks in partnership with UNEP, IUCN and other key institutions.
- Advise on how education and training for sustainable development can be integrated into national educational policies.
- Advance education and training for sustainable development for educators at the national level; refine the concept and key messages for sustainable development.
- Provide financial and technical support (IISD, 1999).

In preparation for the Extraordinary Session of the United Nations General Assembly (June 1997) that looked at progress since the Earth Summit, the CSD recommended that: Chapter 36 (the chapter focusing on education) be considered a cross-sectoral chapter of *Agenda 21*. Since 1992, this chapter continues to enjoy unanimous support from Governments, major groups and the educational community of both developed and developing countries, as it had in Rio de Janeiro. Education is considered indispensable for sustainable development and for increasing the capacity of people to address environmental and development issues. The implementation of Chapter 36 is therefore, seen to influence progress in the implementation of all the other chapters of *Agenda 21*. Recommendations concerning education also appear in each of the action plans of the major United Nations

conferences held after the United Nations Conference on Environment and Development as well as in the three later conventions (on biodiversity, climate change and diversification). For this reason, education can be seen as the cornerstone of sustainable development in all its dimensions. As demonstrated at the Extraordinary Session (1997), many countries had already made the initial steps necessary to reorient education toward sustainable development. Paragraph 105 of the *Final Declaration* endorsed by all countries states:

> Even in countries with strong education systems, there is a need to reorient education, awareness and training to increase widespread public understanding, critical analysis and support for sustainable development. Education for a sustainable future should engage a wide spectrum of institutions and sectors, including but not limited to business/industry, international organizations, higher education, government, educators and foundations, to address the concepts and issues of sustainable development, as embodied throughout Agenda 21, and should include the preparation of sustainable development education plans and programmes, as emphasized in the Commission's work programme on the subject adopted in 1996. The concept of education for a sustainable future will be further developed by UNESCO, in cooperation with others (IISD, 1999, p. 26).

The importance of sustainable development education was also recognized at different regional meetings. Those meetings include: The Workshop on Sustainable Development Education and Awareness, Prague, Czech Republic, November – December 1995; The Seventh Conference of the Ministers of Education of Latin America and the Caribbean, Kingston, Jamaica, May 1996; The Mid-decade Meeting of the International Consultative Forum on Education for All, Amman, Jordan, June, 1996; The Summit of the Americas on Sustainable Development, Santa Cruz de la Sierra, Bolivia, December 1996; The International Conference on Education, 45th Session, Geneva, Switzerland, September-October 1996 and The International Conference on Educating for a Sustainable Future: A Transdisciplinary Vision for Concerted Action, organized by UNESCO and the Government of Greece, Thessaloniki, Greece, December 1997. At the first meeting of the ministers of

education of the Americas, the Inter-American Education Program was approved and a resolution was adopted to put forward the project of Education for Citizenship and Sustainability in Multicultural Societies, and for that purpose, the ministers recommended the coordination of the efforts of other organizations with similar experiences. In the United States, the President's Council on Sustainable Development developed a national strategy for Sustainable Development Education.

The inception of Sustainable Development Education comes from international political and economic forums (e.g., United Nations, OECD) not from the education community itself. Nevertheless, thousands of teachers and other educators across Canada have accepted the concept of sustainable development (LSF, 1994) and have changed in the process. The endorsement of stakeholders from all sectors of society, including government, business, labour and parent groups reinforces the idea. Sustainable development is incorporated into new curricula across Canada. For example, the Pan-Canadian Framework for Science Outcomes – Science, Technology, Society and Environment (STSE) (1996) – reflects this perspective.

In 1999, The Council of Ministers of Education (CMEC) identified the status of sustainable development education in Canada in a report entitled, *The Status of Sustainable Development Education in Canada*. A review of the report indicates that Canada has legislation, policies, and guidelines pertaining to the inclusion of sustainable development concepts in Canada's education system. Canada's provinces and territories have identified the curriculum integration, teacher professional development and innovative educational practices recommended for this genre. The report, available on CMEC's website at: http://www.cmec.ca/reports/index.stm has been recognized

internationally. Note however, that no studies have yet been published to indicate to what extent sustainability exists in teacher education programs, to what extent sustainability is encouraged in Canadian classrooms and the extent to which educational change has taken place.

1.3 Justification of this Study

No studies have been published that observed the curriculum development process of integrating sustainability concepts across the curriculum. Further, as of 2003, no studies have identified a model or well-defined plan for curriculum development processes associated with EfS. Thus, these research products provide bases and insights for educators and curriculum developers to develop and implement an EfS curriculum. Additionally, few studies exist that expose the views of students concerning their human/nature relationship (although see Fox, 1990; Robertson, 1998/1993; Wals, 1992). Few studies expose the understanding, values, and interests of students with respect to how human being should live on Earth if the aim is to move towards a healthy sustainable planet.

More specifically, this study illuminates the path of one Middle Years teacher as she works with a researcher to develop and implement an EfS-focused curriculum in her classroom. This study sheds light on how Middle Years students think and talk about how to live sustainably on the Earth, and how they think about the world and related sustainability issues, problems or themes. The study shares and exposes students' views about their human/nature relationship and how to live on the planet in the next millennium. This study provides educators and curriculum developers with useful

information for effective design, planning and implementation of ecological sustainability-focused curriculum that meets the needs of students.

1.4 Problem Statement

Three general problem areas are outlined and within these areas several questions are listed.

A. To document, analyze and interpret how one Grade 6 teacher works collaboratively with a researcher over several months to plan and design an interdisciplinary ecologically-focused EfS curriculum unit:

Question 1. What dispositions, thoughts, and views does a Grade 6 teacher (Rachel) have about the environment and EfS?

Question 2. How does the researcher intervene in Rachel's thinking with regard to the content of the EfS unit?

Question 3. What issues does Rachel raise concerning the process of developing the EfS curriculum unit?

Question 4. What support systems help this teacher design and plan the curriculum unit?

B. To document, analyze and interpret how Grade 6 students view their relationship with the environment:

Question 5. What are Grade 6 students' views about their human/nature relationship?

Question 6. How do these views develop with respect to their understanding of their relationship with the environment and what it means to live responsibly on the planet?

C. To document, analyze and interpret how the Grade 6 teacher taught the EfS curriculum unit and what sense she made about her teaching and student learning:

Question 7. What character traits does Rachel display when she teaches the EfS unit?

Question 8. How do Rachel's personal practical beliefs about the human/nature relationship and beliefs about student learning translate into or influence her real classroom practice?

Question 9. How does she involve the local community in her EfS teaching?

Question 10. What might be the difference(s) of the intended and the implemented EfS curriculum unit?

1.5 Research Design and Methods for Data Collection

An ethnographic research design is undertaken to acquire an understanding of the curriculum development process associated with Educating for Sustainability, and to capture a holistic picture of the classroom when students study an ecologically focused EfS curriculum unit. Data are collected over the course of eight months. Means of data collection include tape recordings of ongoing conversations between a Middle Years teacher and a researcher as they collaboratively develop EfS curriculum, face-to-face individual interviews with the teacher and her students, and photo-interviews with students; video- and audio-recordings of classroom observations; and content analysis of documents and artifacts. Because researchers are neither neutral nor objective representers of the world (Peller, 1987), in my study I hear the voices of the teacher and her students in the context of EfS curriculum development and implementation.

1.6 Delimitations of the Study

The delimitations of this study are defined in part by the selection of participants for the study through purposeful sampling. Rachel, a Middle Years Outdoor and Environmental Education teacher was selected to participate in the study primarily on the basis of matching the teacher-selection criteria (listed in chapter 3) and her motivation, interest and enthusiasm towards the research project. The selection of her students was primarily on the basis of the students and their parents granting permission to participate in the study.

1.7 Descriptions of Terms

Anthropocentric – A human-centered way of knowing that maintains that planetary life exists to support and sustain only human beings and puts the human species above the rest of the natural world.

Ecocentric - An ecosystem-centered way of knowing that views human beings as part of the ecosystem that sustains them and puts the human species in symmetry to the rest of the natural world.

Ecological Approach - A context and a process designed to help students to become ecologically literate – to understand the "connectedness of things" and to live and act in ways that reflect this understanding. This approach involves knowledge and understanding of the principles of ecology, systems thinking and the practice of ecological values such as cooperation, quality, partnership, and conservation.

Ecosystem approach – An approach that broadly evaluates how people's use of an ecosystem affects its function and productivity (World Resources Institute, 2000).

Interdisciplinary – A knowledge view and curriculum approach that consciously applies methodology and language from more than one discipline to examine a central theme, issue, problem, topic, or experience (Jacobs, 1989).

Interdisciplinary Units – Periodic units or courses of study that deliberately bring together the full range of disciplines in curricula: language arts, mathematics, social studies, and science and the arts, music and physical education. The units are of specific duration: a few days, a few weeks, a semester, or a term.

Sustainable Development – Transformation that fosters social, political, and ecological equilibrium over an indefinite future, that equitably satisfies human needs and allows for the necessary and desired improvements in the quality of existence (Williams, 1994, p. 71).

Sustainable Development Education – A process of raising awareness about various interpretations, assumptions, goals and processes of sustainable development.

Educating for Sustainability – A lifelong process of thinking, teaching and learning ecological and sustainability principles, knowledge, values and attitudes that lead to informed and involved students having creative decision-making and problem-solving skills, scientific, social and ecological literacy, and commitment to engage in responsible individual and cooperative actions leading to a sustainable future for all species on the

planet (adapted from PCSD, 1994). Educating for Sustainability is the use of education as a means to encourage sustainability.

Sustainable Society – The persistence over an indefinite future of certain necessary and desired characteristics of the socio-political system and the ecological systems, that maintains society (Williams, 1994, p. 71).

Sustainability – The ability of a society and process to persist over generations; one that is far-seeing enough, flexible enough, and wise enough, not to undermine either its bio-physical or its social systems of support (Meadows, Meadows & Randers, 1992, p. 209). Synonymous with sustainability is balance and equilibrium. The sustainability (long term survival) of each species in an ecosystem depends on a limited resource base.

1.8 Journey of the Study

Chapter one introduces the study and illuminates the path I traveled with respect to EfS. The chapter provides an overview of the evolving concept of sustainable development and sustainability and identifies education as the key towards bringing about the fundamental shift in thinking and actions that is required for the process of attaining a sustainable future. The chapter identifies the research questions and the gap in educational research that the study aims to address and concludes with definitions of terms and the path the study will take.

Chapter two focuses on EfS goals and learning outcomes, and suggests approaches to teaching and learning drawn from the principles of ecology and EfS. It also identifies the context for effective implementation of EfS and proposes a reorientation of the current education system towards a trans- and inter-disciplinary approach within a

disciplinary education structure. Chapter two also focuses on the factors that affect the curriculum planning, design and implementation including the factors that constrain and support innovation such as a new EfS curriculum unit. Chapter two is used as a framework to understand how a Middle Years teacher designs and implements curricula and how she changes and develops throughout this dynamic process.

Chapter three presents the research design of the study and the methods by which data were collected and analyzed. Included in this chapter are the assumptions and rationale for the ethnographic and phenomenographic research design, my role as a participant observer, the setting of the study, the ethical considerations for the study, the data collection strategies and the data analysis procedures. The chapter also includes a description of the EfS curriculum unit and how it was collaboratively developed.

Chapter four focuses on curriculum planning and design and illuminates how Rachel, a Grade Six teacher, collaboratively works with me, a researcher, over several months to plan and design a trans-disciplinary EfS-focused curriculum unit. Chapter Four also illuminates Rachel's thoughts and view concerning the environment and EfS and her human/nature relationship. This chapter also identifies some important issues that Rachel raises with respect to the development of the EfS curriculum unit. Also identified are the support systems that Rachel encounters during the process.

Chapter five focuses on Rachel's Middle Years students and identifies what views Grade Six students hold about their human/nature relationship. This chapter also identifies how Grade Six students' views develop with respect to their understanding of their relationship with the environment and what it means to live responsibly on the planet. The results are organized into four sections.

Chapter six focuses on curriculum implementation and describes how Rachel teaches the EfS-focused curriculum unit over a three-month period to her Middle Years students and what sense she makes about her teaching and student learning. The chapter identifies Rachel's approaches to teaching and identifies the facilities and constraints Rachel encounters during the teaching process.

Chapter seven discusses issues arising from this teacher-researcher collaborative EfS study. Implications for Middle Years students' EfS education are outlined. Recommendations for future research and policies are highlighted with respect to EfS curriculum development, implementation, and teacher education development.

CHAPTER TWO

EDUCATING FOR SUSTAINABILITY IN SCHOOLS

2.0 Introduction

This chapter focuses on the education change process associated with reorienting existing education towards Educating for Sustainability (EfS) in terms of curriculum planning, design and implementation and the potential issues and supports associated with the process. In light of this focus, the literature review is presented in seven sections.

In the first section, I discuss the link between an ecological approach and EfS. Based on this framework, in section two, the goals, knowledge and skills, values and attitudes associated with EfS are highlighted. In section three, I develop an understanding of learning in educating for sustainability. Section four focuses on multidisciplinary, transdisciplinary, and interdisciplinary approaches in educating for sustainability. Arguments for and against these approaches are presented. Based on the arguments for the various approaches, reorientation of the current education system towards transdisciplinary and interdisciplinary approaches is presented. Specifically, arguments are advanced for a transdisciplinary (one program) and interdisciplinary approach for EfS curriculum planning and design. A number of constraints and factors associated with this reorientation are raised. A description of curricular models for educating for sustainability and highlights of the factors that facilitate and constrain change that might provide indicators for EfS curriculum initiation and implementation are presented.

2.1 Relationship Between Arena's Ecosystem Approach and Educating for Sustainability

Arenas (2000) relates ecosystems to educational systems, thus providing an ecological approach for Educating for Sustainability. His principles of ecology are: interdependence, energy and matter flows, carrying capacity, diversity and resilience to guide teaching and learning. In this section, I first describe Arena's conception of each of the foregoing principles of the ecosystem (Arena, 2000, pp. 62-67). Then I translate each principle to the school learning community in general, and more specifically to Educating for Sustainability in the study of a unit on waste minimization.

2.1.1 Interdependence

Interdependence brings unity to members in a community. In an ecosystem, the health of the whole depends upon the health of each element, just as much as the health of each element depends upon that of the whole. In social systems, interdependence is also essential. If one or a few parts of the system break down, it does not necessarily cause the sudden paralysis of the whole system. Figure 2.1 presents conceptual links between the ecological principle of 'interdependence' and an EfS curriculum unit on waste minimization.

In a learning community, interdependence means that teachers, students, administrators, parents, businesses and community members are all inter-linked in a network of relationships, working together to facilitate learning (Elmwood Institute, 1993).

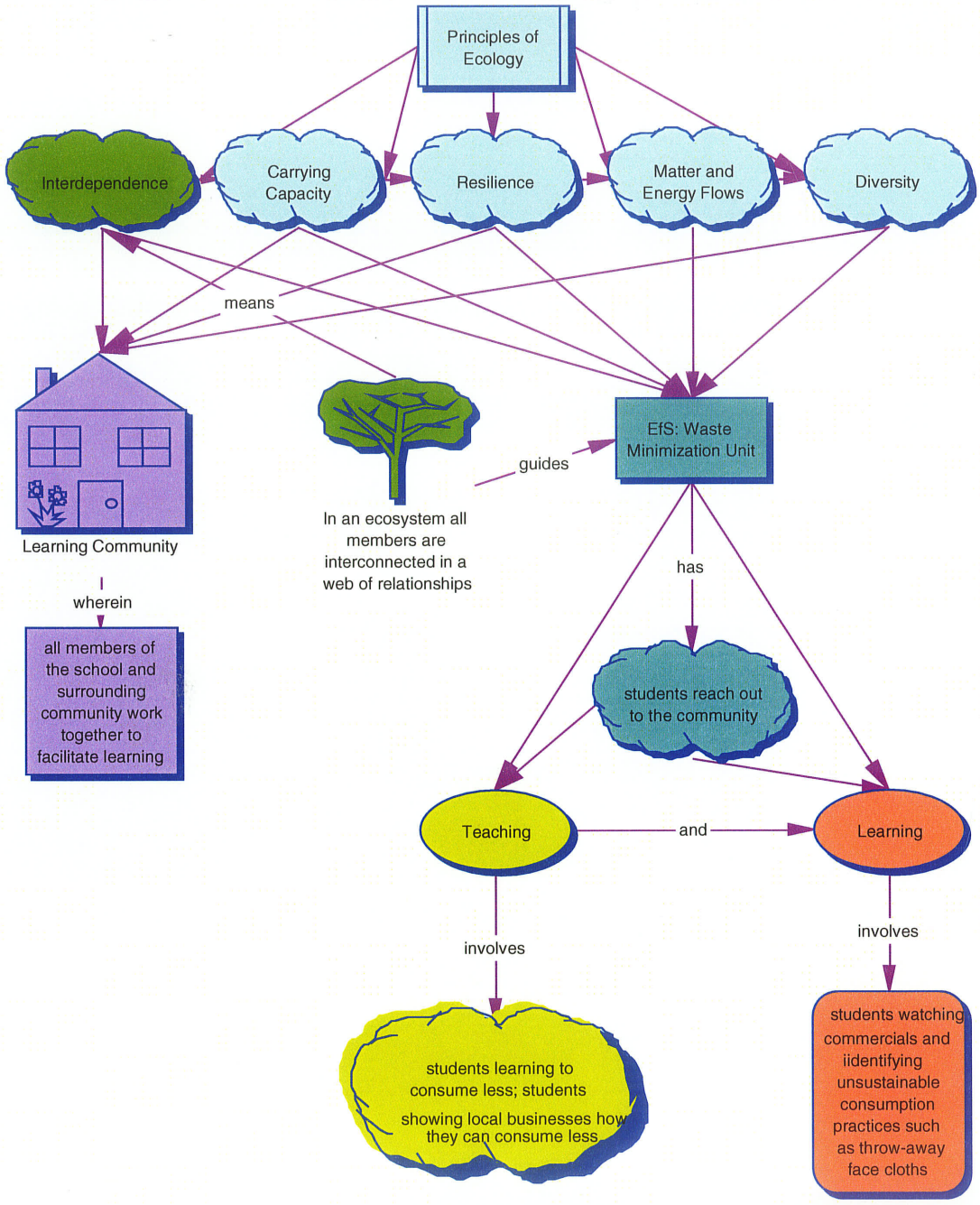


Figure 2.1. Interdependence in an EfS Curriculum Unit

Interdependence applied in an EfS curriculum unit focusing on waste has students seeing their community as an extension of the classroom. Teachers raise students' awareness to consume less and have them collaborate with the local business to reduce waste. Students are involved in learning about ways to be responsible consumers and consume less waste by watching commercials and identifying products that are unsustainable such as throwaway face cloths and disposable diapers.

2.1.2 Matter and Energy Flow

All ecosystems are open systems that require the constant flow of energy and the recycling of matter. Energy enters an ecosystem mostly in the form of solar energy and matter enters, among other forms, as water and carbon dioxide. Plants, which use these elements in their growth process, are eaten by primary consumers – herbivores (e.g., deer), that are in turn eaten by secondary consumers (e.g., puma). Once plants and animals die, their organic material breaks down through the action of decomposers. Decomposers, such as bacteria and fungi supply themselves with energy and release carbon dioxide and mineral salts. Producers (plants) absorb these inorganic compounds, and the whole cycle continues again. At each level of the food chain there is a transfer of energy and matter from plant to animal, from animal to animal, and from animal to plant. The interdependencies among the members of an ecosystem involve the exchange of matter and energy. One important aspect of the cycle described above is the absence of "waste." All matter is continuously recycled in the system. In contrast, in our social systems non-recycled waste is the norm. Consider the functioning of cities: they import immense quantities of energy and matter – electricity, gasoline, food, water and all kinds of materials – and export immense quantities of sewage, contaminated water, pollution

and garbage. This export endangers plant and animal life, including humans (Arenas, 2000, p. 63). Figure 2.2 indicates the conceptual links between the ecological principle 'matter and energy flow' and Educating for Sustainability on waste minimization.

In a learning community, teaching would not flow from the top down; rather there is a cyclical exchange of ideas. The focus is on learning, and everyone in the system is both a teacher and a learner. Members of the learning community also move in and out, finding their own niches in the system (Elmwood Institute, 1993). The inquirers study questions such as, "What is its web-like structure?" "How does the ecosystem function and what principles make ecosystems behave in a sustainable way?" Teachers show students that in an ecosystem there is no waste. As one organism dies, it becomes a resource for another. Students are involved in activities such as exploring how humans manage waste (at landfills) compared with how ecosystems manage waste. Students learn about waste reduction strategies such as recycling, composting and they practice these strategies. Students are involved in creating food composters and observe and record the process of decomposition. Students also explore their local ecosystem and observe how matter and energy flows and how waste is managed within the ecosystem being observed.

2.1.3 Carrying Capacity

Carrying capacity is the maximum number of organisms that can be adequately supported by an ecosystem for an indefinite period of time. When a population grows faster than the availability of resources in an area, a protective mechanism becomes activated that reduces the fertility rate and increases the age of first reproduction. Figure 2.3 shows conceptual links between carrying capacity and Educating for Sustainability.

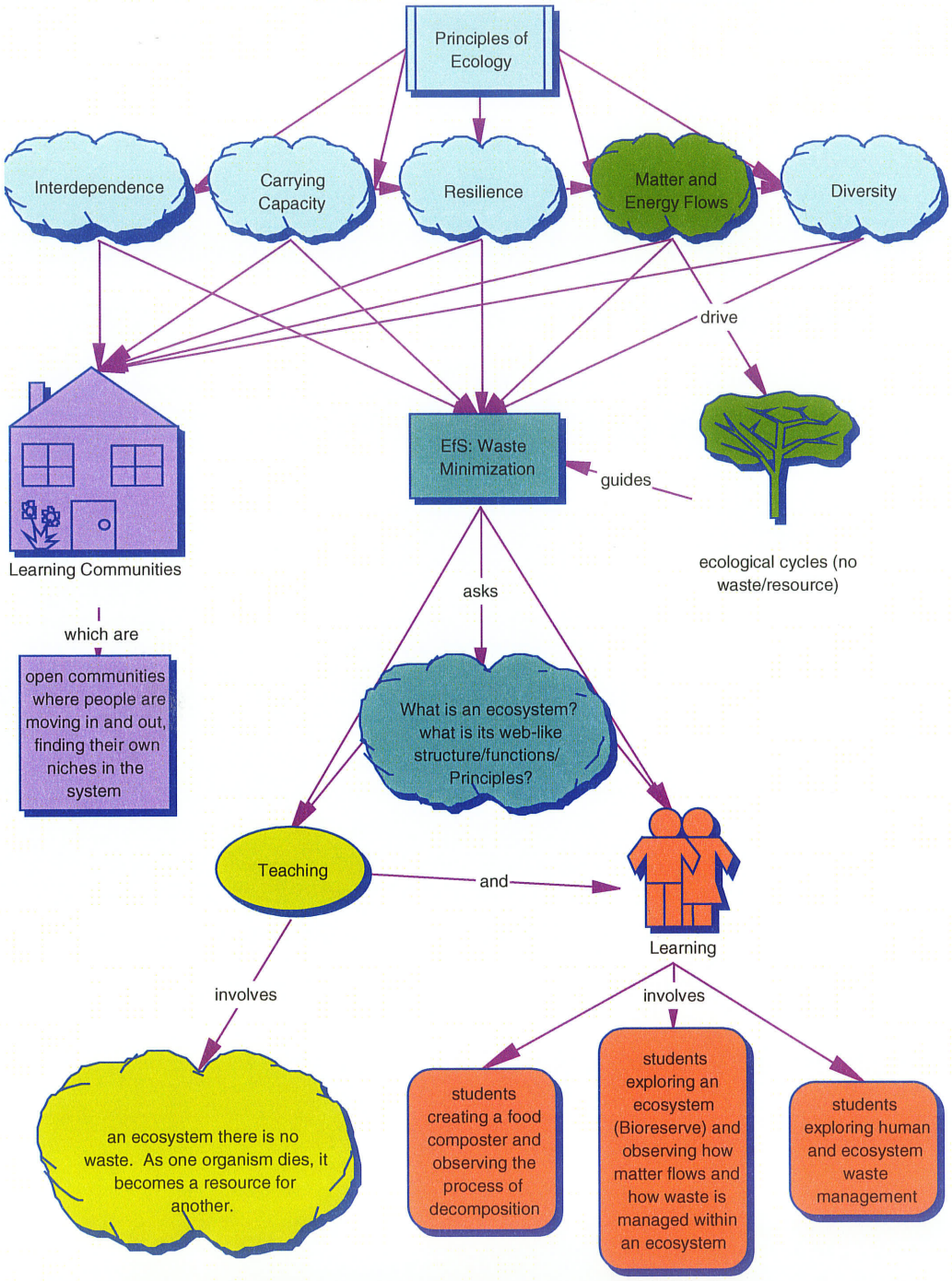


Figure 2.2. Matter and Energy Flow in an EfS Curriculum Unit

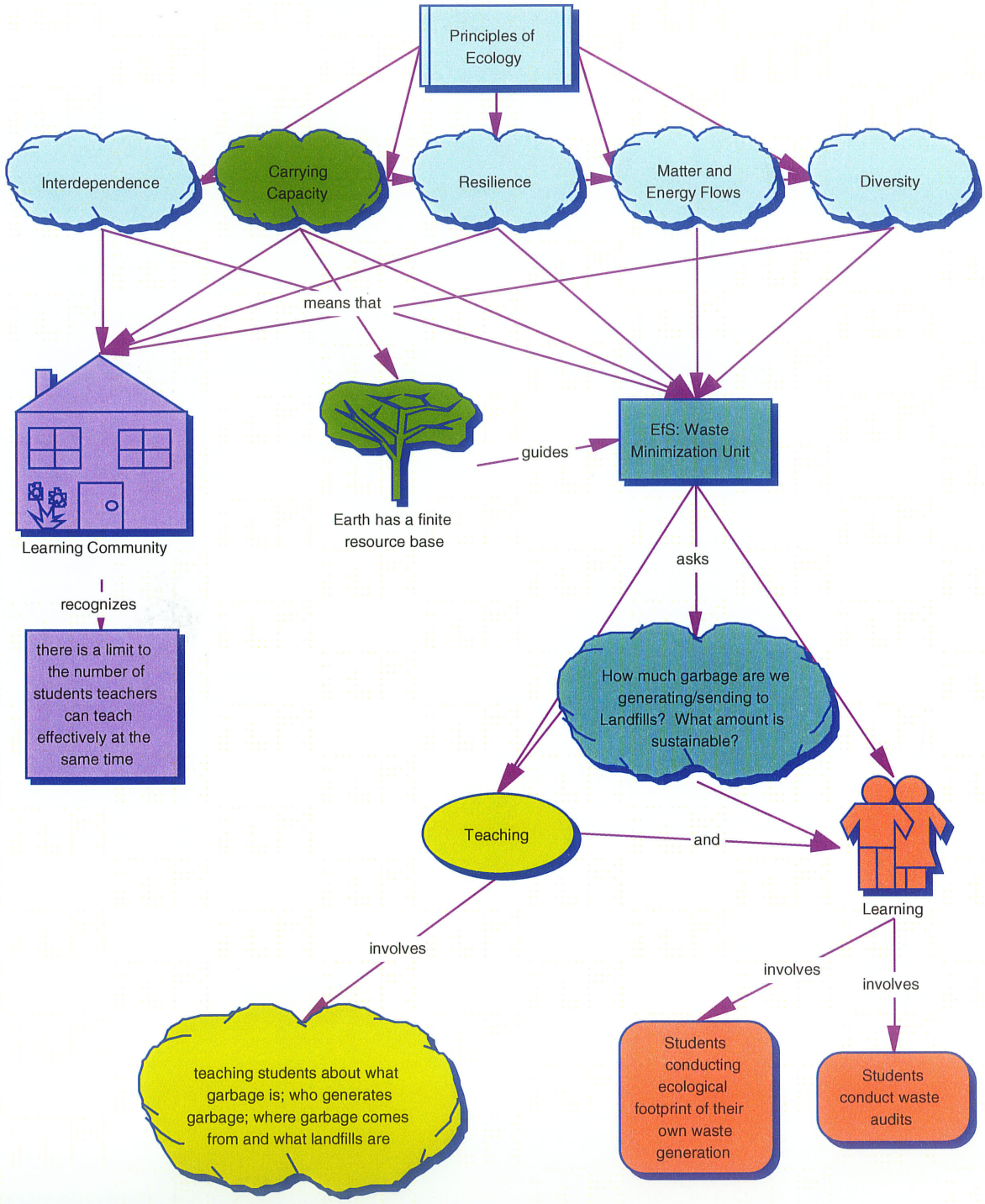


Figure 2.3. Carrying Capacity in an EfS Curriculum Unit

In a learning community, class size and composition are examples of the concept of carrying capacity (Elmwood Institute, 1993). An EfS curriculum unit focusing on waste minimization addresses how much garbage is being generated/sent to local landfills. Teachers help students to learn about what garbage is, who generates garbage, where it comes from and where the garbage is transported to (landfills). Learning activities include students conducting waste audits at school and in their community and conducting ecological footprints of their own waste generation.

2.1.4 Diversity

Diversity (meaning "richness") refers to the number of species that inhabit an ecosystem. The stability of an ecosystem depends crucially on the degree of complexity of its network of relationships, in other words, on the diversity of the ecosystem. Figure 2.4 presents a conceptual links between diversity and an EfS curriculum unit focusing on waste minimization.

In a learning environment, experiences that encourage students to use diverse strategies of learning are essential. Diverse learning styles contribute to the richness they bring to the learning situation. Cultural diversity also contributes to the richness of a learning situation (Elmwood Institute, 1993). This principle, in a waste unit, focuses on the notion that waste is made up of diverse components. Teachers help students learn to sort waste into its component parts (compostable, recyclable, reusable material). Students sort through waste and classify its components.

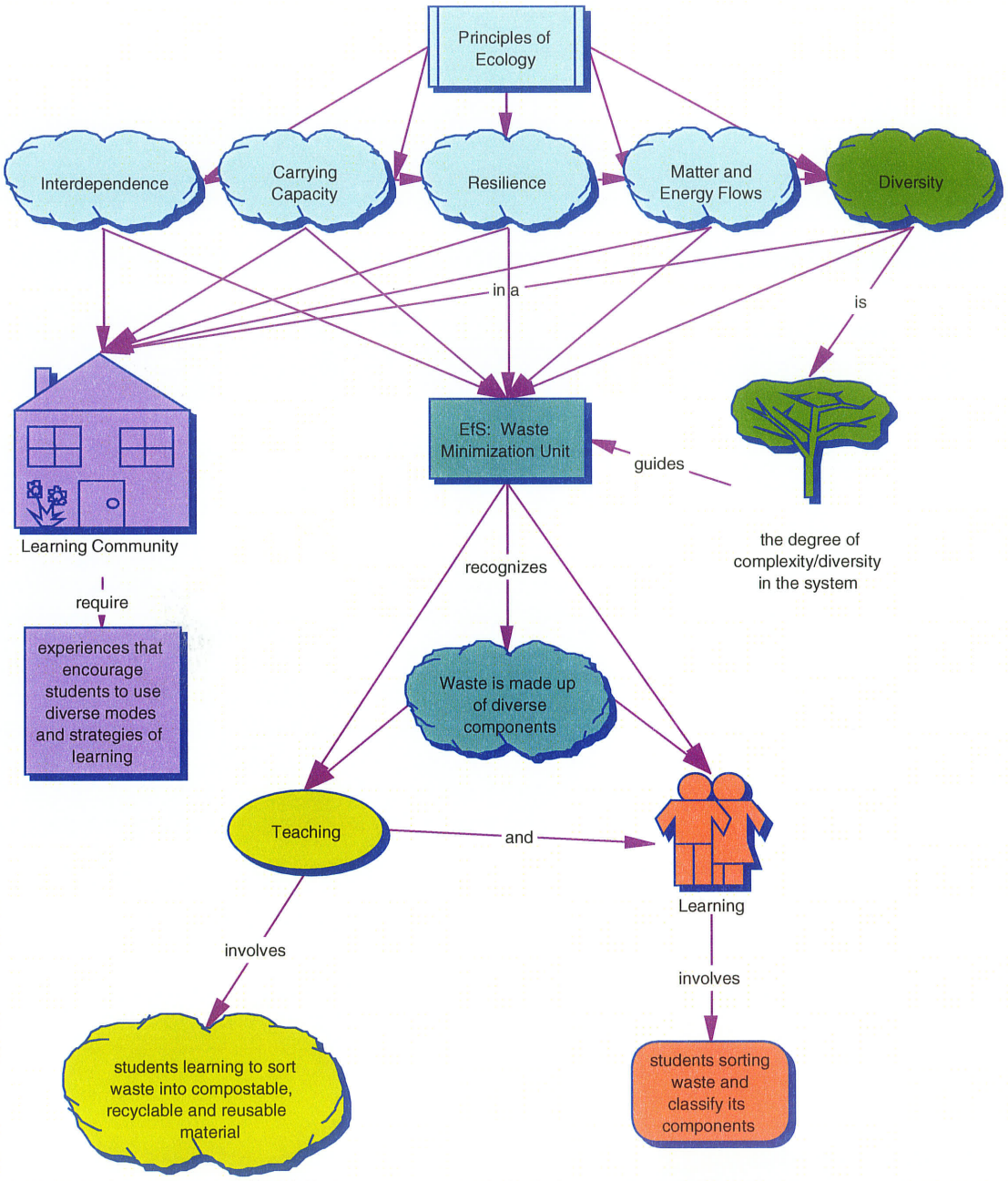


Figure 2.4. Diversity in an EfS Curriculum Unit

2.1.5 Resilience

Resilience/flexibility is the ability of an ecosystem to withstand internal or external pressures without undue damage or deterioration to its normal functioning. If a part of the ecosystem is disrupted, it affects other parts of the system as well. Generally, there is a threshold under which the system can gracefully adapt to shifting conditions (homeostasis). It is essentially a self-regulating mechanism. If the threshold is surpassed, the different components and relationships of the system may be impaired to such a degree that the ecosystem can collapse altogether. When an element in the system is disrupted, feedback mechanisms "inform" the ecosystem of the disturbance and allow the system to go back into balance. This is where the concept of homeostasis comes into play. In their function as feedback loops, ecological cycles have the tendency to maintain themselves in a flexible state, characterized by interdependent fluctuations of their variables. Figure 2.5 demonstrates conceptual links between resilience and an EfS curriculum unit on waste minimization.

In a learning community, there is dynamic change and fluidity. Daily schedules are fluid; each time there is a change of theme, the learning environment is recreated (Elmwood Institute, 1993). A waste unit focuses on how much waste can be generated before the ecosystem/social system loses its ability to maintain balance. Teachers help students to make informed choices/tradeoffs about reducing, reusing and recycling. Students are involved in activities/discussions about their views pertaining to using landfills or incinerators. Students also work towards identifying options for waste reduction in their community (businesses).

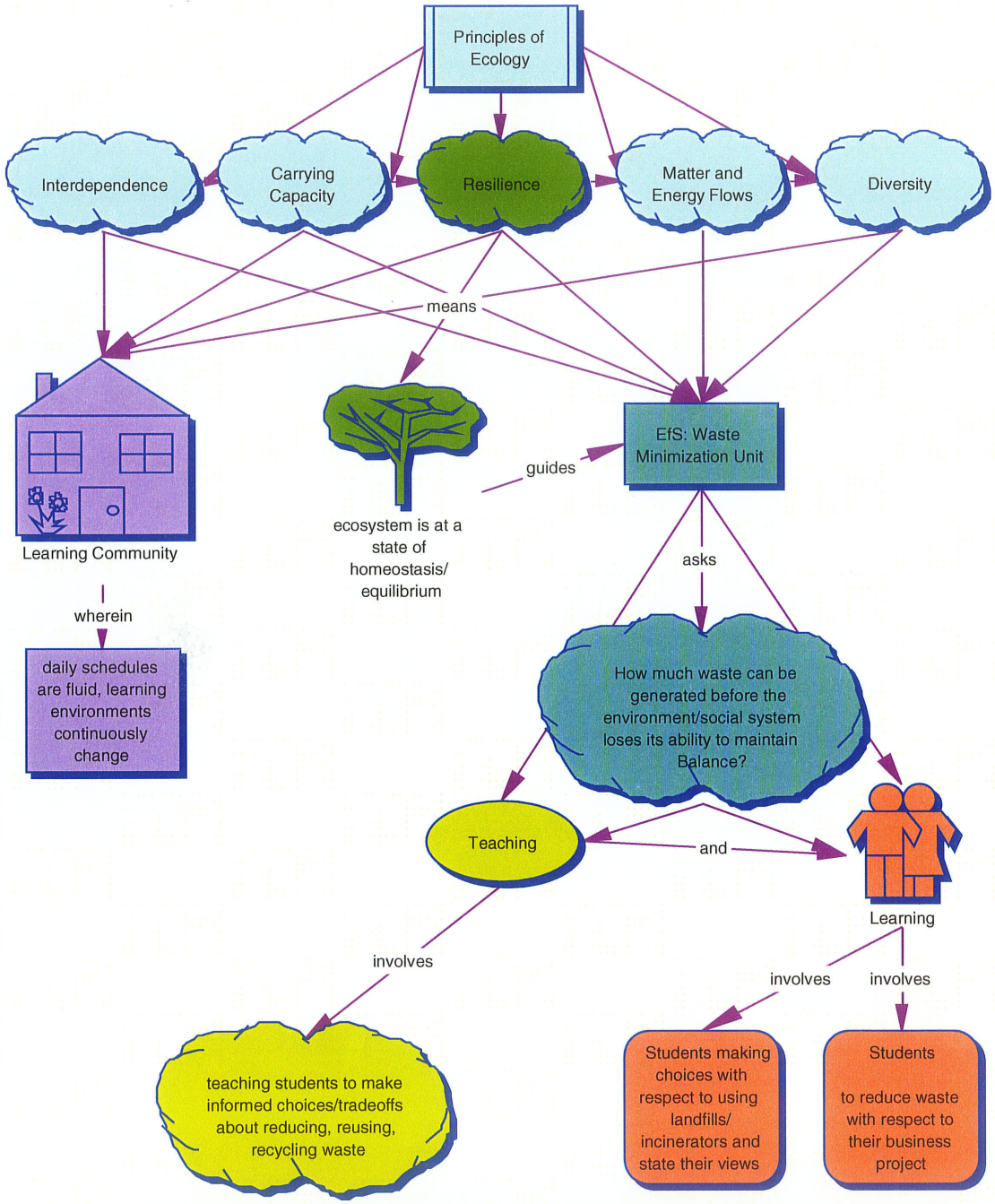


Figure 2.5. Resilience in an EfS Curriculum Unit

Arenas' (2000) translation of ecological principles to a social system such as learning environment should not be interpreted in a narrow sense. For example, he asserts that culture (what makes us human) is obviously absent in an ecosystem and a literal interpretation of ecosystem thinking could cause more harm than good. He asserts however, that a more liberal rendering of nature's lessons may provide missing clues as to how best to restructure our societies (in this case our school and our classroom environments) and our relationship with the environment.

Based on the lessons learned from the book of nature, Arenas (2000) conducted a study on three public schools (one primary and two secondary) that modeled ecological education in Colombia, South America. The schools attempted to foster competence, care, and appreciation to awaken the dimension of the political, environmental and aesthetic in all students. They replaced the individualistic, classroom-based, book-centered learning, so common in modern schools, with a search for balance between the individual and the collective, reflection and action, and school and community. The schools also substituted a fragmented curriculum with an interdisciplinary one. Thus the EfS seeks a balance between classroom-based and community-based learning; individual and cooperative learning; intellect, emotion and aesthetics; theory and practice; teacher-centered and student centered; mental work and manual work, and the school, community and natural world. He argues that schools should start with the realization that the school and the community ought to have a close relationship of interdependence.

2.2 Ontario Learning for Sustainability Partnership Program Portray Ecosystems Approach

Ontario Learning for Sustainability partnership (OLSP, 1996, pp. 3-4) proposed that students require an understanding of sustainability as the interdependence between the well-being of humans and all other living things and demonstrate a systemic approach to issues. Specifically, students need to develop a new way of knowing characterized by ecological perspectives that enables them to strive to live in a sustainable way. Furthermore, students ought to demonstrate a systemic approach to the assessment and evaluation of socio-economic-environmental issues and their implications for the ecosystem that sustains them, self, and other living things and community. In order to develop individual and cooperative strategies and actions leading to a sustainable future, students require an understanding of environmental, economic and social systems.

Concerning environmental outcomes, students require a deep understanding of ecological concepts/principles, systems, issues and the ability to develop strategies for responsible environmental citizenship. Students should be able to demonstrate: basic knowledge of individual biological concepts; knowledge and understanding of ecological systems and cycles; an informed awareness of major ecological issues such as pollution, environmental degradation, climate change, resource depletion, and their causes and effects. Student should also be able to critically analyze the connections between local and global environmental issues and personal lifestyle choices. Students should learn to develop strategies and actions for responsible environmental citizenship within local/global communities.

Pertaining to economic outcomes, students require an understanding of economic principles, systems and issues and strategies for responsible economic citizenship. Students should be able to demonstrate basic knowledge of economic principles and definitions, including currency, assets, liabilities, trade, taxation, bartering, co-operatives, competition, and consumption. Students should also be able to demonstrate knowledge and understanding of economic systems, including the monetary system, accounting system and trade. Students should demonstrate an informed awareness of major economic issues, such as globalization, deficits, taxation, competition, and their cause and effects. Students should be able to critically analyze connections between local and global economic issues and personal lifestyle choices. And, students should be able to develop strategies and actions for responsible economic citizenship within local and global communities.

Regarding social outcomes, students require an understanding of social principles, systems and issues, and strategies for responsible social behaviour, including health, ethno-culturalism and equity. Students require basic knowledge of social concepts and principles, including health, equity, peace, and safety. Students should be able to demonstrate knowledge of social systems including the individual, family, business, government, political and media. Students should also be able to demonstrate an informed awareness of major social issues, such as poverty, disparity, human rights, overpopulation, war, unemployment, and their cause and effect.

To guide students as they learn to live sustainably on the planet, they require practical skills related to inquiry, decision-making and problem solving to enable them to secure sustainable livelihoods. These skills can be achieved by learning to identify

sustainability issues/problems, understanding the issues from various perspectives/stakeholders, knowing how to frame essential questions with respect to those issues, generating options, gathering and analyzing data, sharing findings, identifying possible solutions, and planning and possibly implementing actions. Because EfS is value-based learning, it leads learners to develop decision-making and informed action-taking capabilities within a community.

To deal with sustainability issues, Hopkins and McKeown (2002, p. 7) suggest that students be armed with the following skills and capacity to:

- communicate effectively both orally and in writing;
- think about systems (both natural and social systems);
- think in time – to forecast, to think ahead, and to plan;
- think critically about value issues;
- comprehend quantity, quality, and value;
- move from awareness to knowledge to action;
- work cooperatively with other people; and
- use various processes – knowing, inquiring, acting, judging, imagining, connecting, valuing, questioning and choosing.

Students require skills that help them manage and interact with their local environment, economy and society. Such skills may include: asking essential questions, identifying unsustainable practices, identifying more sustainable options, making sustainable decisions and communicating these decisions and ideas for solutions at home, at school or to a local business. Additionally, students must learn how to collaborate in efforts to handle conflict situations. Katz and Law (1985) suggest that collaboration

requires the ability to listen to the perspectives of others and understand the messages that others are sending. Collaboration also requires that students obtain the ability to express and assert themselves without alienating others (Katz & Lawyer, 1985). It is through the collaborative process that one might maintain the relationships essential to filling one's needs and meeting obligations. Students should gain experience in the use of participatory methods of decision-making.

EfS is a lifelong process of learning ecological and sustainability principles, knowledge, values and attitudes that lead to informed and involved students having creative decision-making and problem-solving skills. They also need ecological, economic, and social commitment to engage in responsible individual and cooperative actions that lead to a sustainable future for all species on the planet. Thus the goal for EfS is to prepare learners for lives in the environmental, economic, political, cultural, and historical systems of which they are a part, and to help students acquire an understanding of how these systems are interdependent and interconnected. The International Joint Commission's Educators' Advisory Council (1993, p. 7) points out that projects demonstrating quality environmental education and sustainable action have the following characteristics:

- a strong, ongoing experiential component;
- a strong action component with a clear context for action;
- a defined process for assessing, planning, acting, reflecting, communicating and celebrating; clear goals and objectives;
- a long term range vision;

- a strong partnership and collaboration with agencies, institutes and volunteers;
- a strong ecosystem and watershed approach;
- connections to post secondary institutions and computer linkages to others.

To acquire such characteristics, OLSP (1996, p. 3) suggest that EfS approaches should be based on the following characteristics:

- integration;
- community linkages/student empowerment;
- transformational leadership;
- local/global connections;
- systemic change;
- the infrastructure needed to support the desired curriculum change (the entire school curriculum requires reorganization whereby staff work in teaching teams to develop integrated units);
- the educating of teachers in the school setting; and
- high standards of professional development to encourage teachers to study in areas outside their traditional subject-based disciplines.

The advantages of students learning in integrated situations include:

- increased focus on their work whether or not a teacher is present;
- increased collaborative learning;
- investment in themselves and learning (seeing the school as being worthwhile and meaningful);
- increased self-direction in their learning and inquiry;

- enhanced creation and reinforcement of connections between subjects;
- development of self confidence;
- experience working in a real environment;
- increased friendships with people they would not normally associate;
- appreciation that everyone has real attributes; and
- development of an awareness and appreciation of the environment.

For integrated learning, developing partnerships with other educational stakeholders (e.g., Ministries of Education, businesses/corporations and the school board) and bringing the community into the school and the school into the community is important. Successful organizational change calls for vision, collaborative teamwork, innovative solutions, celebration, leadership, and partnerships. However, most school programs do not address the principles of learning for sustainability. While some schools incorporate a number of the principles of educating for sustainability, no known sustainability educational program incorporates all principles in its school planning and classroom teaching.

2.3 Learning in Educating for Sustainability

Based on the foregoing ideas of educating for sustainability, I value learning approaches that are drawn from nature's lessons, and learning environments that seek out linkages with the community within systems thinking. All members of the learning community collaborate, cooperate and work in partnership for empowerment. I envision learners celebrating diversity and flexibility. Diversity involves students attempting to understand views different from their own – being able to listen to and understand diverse perspectives, developing communicative processes – expressing their thoughts and

beliefs, and accepting and celebrating cultural diversity and perspectives that various cultures may bring to the learning situation. Flexibility means the use of fluid schedules so that students can address particular themes or issues related to sustainability.

Learning, in this sense, begins with the psychological component and moves to the logical constructs, beginning with the learners' ideas of, views on, and genuine interests in experience related sustainability issues. The most important factor influencing learning is "that which the learner already knows" (Ausubel 1968, p. vi). Thus, students access their prior knowledge, skills, values, attitudes and life practices, allowing them to take an active part in developing new beliefs and views, which may ultimately affect their decisions and actions with respect to addressing sustainability issues. In this regard, students pursue their ideas and interests through project-based inquiry, through which they learn and adopt the principles of sustainability and ecology. The "big picture" is established first, then the component parts fit into that big picture (Robert, 1995). Robert argues that "synthesis" (the big picture) in Bloom's Taxonomy of Learning should be placed first in his sequence of knowledge development. In this project-based experiential paradigm, learning emphasizes the process and not the product. Ebert-May et al., (1993) argue that how a student arrives at a particular option or solution to a sustainability issue or problem is what is important, not the retrieval of an objectively true solution, as would be the case in the behaviourist paradigm. Learning is not merely memorization and acquisition of ecological facts and associated vocabulary, but an understanding of how to attain ecological literacy to live a life in a sustainable society (Ebert-May et al., (1993). In this project/process-based "experiential" paradigm, how a student arrives at a particular option or solution to a sustainability issue or problem is what is important.

Learning is therefore a process of making sense of one's world, constructing meaningful representations, and becoming skilled in the procedures that will allow action-taking (Usang, 1992). In becoming ecologically literate, students identify and address questions about practical (real-life) sustainability issues rooted in concrete situations; students engage in EfS inquiry, problem-solving and decision-making; and students seek answers and pursue interdisciplinary-based knowledge and skills that will inform the EfS issues. Students' choices are seen in a positive light and as a means of gaining new insights. It is through EfS-focused inquiry, problem-solving and decision-making that students discover their connections with nature, come to know the significance of sustainability in their lives, and come to understand the interconnections between environmental, economic and social factors. In this regard, students explore connections in ways that create personal meaning and significance, and become involved in influencing a larger audience beyond their classrooms by advocating solutions, providing assistance or creating products. And, most importantly, students have opportunities to realize that they have the power to affect real change in their world. For example, students in groups might visit local businesses to explore waste management practices, ask questions, then go back to their classrooms to conduct research, identify more sustainable waste practices, then communicate those solutions to businesses and possibly even create something that businesses could use to implement student solutions.

2.4 Educating for Sustainability

The spectrum of reorientation ranges from a high level of integration, cooperation and coordination (a transdisciplinary approach) to a low level of cooperation and coordination (a multi-disciplinary approach). The calls for reorientation point to

multidisciplinary (including subject areas), interdisciplinary (across subject areas) and transdisciplinary (beyond subject areas) approaches. Although hard lines are to be drawn between these approaches in order to capture their differences, the reality is that sometimes these lines can be quite fluid.

2.4.1 Multidisciplinary Approach

Charles (1987) argues for a multidisciplinary approach. Multidisciplinarity is the juxtaposition of various disciplines, sometimes with no apparent connection between them such as: music, mathematics, history, and chemistry (OECD, in Leckie, p. 3). It is essentially additive, not integrative. A multidisciplinary approach maintains intradisciplinary approaches (within subject areas) whereby integration of subject area knowledge and skills are maintained as a coherent whole within a particular grade level.) Kledin (1990) points out that teams working in a multidisciplinary fashion may not interact cooperatively and may still maintain different perspectives within their respective disciplines. In this approach, a variety of unrelated disciplines address EfS at all grade levels, but with no coordination or communication between the disciplines. Charles (1987) calls for a multidisciplinary approach because he believes that it is more expedient to appeal to local mandates (which are predominantly based on distinct and separate disciplines). This approach requires teachers to integrate EfS based on the discipline(s) that they are teaching. This model attempts to emphasize EfS objectives within the context of a variety of disciplines offered simultaneously, but without making possible relationships between them explicit. This approach fully respects students' ways of knowing distinct conceptual structures, and methods of inquiry. This approach has also been termed the "curriculum linkages" or the "infusion" approach (OLSP, 1996).

In Canada, a number of jurisdictions (Alberta, Newfoundland and Labrador, and Manitoba) follow the "curriculum linkages" model. In Alberta's model, for each grade or subject area, there is a general description of individual topics to which students will be exposed. Through this model, there has been some integration of EfS in Canadian curricula however; the emphasis is predominantly within the discipline of science. The Manitoba model integrates sustainable development concepts throughout the subject areas at the K-S4 level wherever appropriate. However, it should be noted upon review of the entire K-S4 curriculum that very few student learning outcomes related to EfS appear in curriculum areas other than the science discipline. And within the science discipline, only two grades (Grade 5 and Senior 1/Grade 9) have been targeted. To address this limitation, Manitoba is in the process of introducing an integrated science stream that could address EfS. Manitoba has also developed a sustainable development support document for educators. There is no evidence what the impact of the integrated science stream will have (since it is not yet implemented) for EfS, nor is there evidence to show how effective the support document may be regarding the integration of sustainable development concepts in subject-areas other than science.

Manitoba is not alone in terms of integrating sustainable development predominantly into the science discipline. Other provinces/territories have followed suit probably because of the "Science, Technology, Society and Environment" (STSE) student learning outcomes identified in The Pan Canadian Science Framework. More evidence supporting this statement can be found in *The Status of Sustainable Development Education* (CMEC, 1999) written for the Council of Ministers of Education. In multi-disciplinary approaches, a theme or topic that focuses on EfS is

presented within an existing subject-centered curriculum. Figure 2.6 presents a description and visual depiction of a multi-disciplinary approach provided by Jantsch (1971).

	General Notion	Type of system	System Config-uration
Multi-disciplinarity	A variety of disciplines, offer themes or topics simultaneously, but without making explicit possible relationships between them. Related content is taught in two or more subjects during the same period of time. There is minimal coordinated planning on the part of the teachers. Students may be able to make the connections without special help from the teachers.	One-level multi-goal; no cooper-ation/com-munication	

Figure 2.6. Multidisciplinary Approach. Source: Jantsch (1971)

Arguments against a multi-disciplinary approach for EfS are associated with the apparent lack of required cooperation and coordination. A sustainability issue can be best understood from the perspective of all relevant disciplines, particularly when economic, social and environmental systems are taken into account and seeing the connections between these systems. The approach has to be integrative. One discipline cannot serve to address all of these systems simultaneously. Furthermore, multidisciplinarity is the juxtaposition of various disciplines, sometimes with no superficial connection between them (e.g., music, mathematics, history, and chemistry) and predominantly additive rather than interactive. Themes and topics related to EfS are not coordinated in any way across the curriculum (no relationship between disciplines is shown) and teachers are not obligated to cooperate or communicate with each other to make those relationships

known. Teacher interaction and cooperation are not required. A pragmatic reason for using a multi-disciplinary approach is that the approach ensures that time is not taken solely from one existing curriculum (Iozzi, 1987) and a particular notion related to the EfS topic could therefore be studied at much greater depth of understanding. For education to simultaneously address economic, environmental and social education initiatives (e.g., issues related to employment and labor markets, environmental education, human rights, peace, gender), these systems must be viewed in an integrated, holistic manner. Therefore, approaches for curriculum planning, design, teaching and learning must be based on holistic, integrated approaches that emphasize cooperation and coordination between the subject areas at all levels. Because of the lack of cooperation and coordination, many players in education meet a multi-disciplinary approach towards the integration of EfS with guarded acceptance (Waters, 1994). The approach that offers the highest level of cooperation and coordination is the transdisciplinary approach.

2.4.2 Transdisciplinary Approach

The transdisciplinary approach goes beyond subject areas and is the approach with the highest level of cooperation and coordination between the disciplines. Williams (1994) and Waters (1994) argue for a transdisciplinary approach for EfS. They suggest that sustainability is an encompassing conception of education and not just a call for a new course to be added to the curriculum. Waters (1994) and Williams (1994) believe that the K-12 curriculum should be re-oriented from a subject-based curriculum to a non-subject-based curriculum throughout all grades and through all levels with the focus on helping students to live in a sustainable society. These authors are suggesting a curriculum approach wherein the whole education system transforms significantly with

changes to the overall systemic purpose in terms of concepts and principles. In practice, this approach translates into a school not teaching traditional subject areas in isolation (e.g., science, social studies, language arts, and mathematics). The focus of this approach is on teaching students how to live sustainably on the planet. A transdisciplinary curriculum model invites teachers from various disciplines working together to guide learners. Learners focus on self-initiated projects. The focus is not on teaching the traditional subjects within a specified timetable, but rather guiding student learning to whatever subject area is required to solve a particular issue. The process of learning is based on students' characteristics, needs, interests and personal learning processes. The teaching process is student-centered. Students may even set the timetable for learning. In this venture, students and teachers collaborate to address a particular sustainability issue. Figure 2.7 presents a description and visual depiction of a transdisciplinary approach provided by Jantsch (1971). Arguments against a transdisciplinary approach for EfS revolve around issues related to implementation. Teachers are required to change their role and teaching approaches – teachers abandon their position of all-knowing sages to learn side-by-side with students. Teachers do not formally address subject areas or their interconnectedness. Teachers must possess in depth knowledge from the environmental, social and economic systems in order to select the subject-based knowledge and skills that stimulate and enrich the learning experiences for students in order to address EfS. Teachers must totally reorganize the learning environment. Also teachers may need professional development for EfS-related goals, student learning outcomes and perspectives. The school administration must fully support the changes required with respect to resources such as human and financial resources and materials.

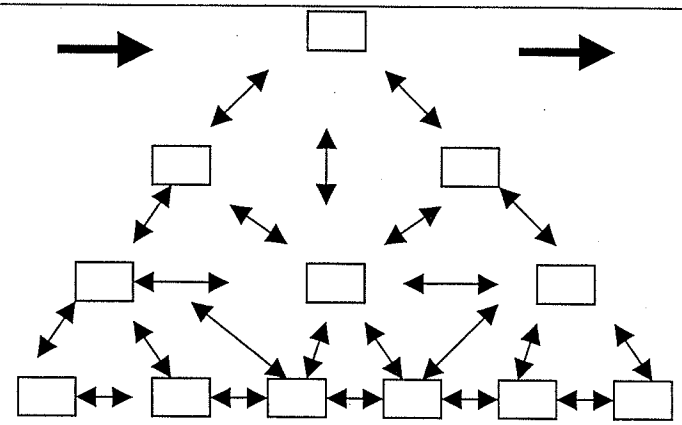
General Notion	Type of System	System Config-uration
The coordination of all disciplines and interdisciplines in the education/ innovation system on the basis of a generalized axiomatics (introduced from the purposive level down) and an emerging epistemological ("synepistemic") pattern. Students identify issues to explore, frame questions, and undertake tasks, applying relevant knowledge and skills from any and all program areas. The students and teachers plan the unit together. All teachers contribute to all aspects of the study (they do not represent a particular program area). The issues studied have special significance to students.	Multi-level multi-goal; coordina-tion toward a common system purpose.	

Figure 2.7. Transdisciplinary Approach. Adapted from Jantsch (1971)

Realistically, a call for a total reorganization of the current education is not likely to happen, given that the public school system has changed very little in the past 100 years (although certainly learning/teaching methodologies have changed). Furthermore, each discipline has its own perspectives, strengths and skills.

These areas should continue to develop and grow over time. For each discipline to contribute effectively to EfS, the growth of knowledge and skill related to each discipline is required. Because of the issues raised with respect to implementation issues, many educators also meet the transdisciplinary approach for EfS with guarded acceptance. The interdisciplinary approach also offers a high level of cooperation and coordination.

2.4.3 Interdisciplinary Approach

In this model, interdisciplinary concepts, issues, and themes are introduced using interdisciplinary approaches. A curriculum becomes interdisciplinary when two or more related disciplines are coordinated from a higher level for "some purpose." Interdisciplinary approaches are characterized as holistic. The important notion here is that with the introduction of interdisciplinary links between organizational levels, the disciplines defined at these levels *change* their concepts, structures, and aims. They become coordinated through a common axiom (a common viewpoint or purpose), however all disciplines involved maintain their intradisciplinary characteristics. Cooperation and communication are strong both vertically and horizontally. In an interdisciplinary approach, two or more teachers with expertise in different subject areas plan, design and implement a curriculum unit based on a central theme, issue or concept rather than by academic discipline. Each subject area teacher addresses the focus through his/her respective subject-area. For example, the mathematics teacher would address

mathematics-related concepts related to the focus of the unit. This approach fully respects a subject area's methodologies, distinct conceptual structures, and methods of inquiry.

Curriculum planning and delivery is complex and time-consuming. There are explicit linkages across subject areas. The unit usually is implemented for a particular time period (a week, a month, a term). All teachers who are involved in the planning and design of the unit are also involved in the implementation of the unit. Figure 2.8 presents a description and visual depiction of an interdisciplinary approach provided by Jantsch (1971).

An interdisciplinary approach requires a high level of integration across the disciplines. Integration involves content and concept connections. Content connections are made among similar subjects, most likely within the same program area. Teachers plan together to integrate material. Students develop knowledge and skills related to particular subjects and apply these to other contexts. Seeing the connections among the subject-specific knowledge and skills enhances students' understanding and interests.

Concept connections integrate a concept through exploration, using the content and processes of several program areas. Teachers must work together to develop units of study. In exploring each concept, students acquire and apply a range of knowledge and skills. Activities emphasize group problem-solving and inquiry across subject areas.

The main arguments against this approach include:

- time may be taken away from the existing curriculum (mathematics, science, etc.) which is already overloaded (Iozzi, 1987) to make way for the planning,

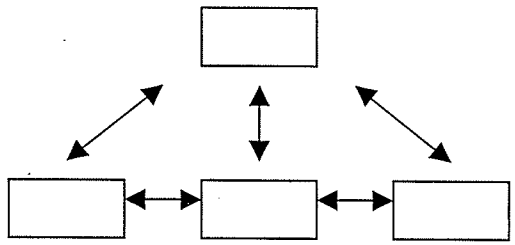
General Notion	Type of System	System Configuration
A common axiomatic for a group of related disciplines is defined at the next higher hierarchical level or sub-level, thereby introducing a sense of purpose; teleological interdisciplinarity acts between the empirical and pragmatic levels, normative interdisciplinarity between the pragmatic and normative levels, purposive interdisciplinarity between the normative and purposive levels. When developing units, teachers represent their program areas.	Two-level multi-goal; coordination from higher level.	

Figure 2.8. Interdisciplinary Approach. Adapted from Jantsch (1971)

- designing and implementation of curriculum units that focus on a common issue, theme or concept.
- integration is often not authentic and meaningful and does not occur naturally within a realistic context.
- time is not available for communication and coordination required with colleagues at both the planning and delivery stages.
- the approach requires teachers to exchange something in their curriculum.

Also, creating a curriculum that promotes sustainability goals is extremely difficult due to: constraints in teacher education and training; a requirement of following a pre-established curriculum; decision-making and the time and expertise required for curriculum development and teachers teaching philosophies.

There are several reasons these constraints exist. Firstly, teachers have generally been trained in faculties of education to use textbooks, work individually and follow a pre-established curriculum. Secondly, it requires time and expertise to create a locally focused curriculum. Thirdly, difficult decisions need to be made regarding what is sacrificed and what is kept from the previous curriculum (Arenas, 2000). At times, nothing is lost.

After viewing multidisciplinary, transdisciplinary and interdisciplinary approaches, it is evident that EfS calls for holistic and integrated approaches to help students understand the interconnectedness of environmental, economic, political, cultural, and historical systems. The multidisciplinary approach has little to offer EfS. The transdisciplinary approach has much to offer; however it is unlikely that the entire public education system will reorient in such a way. However, a part of the formal education

system can be modified to make way for a transdisciplinary program within the existing formal education system. Further, interdisciplinary approaches can be used as well to further reorient the disciplines (subject areas in this case) to address particular components of EfS. Consequently, a transdisciplinary program added to a disciplinary formal education system is recommended for EfS. Also recommended for EfS is an interdisciplinary approach. Let us address what a transdisciplinary program within a disciplinary/interdisciplinary system would look like.

2.4.4 Transdisciplinarity Within A Disciplinary/ Interdisciplinary Formal Education System

The proposed approach for the reorientation of the current education system is a transdisciplinary EfS program within an interdisciplinary learning environment. Figure 2.9 identifies the structure of the education system for this model.

The approach has EfS taught beyond subject-areas (a transdisciplinary one program) and across subject areas (interdisciplinary). The education system is oriented in such a way that all grade levels address EfS in one program called EfS. The program concentrates on units of study focusing on sustainability issues. Simultaneously, where appropriate, EfS student learning outcomes associated with EfS units of study are planned and delivered across subject areas (interdisciplinary). The coordination and communication required between educators is high. The ultimate purpose of the transdisciplinary EfS program is to teach students how to live sustainably on the planet. All subject areas have an additional purpose to their current aims, structures and skills associated within each discipline – that is to make the concept and content connections associated with EfS goals into subject-area outcomes to the extent that is appropriate.

General Notion	Type of System	System Config-uration
The coordination of all disciplines and interdisciplines in one program on the basis of a generalized EfS goals, values, perspectives (introduced from the purposive level down) and an emerging cyclical pattern. School administrators develop a timetable that includes an EfS program within the disciplinary structure. The EfS Teacher works with other subject area teachers (and students) to develop EfS focused units. All teachers contribute to all aspects of the study (they do not represent a particular program area). Within the EfS program, students identify EfS focused issues to explore, frame questions, and undertake tasks, applying relevant knowledge and skills from any and all subject areas. Within subject areas, teachers address EfS concepts wherever appropriate.	Multi-level multi-goal; coordination toward a common system purpose that works towards teaching students how to live sustainably on the planet.	

Figure 2.9. Transdisciplinary/Interdisciplinary EfS Program. Adapted from Jantsch (1971)

Teachers of each discipline also work towards teaching students to live sustainability on the planet using the knowledge and skills generated across the disciplines. In this model, the students, teachers from all disciplines, the EfS teacher, and school administrators would have particular responsibilities.

Students are required to demonstrate sustainable practices throughout their school experience as they move through the various grade levels and as they move from one subject area to another. Students are also required to provide input into curriculum development processes. For example, student input is sought for EfS curriculum planning and implementation. Regarding planning, students provide input regarding what sustainability issues are important and meaningful to them. They provide input regarding what they already know about the issue. Regarding implementation, students work with their peers and with the teacher to create a learning environment that facilitates learning about the issue. Students bring learning materials into the classroom.

The EfS teacher is expected to collaborate with all teachers and with students on the planning, design and implementation of EfS units of study. The EfS teacher is expected to know the curriculum and related student learning outcomes of other disciplines and to attempt to apply these concepts within the EfS program when they apply to teaching students how to live sustainably on the planet. The following pedagogic creed is applicable:

> "The teacher asks the students to join with the teacher in inquiry, into that which the student is experiencing. The teacher agrees to help the student understand the meaning of the advice given, to be readily confrontable by the student, and to work with the student in reflecting on the tactic understanding each has" (Doll, 1993, p. 160).

Related to the expectations identified above, all subject-area teachers are expected to collaborate with the EfS teacher on the planning, design and implementation of EfS focused curriculum units. Teachers are also required to address EfS outcomes in their own disciplines when appropriate. Teachers are expected to work with other teachers to plan curriculum units. Teachers are also required to teach particular aspects of the EfS curriculum when appropriate in their classrooms or elsewhere when the concepts are related to their area of expertise.

The school administrators are responsible for developing a school timetable that provides for the inclusion of an EfS program and to create a school learning environment that is congruent with EfS values, perspectives and goals. School administrators are responsible for enabling the interaction among teachers by providing supports, incentives and recognition for teacher-to-teacher collaborative work (teacher release time for curriculum development; recognition at assemblies, etc.) and for identifying the human and financial resources to make integration possible.

A pragmatic reason for using a transdisciplinary one-program approach to ensure economic education, environmental education and social education issues are addressed simultaneously and systematically; the main notion behind EfS. The one-program approach ensures that EfS learning objectives are systematically taught and can be evaluated (Van Matre, 1990). Further, each subject area involved in EfS continues to develop its own subject area, each with its own strength, skills and perspectives. However, other than developing a particular subject area, each subject area also contributes to a shared vision of sustainability through the weaving of subject-area

contributions. The reality is that for EfS to move forward, it takes a concerted effort from many subject areas, not just a single transdisciplinary EfS program.

There are a number of arguments associated with the creation of a one-course transdisciplinary program. Note that the arguments are similar to those associated with interdisciplinary approaches:

- time is taken away from the existing curriculum (mathematics, science, language arts, social studies, etc.) to make way for the EfS program. The idea is that the program integrates student learning outcomes associated with those respective subject areas, in an integrated way.
- Subject area teachers often feel that they need time in the curriculum to teach students the learning outcomes associated with their subject area.

I refute these arguments, given that the skills and strengths from the existing subject areas are strengthened through the application of skills in the context of the students' everyday practices related to EfS. For example, instead of teaching students about graphing concepts using a textbook approach, an EfS program teacher may have students generate numbers themselves by conducting a waste audit and subsequently generating numbers that are used to help them to understand the concept of graphing and communication. Thus, although time is temporarily removed from one specific subject area curriculum, the student learns and applies discipline-related student learning outcomes through the EfS program. Consequently, the time taken away from other subject area curricula is time well spent if the EfS teacher and all other subject area teachers collaborate on the student learning outcomes that are deemed most important for students to learn.

This approach also requires subject area teachers to exchange something in their curriculum. Good teachers are constantly reorganizing curricula to meet the needs of a diverse population of students. Through collaborative curriculum design and planning processes, all teachers ultimately learn what students are expected to know and do in all subject areas at all grade levels. Through a collaborative planning process, teachers ultimately become aware of what other teachers are planning to teach at a particular time of year at various grade levels. Such a concerted effort by educators ensures that similar concepts are taught and applied at similar times and that duplication of particular outcomes does not occur. Through a concerted, collaborative process, teachers work together and negotiate what is to be combined with other curricula to allow for smooth implementation of an EfS curriculum while teaching students the learning outcomes associated with each subject area. Principals demonstrate effective leadership and support teachers as they make curricular connections through communication and collaboration. Principals also encourage teachers to assess the curricular outcomes in a variety of ways (EfS encourages joint application or process to meet outcomes) so as to make learning "real" for students and "catch" students. Collaboration and teamwork also prove positive in terms of teachers' respecting and valuing each other's contributions to student learning overall.

Another argument that is easily refuted suggests that creating a curriculum that promotes sustainability goals is extremely difficult due to a number of teacher constraints. The first constraint has to do with teacher education. The argument is that teachers have not been educated in faculties of education to teach EfS-related skills, knowledge, perspectives and values. Rather, teachers have been taught in some teacher

education programs how to use textbooks, work individually and follow a pre-established curriculum. I argue that teachers have learned to plan, design and teach in an integrated way at all levels. One teacher is usually responsible for particular subject areas and thematic topics have been used as organizers to teach particular concepts. In situations where different teachers are responsible for different subjects, a considerable amount of organization and planning with other teachers is required to coordinate an interdisciplinary approach. Note also that at the Middle Years and Senior Years levels (Grades five to twelve) most teachers teach more than one subject. Perhaps a call to educate pre-service teachers and reeducate practising teachers in the pedagogy necessary to teach EfS is a solution. It is realistic for teacher education programs to offer a core EfS foundation and instruction course to pre-service teachers so that new teachers come better equipped to teach EfS programs and approaches. It is probably economically unrealistic to retrain practising teachers. However, practising teachers do need professional development related to their knowledge and awareness of EfS and how to teach students to live sustainably on the planet, including the identification of resources that are currently available in that genre.

Another potential teacher constraint has to do with the lack of existing EfS curricula and teachers' potential lack of expertise with respect to EfS goals and desired principles of learning. The lack of existing EfS curricula is certainly a constraint, particularly if teachers opt to use existing EfS-focused curricula, given the time factor associated with collaborative curriculum development processes. The lack of EfS curricula is due to EfS being a new thrust for the education system. EfS evolved through international political and economic forums (United Nations, OECD, OAS) not from the

educational community. Many resources currently exist in the fields of environmental education, population education, global education, and human rights education. Although these foci do not address the social, environmental and economic systems together, they are easily adapted and expanded to focus on all three systems simultaneously; an important requirement for EfS.

The lack of existing curricula can be addressed in a number of ways. A good strategy is for the EfS teacher to work in concert with subject-area teachers to plan and implement EfS curriculum. The EfS teacher leads in developing curricula with other teachers (focuses on EfS) while at the same time taking into consideration subject area student learning outcomes and accessing those in a variety of ways. The EfS teacher leads the collaboration with other subject area teachers to jointly apply the EfS outcomes in subject areas in order to meet all outcomes in a highly coordinated and integrated way. Ideally, the EfS teacher develops the big picture for EfS to which all disciplines contribute. This strategy ensures that the EfS curriculum is not a stand-alone curriculum, but one that is fully integrated with all other subject-areas.

Another argument associated with this model is that the teachers' teaching philosophies may not be congruent with EfS philosophies. EfS teaching philosophies require student-centered, hands-on approaches (as opposed to textbook approaches) that empower students to make decisions and solve problems with respect to EfS issues. The aim is to have students learn by doing things rather than being passive receptors of information by focusing on student-initiated projects. The aim is also for students to have control over their own learning by having choices about what they learn and how they learn and how long the learning should take. Teachers might be in a position to

address student inquiries about a topic in which they have no answers or background. A hands-on approach with a textual foundation may pose a threat to some teachers (some teachers might be more familiar with lecture-style, traditional textbook approaches). Further, learning side-by-side and considering the teacher as equal to the student may also pose problems for teachers and students, because most teachers and students anticipate the teacher to be in control of all learning situations by having power and authority over students. In essence, in the latter case, the teacher asks the students to accept the teacher's authority. In the former, "the teacher is asking the student to suspend disbelief in that authority" (Doll, 1993, p. 160). The role of authority is discussed in the following section. Although these situations pose particular threats to teachers, EfS philosophy does require teachers to temporarily abandon their position of all-knowing sages and to learn side-by-side with students and to work with students in reflecting on the tacit understanding each has.

Another constraint is that the teachers' worldviews may be anthropocentric as opposed to eco-centric (a requirement for EfS). Teachers have to examine how they view their human/nature relations given that their views may cause them to take specific actions. If a teacher has an anthropocentric worldview, then decisions, teaching and actions may be based on what is in the best interests of human beings. On the other hand, if a teacher has an eco-centric view, then decisions, teaching and actions may be based on what is in the best interest of the planet. The teaching approaches may ultimately be fairly different. This is probably the most significant constraint because a teacher's view may ultimately affect what that teacher does and communicates to students on a daily basis. To address this constraint, teachers need to analyze their views and attempt to

model eco-centric views, even when the teacher's personal view may be essentially anthropocentric.

Another constraint relates to collaboration and communication between teachers. To move EfS forward, a high level of communication and collaboration by all teachers is required. Teachers need to work together to:

- coordinate student learning between subject areas and between levels;
- plan and design curriculum units and to carry out activities related to the development process;
- implement the curriculum and reflect on their experiences together; and
- evaluate the curriculum itself, their teaching practices and student learning.

To do all of these things, teachers need to cooperate and demonstrate respect for one another and their particular subject areas. They need to be honest with each other, demonstrate that they are motivated, open to change, flexible and able to listen to one another and respect each other's views and ideas. They need to solve issues constructively, demonstrate that they are willing to take risks, and be willing to put time and energy into the collaborative process. All that notwithstanding, teachers may not have experience or even be motivated to collaborate and communicate with other teachers to plan and implement EfS-focused curricula. Communication and collaboration are important in all aspects of education, not only EfS. Furthermore, communication and collaboration are the behaviours that most teachers attempt to instill in their students. Effective communication and collaboration is required in most aspects of life and are certainly required to live in a sustainable way on the planet. If teachers do not communicate and collaborate effectively, they are not seen as modeling the values that

they deem important for students to understand and practice, which makes it difficult for students to adopt those values and ways of doing things. Furthermore, collaboration in itself helps to develop teachers' skills, builds trust, and encourages respect for one another. Probably the most significant reason for not wanting to collaborate and communicate with other teachers is lack of available time to collaborate and communicate.

Finally, time and expertise are required to plan and design EfS curricula. Teachers need to develop a schedule to work together. They need time to understand and learn the pedagogy associated with EfS. They need time to coordinate, learn, plan, and carry out activities related to the development process. Reflection, evaluation and document processing (if required) also take time. Time is definitely a serious constraint, and is something that should also be considered in terms of teacher preparation and professional development opportunities for practising teachers. If teachers were equipped to plan interdisciplinary EfS units in teacher education programs, the time constraint for practising teachers would not seem to be such a significant constraint. Practicing teachers should spend their time communicating and integrating, reflecting and evaluating, not on learning "how to" plan an interdisciplinary unit. Further, once teachers are involved in a concerted and coordinated planning process, future planning and design processes ultimately require less time because teachers have already learned meta-planning processes. Similarly, practising teachers learn how to plan interdisciplinary curriculum units through professional development opportunities through their school divisions and through provincial professional development opportunities.

In principle, EfS outcomes can be taught within the context of subject areas, however, ideally learning should take place across subject areas and beyond the subject areas. For students to learn how to live sustainably on the planet, students need to identify sustainability issues to explore, to frame questions, undertake activities and tasks, develop and apply relevant knowledge and skills from any and all subject areas. Consequently, the ideal context for students to learn how to live sustainably on the planet is through transdisciplinary and interdisciplinary approaches.

2.5 Constructing an EfS Curriculum Template

> The field of curriculum is moribund. It is unable, by its present methods and principles, to continue its work and contribute significantly to the advancement of education. It requires new principles... a new view...of its problems...[and] new methods appropriate to the ...problems (Schwab, 1978, p. 287)

So far we have discussed ideas associated with using the principles of ecology as lessons towards learning how to live sustainably on the planet. We have identified student learning outcomes and the principles of learning associated with EfS. And we have proposed an approach for the orientation of the current education system towards a transdisciplinary EfS program within a disciplinary/interdisciplinary learning environment.

Based on these foregoing ideas, curriculum development approaches that are associated with *practical* rather than theoretical approaches to teaching and learning are superior for EfS. The theory ought to be "grounded in and must be developed from practice" (Doll, 1993). Doll (1993) argues that this means "teachers and students need to be free, encouraged, demanded to develop their own curriculum in conjoint interaction with one another" (p. 163).

I value a curriculum that is rich in diversity, problematics, and heuristics. However, the curriculum should also be structured so that "the learner in the curriculum course needs to know the material studied well enough and have enough personal confidence to be able both to solve, interpret, analyze, and perform the material presented and to play with the material in imaginative manners" (Doll, 1993, p. 164).

How the curriculum 'plays out' in the classroom has a lot to do with the authority of the teacher. I value a teacher who is "first among equals" (Doll, 1993, p. 167) which means that the teacher is "at one" with the students and their situation. Questions of procedure, methodology and values are decided involving students, teachers, and local traditions. I value teachers that "interpret others' values." The teacher is a "leader from within, not a dictator from without" (Doll, 1993, p. 168). Doll (1993) suggests that to make this happen, teachers and students must work within a realm that is "fascinating, imaginative; where no one owns the truth and everyone has the right to be understood" (p. 168). I value teachers that "develop authority and control instead of imposing them." I value teachers that are open, heuristic, and dialogue-engendering. The assumption is that meaning is made (constructed) through dialogue. Consequently, teachers attempt to keep the "dialogue going" through story telling, interpretation and encouragement. Teachers need to present their lessons with enough narrative to encourage their students and to explore with them the possibilities that can be generated through dialogue.

I value curriculum development processes where the developers are active participants in the planning process – that is, "a maker of meaning" (Doll, 1998, p. 170). During implementation, it is assumed that plans change given that they have been developed though action and will need to be modified through actions. The lesson plans

that make up the curriculum ought to be written in a general manner (the plans may be subject to change). As the lesson proceeds, specificity becomes more appropriate and is worked out conjointly – among teacher and students. This type of planning allows for flexibility and considers the unexpected (Doll, 1993).

I value student evaluation "wherein there is a negotiary process between the teacher and the student for the purpose of transformation" (Doll, 1993, p. 170). Evaluation becomes communal and interactive. It is used as feedback, part of the iterative process of doing – critiquing – doing – critiquing (Doll, 1998, p. 174).

With these values in mind, let us now look at the task associated with the planning and design of a generally structured EfS curriculum unit.

2.6 EfS Curriculum Planning and Design models

The first task in planning and designing an EfS unit is to identify a curriculum design model to follow and adapt. This task answers the question, "How will we do it?" "What process will we follow?" Answering these questions helps curriculum developers to identify which approach to use in order to plan and design a transdisciplinary EfS curriculum unit. Specific questions to investigate are:

1. What curriculum design approach will be used to plan and design the unit? EfS calls for a thorough and holistic understanding of the interconnectedness of environmental, economic, political, cultural, and historical systems. EfS uses ecological approaches.
2. What curriculum design models/frameworks currently exist? There are two major models that exist for the design for integrated curriculum units (Erickson, 1998; Jacobs, 1989; Jacobs and Borland, 1986). Table 1.1

provides the frameworks proposed by Jacobs (1989), Jacobs and Borland (1986) and Erickson (1998).

Table 1.1. Framework for Understanding Interdisciplinary Curriculum Design

Jacobs (1989)/ Jacobs and Borland (1986)	Erickson (1998)
1. Selecting an Organizing Center	1. The Unit Theme
2. Brainstorming Associations	2. Concept (Conceptual Lens)
3. Establish Guiding Questions to Serve as Scope and Sequence	3. Webbing the Topics for Study
4. Writing Activities for Implementation	4. Generalizations (Essential understandings)
	5. Essential Questions
	6. Processes and Skills
	7. Instructional Activities
	8. Culminating Performance

However, although these models are useful, they do not encompass all factors considered important for the planning and design of EfS-focused curriculum units. Most importantly, these models do not address the theory that we learn valuable lessons from ecosystems as sustainable systems of plants, animals and microorganisms and the environment. In Chapter One, I discussed why the ecological perspective that humans are part of nature must inform a sustainable society and that social, economic and environmental systems are interdependent. So, how does this theory translate into the practice of curriculum development and design? Commonly used models for curriculum planning and design do not address many of the requirements of EfS. For example, the models do not address EfS goals, perspectives, and essential learning and corresponding

principles of learning (although most models assume students must gain new knowledge, skills, etc.). These models also do not address the need to identify a focus for the unit through the identification of essential questions and sub-questions using the principles of ecology as guides, although both models include the identification of a focus for a unit. The models also do not take into consideration the need for teachers to build a shared vision for what constitutes a sustainable future and what students should be taught related to that vision (at the very least the connection between themselves and the environment that sustains them). Both models also do not address how existing curricula would have to change to make way for the teaching of an EfS unit. In a general sense, these models are useful in terms of how to identify essential questions, the need to include students in decision-making, and how to design lesson plans and identify curricular connections. Consequently, the models identified by Erickson (1998), Jacobs (1989) and Jacobs and Borland (1986) may be used as a loose guideline while also realizing that these models have particular limitations with respect to the planning and design of transdisciplinary/ interdisciplinary curricula units.

It is clear that change in education is necessary for EfS to come into effect. Consequently, EfS curriculum development and implementation needs to be studied in the context of the change process so that an understanding of this process can be understood.

2.7 Change Factors Affecting Educating for Sustainability

The initiation and implementation of educational change accompanies "change in practice." It involves at least three dimensions (Fullan, 2001):

1) the possible use of new or revised materials (instructional resources),

2) the possible use of new teaching approaches (i.e., new teaching strategies or activities), and

3) the possible alteration of beliefs (e.g., pedagogical assumptions and theories underlying particular new policies or programs.

These intended outcomes are achieved through three broad phases: Phase 1 consists of the process that leads up to and includes a decision to adopt or proceed with a change (sometimes labeled initiation, mobilization or adoption); this phase also includes planning. Phase 2 involves the first attempts to put an idea or reform into practice (referred to mostly as implementation). Phase 3 refers to whether the change gets built in as an ongoing part of the system or disappears by way of attrition or the decision to discard it. There are several factors that affect initiation and implementation of change. In turn, I will discuss these in detail in the following sections.

2.7.1 Factors Affecting Initiation

Initiation is the process leading up to the decision to implement an innovation as well as initial planning, which affects the future of the project. "What happens at one stage of the change process strongly affects subsequent stages" (Fullan 2001, p. 53). The importance of human resources and emphasis on personal and professional growth are vital for implementation of change. Relationships and a sense of community are central to the successful introduction of innovations. Learning teams, study groups, and small action research groups are necessary for building communal relationships. Factors influencing the initiation process are as follows: existence and quality of innovations; access to innovation; advocacy from central administration; teacher advocacy; external

change agents; community pressure/support/ apathy; new policy – funds; problem solving and bureaucratic orientations (Fullan, 2001).

The first factor deals with the argument over locally or externally developed innovations. Local material development aids rapid staff development, allowing teachers to achieve a sense of project ownership and understanding (Berman & McLaughlin, 1978). Developing materials locally has a positive effect on ongoing teacher involvement (Lawrence, 1991). Refuting this argument are Crandell and Loucks (1983) who advocate the use of ready-made innovations when these exist, as the costs involved in innovating at the local level are high, coordination is more complicated and teachers are no more attracted to locally developed innovations than those developed externally. Information about the existence and quality of external innovations however, needs to be made more accessible. Adequate materials and guidelines for understanding the external innovation and how to implement it are also essential. These issues can be easily overcome through computer technologies. However, local development can also meet local needs when teachers (1) are provided with additional resources, particularly release time during the day; (2) are self-selected, highly motivated and capable of integrating theory into practice; (3) have access to outside experts to help them in the development process; and (4) are not hurried for change (Crandell & Loucks, 1983).

Whether the innovation is locally or externally derived, teachers encounter constraints in the innovation process simply because they have little time and energy outside their teaching duties for innovation development. And, if hurried, the innovation may fail.

The second factor affecting innovation is the selectivity that occurs as a result of differential access to information (Fullan, 2001). Access to innovations depends on an infrastructure of communication: ease of transportation, resources, and density of population and ideas in the geographical area. For example, in large school divisions, coordinators and consultants (among others) spend large amounts of time communicating with their peers at conferences and workshops within ongoing professional networks. Administrators, coordinators and consultants in large divisions have access to curriculum resources such as materials (i.e., support documents, videotapes, professional journals, web sites, etc.), learning experiences (i.e., events including conferences, workshops or courses that provide information or learning opportunities in the project's focus area), models (exemplars of effective practices), fax networks (information-exchange networks for educators), and computerized telecommunication networks (i.e., electronic mail and Internet). These school divisions enjoy favorable conditions when it comes to access; northern, remote, rural and small divisions may not. Eventually, due to technology, it is likely that access will become more available over time.

The third factor influencing the initiation of change depends on advocacy from school administration. Advocates refer to educational partners (people whose approval, support, or participation increase the likelihood of success) and champions (people who lend credibility or visibility to the project). Strong supportive leadership is crucial for the adoption and development of an innovation and its implementation (Corbett, Dawson & Firestone, 1984; Huberman & Miles, 1984).

At the local level, the principal is considered to be the most important "gate-keeper" (Fullan, 2001), often determining the fate of innovations coming from the outside

or from teacher initiatives on the inside. The most important function of the leader is to support the innovation in tangible ways (Berman & McLaughlin, 1978; Crandell & Loucks, 1983; Fullan, 1982). Teachers take change seriously when administrators demonstrate through action that they should do so (Lawrence, 1991). Principals show support for an innovation by accessing resources, rearranging schedules and staff assignments, providing ongoing assistance and support and keeping the practice a high priority. Berman and McLaughlin (1978) found that when principals do not show support, projects are rarely successful. The study concludes that the more actively supportive the principal is, the more successful the project is likely to be and the more likely goals are achieved.

The fourth factor related to innovation focuses on the importance of consultants, teachers, and others that can and should take on leadership roles (Firestone & Corbett, 1988; Gersen, Carine & Green, 1982). Tasks may include:

1) obtaining resources such as funds, time for teachers, adequate facilities;
2) buffering the project from external interference and allowing staff the time to develop mastery of the project;
3) providing encouragement and recognition to staff; and
4) adjusting standard operating procedures to fit the innovation, including evaluation procedures and schedules (Firestone & Corbett, 1988).

Most teachers (as individuals or in groups) innovate daily. Fullan (2001) identifies a strong body of evidence indicating that other teachers are often the preferred source of ideas, however he also points out evidence is equally strong that opportunities to interact with other teachers are limited, and when good ideas do get initiated by one or more

teachers, the support of others is required if the ideas are to go anywhere. When schools establish professional learning communities, teachers constantly search for new ways of making improvements and on a larger scale, national and local teacher's societies are becoming strong advocates of reform (Fullan, 2001).

These findings indicate that many teachers are willing to adopt change at the individual classroom level and will do so under the right conditions such as when innovations that are clear and practical, when school boards and principals are supportive, when there is an opportunity to interact with other teachers, when there is advocacy from teacher's societies, and when there is outside resource help (Fullan, 2001). It should be noted that most teachers do not have adequate information, access, time or energy to innovate on a large scale.

The fifth factor related to innovation points to external change agents. External change agents can be referred to as consultants who contributes expertise, information, and discussion, mentors who coach or provide models, critics who help teachers assess project activities realistically, people to whom teachers turn for encouragement and reassurance, strategic networks such as partnerships, twinned schools, community-school teams or learning project groups, and professional organizations including international and national organizations, provincial and local curriculum associations, committees, and special interest groups (Manitoba Education, 1997).

External change agents or facilitators play an important part in initiating change projects. The importance of these roles, especially at the initiation stage, has been documented for a number of years (Fullan, 2001). What is new in the past decade is the enormous presence of large scale, not-for-profit foundations and business partnerships.

Much of the innovative money and opportunities for reform are made possible through foundations (Fullan, 2001).

The sixth innovation factor deals with community pressure, support, opposition, and apathy. "Some communities support innovation, others block it, most are apathetic, and even more are all of those things at one time or another" (Fullan, 2001, p. 61). Based on research findings, Fullan (2001) concludes that the role of the community in the initiation process is not straightforward, but also states that the findings are understandable when considering the following components:

1) Major demographic changes create turbulence in the environment, which may lead to initiation of change or irreconcilable conflict;
2) Most communities do not actively participate in change decisions about educational programs;
3) More highly educated communities seem to put general pressure on their school to adopt high-quality, academic-oriented changes. They also can react strongly and effectively against proposed changes that they do not like;
4) Less-well-educated communities are not as likely to initiate change or put effective pressure on educators to initiate changes on their behalf. They are also less likely to oppose changes because of lack of knowledge, but once activated, they too can become effective.

The seventh factor is based on new policy and funds. New legislation or policy that mandates adoption at the local district level can be cause for developing or adopting new programs or innovations, particularly when the new legislation or policy is accompanied

by financial support[1]. Increasingly, provincial governments are mandating new requirements. Many major educational initiatives are generated through government policymaking and legislation in areas of the greatest need such as special needs and teacher education (Fullan, 2001). However, Fullan (2001) also points out that policies are often left ambiguous and overly general, leaving it up to local districts to adopt policies in principle without actually implementing them to a significant degree. Financial support refers to grants that provide special funding for programming or curricular initiatives, re-allocation of budget priorities (to support projects), or sponsorships from interested parties such as local business. Crandell and Loucks (1983) point out that funds are generally available when an innovation is initially implemented but are not always integrated into annual budgets, thus making it difficult to provide additional materials or facilities over time as required and/or fund ongoing teacher development.

The eighth factor focuses on problem-solving and bureaucratic orientations. The orientation that school boards take to external policy and funding is interesting. Fullan (2001) identifies a study by Berman and McLaughlin (1978) that discovered 25 years ago that adoption of decisions by school districts is characterized by either an opportunistic (bureaucratic) or a problem-solving orientation. Nothing has changed in this regard and many schools and districts continue to acquire new projects and see this as an opportunity to obtain extra resources (opportunistic) instead of focusing on acquiring the projects to address a particular division goal or to solve a problem.

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[1] Financial support refers to grants (special funding allocated for programming or curricular initiatives), re-allocation of budget priorities (commitment of existing funds to support projects), sponsorships (contribution from interested parties such as local business).

The ninth factor for initiating change is climate. Climate can also contribute to the initiation and implementation of an innovation whether it is locally developed or externally acquired. Climate refers to:

- enthusiasm (communication of interest and excitement),
- commitment (visible examples of support for the project demonstrated by such things as attendance at project meetings/events),
- permission to risk (reassurance that fear and uncertainty are natural elements of change),
- valuing of approximation (recognition of mistakes as valuable learning experiences),
- celebration of effort (recognition of effort, growth, and accomplishment),
- trust (belief that participants can and will succeed in effective educational change),
- constructive problem-solving (identifying and dealing with challenges as they arise), and
- time (for learning, planning, doing, interacting, reflecting, evaluating, and documenting) (Manitoba Education, 1997).

Fullan and Pomfret (1977) argue that time is required for teachers to familiarize themselves with or develop materials and to reflect and work on problems of implementation. Teachers also need time to understand or develop and integrate an innovation and its implications.

Teachers need to also be recognized for their commitment and time invested in making a project work. Incentives for teachers are essential (Corbett et al., 1988). "The

most crucial incentive is social support and recognition" (Firestone & Corbett, p. 331) by other teachers and/or the school principal. Incentives include release time, adjustment of classroom responsibilities or positive evaluations.

2.7.2 Factors Affecting Implementation

Implementation refers to what really happens in practice. Implementation consists of the process of putting into practice an idea, program, or set of activities and structures new to the people attempting or expected to change (Fullan, 2001). The revised practice potentially involves changes in curriculum materials, teaching practices and beliefs or understandings about the curriculum and learning practices in order to achieve some sought-after change. Fullan (2001) identifies several critical factors based on evidence, not just theory, in the implementation process. These factors involve: 1) the characteristics of the innovation of change; 2) local roles, and 3) external factors.

Four characteristics associated with successful implementation are the extent to which it is needed, its clarity, complexity and quality (Fullan, 1982/2001). The need for an innovation is determined by the extent to which local concerns or goals are met by its use. The fit between a new program and the needs of a district and/or school is essential. In the early part of the implementation stage, people involved must perceive both that the needs being addressed are significant and that they are making at least some progress towards meeting those needs (Fullan, 2001).

Several studies show that recognition of perceived needs makes implementation more likely to be successful (Berman & McLaughlin, 1978; Crandell & Loucks, 1983; Rosenblum & Louis, 1979) and if it is perceived by users as relevant (Lawrence, 1991).

Fullan (2001) identifies three complications with respect to perceived or felt need. First, schools are faced with overload improvement agendas. How important is this need relative to other needs? Second, precise needs are often not clear at the beginning, especially with complex changes. It is during implementation when people often become clearer about their needs (when they start doing things). Third, need interacts with the other eight factors to produce different patterns. Depending on the pattern, need can become further clarified or obfuscated during the implementation process (Fullan, 1982; 2001; Lawrence, 1991).

2.7.2.1 Clarity

Clarity is the extent to which the goals and means related to an innovation could be interpreted and understood by users. Teachers, for example, may not be clear about what they ought to do differently in their classroom. Research shows that lack of clarity can be the most significant reason why an innovation such as implementing a new curriculum or policy has not been carried out (Carters & Pellegrin, 1973; Fullan, 2001/1982). The more complex and unclear the change appears, the more likely it will be avoided (Fullan & Park, 1981; Robinson, 1978).

There is little doubt that clarity is an important ingredient in the change process, since problems related to clarity appear in almost every study of implementation change (Fullan, 1999; Gross & Bernstein, 1971). Materials that are vague or not practical to use contribute to lack of clarity. But, Fullan (2001) points out that it is possible to have "false clarity." False clarity occurs when change is interpreted in an oversimplified way; that is, the proposed change has more to it than people perceive or realize (p. 77). For example, when teachers implement a new curriculum, they may not change their teaching

practices, or their beliefs. They may simply teach the new curriculum in the same manner they have taught the old curriculum in the past and may fail to incorporate significant features of the policy or goals that it is supposed to address. Fullan (2001) provides evidence that not everyone experiences the comfort of false clarity. "Unclear and unspecified changes can cause great anxiety and frustration to those sincerely trying to implement them" (p. 77).

2.7.2.2 Complexity

"Complexity refers to the difficulty and extent of change required of the individuals responsible for implementation" (Fullan, 2001, p. 78). Any change can be examined with regard to difficulty, skill required, and extent of alterations in beliefs, teaching strategies, and use of materials. Many educational changes require an array of activities, structures, diagnoses, teaching strategies, and philosophical understanding if effective implementation is to be attained (Fullan, 2001). Less complex innovations tend to affect teacher practice less. Berman and McLaughlin (1978) found that when innovations are broad in scope and make great demands on teachers, an effort is made to incorporate them into practice (although teachers may run into stress and burnout as a result), less complex innovations tend to affect teachers less. Simple changes may be easier to implement, but may not make much difference in terms of alterations in beliefs, teaching strategies and so forth. Simply put, if there is "no pain", there probably will be "no gain."

2.7.2.3 Quality

Innovation should incorporate some measure of quality (the intrinsic merit of an innovation). The extent to which an innovation can be put into practice refers to its practicality. Sometimes, when decisions to adopt an innovation are made on the ground of political necessity, or on the grounds of perceived need without time for development, inadequate quality can result (Fullan, 2001). Fullan (2001) states "when adoption is more important than implementation, decisions are frequently made without the follow-up or preparation time necessary to generate adequate materials" (p. 79) resulting in difficulties associated with putting the program or innovation into practice. If teachers judge an innovation to be impractical, that is, not being able to put the idea, innovation, curriculum into practice, teachers will be less likely to put effort into its implementation (Waugh & Punch, 1987). Practicality is an important way in which teachers judge whether or not to use innovations in their classrooms (Lawrence, 1991).

The category of local roles touches upon the social conditions of change; the setting in which people work; and the planned and unplanned events and activities that might influence whether or not given change attempts will be productive. Implementation of an innovation may be successful in one school system, but not in another. What factors account for this? Fullan and Park (2001) point to a substantial amount of evidence that identifies at least six factors that might account for this.

If a school or school division has had previous successes implementing innovations, programs, curricula, etc., chances are, they will tend to be successful. Unfortunately, the opposite is also true, "the more that previous attempts at change have been painful and unrewarding, the more skeptical people will be about the next change

that comes along." Fullan and Park (2001) argue that implementation works more effectively when school systems have explicitly planned for the following: training of principals; professional development for teachers and input from attaining board and community support (i.e., parents), recognizing implementation takes time and requires monitoring, and planning to take steps to address teacher overload problems.

The support of central administrators is critical for change in district practice (Crandell & Loucks, 1983; Fullan, 2001/1982). The central office administrators and other key central administrators (superintendents) set the conditions for implementation to the extent that they show specific forms of support and active knowledge and understanding of the realities of attempting to put a change into practice (Fullan, 2001). The central office administrator coordinates the program and indicates to others that the innovation is to be taken seriously. Further, district administrator's affect the quality of implementation to the extent that they understand and help to manage the set of factors and processes described in this section. Superintendents can "demonstrate" support by actively supporting new proposals, by visiting schools to see how things are playing out, by following through on decisions, by releasing funding for professional development for principals and teachers, through encouragement, and other supportive gestures. Fullan (2001) points to major research studies that show that the local implementation process at the district level is essential if substantial improvement is the goal.

The role of school boards and communities ranges from apathy to active involvement. School boards can indirectly affect implementation by hiring or firing reform-oriented superintendents. School board members can also direct funds and consequently can encourage or discourage an innovation. Demographic factors often put

pressure on schools to adopt new policies and may affect implementation. Demographic factors refer to such things as whether a school is in a high-income or poor neighborhood, rural or urban, and the socio-economic mix of students.

Evidence indicates schools boards and individual parent support is essential for effective implementation (Fullan & Park, 1981). It is possible for implementation to occur without the community when the community is content to leave decision-making to the professionals however, Fullan and Park (1981) point out that implementation benefits from more active knowledge and support from parents. A community that is against a school project can seriously hamper its progress (Miles, 1980).

The principal strongly influences the likelihood of change (Fullan, 2001). But, most principals do not play instructional or change leadership roles (Berman & McLaughlin, 1978). "Projects having the active support of the principal were the most likely to fare well" (p. 124). Fullan (2001) quotes Berman and McLaughlin (1978, p. 128): "one of the best indicators of active involvement is whether the principal attends workshop training sessions." If the principal does not gain some understanding of the dimensions of change (beliefs, teaching behaviour, curriculum materials) he or she will not be able to understand teachers' concerns and consequently will not be able to provide support for implementation (Fullan 2001). Refer also to the section "Advocacy from school Administration" for specific tasks principals can undertake to show support for innovations.

Teachers' individual characteristics and collective or collegial factors play important roles in determining implementation. Huberman (1988) found that the psychological state of a teacher could be more or less predisposed towards considering

and acting on improvements. Teachers' personality, previous experience, stage of career, and sense of efficacy may lead them to take action and persist in the effort required to bring about successful implementation. For example, a sense of efficacy on the part of teaching staff is strongly correlated with effective schools (Berman & McLaughlin, 1978; Fullan, 1982). This means that teachers must believe that they can help even the most difficult and unmotivated students.

Relationship with other teachers is a critical variable, since interaction with others influences what one does. Fullan (2001) stresses the importance of peer relationships in school. He states,

> Change involves learning to do something new, and interaction is the primary basis for social learning. New meanings, new behaviours, new skills, and new beliefs depend significantly on whether teachers are working as isolated individuals or are exchanging ideas, support, and positive feelings about their work (p. 79).

The quality of working relationships among teachers is strongly related to implementation. "Collegiality, open communication, trust, support and help, learning on the job, getting results, and job satisfaction and morale are closely interrelated" (Fullan 2001). Berman and McLaughlin (1978) and House and Lapin (1978) state that inter-teacher professional interaction is a strong indication of effective schools. This may include frequent talk among teachers about the practice of teaching, observation, observation of each other's teaching and working together to plan and design materials (Firestone &Corbett, 1988). Teacher interaction generates commitment to the school and school projects and is a vehicle through which teachers develop shared values (Lawrence, 1991).

The broader society also affects implementation. Broader society, in Canada, includes the ministries of education, faculties of education and other regional institutions. In the United States, broader society includes state departments of education and federal agencies. Governments can put pressure on school divisions to support a particular policy or legislation. Governments can also provide funding support of an innovation. Both government pressure and funding provides legitimacy to the innovation. Innovations are affected by the extent to which they are compatible with curriculum mandated by Ministries of Education. Incompatible innovations may have a more difficult time becoming implemented (Lawrence, 1991).

Lack of role clarity, ambiguity about expectations, absence of regular interpersonal forums for communication, ambivalence between authority and support roles of external agencies, and solutions that are worse than the original problems combine to erode the likelihood of implementation (Fullan, 2001). However, recently, departments of education have had some direct influence on accomplishing specific learning outcomes through resource support, standardization and closer monitoring.

Societal orientations affect governmental and other political decisions. Public concerns influence policy and program initiatives in government and the educational system (Fullan, 1982). If acceptance is higher in the general population, innovations have a greater chance of governmental support and funding. Administrators, teachers, students and parents are also included for their values and opinions as influenced by events and orientations in wider society (Lawrence, 1991).

The implementation process also brings with it some constraints. Constraints to implementation may be lack of resources such as materials, time, funds and community

support. Samuel (1991) claims that materials are not always available or are not suitable for teachers' needs. Indeed, Childress (1978) found that in 82.1% of cases, material is developed primarily by teachers. Samual (1991) identifies time as a significant constraint. He contends that teachers have little extra time to educate themselves and work with others to develop and implement curriculum. Furthermore, time available to cover the curriculum is also seen by teachers as being in short supply (Fletcher, Rhoton & Bennett, 1979; Ham & Sewing, 1988; Wint, 1977). Childress (1978) and Ham and Sewing (1988) maintain that lack of funding may also be of significant concern. Indeed, lack of funding is a concern particularly if field trips and other initiatives are required to implement a curriculum effectively. Furthermore, community support is also required for effective implementation. For example, schools/teachers might approach businesses/ organizations within their community to donate time, expertise and/or resources (donations) to help implement the curriculum effectively. If community businesses/organizations do not donate their time or expertise, that too could constrain teachers' attempts toward effective implementation. Additionally, parental support is also required. Parents may be asked to donate their time to help students do projects that take them into their community during school hours. Parents may not always see the merit of their children doing project-oriented work surrounding community sustainability issues and may raise issues with respect to the need for SDE in general. Parents might not understand what EfS is and why it is important and may question the aim, goals and methods of instruction.

2.8 Chapter Summary

In this chapter, I develop Arena's ecological perspective to argue for particular goals, student learning outcomes and a view of learning associated with EfS. The goal for EfS is for educators to prepare learners for lives in the environmental, economic, political, cultural, and historical systems of which they are a part and to help students acquire an understanding of how these systems are interdependent and interconnected. Essential understandings include an emphasis on knowledge, skills and values related to environment, economy and society and the harmonization of these in decision-making, driven by the principles of ecology. EfS skills emphasize inquiry, problem solving and decision-making skills. Values and perspectives include assumptions about sustainability, such as a healthy ecosystem being critical for sustainability. I argue for a particular view of learning in EfS that is compatible with the ecosystem. I then present arguments for a reorientation of the current education system towards transdisciplinary and interdisciplinary approaches. I specifically argue for a transdisciplinary (one program) and interdisciplinary approach for EfS curriculum planning and raise a number of constraints and factors associated with reorientation of the education system. The curriculum development models identified in this chapter may serve as a loose guideline to help a teacher or a curriculum developer understand how to proceed with planning, designing and implementing an interdisciplinary EfS curriculum unit. However, it should be noted that these models have significant limitations in terms of how to select a focus for the unit, how to build a shared vision, and how to identify essential focus questions based on the principles of ecology. These models do, however, shed light on how to identify essential questions that are not drawn from ecological principles, how to create

lesson plans and write activities and procedures for classroom instruction and, given that no other models exist, provide a point from which to start.

It is clear that in order to fully understand the change process associated with reorienting the education system toward EfS teaching and learning, an understanding of the change process in education is required. Hence, predominantly, Fullan's change factors affecting teacher initiation and implementation of curriculum are evoked to enlighten a change process that might develop for EfS. Initiation of curriculum includes existence of quality innovations, access to innovation, advocacy from central administration, teacher advocacy, external change agents, community pressure/support, new policy/funds, development of action plan, supports – materials, time, funding and ongoing assistance. Factors affecting implementation include characteristics of the change (need, clarity, complexity, and quality/practicality) local roles (the school board/principal), the teachers' role and external factors such as government support.

The theoretical frameworks identified above serve as guidelines to attempt to understand and "make sense" of the change (reorientation) process a Middle Years Outdoor and Environmental Education teacher (Rachel) experiences as she develops an EfS-focused curriculum unit with a researcher and then teaches the unit to Middle Years students. This chapter will be used as a guideline to understand how Rachel designs and implements curricula and how she changes and develops throughout this dynamic process.

The next chapter outlines the research design, methods and procedures used in the study. I discuss the ethnographic research design, my role as a participant observer, the setting of the study (including the actors and events that affect them), the ethical

considerations for the study and the data collection strategies and data analysis procedures. The chapter also includes a description of the EfS curriculum unit, its instructional lessons and how the unit was collaboratively developed.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

There are three objectives to this study: (1) to learn how a Middle Years teacher, when working collaboratively with a researcher, develops an ecologically-focused sustainable development Middle Years curriculum unit; (2) to become aware how a class of Grade Six students thinks and talks about sustainability issues; and (3) to understand the meanings that the teacher attaches to the implementation of the unit and how students learn sustainability issues. To attain these purposes, this chapter develops ethnographic methods describing the actors (a Middle Years teacher and her Grade Six students), the events (curriculum development and implementation), and the context of inquiry (school classroom). Ethnographic methods involving observation and interviews are also described in this chapter.

3.1 Methodological Frameworks

The study aims to "strive for understanding" (Merriam, 1988) of the social phenomenon of Educating for Sustainability (EfS) in a Middle Years School in a certain time period. The researcher explores a single phenomenon (educating for sustainability), bounded by time (June – December) and activity (curriculum development and implementation), and collects detailed information by using a variety of data collection procedures (observation and interview) during a sustained period of time (eight months) (Merriam, 1988; Yin, 1989).

The study consists of the teacher and researcher carrying out on-going conversations while developing EfS curriculum, the researcher observing the events in the classroom when the teacher taught the EfS unit (September to December), and the researcher conducting individual interviews with the teacher and students. These ethnographic data-collecting methods allow the researcher to "describe" and understand the "people" (the teacher and her students) being studied (Chuborn, 1991). The emphasis is to interpret the teacher's perspectives throughout the process of curriculum development and implementation. This is the reason for in-depth interviewing and continual and ongoing participant observation of a situation (Jacobs, 1997). Rich descriptions are elicited from the teacher and students through the use of probing questions in "face-to-face interviews" (Field, 1983). The attempt is to "capture the whole picture" that is, the teacher-researcher curriculum development effort, teaching and learning in the EfS unit, teacher-student interactions, and peer interactions, to reveal how people describe and structure their world (Fraenkel and Wallen, 1990).

Believing "collaboration is an alternative to other attempts to nurture growth and facilitate change, which are based on either the withdrawal of the researcher from the setting or the researcher being non-participant observer in the setting, which he/she is seeking to change" (Ebenezer, 1991, p. 39), I worked collaboratively with the teacher from June to August 2001, in developing the EfS curriculum. I was a "participant observer" (Hammersely & Atkinson, 1981) fully "immersed" in the curriculum development process to study the integration of the sustainability issue of waste minimization guided by the principles of ecosystem into her curriculum. When the teacher implemented the EfS curriculum from September to December, I was an

"observer" in the classroom. Through this complex, long-term collaborative project, the teacher and I endeavored to "develop a shared language" (Erickson, 1998; Wideen & Andrew, 1984), even though we appreciated different perspectives in regard to curriculum development.

3.2 The Researcher's Background

In qualitative research, the researcher is the instrument in collecting worthwhile data. Hence it is important to reflect on my perceptions of the formal education system and educating for sustainability, shaped by my personal and professional experiences. Personal values, assumptions and biases that I bring from my experiences may be considered as useful and positive contributions, rather than being seen as detrimental (Locke, Spirduso & Silverman, 1987).

For several years, I have been the Coordinator for Sustainable Development with Manitoba Education and Youth. In this capacity, I have had the opportunity to work with teachers and curriculum developers in the area of sustainability. I have also had the privilege of playing a major role in developing government documents on sustainability. From September 1998 to November 2000, as a project leader for the development of a document entitled: "Education for a Sustainable Future - A Resource for Curriculum Developers, Teachers and Administrators," I worked with six teachers and four curriculum developers from four subject areas to develop an interdisciplinary framework for Educating for Sustainability. The Framework identifies the knowledge, skills, values and attitudes and life practices students require in order being educated for sustainability.

From September 1998 to November 1999, as a staff member on the Manitoba Round Table for Sustainable Development 's education and communication committee in

the development of a Sustainable Development Education Strategy, I coordinated and conducted eight open public sessions and focus group tests related to the Round Table Sustainable Development Education Strategy Concept Paper in eight regions throughout the province. Under the auspices of the Education Committee Chair of the Round Table, I collected and analyzed the data and prepared an executive summary. Currently, I work as a staff member on the same committee (with different members) with the Round Table to develop an education and communication strategy for the province of Manitoba.

From June 1998 to April 2000, I worked with all branches of Manitoba Education, Training and Youth to develop a Departmental Sustainable Development Action Plan. I developed a framework and template for the strategy, and all branches within the department submitted strategic plans identifying how the principles and guidelines of sustainable development are taken into consideration in all branch activities, programs, curricula, policies, initiatives and strategies. I combined these strategies into a Departmental Action Plan.

In the summer of 1999, for the CMEC (Council of Ministers of Education), on behalf of Manitoba Education and Training, I researched and developed a Report entitled: "The Status of Sustainable Development Education in Canada." The document, which has been recognized internationally, identifies the state of sustainable development education in Canada. It is available on CMEC's website at: http://www.cmec.ca/reports/index.stm.

Also, from 1998 to 2000, I carried out numerous information sessions related to sustainable development background, legislation, and the Departmental Sustainable Development (SD) Action Plan in most branches within the Department of Education. I

also carried out information sessions related to educating for sustainability within teacher education programs in two universities in Manitoba—The University of Manitoba and The University of Winnipeg.

In the summer of 1999, with a not-for-profit organization (Learning for a Sustainable Future - Canada), I coordinated in-service teacher workshops regarding educating for sustainability. Over 100 teachers in Manitoba participated in the professional development opportunity. In 2000, I coordinated an Education for Environmental and Sustainability Education Information Session for Environment Canada pertaining to the development of a national strategy focusing on Environmental and Sustainability Education.

From 1998 to 2002, I conducted many professional development sessions for teachers and students related to sustainable development education within numerous school divisions in Manitoba, Special Area Group conferences, and other events. During this time period, I also administered, managed and monitored numerous Sustainable Development Innovation Fund projects, including working closely with proponents to ensure that sustainability concepts were clearly recognized.

Through these initiatives I have enhanced my awareness, knowledge, skills and sensitivity to many of the opportunities, challenges, decisions, issues and constraints that can be encountered as one attempts to develop and implement an interdisciplinary curriculum in a discipline-based education system, particularly in the area of sustainability education. The initiatives in which I have been involved, particularly over the past four years, have provided me the necessary conceptual and practical tools to work with the teacher and her students in this study.

Because of previous experiences working closely with teachers, curriculum developers and policy makers in educational settings, I bring certain assumptions to this study. These assumptions shape the way I view and understand the data I collect, and the way I interpret my experiences and the experiences of others. I began this study with the following assumptions:

- we can learn how to live sustainably on the planet by mimicking the behaviour of ecosystems and related principles of ecology;
- students can teach us a considerable amount as to how we should live on the planet if we ask them to share their thoughts;
- students would have many ideas and strategies for us to consider as curriculum is being designed and implemented;
- a teacher and I could develop a sustainability focused curriculum unit while recognizing that it would take considerable motivation, materials, time, resources, and assistance;
- the implementation of the unit will be filled with adjustments, unanticipated surprises and challenges, but that it would be a rewarding experience for the teacher and her students; and
- the teacher, after working with me to develop and teach one unit, could effectively lead her colleagues to develop and implement another curriculum unit.

3.3 Meeting Rachel

Rachel and I met for the first time in the summer of 1999. She had attended an Information Session, Education for Environmental and Sustainability Education, which I

coordinated for Environment Canada at my place of employment, Manitoba Education and Youth. Approximately, 35 participants attended the information meeting.

During the session, a representative from Environment Canada asked participants to share information with respect to what was happening in Manitoba regarding sustainability and environmental education and where we might go from here. In response, I spoke at considerable length about the progress that has been made in the province in regard to the CMEC status report that has been published, the Sustainable Development Innovation Fund available to Manitobans for sustainability-related initiatives, and curriculum development and integration activities currently underway in K-12 school programs. I suggested that we might build upon practices that are currently underway in this jurisdiction, and learn from other jurisdictions about their successes in this area.

After the session concluded, Rachel asked me about the grant and the curriculum framework I had mentioned during the discussion. We discussed the grant, its objectives, and the criteria used for assessment. I then invited Rachel to my office to provide her with an application and other pertinent information. Rachel told me that she was a Middle Years teacher, teaching Outdoor and Environmental Education (OEE) at Georgetown Middle School (a pseudonym). She mentioned that there are no provincial curriculum guides for teaching OEE and consequently was continuously designing her own materials. I offered her the Educating for Sustainability curriculum framework document, and we discussed at length who helped create it, how it was created, the content, how it might facilitate curriculum development processes in this area, and my reflections on working as a project leader. She accepted the document and said she was

anxious to go home and read it. During our conversation, I listened to her thoughts regarding an idea she had for acquiring funding through the Sustainable Development Innovations Fund and offered to help her develop the proposal. She took me up on my offer and invited me into her school the following week to discuss the proposal with her, her principal and a colleague at her school.

3.3.1 A Grant Proposal Meeting with Rachel and her Principal

During the meeting at her school, the principal, Rachel, a colleague and I discussed what was required for the development of a proposal. We discussed the objectives of the grant, the application process, the criteria by which the proposal would be assessed, funding limits, and other pertinent information about the application process. We also discussed the philosophy of the school and its environmental education focus. We had a long discussion about what the differences/similarities are between environmental education, outdoor education and sustainable development education and educating for sustainability. We discussed the importance of using the characteristics of ecosystems as a gauge in decision-making. Through our discussions, it was evident to me that Rachel and her principal shared a similar world view to mine. The principal and Rachel told me about the "bioreserve," a 45-hectare park near the school that used to be a site for a wood preservative plant that coated hydro poles and railway ties with creosote. They informed me that the contaminated soil is now contained underneath two specially built hills that are now covered with grass. Over 1000 trees (ash, cottonwoods, aspen) have been planted on the site, which is now an outdoor education site for their middle school students.

The principal and Rachel also told me about another site in the division called "The Habitat" that is similar to the "bioreserve" in that it provides a home to a diverse population of plants and animals. They informed me that "The Habitat" is in jeopardy of being destroyed due to a political battle in the neighborhood related to littering and garbage. The school division has received complaints from residents that the Habitat was full of garbage. Some residents charge that the site is unsightly (due to the tall grass) and should be destroyed. Rachel and the principal were clearly upset with the prospect of losing the Habitat for the value it has in terms of an undisturbed habitat and for student learning, and asked me if I had political connections that might help with their fight to save the Habitat from being mowed down. Although I stated that I didn't have many connections politically, I offered to make some phone calls to various civil servants that I knew in another government department. I also provided the team with a few phone numbers and names of individuals who might help with their plight. Our one-hour meeting lasted over two hours. We hesitantly called the meeting to a close. The principal gave me some documentation outlining the problems associated with "The Habitat" for further review. We promised to meet again to further develop the ideas related to the grant proposal. We built almost instant rapport. Through conversation, I learned about their school philosophy and the importance they place on sustainability education and their commitment to it. They discerned that I shared their philosophy and I would help them in any way that I could.

I immersed myself in their plight to save "The Habitat." I made phone calls, read up on newspaper articles and spoke to many contacts. The school, Rachel, the principal, the bioreserve, the habitat, and the students that would be impacted were constantly on

my mind. Although I wasn't consciously looking for a school and a teacher with which to conduct my research at that particular time, it turned out that sub-consciously, I had found the school, a motivated and enthusiastic teacher and a very supportive principal. Or did they find me? That, I will never know for certain. Either way, it was meant to be.

3.3.2 Inviting Rachel to Participate in the Study

In early May 2001, I decided to ask Rachel to participate in my research project. I already believed that her principal would be supportive. Through discussions, I was aware that Rachel had an eco-centric worldview. Because of her involvement with activities such as coaching and instructing, I judged that Rachel would be committed, hardworking, dependable and enthusiastic about my research study as well. We had developed a good rapport—an important aspect in ethnographic research. I liked her and I knew that we would get along well throughout the duration of my research.

I contacted Rachel by telephone at her school and asked her if she would be willing to participate in my research study. Her reaction on the telephone indicated to me that she was thrilled with the idea of working with me over the summer months to develop a curriculum that would be implemented in her classroom in September. She accepted my invitation, in writing, to participate in the study and allow her students to participate in the study.

3.3.2 Selecting Rachel's Students

Following approval from the Ethical Review Committee, Faculty of Nursing, University of Manitoba (see Appendix A for ethics letter of clearance), in the beginning of September 2001, a class of Rachel's Grade Six students was purposefully selected to

participate in the study primarily on the basis of the students and their parents granting permission to participate in the study. Rachel taught six Grade Six classes, labeled 6-1 to 6-6. The study required that only one group of Grade Six students are selected for the study. Recognizing that I might not get consent from all students and their parents to interview, and to observe (video and audio-tape) and collect work, I requested consent from the first Grade Six class (6-1). I planned to select the class for the study if fifteen of the twenty-six students and their parents gave consent. If less than fifteen students gave consent, the plan was to request consent from the next class of students (6-2) and so on. Sixteen students and their parents provided consent from 6-1, the first class I had approached for participation in the study.

The 6-1 class consisted of twenty-six students: fourteen male students and twelve female students. There were two special needs students (both males). From the sixteen students that provided consent, eleven were female and four were male. The two special needs students did not give consent to participate in the study. Three of the sixteen students were of diverse cultural backgrounds including one First Nation's students. All students were twelve years old when the study commenced.

3.4 Ethical Considerations

Most authors who discuss qualitative research design address the importance of ethical considerations (Locke, et al., 1987; Marshall & Rossman, 1989; Merriam, 1988; Spradley, 1980). To an extent, ethnographic research is obtrusive. Participant observation invades the lives of the informants (Spradley, 1980), and sensitive information is frequently revealed. Thus, I had an obligation to respect the rights, needs,

values and desires of Rachel and her students and the following safeguards were employed to protect Rachel and her students as human subjects.

Before the study began, the research objectives and how the data would be used were articulated verbally and in writing to Rachel and her students, so that they were clearly understood. I explained the purpose, significance, and students' involvement in this project. At that time, I encouraged questions, and answered any questions the students had about the study and their involvement in this study. After the explanation of the project, I distributed letters and consent forms to all students. I read the student letter to the students during class time and asked students to read the letter with their parents/guardians at their homes. Each student was asked to sign the consent form if they were willing to participate in this study and return the forms to the teacher on the next day of classes. The students were informed that they did not have to participate in this study if they did not want to.

I assured those students who did not want to be part of the study that they would not be video- or audio-taped at any time. There were two videographers in the classroom during all lessons. One videographer, a graduate student researcher, focused on the classroom, that is, on the teacher and the participating students. I was the other videographer and focused on the small study group of participating students. The graduate student researcher, who was responsible for videotaping the classroom discussions, focused only on Rachel and participating students. However, students were not moved off-camera. Instead, the videographer made a conscientious effort to exclude non-participating students from all video-recordings. The videotape was edited later to exclude students who were accidentally recorded.

Rachel and her students were informed of all other data collection devices and activities including photo-interviews, and document and artifact collection, including photo-essays. Students were asked to respect the rights of others when practicing photography. In the event that students photographed persons, places or things for their photo-essays, students were instructed to not take photographs of anyone or anything that was identifiable without prior permission. Students were asked to ensure that permission was granted before any photographs were taken. If permission was granted, the student provided a Photography Consent Form (within Appendix B: EfS curriculum unit: Learning from ecosystems about sustainable waste practices) to the subject or owner of an object that included an explanation of the purpose and significance of the request and the project. Once the form was signed, the student then took the photograph.

Prior to analysis of the data, the videotapes and selected pieces of students' work were stored in a locked cabinet. The data will be preserved until 2009, at which time they will be destroyed. Students' names were not identified in students' work (for example, photo-essays) and video-recordings. Students' names were removed from their work prior to long-term storage of data. The participants' real names and the school name were not used in any publication or presentation; only their contributions of ideas and their work were included.

The participants, caregivers, and school personnel were informed that all students would be treated in the same way with respect to schoolwork and grading. They could decide to withdraw from the study at any stage by informing the researcher or the teacher verbally or in writing.

The participating students were not compensated for their participation in this study. I gave the teacher 27 cameras for students to use to develop the photo-essays and to retain for future student use. All students participated in the development of photo-essays, and consequently all were provided with a camera. Although Rachel did not expect compensation for her involvement in the study, because of a grant received from the Province of Manitoba, she was given travel expenses and an honorarium for her participation in the development of the EfS curriculum unit.

3.5 Our Approach to Unit Development

Appendix C highlights the landmarks of our curriculum planning and design journey including dates of our meetings, what we discussed/did during our planning sessions and the technology and curriculum resources used.

Our approach for interdisciplinary curriculum planning and design includes the following steps:

1) identifying goals, student learning outcomes and principles of learning associated with sustainability education,
2) identifying an approach to curriculum planning and design,
3) developing a time schedule,
4) selecting a focus,
5) building a shared vision,
6) creating lesson plans including the identification of curricular , and
7) reorganizing Rachel's existing curricula to make way for the teaching of the new unit.

3.5.1 Identifying Goals, Learning Outcomes and Principles of Learning

The first task in curriculum development is to identify goals, student learning outcomes and principles of learning. This factor took into consideration fundamental questions related to sustainability education: What is EfS? What are EfS goals? What student learning outcomes are associated with EfS goals? (See Chapters 1 and 2 for answers to these questions).

3.5.2 Identifying Curriculum Design Model(s)

The second task is to identify a curriculum design model. This means answering the question: How will we do it? What process will we follow? Answering these questions help to identify the approach to plan and design an interdisciplinary curriculum unit. Questions to investigate are: What curriculum design approach will be used to plan and design the unit? What curriculum design models/frameworks currently exist? A number of models/frameworks exist related to interdisciplinary curriculum planning and design. Jacob and Borland's (1986) Interdisciplinary Curriculum Planning and Design Model was modified to meet our needs. We used Jacob's (1989b) version of the model during our development sessions.

3.5.3 Developing A Time Schedule

The third task is to develop a time schedule. This means taking into consideration the time factor associated with the planning and design of an interdisciplinary curriculum unit. Questions related to time include: How much time do we need to complete the unit? How will we manage our time? When will we start? When will we aim to complete the unit? The anticipated implementation process could dictate the end date for the

completion of the unit. What other responsibilities do we have? What other activities are we involved in? Consideration for family matters, extracurricular activities, vacations and related activities are important. What unexpected events could occur to change our schedule? Unexpected events such as extended health issues could occur during the planning of the unit. Discussion about these unexpected events throughout the planning sessions lessened the stress associated with not being able to meet on a prescheduled date and time. It is also important to recognize that time schedules change over time as unexpected events occur and need to be shaped and reshaped throughout the development process, as was the case in our planning process.

3.5.3 Selecting a Focus

The fourth task is to select a focus for the unit. The focus of the unit is a sustainability issue, concern, concept, problem or question under study. In a student-centered curriculum, the "focus" of the unit should be based on what students are interested in learning about. Identifying a focus for the unit begins by reflecting on your own and/or with colleagues about what might interest students at a particular level. We discussed questions such as, What am I concerned about? What are you concerned about? What priority concerns do we share? What are our students concerned about?

In choosing a focus, the following criteria should be considered:

- Are students interested in this issue, concern, concept, problem or question? If students have no interest or are not concerned about the focus of the unit, they will not be as engaged in learning. "It is obviously important to select a topic that is relevant to students… Students can aid in the process by helping select topics" (Jacobs, 1989b, p. 55).

- How important is the issue or concept? How widespread is the issue or concern? Are we comfortable teaching about this focus? Teaching about the affects of "boating" on the economy, on the environment and the health and wellness of people and other living things to students may not be in the comfort zone of teachers who are avid boaters.
- What impacts (positive or negative) does the focus have on student behaviour? Will learning about the issue, concern or problem have the potential of positively changing student behaviour?
- What information is available related to the focus of the unit? Teachers have little time and energy outside their teaching duties.
- Would the learning community support the focus of the unit? Are resources available? Resources include curriculum resources, human resources, advocates, and financial (i.e., grants, sponsorship).
- How much time will be allotted to the unit? Some problems or concerns may take more time to study than others. Jacobs (1989b) suggests that the focus should neither be so general and all-encompassing that it is beyond the scope of a definitive investigation, nor should it be so narrow that it restricts the parameters of the study (p. 54).

Erickson (1998) views that the focus for the unit should be "idea- or concept-centered" not topic-centered (p. 51). Erickson asserts that topic-centered curricula focus heavily on the memorization of facts and assume the development of deeper ideas. Idea- or concept-centered curricula focus on deeper, conceptual ideas and use facts to support the understanding (p. 51). "It is the difference between the facts of the Alaska oil spills

and an understanding of the importance of environmental sustainability" (Erickson, 1998, p. 50).

Once the general idea or concept has been identified, an essential question and sub-questions need to be identified while considering the principle(s) of ecology as a guide. The essential question(s) together with the principles of ecology provide the structure, scope and sequence and direction for the unit.

The essential question provides a framework for integrating subject matter "horizontally," i.e., within each grade level. An essential question "engages students in the study and creates a bridge between performance-based activities and deeper, conceptual understanding" (Erickson, 1998, p. 90). Jacobs (1997), in Mapping the Big Picture, states:

> The essential question is conceptual commitment. In a sense you are saying, 'This is our focus for learning. I will put my teaching skills into helping my students examine the key concept implicit in the essential question' (pp. 26-27).

There are a number of reasons why essential questions are important, states Erickson (1998): "We can help students discover patterns and build personal meaning through the effective use of questions. Essential questions allow for inductive teaching - guiding students to discover meaning rather than relying mainly on deductive lecture methods. Essential questions are one of the most powerful tools for helping students think at more complex levels" (p. 91).

Essential questions have far greater power in the instruction process than do traditional "objectives." "When curriculum is formed around questions, the clear message to students is that you are probing with them" (Erickson, 1998; Jacobs, 1997, p. 26). The essential question is difficult to write (Erickson, 1998). She suggests

identifying "why" and "how" [rather than "what"] questions. "What questions won't guide thinking to deeper waters?" (p. 92). An essential question for the unit of study in this project is: How can we better manage solid waste?

The essential question ultimately raises more sub-questions. What is solid waste? Who generates solid waste? These sub-questions create a scope and sequence. All developers, including students, should have a voice in the identification of these sub-questions. At the very least, if students are not part of the development team, they should be introduced to the essential question and sub-questions in order to identify the scope and sequence for learning. Jacobs (1989b) states, "We would never give students a textbook without a table of contents that outlines the scope and sequence of the book." Research has demonstrated that thinking and learning are primarily deductive, holistic processes. Thus, students should be introduced to the essential question (the big picture) and sub-questions as the context within which relevant facts and basic ideas can be selected, organized, and used for understanding. The essential question serves as the picture of the jig saw puzzle, and the sub-questions and related facts and ideas as the pieces that fit together to work towards answering the essential question. Students, once introduced to the essential question, have the mental framework necessary to put all the "pieces of the jig saw" together. The essential question serves as the criterion for selecting the content to be studied. Only content that is relevant to the essential focus question needs to be addressed.

The essential question is connected to the shared vision. The essential question helps move toward the shared vision. A time frame is set for pursing the essential question (e.g., 8 weeks).

The unit is organized around a set of fundamental ecological principles/concepts. If the unit is interdisciplinary, these principles are applied throughout the unit in each subject area thus creating linkages. Examples of key ecological principles are included in Chapter 1 based on Arenas' (2000) theoretical frameworks.

The ecological principles further define the scope, direction and structure for the unit and help developers (including students) frame better questions. For example, the question, "What can we learn from ecosystems about how to better manage our waste?" We focuses on the idea of ecological cycles. In an ecosystem, there is an exchange of matter and in continual energy cycles with the cycles acting as feedback loops. As one species dies, it becomes food for another species, thus posing a sub-question, "How do ecosystems manage waste?" When used together, the essential question and the unifying concepts provide both structure and direction for the unit.

The creation of a conceptual map further organizes the thinking process associated with the essential question. A conceptual map provides the visible linkages of the essential question and sub-questions and graphically depicts the direction and scope of the unit that helps to organize concepts, ideas, and information in a logical way showing the interconnections of ideas. Figure 3.1 is the conceptual map developed with Inspiration Inc. (a conceptual mapping software program) that visually represents the EfS vision for curriculum development, which can be further refined and worked with.

3.5.4 Building a Shared Vision

The fifth task requires the building of a shared vision for the EfS unit. A shared vision is the answer to the question, "What do we want to create?" (Senge, 1990). A shared vision is a picture of the future that two or more individuals seek to create.

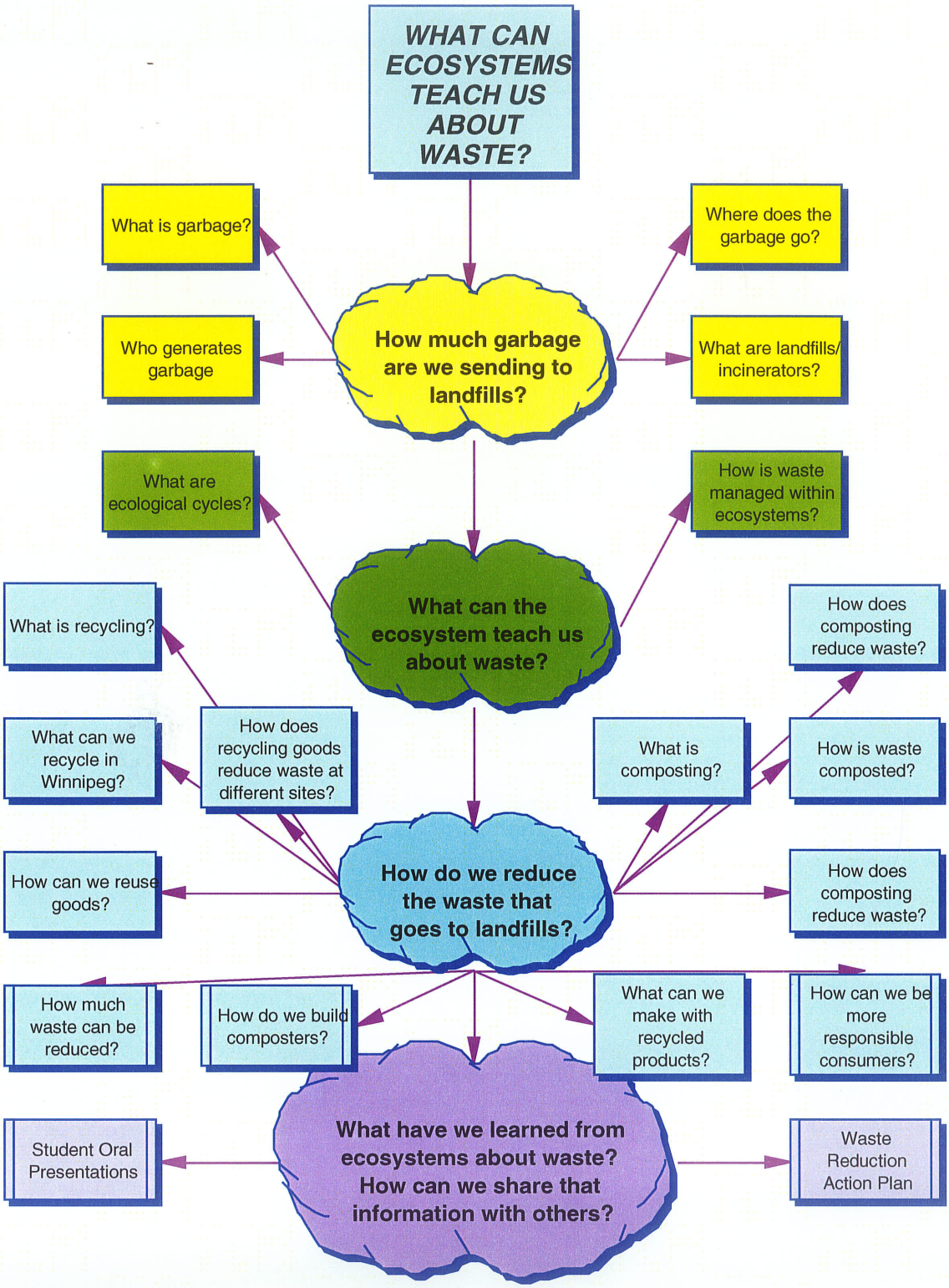

Figure 3.1. Conceptual Map

"When people truly share a vision they are connected, bound together by a common aspiration" (p. 207).

The purpose for developing a shared vision answers the question "Why?" "Why are we developing this unit?" Answering this question provides individuals an opportunity to build a sense of commitment together, to create an image of what might be possible. Another purpose is to ask, "How do we want to achieve this?" For example, "What principles will guide us and how will we act?" This question helps identify the core values that are important in getting there and identifying goals to be achieved along the way (Senge, 1990). Gibbons and Norman (1983) suggest that the creation of a vision becomes a self-fulfilling prophecy, "The mind shapes the reality we experience by creating a vision of the life we desire. We set all our powers in motion to bring it about. That picture of the future becomes a self-fulfilling prophecy" (p. 87).

A vision can be captured in a clear statement that describes an ideal scenario. The vision for the unit might begin by focusing on what collectively unit developers want students to learn and how. All developers participating in the development of a unit should have opportunities to contribute to the writing of a vision statement. A clearly written, detailed vision statement is written and revisited often by each developer during the development of the unit.

The process of building a shared vision provides opportunities for developers to reflect on their mental models in relation to others in terms of how they see the world, why they see it a certain way, and what they do as a result. This step is important because mental models are the basis of how we see things and what we do as a result. Senge (1990) emphasizes that "mental models are *active* (his emphasis) - they shape how

we act and they also affect what we see" (p. 175). Two people can identify a focus for the unit and when asked to describe that focus, come up with two different ways of describing the focus. The building of a shared vision helps developers to develop a vision that all can commit to and care about carrying out.

3.5.4 Creating Action/Lesson Plans for Implementation

The sixth task is to create lesson plans for implementation. This task relates to what exactly students will do during each class period designated to the unit to examine and explore the essential question and sub-questions.

Lesson planning requires one to consider the essential question, sub-questions, student learning outcomes, curricular connections, procedures and resources (materials, speakers, etc.) required for the unit. Lesson planning also takes into consideration how the teacher gathers information that students already know about the question(s) under investigation; that is in groups or individually. Questions to consider during the process of creating lessons plans are: How do students learn? How can sustainability issues best be taught? How can learning be assessed?

An action/lesson plan should engage students in identifying sustainability issues/problems, solving problems and making responsible decisions. A decision-making model guides activity to ensure the cultivation of problem solving. The process is represented as a cycle, referred to as Sustainability Problem Identification, Problem Solving and Decision-making Cycle (Figure 3.2). The process (cycle) includes: the identification of sustainability issues or concerns; viewing an issue from different perspectives (stakeholders); gathering data; proposing creative options; evaluating options; making responsible decisions based on the information gathered; developing an

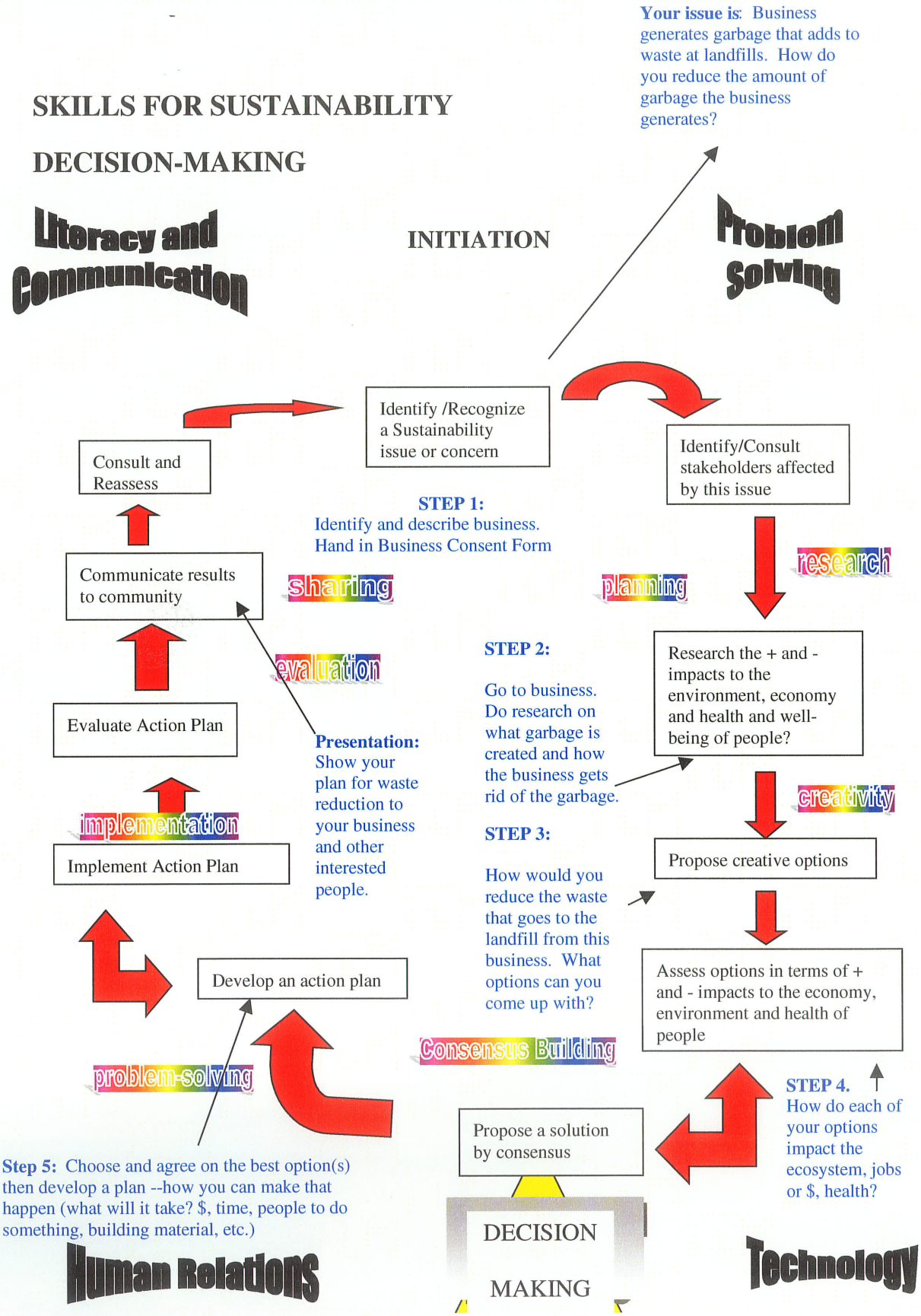

Figure 3.2. Sustainability Decision-making Chart. Adapted Manitoba Education (2000)

action plan (how can we make this happen?); implementing and evaluating the action plan; communicating results, and consulting and reassessing the issue.

Assessing student learning is based on specific requirements associated with the process of carrying out the requirements connected with sustainability issue identification and decision-making. The process of evaluation can be in the form of an assessment rubric such as the one shown in Figure 3.3.

Careful planning is required to ensure that all students learn. Many developing teams prefer to use a lesson plan such as the Lesson/Focus Plan identified in Table 3.1 as a guideline but recognize that continuous shaping and reshaping of plans is required over time. The written lesson plan encourages easier collaboration with colleagues. With activities and evaluation procedures completed, the unit is ready for implementation.

3.5.5 Identifying Curricular Connections

This factor relates to how the unit links to other subject student-learning outcomes in order to identify connections across the curriculum. The questions that relate to identifying curricular connections are: What are other teachers teaching throughout the school year at a particular level? A Year at A Glance framework helps to identify what other subject-area teachers are teaching and the topics being focused upon. What student learning outcomes from other subject areas are similar to the student learning outcomes identified in the unit? Review all core area curriculum frameworks to determine which outcomes match the unit being developed and record student learning outcomes within each lesson plan. The listing of student learning outcomes addressed by the unit helps other teachers know how the unit works to address their mandated curriculum. The

Specific Requirements	4 POINTS	3 POINTS	2 POINTS	1 POINT
Complete decision-making Model	Complete model	Model missing 1-3 steps	Missing 4 or more steps	No model completed.
Step 1. Businesses signature sheet handed in	On time	One lesson late	Two lessons late	Not handed in.
Step 2. Going to Business and research their needs related to waste	Learned about four or more + and or - impacts the business has on the environment, jobs and health (people and other living things)	Learned about three + and or - impacts the business has on the environment, jobs and health (people and other living things)	Learned about two + and or - impacts the business has on the environment, jobs and health (people and other living things)	Learned about one + and or - impact the business has on the environment, jobs and health (people and other living things)
Step 3. Creative Options	Create options for four or more impacts (+ and -)	Create options for three impacts (+ and -)	Create options for two impacts (+ and -)	Create options for one impact (+ and -)
Step 4. Assess Options	Identify three or more + or - impact that may result from two options	Identify two + or - impacts that may result from two options	Identify one + or - impacts that may result from two options	Did not identify any + or - impacts that may result from two options
Step 5. Propose an option/develop Action Plan	Clear steps/actions business should take to reduce waste (must be realistic)	Limited steps and actions business should take to reduce waste (must be realistic)	Limited steps and actions business should take to reduce waste (not realistic)	No steps and actions for business to take to reduce waste.
Information Typed	Typed, grammar/ spelling correct	Typed, few spelling and grammatical errors	Typed, many spelling and grammatical errors	No typed
Use of pictures, charts, sketches, explanations	3 or more	2	1	None
Format/Organization (Title pages, signature letter, organized layout)	Very well organized (number pages, logical sequence,	Well organized	Poorly organized	Unorganized

Figure 3.3. Assessment Rubric

Table 3.1. A General Lesson Plan

Grade: _____

Interdisciplinary Unit: _____ Teacher(s) _____

ESSENTIAL QUESTION:
(What is the Essential Question of the Unit?)

SUB-QUESTION:
(What is the Sub-Question of the unit is this lesson addressing?)

ECOLOGICAL PRINCIPLE(S):
(What ecological principle(s) should be taken into consideration in this lesson?)

STUDENT LEARNING OUTCOMES:
(What concepts, knowledge, skills, values and life practices do you want students to demonstrate?) What do I want students to know, understand, and be able to do as a result of this lesson?)

CURRICULAR CONNECTIONS:
(What student learning outcomes from other subject areas are related to this lesson?)

GROUPING:
(Which outcomes can best be achieved individually, in pairs, in small groups, or in the whole class? How will groupings be determined?)

PROCEDURES:

(What activities can be used to engage students with essential question and sub-question that will lead to the unifying concepts? Is there a coherent link between the activities, the question and the unifying concepts; How will students activate and extend prior knowledge and make connections with what they know already about the sub-question and what they will learn? How will students acquire new information or processes? How will students apply, consolidate, or extend the information or processes?)

LEARNING RESOURCES:
(What learning resources, material, equipment, multimedia, etc., will you or the students require to carry out the activities?)

EVALUATION/ASSESSMENT:

(How will you assess student learning? (i.e., rubric, interviews, writing tasks, oral presentations, projects) Does the lesson offer students a variety of ways to demonstrate their learning?)

Adapted from Erickson's (1998) "Unit Plan" (p. 70) and Jacobs' (1989) "Activity Plan" (p. 64).

linkages identified encourages other teachers to teach similar learning outcomes in their subject areas, thus making student learning transfer across the curriculum a reality.

3.5.6 Adjusting the Existing Curriculum

The last task is to reorganize the existing curriculum. This task is related to how the existing curriculum is reorganized/modified to make way for the teaching of the new unit. It includes such questions as, What is the "big picture" for this program? How does this unit fit in to the "big picture?" What has to stay the same? What has to change? What will be eliminated from the program? In what order should the units be taught? What issues need to be addressed to ensure that the overall scope, structure and direction of the program leads to logical conceptual understandings?

3.6 The EfS Unit Plan

The transdisciplinary EfS Unit, *Learning from Ecosystems About Sustainable Waste Practices*, consists of eleven lesson plans that address the unit's essential question: What can ecosystems teach us about waste? The unit is divided into four sections. The first section (lesson plans #1-3) addresses the question: How much garbage are we sending to landfills? The second section (lesson plan #4) addresses the question: What can the ecosystems teach us about waste? The third section (lesson plans #5-10) addresses the question: How do we reduce the waste that goes to landfills? Thus lessons five through ten revolve around matter flow in an ecosystem - consequently reducing, reusing, recycling and composting concepts are introduced. The fourth section (lesson Plan #11) addresses the question: What have we learned from ecosystems about waste and how can we share that information with others? Consequently, the last lesson

focuses on communication and sharing with others what was learned as a result of participating in the unit.

Embedded in the lesson plans for the unit are the essential question and sub-questions, key ecological concepts, student learning outcomes/objectives, curricular connections, materials required, procedures and forms of assessment. Table 3.2 presents a specific lesson plan (Lesson Plan #1). Table 3.3 presents an overview of the unit plan including an overview of all lesson plans. The overview identifies the organization of the lesson plans within the unit framework. In addition, each lesson plan is presented highlighting the unit sub-questions addressed, student learning outcomes/objectives, activities, whether activities are teacher- or student-centered, means of student assessment, and curricular connections to Manitoba and Pan-Canadian curricula.

Each lesson is designed to help students acquire a deep understanding of the systems they are a part of with questions and sub-questions: What can the Ecosystem teach us about waste? How do we reduce the waste that goes to landfills? What have we learned from ecosystems about waste and how can we share that information with others? The thread or big idea by which all lessons are united is the notion of ecological cycles - that there is an interdependency among the members of an ecosystem which involves the exchange of matter and energy. Rachel and I wanted students to conceptualize how much waste humans produce and where the waste goes. We also wanted students to understand the notion of ecological cycles and try to mimic ecosystems in their own lives as consumers and producers of waste through reducing, reusing and recycling waste.

Table 3.2. Unit Lesson Plan #1

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: How much garbage are we sending to Landfills?

Lesson # 1: Introduction to Garbage

Discussion: We will be extending the students' knowledge of waste to applications in the school and at home.

Student Learning Outcomes:

- Students will describe what garbage is and who generates garbage.
- Students will conduct a garbage audit using lunchroom waste.
- Students will develop a photo-essay.
- Students will develop skills related to operating a camera.
- Student will use writing skills to express in words the photos they have taken and chosen.

Curriculum Connections:

Mathematics:

GLO Statistics Strand for analyzing and graphing (garbage audit)

GLO Number Strand with weighing garbage and determining percentages of each category (garbage audit).

English Language Arts:

GLO 1.1 Discover and Explore (purposeful and productive exchange of ideas, oral and written expression of opinions) (photo-essay)

GLO 3.1 Plan and Focus (record information) (photo-essay)

GLO 3.2 Select and Process (note making and key ideas) (photo-essay)

GLO 4.2 Enhance and Improve (word processing and peer editing) (photo-essay)

Science (Pan Canadian):

Skills:

205. Observe and investigate their environment and record the results.

207. Work collaboratively to carry out science-related activities and communicate ideas, procedures and results.

Knowledge:

301. Describe and predict causes, effects and patterns related to change in living and non-living things.

Attitudes:

416. Appreciate the importance of accuracy and honesty.
420. Show concern for their safety and that of others in planning and carrying out activities and in choosing and using materials.

Science (Manitoba 5-8 Curriculum)

C6. Employ effective communication skills and utilize information technology to gather and share scientific and technological ideas and data.
C7. Work cooperatively and value the ideas and contributions of others while carrying out scientific and technological activities.
C8. Evaluate, from a scientific perspective, information and ideas encountered during investigations and in daily life.

Objectives:

- To understand what garbage is.
- To determine who generates garbage.
- To conduct a garbage audit within the school.
- To determine how students contribute to the garbage in the school.
- To develop a photo-essay.

Materials:

- Fever Chart (to calculate garbage audit information)
- Information from Trash Attack
- 1 bag of garbage
- 3 pairs rubber gloves
- plastic to cover floor
- 25 cameras
- 25 camera film (12 pictures each)
- 25 photo albums
- labels/masking tape for camera

Procedure:

Introduction: What is garbage?
Group students into five groups.
Students will brainstorm for 30 seconds about the things they throw away.
Students will count the items. Each group shares five items that have not been stated.
Teacher will record on the board.

Who Generates Garbage?

Students will discuss in a teacher led discussion where garbage comes from. Some examples are homes, industry, businesses, animals, people, etc.

Garbage Audit:

Select three volunteers to separate the garbage with the class giving directions. Weigh total bag then each garbage component (composing, recycling, waste). Record whole and part measurement on Fever Chart.

Photo-Essay:

1. Give each student a camera.
2. Show students how to use the camera.
3. Show students how to load film into camera.
4. Show students the Albums.
5. Demonstrate what the students will take pictures of and explain that they will be writing about pictures they chose.
6. Inform students that they will be given time throughout the unit to write about the pictures they take. Film will be handed in after lesson 3 (12 pictures).
7. Students will choose 3-4 of the photos and write about them in their own time.
8. Students will be asked to express the image that they took and why they took a particular photo.

Table 3.3. EfS Unit Plan

Lesson #	Sub-Question	Student Learning Outcomes	Curricular con-nections	Activities	Teacher-centered/student-centered	Student Assessment
Lesson Plan #1 Introduction to Garbage	How much Garbage are we sending to landfills? How much Garbage are we sending to landfills?	• What is garbage? • Who generates garbage? • Develop a photo-essay • Operate a camera	Math ELA Science (PC/MB)	1. Students discuss the things they throw away. 2. Students share responses with other groups. 3. Students discuss where garbage comes from 4. One group of students conducts a garbage audit with class assistance and weighs garbage components and records 5. Students observe how to take photographs with a camera and develop a photo-essay	1-2 Group-work 3 - Teacher-led discussion 4-Groupwork 5- Teacher-led demonstration	Participation in group work and teacher led discussions
Lesson Plan #2 Landfills/Incinerators		• Where does the garbage go? • What are landfills/ incinerators	Math ELA Science (PC/MB) Social Studies	1. Students discuss where the garbage goes after the garbage person picks up the garbage. 2. Students share responses with other groups 3. Teacher presents information about landfills and incinerators 4. Students choose between landfills and incinerators/vote/explain their preferences. 5. Teacher introduces the Business Waste Reduction Action Plan	1 - groupwork 2 - groupwork 3 - teacher-led discussion 4 - student make choices	Participation in group work and teacher led discussions Assessment rubric
Lesson Plan #3 Landfill field trip				1. Students participate in a field trip to a local landfill site 2. Students complete their Ecological Footprint	1-Interpreter led field trip 2- Hands-on activity	Participation on field trip.
Lesson Plan #4 Ecosystems and waste	What can we learn about waste from ecosystems?	• What are ecological cycles • How is waste managed within an ecosystem?	ELA Science (PC)/MB)	1. Students participate in a class-discussion regarding their knowledge about ecosystems. 2. Students observe and discover how ecosystems manage waste and record observations. 3. Students participate in a group discussion about how waste is managed in nature. 4. Students share their observations about how waste is managed in nature.	1/4 - teacher led discussion 2. student observation (hands on activity) and discovery 3. group discussion	Participation in group work, teacher led discussions and nature observation and discovery activity.

Lesson Plan #5 Recycling	How do we reduce the waste that goes to landfills?	• What is recycling? • How does recycling goods reduce waste at different sites? • What can we recycle in our city?	Math ELA Science (MB)	1.. Students discuss their knowledge of "recycling"; what could be included in their Business Action Plan with respect to waste reduction? 2. Students go through their lunch bags individually and record their scores (points for recycling, composting, reusing) 3. Students discuss and share ideas about where the recycled goods go once they are placed in the recycle bins. 4. Students watch a video focused on garbage and ecological processes. 5. Students identify their business for the Business Action Plan 6. Students conduct group work to develop a waste audit and waste reduction strategy for their selected business	1-teacher led discussion 2-student hands-on activity 3- teacher led discussion 4-student observation 5-6 student activity (hands-on)	Students participate in group work and teacher led discussions Student assessment based on rubric (identify business/develop strategy)
Lesson Plan #6 Composting		• What is composting? • How does composting reduce waste? • How is waste composted?	Math ELA P.E./Health Science (PC/MB)	1. Students write a quiz about composting. 2. Teacher led discussion on student responses. 3. Students make composters with two litre drink containers using food waste 4. Teacher led discussion about effective composting strategies 5. Class discussion and demonstration regarding Vermi composter and other types of composters.	1/2- teacher led 3 - students make composters (hands-on activity 4/5 teacher led/demonstration	Participation in hands-on activity and teacher led discussion/demonstration
Lesson Plan #7 Composting		• How does composting reduce waste? • How is waste composted? • How do we build composters?	Math ELA P.E/Health Science (PC/MB)	1. students build composters in groups	1 student led activity (hands-on)	Participation in group activity

Lesson Plan #8 Reuse	How do we reduce the waste that goes to landfills? (Continued)	• How can we reuse goods • What can we make with recycled products?	Math ELA PE/Health Science (PC/MB)	1. students visit business to conduct waste audit	1 - students in groups conduct site visit to business	Participate in group activity Assessment rubric
Lesson Plan #9 Reuse		• How can we reuse goods • What can we make with recycled products	Math ELA PE/Health Science (PC/MB)	1. Students continue working on Business Action Plan (students visit business if applicable 2. Groups to show draft business waste audit and waste reduction strategy to teacher	1. student led activity (site visit or group work on Business Action Plan assignment	1. Students participate in group work /Rubric
Lesson Plan #10 Reducing Waste and Being Responsible Citizens		• How much waste can be reduced? • How can we be more responsible consumers/ citizens?	Math ELA Science	1. Students write out composting experiment in journal (what is happening to the food?) 2. Students conduct another garbage audit, record measurements and compare results from first audit 3. In groups, students discuss how they can make a difference 4. In class discussion, students share ideas from groups 5. Students begin writing their photo-essays	1-Individual student writing activity 2-Group hands-on activity 3-Group Activity 4-Teacher led discussion 5-Individual student writing activity	Participation in group work and teacher led discussions and individual activities.
Lesson Plan #11 Communica-tion and Sharing	What have we learned from eco-systems about waste? How do we share what we have learned?	• Student oral presentations	ELA	1. In groups, students present "Action Plans" to representations of business and community members	1-Group presentations	Participation in group presentations and preparations for presentations/ Rubric

3.7 Research Contexts

This section describes the setting and identifies the schedule for our unit planning and design. It also describes the setting and schedule for the teaching of the unit to one class of Middle Years students.

3.7.1 Setting and Schedule of Curriculum Development

The curriculum for this study was developed in my own home because the teacher's school was closed during the summer months. Also, we ruled out the university as a work place for developing the curriculum because of the potential hassle involved in identifying meeting rooms and hauling video equipment to and from my home to the university. For practical reasons, we conducted all curriculum-planning sessions at my residence. A video camera on a tripod was set up to capture our discussions.
Rachel and I met on nineteen separate occasions to plan and design our SDE unit. We began our work on June 3, 2001 and concluded on August 22, 2001. We met for 45 hours to plan and design the unit. Duration of planning sessions ranged from one hour to four and one-half hours. Of the nineteen sessions, fourteen sessions occurred on schedule related to our employment commitments and extra-curricular activities.

3.7.2 School Setting and Teaching Schedule

The implementation of the new unit took place in the Grade 6 Outdoor and Environmental Education classroom at Georgetown Middle School. The school is located in an urban community of residential dwelling with both an elementary school and a secondary school.

The Outdoor and Environmental Education classroom looks like a traditional theatre-style science classroom. Rachel's pre-allotted Outdoor and Environmental Education (OEE) schedule consists of two periods during each of day 3 and day 4 of the six-day school cycle. On day 3, OEE is slotted during two periods from 12:45-2:00 p.m.; on day 4, OEE is slotted from 9:00 - 10:20 a.m. The EfS unit concluded after 14 sessions (October 9-December 14). With the exception of a field trip to a local landfill site that took the equivalent of two sessions, most sessions were 80 minutes in duration. The 14 sessions represent 10 weeks or approximately 1120 minutes (18.6 hours) of instruction in EfS.

3.8 Data Collection

Data were collected over the course of eight months from June to December 2001 in two phases: Phase 1 (June - August 2001) — The teacher and I met on numerous occasions to plan and develop a curriculum unit at the Grade Six level. The unit focuses on waste (Appendix B). Phase 2 (September 2001 - December 2001) — Data collection occurred as Rachel implemented a sustainability-focused curriculum unit with one of her Grade Six Outdoor and Environmental Education class.

Means of collecting data included teacher face-to-face interviews, student face-to-face interviews and photo-interviews, classroom observations (video and audio taping), and document and artifact collection. Photo-interviews involved students taking photographs related to a sustainability issue they were learning about; students writing about personal perceptions of their photograph(s); and interviewing students using student photographs as artifacts. All of the interviews were video- and/or audio taped.

All electronic recordings were transcribed verbatim, analyzed and interpreted in a timely fashion.

3.8.1 Teacher Interviews

I set out to meet Rachel as a learner. Although I was well-read on Educating for Sustainability, curriculum development processes and ecological ways of knowing, I wanted first and foremost to be thought of as a learner. I did not want to be classified by her as "the expert." I wanted to learn as much as I could to translate theory into practice. I believed that I knew "what" an ecological approach to EfS was. What I didn't know was how EfS would 'play out' within a real education setting. I needed her to show me how this was done practically. For that, I knew I had to listen carefully and observe her and her students' every action with respect to how she developed the curriculum unit and what she took into consideration when doing so. Listening and watching had to be my strong points.

I conducted three semi-structured face-to-face interviews with Rachel during the curriculum planning sessions at my residence. The interviews were conducted in July, August and September 2001. The first interview was conducted on June 31, 2001 after we had our tenth planning session, that is, approximately one month after we commenced the planning process. The second interview was conducted on August 22 after our last curriculum unit design and planning session, that is, approximately one month later. The third interview was conducted on September 17, 2001 approximately one month after we completed the curriculum planning and design process.

The curriculum-planning interviews consisted of questions pertaining to Rachel's views about what life in a sustainable society would be like and her views about what

curricular content would help students believe, feel and act in such a way to achieve a sustainable society. Questions also asked were related to how that content would be organized to facilitate the coordination of student readiness and learning. The interviews also focused upon Rachel's reflections pertaining to the development of the waste unit.

I conducted one interview every six days (each school cycle) with Rachel throughout classroom instruction. Each interview was approximately 45 minutes. Interviews consisted of Rachel reflecting on the past week's two 80-minute lessons on sustainability. The "during teaching interview" questions pertained to the actual practices in the classroom such as:

1) What sense do you make about teaching a sustainability-focused unit?
2) What sense do you think your students are making about what you are teaching?
3) What sense do you think your students are making about how you are teaching?
4) The "reflective interview" had the teacher reflect back on her practice.

During each reflective interview, I played a section of the video recording taken during a sustainability-focused lesson and asked Rachel: "What thoughts and ideas do you have with respect to your teaching and student learning?"

3.8.1 Student Photo-Interviews

I set out to meet the students face to face with a mind full of questions, convinced that I had to know what types of questions I should ask before I began my research. Again, I was the learner, not the expert. I did not know what they would say, or how they would say it. I knew that I had to listen very carefully to every word they had to say and

make notes of how they said it. I did not want my questions to appear one-sided. I did not want to "mine the minds of the participants" (Holstein & Gubrium, 1995). I wanted my respondents to have a lot of say in the shape of our conversations; conversations to be "our" conversations, "our" purpose. I did not see the students as merely vessels to which I expected straightforward access. I wanted to ensure that my style attempted to embrace an active, open-ended in-depth interview, "a politically correct dialogue where researcher and researched offer mutual understanding and support" (Atkinson & Silverman, 1987, p. 305). I wanted the interviews to be thoroughly collaborative to the core; the students to feel empowered to guide the dialogue, and comfortable asking their own questions, the students to have control of the process for deciding what would be shared and why, and to be pulled into a dialogue that was a collaborative production of meaning (Green, 1998). I also wanted to ensure that our conversations did not leave the students hopeless about effecting change within the world, to believe that they were an important resource for advice and understanding, and that they had the power to effect positive change, particularly in their own learning.

I conducted two semi-structured face-to-face photo-interviews with each participating student for 30-60 minutes at Georgetown Middle School in a small office normally used for the school guidance counselor three doors away from the principal's office. The first interview took place before the unit was taught. The second interview took place immediately after the unit was taught.

3.8.2.1 First Photo-Interview: (September 1-14)

Before the first unit commenced, I interviewed all 16 participating students using a semi-structured photo-interview format to capture their worldview and perceptions and thinking about sustainability issues. I showed them a photograph that I took of an area with trees, grass, bushes and another photograph of a landfill site. I asked them what the photographs meant to them and how the photographs made them feel. I asked them to identify what they could teach their teacher about waste and energy. Interviews averaged 30 minutes.

I asked students what a healthy/unhealthy planet means to them and what kind of world they (and/or their children) would like to live in when they grow up. I asked them if they felt that they are connected or separate from nature and whether they think that human beings are greater than, less than or equal to other living things and why.

3.8.2.2 Second Photo-Interview: (December 17-20)

After completing the waste unit, I interviewed all participating students again using a 45 minute semi-structured photo-interview format to capture their worldview and perceptions and thinking about sustainability issues. The photographs taken by the students during unit implementation were discussed. We also discussed their photo-essays and artwork related to the unit. The students had been taught how to construct a photo-essay as part of their lesson. I provided each student in the classroom with a camera and film throughout the duration of this study. I processed the film for the students. Each student was shown how to operate a camera; the rules for photo taking and how to obtain consent from photographed subjects as part of the lesson.

Photo-essays involved students taking photographs of images that reflected a healthy or unhealthy planet or the sustainability issues being taught by the teacher. Students chose to write about four of the twelve or more photographs they had taken. They wrote about the photographs in their language arts classroom. The language arts teacher guided the students in terms of what they could communicate about their photographs based on an assignment developed collaboratively by the language arts teacher and me entitled "My Waste Unit Photo-Essay." For example, students were asked to communicate in writing such information as what the photographs portrayed to them, why the photograph was taken and what relevance, if any, the photograph had to the topic under discussion in the classroom. Students were also asked to share their feelings, values and beliefs about what they saw in their photographs.

3.8.2 Observation

I was an active participant in the planning session when Rachel and I refocused her Grade Six Outdoor and Environmental Education curriculum to one that focuses on EfS. To preserve an objective record of observation, I videotaped all planning sessions.

I collected data by observing classroom interactions among participating students and between the participating students and the teacher. To preserve the record of observations (both linguistic and situational), I videotaped large group sessions (classroom discourse) and video- and audio-taped one small group of students during classroom activities. In this manner, I was able to track the process with one small group of students throughout the study. Similarly, I was also able to track the teacher's conceptual growth in terms of her understanding and practice as it related to EfS.

From the students that gave full[2] consent to participate in the study, a small student group (n = 6) was selected in order to capture their conceptual ideas and interactions with each other and the teacher. To preserve a natural classroom environment, all students (whether participating in the study or not) were organized into groups ranging from four to six people. The small student group that was selected was the group that sat closest to the front of the room near the area where the audio and video equipment was to be located (for logistical purposes). All other participating students were located behind the small group of students to prevent accidentally videotaping non-participating students (see ethics section).

The small group was audio- and videotaped during all lessons. The intensive study research group was treated identically to other groups in the classroom in terms of educational opportunity. The group was however, the focus of more intensive study.

3.9 Data Analysis

Marshall and Rossman (1989) and Merriam (1988) contend that data collection and data analysis must be a simultaneous process in qualitative research. Throughout the data analysis process, ethnographers index or code their data using as many categories as possible (Jacobs, 1997), and seek to identify and describe patterns and themes from the perspective of the participant(s). They then attempt to understand and explain the patterns and themes (Agar, 1980).

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[2] Full consent consisted of students and their parents/guardians who gave consent to being audio/video-taped, interviewed, and the collection of their work. Of the 16 students that gave consent, only ten gave full consent. Some students declined collection of their work. Some students declined being audio and/or videotaped. All 16 students gave consent to be interviewed.

Student interview transcripts were read with the research question in mind, and descriptive words or phrases were attached to short sections of the transcript; "utterances relevant to the question" (Marton, 1988, p. 198). For example, a number of students attributed the notion that nature is living and humans are living, in support of how they viewed their relationship with nature. This was framed as a potential category (labeled Life based intrinsic value). Subsequently, sections of the transcripts alluding to this category were labeled. These transcripts were organized together. This electronic sorting allowed for numerous excerpts to be considered together. In this manner, the research interest shifted from an individual's statement to the "pool of meanings" within a particular view which was being framed and elaborated (Marton, 1988, p. 198). Chapter Five presents the phenomenographic research tradition used to make meaning of Middle Years students' views of human/nature relations.

The method for analyzing student/teacher, student/student talk (interactive) data was through discourse analysis. Conversations are word-processed in a dialogue form, then numbered patterns of meaning are identified. The text that conveys these meanings is identified and labels are attached that best reflect the dialogue for that particular interaction. Each category label is supported by teacher/student or student/student dialogue. Reference is made to each of the original numbered lines of the dialogue.

The teacher interview data and the planning session data were analyzed inductively. Verbatim transcripts of the audio/video-taped interviews and the audio/video taped planning sessions were produced. Once the transcripts are reviewed, they are shaped into a portrait presentation, in a manner of speaking, a case study framed in narrative. In the narrative, the meanings that best contribute to the curriculum development process for an

ecological approach to EfS is retrieved. In essence, the portrait provides the contextual shape for the data. Through this medium, our lived experience designing and planning our unit and the interview data are presented and bounded by emerging themes as we collaboratively plan and design our unit.

3.10 Internal and External Validity

In ensuring internal validity, the following strategies were employed:

1. Triangulation of data - Data were collected through multiple sources including interviews and photo-interviews, observations, artifact collection;
2. Member checking - Rachel served as a check throughout the analysis process. An ongoing dialogue regarding my interpretations of her reality and meanings ensured the truth-value of the data; the informants (small student group) served as a check through the analysis process. An ongoing dialogue regarding my interpretations of their reality and meanings ensured the truth value of the data;
3. Long term and repeated observations at the research site - Regular, that is every day 3 and 4, observations of similar phenomenon (classroom teaching about sustainability issues) and setting (classroom - indoor or outdoor) occurred onsite over a four month period of time;
4. Participatory modes of researcher - the informant (the teacher) was involved in most phases of this study, from the design of the curriculum to checking interpretations and conclusions of this study; and

5. Clarification of researcher assumptions - At the outset of this study, researcher assumptions were articulated in writing in the dissertation under the heading "The Researcher's Role."

The primary strategy utilized in this study to ensure external validity is the provision of rich, thick, detailed descriptions so that anyone interested in transferability has a solid framework for comparison (Merriam, 1988). Three techniques to ensure reliability were employed in this study. First, the researcher provided a detailed account of the focus of the study, the researcher's background, the informant's position and basis for selection, and the context from which data were gathered (Goetz & LeCompte, 1982). Second, triangulation or multiple methods of data collection and analysis were used, which strengthens reliability as well as internal validity (Merriam, 1988). Finally, data collection and analysis strategies were reported in detail to provide a clear and accurate picture of the methods used in this study. The validity of this study rests on the principle of "reality as socially constructed" (Merriam, 1988). For Merriam (1988), reality is not an objective truth; rather it is multidimensional and ever changing. The mediums through which events are interpreted are people's perceptions. The researcher is the "primary instrument" whose job it is to collect reliable evidence.

I have attempted to represent multiple realities in this study by (a) collecting data from participants in the selected school, including the teacher and her students, (b) assessing new evidence as it arises, (c) reflecting on different ideas and comparing these to the data collected, and (d) using multiple methods such as classroom observations, interviews (photo-essays), and document analysis (Denzin, 1978).

3.11 Chapter Summary

This chapter identifies the procedures used in the study for data collection, analysis and writing to address the three objectives of this study that have been previously identified in the *Introduction.* I identify the case study approach using ethnographic methods as the type of research design given that my primary concern is associated with the process involved in creating and implementing a sustainability-focused unit (as opposed to the product). I identify my role as a researcher and highlight my personal and professional experiences, values, assumptions and biases regarding educating for sustainability given that I was the primary instrument in this study. Then I describe how a Middle Years teacher (Rachel) and her students were purposefully selected to participate in the study as participants and highlight the events that took place with respect to curriculum development and implementation of the EfS unit. I then highlight my data collection and analysis procedures used in the study which lead me to a discussion of the ethical considerations that I addressed as a result of the means of data collection used (observations, interviews and document and artifact collection and audiovisual material (e.g., photographs)). I present the approach used to develop the EfS unit. The seven steps include:

1) identifying goals, student learning outcomes and principles of learning associated with educating for sustainability;
2) identifying an approach to curriculum planning and design;
3) developing a time schedule;
4) selecting a focus;
5) building a shared vision;

6) creating lesson plans which included the identification of curricular connections; and

7) reorganizing Rachel's existing curriculum to make way for the teaching of the new unit.

I then present the EfS Unit that a Grade Six teacher and I collaboratively planned and designed over a several month period. This discussion illuminates the curriculum development and implementation settings and schedules. The chapter concludes with an overview of the data analysis procedures used in the study and my methods of verification.

The following chapters highlight the outcomes of the study and its relation to theory and literature. The next chapter (Chapter Four) illuminates how Rachel, a Grade Six teacher, collaboratively works with me over several months to plan and design an EfS curriculum unit. Chapter Five sheds light on how Grade Six students think and talk about sustainability issues. Chapter Seven highlights Rachel's thoughts related to the implementation of the EfS unit and how her Grade Six students learn sustainability issues. The final chapter identifies the outcomes for the study and provides the reader with a sense of how the outcomes compare and contrast with Educating for Sustainability and curriculum development theories and literature.

CHAPTER FOUR

TEACHER/RESEARCHER CURRICULUM DEVELOPMENT: RACHEL'S MEANING-MAKING

4.0 Introduction

This chapter is an interpretive account of how Rachel, a Grade Six teacher, collaboratively worked with me, a researcher, over several months to plan and design an interdisciplinary ecologically focused Educating for Sustainability (EfS) curriculum unit. First, I delineate Rachel's disposition, thoughts and views on the environment and EfS. Second, I outline some important issues that Rachel raised about teacher/researcher collaboration, particularly pertaining to similar work in the future. Third, I point out the support systems that helped in the development of the unit.

4.1 Rachel's Outlook on the Environment and Efs

Rachel, in her own words is "a real enviro freak." Her eco-centric worldviews lead to what she means by EfS for children. My intervention in Rachel's thinking process is laid out. I then focus on Rachel's practical perspectives, which include "hands-on," "student-centered," and "experiential" learning for EfS.

4.1.1 A "Real Enviro Freak"

While in the bathroom at work, Rachel saw her friend blow her nose, throw the Kleenex into the toilet and flush. She expressed her disapproval to her friend by saying to her, "That's twenty liters of water you just wasted for that Kleenex." Instead of her friend getting defensive, her friend said, "You're right, I shouldn't have done that."

Rachel and her friend had gone mountain biking and they were driving back home. At the red light in the junction of a major intersection, Rachel saw an older women smoke a cigarette in her car then throw the cigarette butt out the window. Rachel stared at the lady in disapproval. With disgust on her face, she turned to her friend and said in a loud voice, "Did you see that? She just threw that out." A man on the passenger's side of the older women's car rolled down the window and yelled across to her, "What's your problem?" Rachel responded, "She just threw that out!" Then the man responded, "So what?" Rachel retorted, "So that's disgusting! Why are you littering? Keep it in your own car." The gentlemen yelled back and drove away.

Rachel shared these two episodes with me and expressed that she was turning into a "real enviro freak." Rachel's disposition and my own viewpoints of the environment are manifested in the following teacher/researcher conversation about the use of powerboats:

Rachel: I told Marvin today he couldn't even go look at that boat. He said, "What? A canoe?" He said, "No, a ski boat," I said, "You can't be married to a sustainable person and drive around that pollution machine." He says, "I've already heard that before."

Researcher: Why do you think he (my husband) doesn't have a boat? I said, "You can look all you want. It's not a financial decision I have to make. It's an ethical one. Am I willing to live with that decision?"

Rachel: Tell him to get a canoe and paddle real fast.

Researcher: He has a canoe.

Rachel: But he can paddle real fast if he wants to ski behind it.

Researcher: Bought him a paddleboat.

Rachel: Oh, really?

Researcher: And he has a rowboat. He doesn't need another boat. (June 22, Session #7, lines 365-376)

Rachel is about to be married and I have been married for several years. Our individual views on our partners owning a powerboat are similar, that is, there is no need to own a powerboat. Our views are based on eco-centric worldviews that affect us even in our dealings with our partners and the decisions we make.

4.1.2 Eco-centric Worldviews

I was curious to find out more about Rachel's views on sustainability issues. So we focused on the following questions: What would life be like in a sustainable society? What do you think a healthy planet is and what does a healthy planet mean to you? What do you think an unhealthy planet is like? What does sustainable development mean to you? Do you think human beings are a part of, or separate from, the Earth? Are human beings superior to other living things?

Rachel perceives life in a sustainable society to be "nice" with certain conditions: the whole city would be a much more pleasant place to be with much smaller amounts of waste going out, which would cost taxpayers less money; growing more things whether it be trees or trying to grow native plants or even gardens; people themselves need to become more sustainable instead of having to run to the store all the time, that is, feeding themselves to save money; and not having to work as much to spend more time at home. These are components of a big cycle to attain sustainability for Rachel.

A healthy planet, according to Rachel, involves the environment and atmosphere being healthy. To her, the fact that people are thinking about shipping their garbage into space or going that far out is just horrible. Concerning the water, Rachel suggests that people shouldn't have to treat it if they are very careful by reducing pollution. Reusing and recycling instead of throwing things out, and trying to decrease the whole

consumerism of the planet contributes to a healthy planet. Rachel states that taking care of people who might not be able to take care of themselves, such as people who are experiencing famine and don't have healthy water, leads to a better planet. A healthy planet means the need for education, which will legitimately cost more money. In a perfect world, there wouldn't be famine and war and everything else, Rachel comments. An unhealthy planet, Rachel observes, is very similar to what we have in the industrialized societies, with smog and pollution and lack of clean drinking water. "What is going on in non-industrialized areas are famine and no clean drinking water."

Sustainable development to Rachel means life practices on sustainability; how things need to become more sustainable through an increase in knowledge at all levels, and how to start at the grass roots level with children and their families and their homes, and all the way up to the communities and cities.

Rachel thinks that human beings believe that they are "above the earth", that they "don't even walk on the earth." "Americans and Canadians generally think that they aren't really a part of the Earth. They think that they're something separate from the Earth." But as a human being, she is beginning to believe we aren't separate. "The destruction that we are causing is amazing. We laugh about the dinosaurs and how they were so stupid to become extinct, yet they lived on the earth for five hundred million years or some huge number and we haven't even been around for a million, and yet we will be extinct very soon in a lot less time than the dinosaurs." Rachel is of the view that we need to maintain a balance. Often she feels that people are becoming more environmentally friendly, and they think that they have to give up a lot of things that they don't have to. It's just about choices and making better choices and not necessarily

giving up, but just choosing something different. But it's also very hard because we live in a very materialistic society. Rachel finds herself doing things and buying things that she might not necessarily need, but she is working toward remedying that. She also feels that there is not a big selection of environmental products and those products that can be purchased are expensive.

Rachel does not think that human beings are superior. She means that our physical make up is completely inferior to every other mammal; we don't have strength, we don't have speed, we don't have anything to protect ourselves except our brain. Rachel believes that our brains have gone past protecting ourselves and are damaging everything else. "People are totally taking advantage of our brain and not using it for the right things." Rachel's worldview regarding the disconnection between humans and other living things is highlighted in a research paper entitled *Humankind and the Reluctance to Develop a Relationship with Mother Earth* that she wrote for an environmental science course at the University of Manitoba. Her paper explores the causes of the reluctance of human-environmental relationships and discusses some potential solutions to this concern. Her thesis is that humans have become disconnected from nature because of cultural shifts, a loss of community that was once the basis of society and finally caused by a communication breakdown. She suggests in her paper that there are many solutions to these large problems, but the most simple is basic education for the children.

4.2 EfS for Children

I asked Rachel for her views on EfS by posing three related questions: What does Sustainability Education mean to you and to your students? What do you think students should actually do that would contribute to a sustainable future? How do you think you

should prepare students for lives in the systems of which they are a part through the curriculum unit? To these questions Rachel responded:

> Well I think, basically, the most important thing is the action. And, if they have the knowledge and the skills and have developed these values, and their attitudes have shifted, then naturally they will do it. Because it's not more difficult to do sustainable things. It might be more costly, initially; for example, the light bulbs that are long lasting. We've systematically being trying. Now every time a light bulb burns out, we go and spend $20 dollars as opposed to two dollars to get these better light bulbs. But it's just, you know, once you have that knowledge you have to apply it.... I think once they are given knowledge, the information about, you know, what we have been doing to our planet and how to make things a little bit better, I think once they have that information they will be able to develop attitudes toward which way they want to go. Some kids might say "I don't care," and other kids might become very passionate. We can't force attitudes on to the kids. We can show them, we can teach them, we can tell them how we feel, and we can give them the skills to make that choice, but we can't make them do that. So, I think that by giving them the knowledge and being positive role models and demonstrating what we want, then they can make an informed choice and hopefully become better citizens. (September 17, Teacher Interview, lines 174-182)
>
> For example, how looking at an ecological cycle can be applied to their daily life. "Don't throw out that apple. Put it in a compost bin and something good will come of it as opposed to it going to the dump and causing problems." And I think that it was important for them to see benefits of choosing smart consumer products as opposed to something that's considered wasteful and just making better choices, informed choices. (February 1, Teacher Interview, lines 402-408)

Rachel considers that appropriate knowledge, skills, values and attitudes leads to sustainable and responsible acts. She supports this argument with examples: (1) buying an expensive energy efficient light bulb over a cheap energy consuming light bulb, and (2) throwing out an apple in a compost bin versus putting it in a waste bin. She reminds me that not all students become passionate about sustainability issues. She suggests that through modeling appropriate behaviour, by providing examples and instruction, we help students in learning and in raising their awareness to make informed choices.

I agree with Rachel that, through good examples, we help students learn how to make informed choices, however, I also believe that students need to learn principles of

ecology in order to guide the choices that they make with respect to sustainable decision-making. Rachel had not yet addressed this idea, consequently, I intervened in her thought process.

4.3 Researcher's Intervention

Throughout our planning sessions, Rachel and I discussed EfS student learning outcomes and how the principles of ecology help teach students to live sustainably on the planet. Consider the following teacher/researcher conversation:

> Researcher: Now if we're going to be teaching the kids to try to understand how they can live sustainably...that is, contribute to a sustainable future for them and for future generations, they need to know the principles of ecology and what makes nature sustainable. These are like, guidelines that we can then take for ourselves as we are carrying on our actions, right? ... If we understand that diversity is very important in ecosystems for sustainability, then we also know that it's important for diversity of the planet to remain a diverse, multi-cultural planet...
>
> Rachel: Yeah (June 6, Session #3, lines 186-194)

My suggestion to Rachel is that when children learn to allow principles of ecology to guide their actions, they learn how to live more sustainably on the planet. In support of this argument, I gave the following example: If we understand that biological diversity is important to the sustainability of natural ecosystems, we should also understand that a diverse, multi-cultural society is also critical to the sustainability of home (the planet). I also discussed with Rachel how the principle of "ecological cycle" provides the concept of living responsibly with respect to waste.

> Researcher: I'm thinking, Okay. How can you get the kids to understand cycle and the fact that in the ecosystem there is no waste, like in the bioreserve? It's, as one thing dies another organism uses.
>
> Rachel: Yeah.

Researcher: But in a business or in a school, or even in government, we create, we use, we throw away. But in the ecosystem there is no waste. So, how could there be no waste? Why don't we re-use it? That sort of concept. (June 6, Session #3, lines 202-208)

What communicated to Rachel is the notion that ecological principles can and should serve as guidelines toward understanding how we should be living responsibly and sustainably with respect to waste because within an ecosystem, nothing is wasted. Within an ecosystem, as one thing dies it becomes a resource for another organism and so the cycle continues. Therefore, as communities of animals and plants recycle everything, so should we. However, we read to change our mindset from viewing waste as "something to be thrown away" to viewing waste not as waste, but as a resource to be used again, a resource that we "value." If we adopt that mindset, we allow the ecological principle (ecological cycle) to guide our thinking, our behaviour and our actions no matter what system we find ourselves within. No matter what man-made system we are in (school, government, and business); we allow the ecological principles to guide our procurement decisions (the purchasing, use and disposal of goods, and services).

These ideas were internalized by Rachel based on her response to my interview question about what the essential question was that we addressed in our waste curriculum unit:

> Basically, what we can learn from ecosystems is their waste. How they might dispose of waste and what we can get out of it. Or, what they do with their waste, and how we should be, maybe, paying closer attention to our ecosystems to get ideas and information. (September 17, Teacher Interview, lines 147-149)

When I asked Rachel, "Why," she responded:

> Because in an ecosystem, in a natural ecosystem, there is no such thing as waste because everything is used properly and reused or recycled or breaks down. Only humans create things that don't break down naturally. September 17, Teacher Interview, lines 151-153)

Because of my intervention, Rachel believes that human beings can learn valuable information from ecosystems regarding how to better manage man-made waste. Her belief is tied to the notion that human beings create things that don't break down naturally, while natural ecosystems produce only waste that either breaks down or is reused or recycled over time.

Throughout our planning sessions, Rachel and I also discussed how students might best acquire EfS knowledge, skills, values and attitudes and what principles of learning are best suited for EfS. We both agreed that the unit should be student centered and the principles of learning should be based on hands-on, experiential approaches, wherein students make their own decisions. We both believed that our unit should be practical and "real" to students.

4.4 A Practical Perspective

Throughout our planning sessions, Rachel and I aimed to ensure that the curriculum unit was student-centered and oriented towards problem-solving and decision-making. Consider the following teacher/researcher conversation on building models — a hands-on approach:

Rachel: You know what would be really cool, and I don't know how realistic it would be, but we do recycling, and energy, and build something, build an energy creator with recycling material. I think that would be neat, and then show their models, their working models.

Researcher: I'm big on hands-on creativity.

Rachel: I love to build things, well I'm not very good at building things, I like the kids building things, I like to watch them build things. (June 4, Session #2, lines 1346-1358)

Rachel and I believe that students learn by doing things rather than being passive receptors of information. For example, we both suggested that students learn to recycle and "build" models of things that really worked as part of the unit. Another example of concept development through a hands-on approach evolved concerning students' choices. Consider the following conversation:

Rachel: We had a fairly in depth First Aid unit and First Aid was completely hands on, a bit of theory, but you know, a lot of mouth to mouth. And they sort of remembered you know, hand placement, they sort of remembered when you do it, but they didn't know all the steps because it's not practiced through the year. But they're not going to remember the stuff that they read out of a textbook.

Researcher: No.

Rachel: The next year if they can't remember First Aid, what's the use?

Researcher: That's right. And chances are if they understand the concept and if somebody was in a choking position they might recall, oh Heimlich.

Rachel: Yeah

Researcher: And then go and do it and save somebody's life.

Rachel: Well, two girls did do CPR on a guy.

Researcher: Oh really?

Rachel: Two of our grade eight girls. He died, but the fact is they stood there. He walked out of his house, they were walking to the library and this old man was walking down his front walk and he collapsed in front of them.

Researcher: Um hum.

Rachel: And I guess, probably they said it seemed like a long time, but probably for about thirty seconds they kind of stood there, no one else is around, they were sort of freaked out and then they just sprung into action and...

Researcher: Perfect.

Rachel: They actually did mouth to mouth

Researcher: Anyone call 911?

Rachel: The wife came out and then they sent her back in to call 911 and they were doing CPR and mouth to mouth on this old man.

Researcher: And he probably had a heart attack.

Rachel: Yeah, unfortunately, he died.

Researcher: Yeah.

Rachel: Cause imagine if he had lived, that would have been...

Researcher: Yeah.

Rachel: Just the hugest reward for you know.

Researcher: But just the fact that they did that.

Rachel: Oh, it was so amazing, I didn't even believe it. (June 3, Session #1, lines 728-765)

It is apparent that Rachel advocates concept learning through hands-on approaches as opposed to simply memorizing terminology from a textbook. The story that Rachel shared with me about two grade eight students who attempted to save an elderly man's life after he had suffered a heart attack is an example of students benefiting from teaching and learning using practical, "hands-on" approaches. Rachel believes that these students would not have known what to do and may not have attempted "mouth-to-mouth" resuscitation if they had simply learned the theoretical procedure of resuscitation.

Some pertinent activities related to our topic were: students picking up garbage on the school ground — sorting, classifying, and graphing results; planning, designing, building and selling composters; using composters/recycling bins; tending to a rooftop garden; sending produce to a charity; building a flower garden, tending it and disposing

of waste using composters; learning about packaging of products by physically looking and holding products that can and cannot be recycled; having experts from the universities or elsewhere speaking to students and demonstrating sustainable waste practices with students; participating in recycling, reducing, composting in their school; creating a bulletin board collage and/or library assignment related to waste minimization in the classroom; developing sustainability-focused learning centres, making a landfill pie; and developing web sites and posting pictures related to waste and students sewing green lunch bags. To augment hands-on learning, Rachel considers students doing debates, developing photo-essays, conducting presentations, working in groups to share ideas about waste issues, and going on field trips. Rachel's objective is to enable students to become actively involved in their own learning so that all students enjoy learning about waste and the issues related to the topic. Rachel also continuously looks for ways that students might make connections with their community throughout the course of the unit and looks for ways to "make it real" for students. The activity she ultimately chose to facilitate a strong connection between the community and the students required groups of students to approach businesses to do a sustainability audit on their waste generation and disposal.

Rachel discusses having students explore their outside environment and learning through experiential approaches. Consider the following teacher/researcher conversations regarding learning through experience:

Rachel: Or we could add another lesson. It would depend on the time of year, and how we could fit this in, go to the Bio Reserve and say, okay, in your groups, in a half an hour, find examples of how nature is recycling itself and then come back and discuss.

Researcher: Okay.

Rachel: They go to the bio reserve, if it's fall they can look and see leaves falling off the trees, they're breaking up, they see a little mouse living in the leaves that have fallen or you know, that sort of thing.

Researcher: Uh huh.

Rachel: Like who knows what they might come up with. (August 9, Session #15, lines 241-248)

...

Researcher: Okay, lesson three is landfills. Look how humans are doing this. This is how humans are handling their waste. Now, how does an ecosystem handle its waste?

Rachel: Right.

Researcher: Totally different concepts of learning. I like it.

Rachel: I want them to be out and about a little bit more, so that's good. (August 9, Session #15, lines 428-433)

Rachel believes in providing students with opportunities to explore and compare natural and constructed environments. Examples include: students physically going outside to a natural tall grass, wetland, partly forested area near her school (the "bioreserve"); and students participating in a field trip to a local land-fill site.

Rachel is an advocate of empowering students to make their own decisions. The following excerpt captures Rachel's views with respect to student empowerment:

Researcher: Yesterday, I was telling one of our policy analysts about what we were doing related to the businesses in the area and she says it is a really good idea. She asked, "Have you thought of giving the students any ideas about the business?" She said, "It would really be a shame and it would almost defeat your purpose if first of all the business didn't allow them in, they weren't receptive to the idea and if they picked a business that didn't have any waste issues then what would they do?" She said, "Would it not be better for you and your teacher to investigate coming up with the possibility with five of these businesses ahead of time, getting consent yourselves to see if they'll be receptive? And you have a better understanding of the waste issues if you look at a business and then you could just let the groups pick

which business they want out of the five." She said, "It would be a real shame," and she said, "She's seen this happen where teachers are really energetic about doing something in the community and then the community isn't receptive and then the kids get discouraged and they get discouraged and then what?" So, what do you think of that?

Rachel: I agree she's probably right, but then we've taken away the power from the kids 'cause we are doing all the work plus I'm doing this with all my classes so am I going to find thirty businesses on my own that are receptive? Probably not, so there is enough kids that I think that parents work in [location][3] that they can go through their parents. Like I would have never thought this would work except for...

Researcher: Ok.

Rachel: So, the reason why I think this still will work is because when we're doing our "change project" with that one class, we had two boys that just phoned some company basically out of the phone book and they said come on down and they were super receptive.

Researcher: You're not concerned?

Rachel: No, and I would like to have a couple businesses at the back, like [name of a business in the area] I know I can probably weasel something in because I know the owner's step son, so if I have that as my back up when a group comes up to me and says you know we've already phoned three places and they won't take us, I'll say, "Here you go."

Researcher: You're going to let them try on their own first?

Rachel: Absolutely, I think that I don't want to set them up for failure, but I don't want to hand them over their assignments too. (August 11, Session #16, lines 1136-1155)

Rachel believes in empowering students. She believes that having students identify businesses for waste audit purposes, whether successful or not, would be a good learning opportunity for students that would give them a sense of empowerment. Rachel feels that student should be empowered to make their own decisions even at the expense of not

being successful. Rachel believes that students can and should make mistakes and sees that as a positive learning experience. She feels that students can learn as much from their successes as from their failures.

In summary, throughout our planning sessions, it was evident that Rachel's ideas revolved around a practical perspective that involved learning concepts through a hands-on approach, building models, carrying out discourse, making connections with their community to "make it real," experiencing the environment, and empowering students to make their own decisions. A practical perspective of this sort led us to first identify essential questions that drove the unit of study in waste minimization.

4.5 Identifying Essential Questions for Unit Focus

The identification of essential sustainability-focused questions is critical for sustainability focused units. Sustainability is about decision-making, problem solving which requires asking questions — questions that cause a person to take a step back and rethink what they are doing and why and how things could be done in a more sustainable, responsible manner. The essential sustainability-focused question and sub-questions serve to structure and provide direction for the unit. As the scope and sequence of the essential question and sub-questions are identified, the unit begins to take shape. In essence, the establishment and organization of the essential question and sub-questions identify the framework that the teacher and students use to investigate the topic for the unit.

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[3] The name of the place that Rachel is referring to has been replaced with the word "*location*" as the name identifies the area.

Our focus for the unit became clear when we developed essential questions and sub-questions for our unit. The essential sustainability-focused question provides the direction our unit and the sub-questions identify the framework for teaching and learning. Jacobs (1997) states in *Mapping the Big Picture* that the essential question is a "conceptual commitment" (p. 26) of what the focus of the unit will be about. In a sense, Rachel and I were saying to each other, "This is our focus for teaching and student learning to examine our sustainability topic." Of course, Rachel and I did not arrive immediately at the conclusion that the essential question(s) would serve as our focus for teaching and learning. It was only after considerable debate about the components that shape the focus of our unit (student learning outcomes, learning objectives, and available resources) that we worked out this important step in our unit development process. The following conversation/debate captures our struggle with respect to what should serve as our focus for teaching and learning:

Rachel: Because we can't come up with activities without knowing what the curriculum says.

Researcher: That's right.

Rachel: If we want true integration, well then, we can't come up with the outcomes until we have some exciting activities. If we come up with all these wonderful outcomes, and then go, okay, what are we going to do to teach this?

Researcher: Okay, you know what I'm thinking about outcomes though - the outcomes that we just saw in the curriculum we should pull them out and have them all in front of us, so that as we're thinking about activities, then we'll see how it links to the different outcomes.

Rachel: Yep.

Researcher: That's all.

Rachel: But the thing is that we want to include those, but we need fun activities. If we look at all the outcomes, and say, okay, what can we do with these? Well, we could sit down and write a book. Well, that's not going to catch them.

Researcher: No.

Rachel: So, we need the activities and then we can adapt the activities to match all the outcomes or a portion, but we're not going to be able to hit every outcome that we wanted to because we've listed, you know, probably thirty outcomes between all the subject areas.

Researcher: Yeah.

Rachel: If we only hit twenty five.

Researcher: Good for us.

Rachel: Well that's still true integration.

Researcher: See, once we have the theme—well, we have the theme—it'll be waste management, and we identify the essential questions. Like the umbrella question.

Rachel: Yeah.

Researcher: Once we have that question, the sub-questions will almost tell us what kind of activities we have to do. Like "what is?" like remember yesterday when we were talking. What is garbage? Who makes garbage? Where do we put garbage?

Rachel: Yeah.

Researcher: That we have found in here an outcome "to sort" and this is composting, and then we'll find all kinds of activities to address that outcome. The student learning outcomes are related to the questions.

Rachel: Oh yeah, completely.

Researcher: Unless you know what question you are asking, or what you are going to do related to the activity, the outcome doesn't mean a darn thing.

Rachel: Right.

Researcher: Because an outcome is, oh, a kid is going to demonstrate that he can present something. Well, unless there's something useful to present, what's it good for?

Rachel: Yep.

Researcher: Just so we agree. (June 25, Session #9, lines 773-834)

Rachel and I struggled with the idea of what comes first, activities or student learning outcomes. On one hand, Rachel believes that her curriculum unit focus should be guided by "fun" activities that are later adapted to match the student learning outcomes. She argues if student learning outcomes were identified first, she would potentially have problems coming up with "fun" activities that would address those learning outcomes. Rachel feels that students would not be engaged or "caught" if student learning outcomes were identified prior to identifying learning activities. Rachel puts a lot of weight on engaging or "catching" the students and thinks that the identification of "fun" activities would engage students. I, on the other hand, believe that the essential question and sub-questions ought to be identified first, followed by corresponding student learning outcomes, then identification of assessment, then activities. After some debate, Rachel agrees to identify an essential sustainability-focused question and sub-questions for our unit.

This debate led us into a discussion in Session #10 about which questions are the most important regarding waste and consumption issues. Once we agreed to identify essential questions in order to select one, we began to review government policy documents related to waste minimization and consumption (e.g., the *Manitoba Sustainability Indicators and Reporting (2000)).* The issues identified in this document under the categories "waste" and "consumption" helped to guide our decision-making

with respect to identifying the essential question(s) deemed important to address in our waste unit. Given that most policy documents that we reviewed were based on considerable consultation by all sectors (business, industry, governments at all levels, educators, religious organizations, non-government organizations, youth, Aboriginal representation, and others) of the Province, we felt that the issues were well thought-out, researched and made sense to us. Rachel and I could relate to the issues identified in government policy documents related to waste and consumption, and we felt that students would also be able to relate to those issues. The following excerpt captures our decision-making with respect to the identification of the essential questions based on the provincial document.

Researcher: ...I brought this pile (points to stack of papers) and then I thought the Manitoba Government has a *Sustainable Development Act* and a requirement to develop sustainability indicators.

Rachel: Okay.

Researcher: Now, what those are measures of different aspects related to the environment, the economy, and the health of people, right?

Rachel: Right.

Researcher: So in the economic part of it, you'd have employment and so forth; in the environmental part of it, you'd have fish and water and all those components, right? Two years of this work has been done already to develop this indicator report. I took a piece of that where it talks about waste and where it talks about energy. And what are the issues and how do you measure them and from there, I pulled together some of the essential questions that the government thinks are really important and consequently, we might think are important.

Rachel: Okay.

Researcher: Yeah. So, we'll look at that just to give you an idea of what they did give a wide scope. They got the words right, the definitions are in there, the glossary is in there, ecological footprints are in there the dash board of sustainability is in there, you know.

Rachel: I've never heard of that before.

Researcher: Now, in this document they didn't have waste, per se. And they classified consumption as the use of goods and services and waste, which makes perfect sense because if you don't buy goods and services, you'll have nothing to throw away, right? So, to me, it makes sense to lump together in one.

Rachel: Yeah.

Researcher: I never thought of it that way, but that's what...

Rachel: If you don't consume, you are not producing.

Researcher: That's right. In this category, or this unit on consumption will deal with demand and uses of goods and services and the waste products resulting from their use. Consumption increases economic activity and is associated with the increase in standard of living; however, waste generation is associated with higher levels of consumption. It's like a feedback loop. The bigger the standard of living the more waste and the more waste, you know, and on and on.

Rachel: Yeah.

Researcher: (Reading from files) Resource depletion in producing waste is not sustainable nor is it economically efficient. So, this waste cuts against sustainability right there, and that's why. Unsustainable consumption of resources will compromise the ability of future generations to meet their needs. That's what sustainable development means. Okay, so this indicator will give them a whole picture of waste and consumption. This indicator is waste disposal and waste recycle or reused. That's what it's about. It basically tracks the amount of waste that goes to the landfills and much of it is recycled and stuff like that. So, I thought that was at least a good place to start looking at the issue.

Rachel: Yeah.

Researcher: And, so this is what I have come up with for that one (pointing at paper). Okay, so this would be our unit, our essential question. How do we use less goods and services so that we generate less waste? Okay in order to answer this question, you need to know how much waste we are sending to landfill sites. So how much is the school contributing in terms of lunch garbage?

Rachel: Yeah.

Researcher: And house garbage and all of that, okay. So they would understand that. How do we reduce the waste that goes to landfills? So, there comes the recycling, the composting. What do we have to change and do differently so all this crap doesn't go in to the landfills?

Rachel: Right.

Researcher: So that we don't contribute to this. And then this is how we reduce it (referring to folder) but what goods can be recycled, what could be composted. We could do the composting, we could do the recycling bins and all of that here because it directly relates to answering this question.

Rachel: Right.

Researcher: And then what goods can be reused, because here they have an indicator. Waste recycled or reused and then they track that over time because that takes away from waste stream going to the landfill, right. And then you're not using virgin resources to create it and all of that, right. So this kind of gives us the essential questions for the activities that we already talked about.

Rachel: Yeah.

Researcher: When I made these questions, all I did was read this on consumption and pull the main principle coming from that and basically looking at the indicators. So, I talked about disposal and then waste recycling and reusing, but put them in questions that I thought for grade 6.

Rachel: Yeah.

Researcher: Student would understand. Does that make sense?

Rachel: It completely makes sense. I think that some of the wording will just have to make it more simple.

Researcher: Yeah. The ideas are the same?

Rachel: Yeah, absolutely. Those exact ideas are good.

Researcher: Like, I just looked at this (pointing at booklet) are we missing something?

Rachel: Not that I can think of right now.

Researcher: From what you normally do.

Rachel: No, not from what I normally do, but this is different (June 27, Session #10, lines 478-551).

Because of our struggle with the identification of the essential question, I came to the teacher/researcher meeting with a set of essential questions that I had framed based on a governmental policy document I had contributed to and had access to through my government position. I came prepared to help Rachel understand how we can link the government document to our unit. Rachel did not know about this document before this session and had no idea that such a document existed. During our session, I explained the document's purpose and contents and how our essential questions for our unit could be drawn from the policy document. Framing our essential question and sub-questions based on sustainability indicators presented in the policy document made sense to Rachel, however, she suggested that the terminology be altered to meet the needs of Middle Years students.

The above excerpt clearly shows that it is not a conversation where both parties are contributing. The expertise and the experience of the researcher because of her government position play out. This reveals how a researcher can influence a teacher to look carefully at government documents and draw pertinent information. A teacher may not have ready access or understand or even know unless it is brought to the attention by the expert, in this case, the researcher.

We further clarified (revised) our essential question. Consider the following teacher/researcher conversation:

Rachel: So, maybe the main question is not how do we generate less but how do we, how do humans use more of an ecological approach to waste?

Our main question is how do we generate less garbage, when our question should be about generating the right garbage.

Researcher: Yeah, the whole reusing, reusing. Or if we're going to be mimicking the characteristics of an ecosystem related to waste, what could the essential question be. See that's perfect because now it's changing our focus a little bit more than how do we generate less waste. Like so what, why is that even that important? How should humans…?

Rachel: Use.

Researcher: View waste?

Rachel: No, something to do with use ecological principles when creating waste or how should humans - oh man, what am I trying to say.

Researcher: Use ecological principles.

Rachel: When generating waste. And then that way, our essential research question is more on the topic of what you are suppose to be doing.

Researcher: Uh huh, yeah. And that would help get that message into the kids minds as well.

Rachel: And we still need to cover all this information.

Researcher: Yeah.

Rachel: But then, basically, all we're saying is now that we learned how humans do it and you know, the benefits of the way some people recycle or reuse now, look at how nature does it, what else can we do?

Researcher: Uh huh …

Researcher: How does ecosystem, how does the ecosystem - what could we learn about the ecosystem and its waste?

Rachel: Yeah.

Researcher: What can the ecosystem teach us about waste? Okay?

Rachel: That's good. (August 9, Session #15, lines 328-462)

Rachel and I made a fundamental shift to an eco-centric focus by revising our previously developed question: "How do we use fewer goods and services so that we

generate less waste?" to our new question: "What can ecosystems teach us about waste?" The decision essentially changed the focus and scope of our unit. By refocusing our question to consider the "ecosystem" as a guide to managing waste, our question changed from merely focusing on generating less waste, with no direction identified as to what might guide our actions, to a question guided by the principles of ecology. The latter provides principles to live by and directs actions toward generating less waste (and why) and addresses the notion of ecological cycles wherein waste for one species is food for another and so the cycle continues. In this case, waste can be viewed as a resource in a continuous cycle.

The result of revising our essential question led to the development of a lesson plan dealing with the "ecosystem" component of our essential question. The new lesson plan addresses what we can learn about waste from ecosystems. To address that question, two additional questions were posed: What are ecological cycles? How is waste managed within an ecosystem? To address these questions, the students would be involved in a class discussion and sharing about what their previous "ecosystem" knowledge is. Following that, students would leave the classroom to go to the "bioreserve" to observe and record how waste is managed in that natural ecosystem. Following the field trip to the "bioreserve," students (arranged in groups) would share their ideas with their peers and participate in a class discussion to share their groups' observations with respect to how waste is managed at the "bioreserve." These ideas are visually captured in a conceptual map (Figure 4.1) using "Inspiration" software. Subsequently, this map is revised based on the modification of our essential question. Consider Rachel's views regarding the "Inspiration" software program:

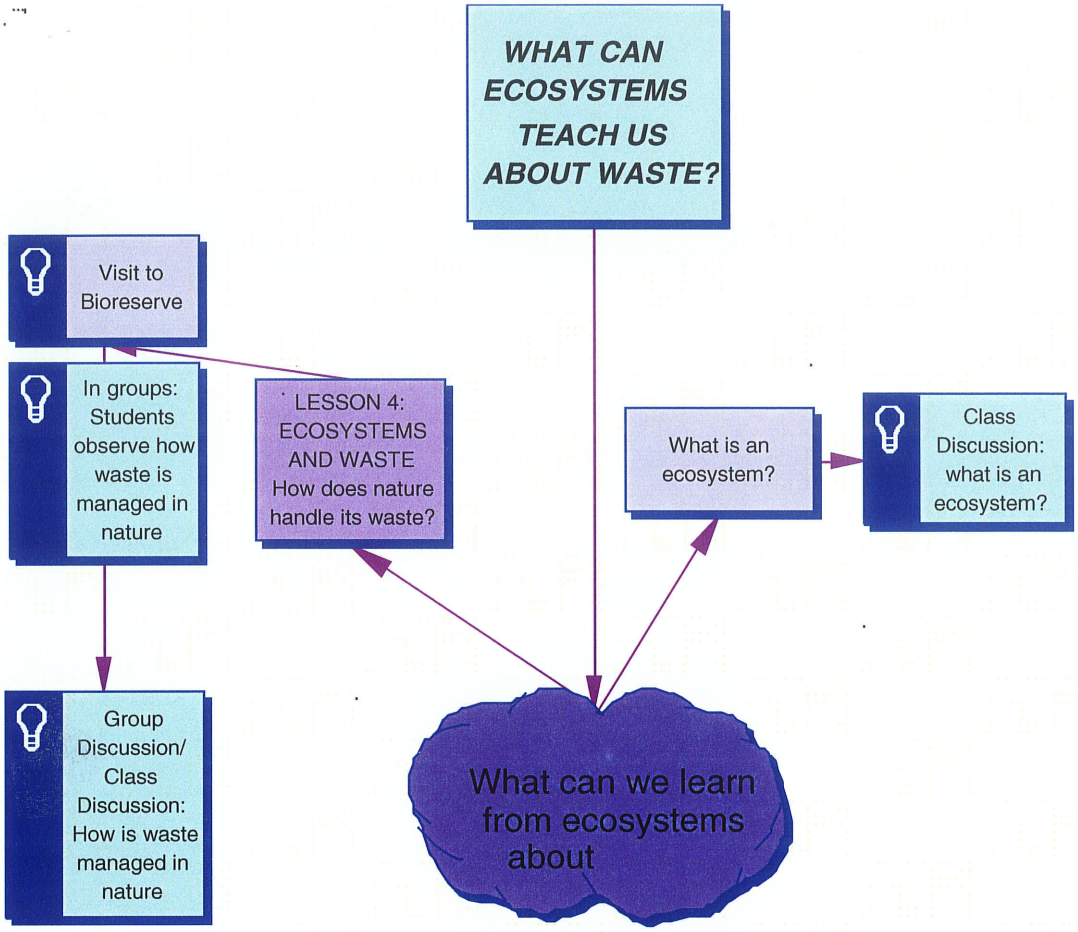


Figure 4.1. Essential Question Mapping

> Using Inspiration, I think, really helped me in a visual way to see how things would play out. And I think that was a good way of how we started the unit. How it evolved from our first plan to our final plan was completely different. Our essential questions changed as we developed our unit. (February 1, Teacher Interview, lines 578-580)

Rachel felt that the conceptual mapping tool helped us to create a visual picture of our thoughts. The tool (Inspiration) was useful in that it allowed us to modify our visual representation of our unit easily as we changed our thinking about what the essential questions should be. In essence, the tool enabled us to develop a shared vision of how

the unit would be structured and how it would play out. Consider Rachel's views on the mapping tool after the completion of the unit:

> The whole thing about Inspiration, I think made it very, very easy. It organized our thoughts and sure, our first copy looks absolutely nothing like what we have now, but the fact is it leads us in sort of a direction, where we wanted to go, where we came from and then we modified it and that was fine, but it made it very easy to see the linear progressions that we were taking. So I really think that sped up our process because we spent one evening up on the computer and we had basically our whole unit there and adapt and change a little bit but that was it. (August 22, Session #19, lines 1023-1030)

Rachel believes that the tool (Inspiration software) helped to organize our thoughts and visually set the direction and destination for our unit. Although one path was not followed (given that modifications had to be made along the way), the tool helped to clarify our efforts to trailblaze our own path to our eventual destination. Sometimes "trailblazing" is difficult. It is certainly difficult when each participant had very different ways of developing curriculum. As adult learners, we have our past experiences to contend with. Rachel had previous experience developing curriculum, and so did I. My past experiences lead me to believe that a planning process "meta-planning" is required to effectively plan a curriculum unit. Rachel's past experiences lead her to believe that resources ought to be identified and then "some sort of synthesis" ought to take place. We had some decisions to make. Were we going to have to learn how to plan an interdisciplinary sustainability focused curriculum unit, or were we going to collect resources and do "some sort of synthesis?"

4.6 Meta-planning Vs "Some Sort of Synthesis"

In the following teacher/researcher dialogue, Rachel contemplates on her past practices of curriculum development and what she now observed as a result of collaboration with a researcher.

Rachel: When I normally create units, I am not as meticulous. I kind of look at a term, and the resources I have. I go day by day and if one day the activity ends quick, I might have to start the next part of it. Or, I am not nearly as meticulous as we have been with everything so this is a really good experience.

Researcher: How do you develop a unit? How do you...normally do it?

Rachel: Umm, well for example, my unit this year was the trees and I went to Forest Ed workshop and came back with all these great things that I wanted to do and just you know, getting resources and learning.

Researcher: Uh huh.

Rachel: Being out there and having hands on things. The recycling and garbage one this year just came up in the news. So that was a big issue. So I thought no better time than to tackle it right now, Ok... I have some themes that I like to focus on. And then, just whatever comes up along that is really natural, like I told you before about the garbage debate sort of arrived. And I had sort of planned on doing recycling, but you, the opportunity presented itself and with it being so big in the news, it was really good to have that change." (June 3, Session #1, lines 128-130)

Rachel's experience planning units involves identifying some themes then identifying resources and creating activities around those themes. Rachel looks for opportunities and resources that she can apply in her classroom. She collects resources at workshops and immediately applies what she has learned in the classroom. She is attentive to current media issues and integrates those issues into her teaching. She even views my project as an opportunity to enhance her curriculum and her teaching. Her

previous curriculum development experiences did not include how to plan a curriculum unit.

Another example of Rachel's previous approach to curriculum development follows in another researcher/teacher conversation:

Researcher: Yeah

Rachel: And the way I go about it is, I gather resources, I gather information and then I sort of try and figure out how I can get my information across as well as them finding their own information.

Researcher: Uh huh.

Rachel: And then some sort of method, you know, some sort of synthesis bringing it all together and then evaluation.

Researcher: Okay, so that's about the same kind of thing that we're doing but this is more structured and we're actually going through the plan and kind of...

Rachel: Yeah. (June 17, Session #5, lines 65-82).

Rachel differentiates between our structured curriculum planning approach (using Jacob's curriculum design and planning model) and her way of gathering resources and then bringing it all together ("some sort of synthesis"). Rachel feels that if it were not for Jacob's (1987) planning model, she would have simply brought in all her resources, asked me to bring in all of mine and then we would decide what to include in the lesson based on resources identified. Rachel describes the process she would have used if it were not for my intervention with respect to planning:

> Yeah. And I would have said, Well, I'm really interested in this. You've got a lot of information on this. Let's narrow it down. What do you want to do? And that's how I would have done it. Just combining interests because if I'm not interested I'm not going to be motivated. (August 22, Session #19, lines 1016-1019)

We did not follow Rachel's method of curriculum planning. Instead, I convinced Rachel that we should learn how to plan an interdisciplinary unit first by following an existing model. In this case, the model that we chose was Jacob's (1987) interdisciplinary curriculum planning and design model. Rachel's initial expectations of our curriculum development process were different than how the development process played out. Consider Rachel's statement:

> So I didn't really expect the whole month of June to be just planning how to plan. Like, learning how we're going to do this. But it's pretty much how it ended up being until the end when we finally picked our topics. And I went "Oh my God." I would have picked the topics the first day. I would have said, "What do you want to do? Well this is my information. You got this information, okay, let's do these." (August 22, Session #19, lines 1008-1012)

Rachel did not anticipate "planning to plan" and did not really view "learning to plan" as part of our curriculum development process. Rachel elaborated on this point during our interview sessions.

> I think that it was less of, out of the whole time spent, I think less of it was actually planning the unit and most of it was planning to plan. Um. I guess that would be called meta-planning. Thinking about planning. And basically, we planned to plan for most of the time, and once we decided how we were going to do it, and what we were going to do it on, it just naturally really, really flowed, and we just bounced ideas off each other then it just happened. And then, going back and trying, and relating the curriculum was another huge time period. So the actually planning, I think, went very easily and very smooth. It was all the work that led up to it and the work after it to make it what we wanted it to be. (September 17, Teacher Interview, lines 99-109)

Rachel does not consider that "planning to plan" or "thinking about planning" is a significant part of the process associated with developing a curriculum unit. Rachel appears to consider the activities and experiences <u>after</u> the action plan has been developed as more a part of the planning process than the activities and experiences <u>preceding</u> the action plan (action plans take into consideration what to do and how to do

it). Rachel believes that the activities associated with curriculum planning and design (identifying time schedules, identifying SE goals, principles of learning, student learning outcomes, choosing a design model, selecting a topic, building a shared vision, identifying essential questions and identifying curricular connections) are not really part of her idea of curriculum development. Her notion of curriculum planning involves finding resources and creating activities around those resources (unit planning and activity selection).

The expectation that Rachel had regarding how curriculum ought to be developed had little to do with "meta-planning" as she called it. Consider the following supporting statement:

> Well, our development and design was completely different than what I had expected. We sat down. We watched videos. We read information on how to plan a unit, oppose to going in head-first and doing it. Then, we took all our resources and put them together and sort of looked at what our options are, narrowed down to a few of our ideas that we wanted and then we chose one. Then the development, we looked at what are some of the activities we can do, and worked around that and how the students can learn the end results of what we expected. And then we broke it down to objectives and then looking at the curriculum with activities, and our lessons, how that played in. (February 1, Teacher Interview, lines 596-603)

Rachel's perceptions of "curriculum planning" were different than my perceptions. I believe that a curriculum unit ought to be developed based on a foundation supported by goals, principles and learning outcomes and a shared vision of what is to follow. I also believe that activities and resources are to be found (or created) once decisions are made with respect to what knowledge, skills values, attitudes or life practices are deemed important to learn and why.

Unfortunately, Rachel and I did not have any discussions about our vision of what ought to happen in our curriculum development process. Rachel and I both assumed that

we knew individually how to develop curriculum without ever communicating "how it should be done" to each other. As it played out, her vision of how a curriculum unit ought to be developed was significantly different than my vision - in retrospect, we obviously did not have a shared vision of curriculum development. Fortunately, the lack of a shared vision did not get in the way of Rachel and I achieving our goals. Perhaps, a shared vision with respect to how to "do" something is not as important as collaboration and finding a way to "do it" together. For example, had I not had a different vision of curriculum development than Rachel, she may not have learned how to "plan to plan." My interpretation of the events as they played out are: if it had not been for my "meta-planning" intervention, Rachel would have relied on her past curriculum development experiences to develop our curriculum unit wherein there would be no plan and no process identified, only resources. No professional development opportunities would have been acquired. And I would not have learned how one teacher normally plans. Although our planning process played out differently than Rachel had envisioned, we were both pleased with the outcome, particularly because we had both learned something new - she learned how to plan an interdisciplinary sustainability-focused curriculum unit; I learned how one teacher plans units.

A shared vision of how to plan and design curriculum units is important, but perhaps more important is a shared vision with respect to human/environmental orientations.

4.7 Pioneering Trailblazers: Building a Shared Vision

As a result of ongoing conversations, I came to know more about Rachel. I began to understand how she thinks about her connection with the environment. I began to

understand what she means by sustainable development and what it means to her to educate her students about sustainability issues and how she goes about doing that. Through our researcher/teacher discussions and our collaborative work together, we developed a shared vision of what kind of unit to create and how to create our unit. Throughout our planning sessions, we continuously addressed why we were developing the unit and how we were going to achieve our goal. Although we had different reasons for unit development and how development should be done, through our collaborative process, our vision emerged from the process of reflection, conversation, debate and discussion. Consider Rachel's comments with respect to her reasons for unit development:

> And I am always interested in bettering myself. And I was viewing this as a sort of professional development. I would be able to spend some time with you, work on some stuff...and that would be it.... I am not looking at this from any benefit other than the fact that I will become a better teacher and my students will have a lot better quality lessons because we are spending so much time planning. And then later on, I will be able to take the information I learned here and make all of my lessons better. (June 31, Session #13, lines 179-201)

It is apparent that Rachel and I had different visions of the rationale for unit development. Rachel's vision was to work with me to develop a curriculum unit over the summer months that she would teach to her Middle Years students in the fall. Her purpose was to work with me to develop a curriculum in a program where none currently existed, to learn how to develop curriculum units and to provide better quality lessons for her students. My vision was to learn how to translate theory into practice by working with Rachel to develop an ecologically focused EfS curriculum unit and to document our process. My vision also included observing her teaching the unit to Middle Years students, observing her students during the process, and developing a model for an

ecological approach to EfS for other educators and education policy makers. For Rachel, the desired outcome or deliverable was a new curriculum unit. For me, learning about our curriculum development process was my desired outcome.

During our planning sessions, we discussed and sometimes debated exactly what we were going to do and how we were going to do it. The process of building a shared vision was continuous. We knew the direction we were aiming for, however, we were flexible in determining how to get there and how long it would take. Rachel elaborated on this point during our interview sessions.

> In the beginning no, it wasn't clear because there was all these different things, we didn't know each other and we didn't know how we were going to work together. (February 1, Teacher Interview, lines 780-782)

Rachel highlights the uncertainties associated with our process. Consider the following statement.

> I had no idea, I didn't think it would take nearly as long as it has. I didn't envision us hanging out in your basement. I was concerned about not being motivated. I knew it would take longer than I thought, but I knew it wouldn't be a chore. This had turned out much better than I ever would have expected. (August 22, Session #19, lines 1073-1076)

Rachel also comments on the importance of being flexible with respect to our differing visions.

> Then our focused changed but that was really good because it was definitely a dynamic unit. And as we worked to where we wanted to get, all this previous stuff had to adapt to what we wanted to get to at the end. And if we weren't able to be flexible and dynamic then I think that the unit would not have been as successful as it was. (February 1, Teacher Interview, lines 607-610)

Rachel believes that if we were rigid in our approach, the unit would not be as well done, as she believes it could be. Rachel alludes to the idea that collaborators have to be flexible and think of the curriculum development process as a fluid, dynamic one rather

than a rigid, linear process. She also highlights the notion that the unit may not be developed ideally at first, though through the change process, the unit eventually takes the shape that is desired.

Through our discussions during the planning sessions, we built a shared understanding of what was collectively important to both of us and why. During our sessions, we expressed to each other why the development of the unit was important. Consider Rachel's statement:

> I was telling [name of principal] and I don't know if I ever told you this but I was really impressed with the fact of how respectful you were - Here you are doing your Ph.D., you're a big government person, you're very knowledgeable and yet you're listening to me. At that point I had only taught for two and a half years and you were asking my opinion. And if I said something, you were, like, "Oh yeah, that's right!" (February 1, Teacher Interview, lines 708-711)
>
> I think we have been extremely lucky in the fact that we get along. This is what I tell people all the time. Here's this extremely intelligent person. But you listen to me. You respect the fact even though I've been teaching only a couple of years, you listen to me. Like, I know what I'm talking about and I find that very interesting because it's very hard. Even in school because I'm the youngest teacher there. You completely listen to me and that is amazing. (August 22, Session #19, lines 1053-1058)

Rachel spoke from her heart about what really mattered to her. I spoke from my heart about what really mattered to me. I felt a considerable amount of openness and genuine caring about what we were doing and why. I felt that I was being listened to and that my thoughts and perspectives were respected. Rachel had excellent attending skills.

It is apparent from the excerpts above that Rachel also felt that she was also listened to and that her points of view were taken into consideration. She had a great deal of respect for me as a person, a researcher and a government employee. Rachel left me with the impression that she has high regard for government employees and expects them to be intelligent people. Recognizing these characteristics, she considers their viewpoints

as important. Additionally, she thinks she is an intelligent person with good ideas but because she only has three years teaching experience, she finds that her peers do not hold her views in as high regard as they should. Rachel is correct in her assumption that I hold her views in high regard. I have a great deal of respect for Rachel and tried to demonstrate my respect for her by listening to her, considering her ideas and recommendations and acknowledging her skills and abilities throughout our planning process.

During an interview, I asked Rachel whether we built a shared vision and if we did, how we did so. Rachel responded that indeed we did build a shared vision and explained in detail how we did so.

Rachel: I think so. I think that our visions that we came into it on our own. Not on how to develop it, bùt just on the idea of waste minimization itself. I think we had very compatible views on the environment and I think that made it easier. And then the development part - that was more of a challenge because you wanted to do it one way. I wasn't planning on doing it that way. I knew it was probably the right way to do it, but I knew it would take a lot more time and once again that,

Researcher: You mean the planning part of it?

Rachel: Yeah.

Researcher: Ok.

Rachel: And that is a big difference between the two of us. When you're going to do something you're going to do it right and when I do something, I'm just going to do it. And it will become right as I teach it, whether or not I record that after, that's something I personally need to work on. (February 1, Teacher Interview, lines 614-626)

Rachel believes that we successfully developed a shared vision, given that we have compatible world views about our place within the environment; we both see ourselves as one with our environment, not separate from it. We see ourselves as no more important

than other living things on the planet and we believe that we should do whatever we can to sustain the planet that sustains all living things.

Rachel also recognizes that although we shared the same vision of why the unit should be created, we did not have a shared vision of how to develop the unit in terms of its approach because we both knew why we were developing the unit, we would build a sense of commitment together. Where we experienced difficulties with respect to a shared vision was how do we achieve what we want to do. For example, "What principles will guide us?" Whereas I wanted the principles of ecology to guide our work, Rachel did not see that idea as important until I communicated the importance of those principles to our work. Initially, Rachel also did not see how "planning to plan" would help us achieve our goal, however, after some intervention, I eventually convinced her that learning how to plan a unit would be beneficial to us both and would translate into a well-thought out unit.

The process of building a shared vision through collaboration provided an opportunity for Rachel and me to reflect on our respective mental models in relation to how we see the world, why we see it in a certain way, and how we act as a result. Senge (1990) emphasizes that mental models are *active* (his emphasis) — they shape how we act and they also affect what we see (p. 175). The importance of building of a shared vision can not be understated. It is through our shared vision (why we do what we do and how it is done) that we are able to commit to and care about creating the unit.

In response to my question about whether our expectations of the outcomes were the same or different, Rachel responded that she thought they were the same:

> I'm sure if we didn't have that, then we wouldn't have had the same expectations and we wouldn't have been able to come to make sense somewhere where we wanted. (February 1, Teacher Interview, lines 632-633)

Rachel considers a shared vision important to our process. She believes that if we do not have a shared vision (same expectations) we would be able to make sense of where to go (our destination) and how to get there (our process). The process of developing a shared vision is critical to the goal attainment. Although Rachel and I had different reasons for developing the curriculum unit and different assumptions about unit development, our shared visions of what we were doing and why was continuously clarified throughout the development process.

As we spent time working together, debating and discussing exactly what to do and how to do it, we managed to arrive at our destination by blazing a path together that had not previously existed. Together we "cut a path" to our destination through our shared vision.

We were pioneers who faced many obstacles on our way, but had am effective support system to reach our destination. The following two sections highlight through Rachel's eyes some of the most significant obstacles of our journey and supports that led us to our desired destination.

4.8 Rachel Highlights Significant Obstacles of Our Journey

Rachel contemplated a number of issues. They included: missing partners in interdisciplinary curriculum development, time commitment for collaborative effort, previous experience with collaborative work, acknowledgment and support at home, teacher responsibilities, and non-existent EfS curriculum.

4.8.1 Missing Partners in Interdisciplinary Curriculum Development

A student-centered curriculum development process requires the input of students' ideas in the curriculum planning process. As well, it is important to involve teachers from multi-disciplines in the curriculum development process. The following comments by the researcher and the teacher clearly indicate the reality of the context with respect to both parties being absent in developing the unit.

> Researcher: ...Now they're saying we have to do this with the students. For this to be totally student-centered, we should probably do that. How are we going to do that?
>
> Rachel: I don't know how realistic that would be for the first unit because the kids are just going to be coming in and we're going to be teaching them fairly close to the beginning of the year. (June 16, Session #4, lines 114-119)

We wished to develop this unit with students' input. But the question was "How do we do that when students are on summer holidays?" Given that Rachel did not know who her students would be (students would be coming to her middle school from three feeder schools), attaining students' input during the planning and design process proved to be impossible.

Although we did not include Grade Six students' interests directly by inviting them to participate in our planning sessions, we nevertheless made a conscious effort to identify a focus for our unit and select activities that we believed would engage students. Given that Rachel had taught at the Grade Six level for three years, she felt that she had a good idea what students at that level would (and would not) be interested in with respect to the focus of our unit. Rachel also considered her future Grade Six students in terms of their ability to understand particular concepts. For instance, when Rachel and I were

attempting to identify the essential question and sub-questions for our unit (Session #10), Rachel suggested that the wording of the questions be simpler so Grade Six students would understand the terminology.

Her previous experience teaching Middle Years students about "recycling" and my knowledge of solid waste and composting practices were factors in determining what the topic and focus for our unit would be, particularly regarding the development of lesson plans and activities surrounding these particular area. Another factor was her experience with students in an area that she termed a "bioreserve" (a natural tall grass, wetland, and partly forested area) within walking distance of the middle school.

Rachel also took into consideration students' past experiences. Rachel believes students' previous experiences in school and in program areas strongly influence the outcomes of future experiences. In other words, if students like a program or topic area in earlier years, the chances of them liking a similar program in future years is greatly enhanced. She believes that the opposite is also true.

Rachel and I did not always agree on student interests at the Grade Six level. For instance, I expressed that students at the Grade Six levels would be able to understand the concepts of "population" and "exponential growth" as they relate to consumption patterns and waste patterns over time. Rachel did not agree with me but explored the idea nevertheless. Consider the following teacher/researcher discussion:

Rachel: I can't even imagine. If we wanted to talk about population, I guess one way we could do that, to make it more realistic is using rice. Say you know this is the population in nineteen forty if we wanted to get into real detail here.

Researcher: Uh huh.

Rachel: This is the population in two thousand and one, this bag of rice.

Researcher: Uh huh.

Rachel: This is what it is now. They can see that. You know that many...

Researcher: And this amount of rice produces this much garbage so obviously this much rice would produce that much garbage, so they'd see that it's much bigger.

Rachel: And also just the fact that we're a lot more wealthy.

Researcher: I'll put "rice" in brackets and you can.

Rachel: Well, we can do that.

Researcher: You can do that if you want, but that would be a good, like the concept there is exponential growth over time.

Rachel: Yeah that's.

Researcher: But that's a little bit too, but they would understand that it's increasing over time.

Rachel: Yeah

Researcher: And that it doubles every year. And so, what do you think is going to happen in another twenty years? And then this is a prediction that if everything happens the same way, that here it's doubled, then chances are this will double again, so this is what you're going to have, and then you're going to have two bags of garbage. We need two bags of rice - that much more garbage.

Rachel: Out of control.

Researcher: Yeah, it's kind of scary.

Rachel: It is scary. (July 10, Session #12, lines 380-404)

Rachel did not believe that most students at the Grade Six level could understand concepts such as "exponential growth" and "population," but attempted to identify a strategy that would help students to understand these concepts by using bags of rice. After some discussion, however, we decided to exclude those concepts from the EfS unit

given the complex concepts for Middle Years students. I valued Rachel's experience teaching Middle Years students and accepted her views when she suggested that Middle Years students would not understand particular concepts.

Rachel and I both wanted to attain student input in our development process, but given that we were developing our unit during the summer months, we knew that attaining student input would be impossible. Although we recognized that, we nevertheless discussed how we might approach students to attain their input in future unit developments, such as the "energy" unit we were planning to develop after the waste unit was completed.

Researcher: I think we should involve, like right now we're doing the waste one and the students are going to be involved in identifying this essential question.

Rachel: Yeah.

Researcher: Right? But when we do the first unit, you teach the first unit to them for, four or five weeks in before we teach the unit on energy. We could take an hour out of a class or half an hour out of the class and say you know, in five weeks we're going to be doing a unit on energy, so I want you to think about that and the, this are the main issues, okay? So given that, what do you think a question that you would ask would relate to that? And I bet you they come up with exactly what, some of, and then they'll understand and then we can say okay you asked us this.

Rachel: Yeah.

Researcher: You said this was important to answer, this was important, we need to know this to be able to answer this.

Rachel: Okay.

Researcher: Okay, so you know what, Chris and I will go away while we're teaching this unit on waste or consumption. We're going to go and get information resources to help you answer these questions. And then they'll see that what you're doing is driven by them.

Rachel: It's their questions. Yeah.

Researcher: It's their questions. And if they have other questions that we didn't think of, well then we can add them.

Rachel: Yeah.

Researcher: And you can go and get, you know, other stuff.

Rachel: Yeah.

Researcher: Say, oh that's a good point we can go and find. I mean, you can always go and find stuff. (June 27, Session #10, lines 564-586)

During the development of our next unit, Rachel and I planned student input. We recognized that we would have full access to the students and we decided to use that access by brainstorming essential questions and sub-questions with students for the next unit. Our plan was that after hearing students' input, Rachel and I would use their perspectives to develop the next unit, thus giving the students an opportunity to have input into the development process and essentially drive the structure and scope of the unit and the direction that it would take.

Rachel also recognized that although we were aiming for an interdisciplinary approach to curriculum development, the lack of other teacher participation served as a constraint.

> It was primarily disciplinary because I am the main person teaching it. But with an interdisciplinary slant where, we are trying, first of all, all of the teachers know what is going on. And they are attempting to help out in small ways, so sort of a, not to the full extent of parallel integration, but what they are doing at the same time might related to what we are doing in the waste unit and some of the information that is generated in our class will be used in their classroom. For example, numbers from our class will be used in math. Topics that we talk about might be used in language arts. So, I wouldn't say that it is a full interdisciplinary thing, but at least the other teachers are aware and are interested. (September 17, Teacher Interview, lines 112-118)

First, interdisciplinary curriculum planning and design requires teachers representing other disciplines to work together cooperatively to development the unit. In this case, only one teacher (Rachel) participated with me in the development of the unit. We felt that other subject area outcomes were taken into consideration even though other teachers were not present to identify outcomes related to their particular subject-areas. Consider the following excerpt:

> Researcher: So we are going to have to put our different hats on. Okay, we're also going to have to be the L.A. teachers, the science teachers, the math teachers, the so forth, right?
>
> Rachel: Right (June 16, Session #4, lines 1476-1478)

We overcame this obstacle by getting a handle on other subject areas and acquiring a good knowledge of other subject-area student learning outcomes and worked to include those into the unit. We also believed that if other teachers participated in the curriculum implementation process, the deficiency of not including teachers in the curriculum development process might be alleviated.

Although we overcame the obstacle of not attaining students' and other teachers input into our curriculum development process, Rachel and I readily saw the time commitment for curriculum development as a factor to take into consideration in future collaborative efforts.

4.8.1 Teacher Time Commitment for Collaborative Effort

Time was an important factor in our curriculum development process because we needed time for coordination, for learning, for planning, for carrying out activities related to the development process, for reflecting, for evaluation, and for document processing

— all activities in our trailblazing process. Rachel readily saw the amount of time spent on the development of the unit.

> I think the time was probably the worst thing. We spent a long time. I think this is our twentieth session. It doesn't feel like it because it's been spread over three months. You can't spend fifty hours with someone without finding what your boundaries are… If there had been more time, well we ended up having enough time and that worked out ok, but I think that in the future, for other people, it would be difficult to do this, just because…so time is the only factor that has the potential for impeding this. (August 22, Session #19, lines 1079-1084)

To Rachel, curriculum development takes too much time. Not everyone would spend as much time as we did planning a curriculum unit. In the future, for Rachel, the time commitment will be an issue, particularly if other teachers become involved in the development process. Fullan (2001) suggests that teachers have little time and energy outside their teaching duties for innovation development. And if hurried, the innovation may fail.

It is evident that the time commitment involved in curriculum development is substantial (in our case, our curriculum development took forty-five hours over a three month period) and can be a notable constraint if not taken into consideration in planning curriculum development processes. The time to learn how to plan is a time-consuming experience. Had Rachel already had that knowledge, the time taken to develop the unit might have been significantly shorter.

Rachel did not realize initially that she would have to learn how to plan as part of our process. She did not take learning to plan into consideration when she agreed to work with me to develop our unit. I also did not know in advance that we would spend as much time as we did exploring other interdisciplinary curriculum design and planning models and learning how to plan. I assumed that Rachel already knew how to plan a

curriculum unit given that she obviously had to plan for her teaching and student learning for her Outdoor Education Program that she was teaching in her Middle Years School.

Currently, no curriculum (mandated or otherwise) exists for Outdoor and Environmental Education in the province where Rachel teaches. Consequently, Rachel developed curriculum on her own accord. She has mixed feelings about the fact that she did not have access to sustainability-focused curriculum in her teaching.

4.8.2 Non-Existence of Sustainability-Focused Curricula

Rachel voiced her concern about the lack of existing sustainability-focused curricula at the Middle Years level.

> Well it wasn't a constraint because we didn't have to do any of that if we didn't want to, and because outdoor environmental Ed does not have it's own curriculum, at the beginning, when I first became that teacher it, not having a curriculum was huge constraint because curriculum can guide, and the curriculum gives suggestions, curriculum has outcomes that you have to do. (February 1, Teacher Interview, lines 916-920)
>
> That's why I'm lucky 'cause I don't have one so I can do whatever I want. (August 11, Session #16, lines 26)

At the beginning of her teaching career, Rachel felt that not having a curriculum to guide her teaching was difficult for her. However, during several discussions, I learned Rachel's views about not having to teach a prescribed curriculum.

Rachel provides other advantages of being without a prescribed curriculum:

> And not having that guide really was difficult for me, and now it's good cause I don't need that guide, because I am achieving a lot of things that I think that may not be included in a curriculum and it gives me the freedom to do what I would like. And what topics may come up, last spring the big thing in the news was the garbage debate, and that was something that I really wanted to talk about and I didn't have to worry about trying to fit it into a set curriculum. But I think trying to integrate with other teachers, I think that a curriculum is a constraint because they're so concerned about covering their which maybe if I had a curriculum I might understand it but I don't understand why they feel that they have to get

> everything done, there's no that's going to come in and slap their hand and fire them if they don't do it, and Peggy has told us more than a hundred times, don't do everything, if there's something that you can go deeper on and make meaning for the kids, you don't have to do it all. (February 1, Teacher Interview, lines 922-933)

Rachel considers not having a curriculum to follow a disadvantage early in her teaching career because she does not have a guideline to follow, however as she becomes more experienced and confident in her abilities as a teacher, she finds the lack of a curriculum an advantage. She can focus on topics that she believes are important, current (in the media), relevant and makes meaning for students.

Rachel's concern regarding the lack of EfS focused curriculum material is not surprising given that EfS is a relatively new focus for the formal education system. The curricular focus in Canada is the "infusion" method whereby sustainability concepts are incorporated, infused, or integrated into existing disciplinary curricula (science, social studies, etc). Consequently, no formal "curriculum " for EfS has been developed. The infusion has occurred predominantly within the science discipline in Canada under the "Science, Technology, Society and the Environment" (STSE) student learning outcomes.

The lack of sustainability-focused curricula in Canada was an important constraint for Rachel at the beginning of her teaching career. However, as she pointed out, not having a curriculum to guide her teaching activities later in her career was seen as positive factor giving her "freedom to do what she liked."

In addition to not having access to an Outdoor and Environmental Education curriculum to guide her teaching, Rachel was dealing with prior negative collaborative experiences with other teachers and other researchers. Rachel's previous experiences with collaborative work served as a potential constraint.

4.8.3 Rachel's Previous Experience with Collaborative Work

Rachel discussed her experience with other collaborative work:

So, I didn't realize that we had to plan to plan, that was the first thing, I was really surprised when we came here and you had all these resources on how to do this. I thought we were just going to sit down and do it and I really had no idea. I thought we would just go on our previous knowledge instead of coming up with these new ideas and that was really interesting for me to actually watch the videos and get these new ideas. Because I've been to seminars on integration and actually it was funny because my first year at Georgetown Middle School, I was on the Grade Seven team and we really wanted to do some integration and I took the lead for the last few months and I set up lunch time meetings and I brought treats, the leaders would bring in treats for our team meetings and I invited everyone to come and it was really just my friend and I eating all my treats, but I brought really good treats...trying to get everyone out because I came from Early Years where everything was integrated, I was the Early Years pilot program. You're the only teacher so it's not like you had to finagle with anyone else and you can integrate everything. And I came from a multi-age class, Grade One, Two and Three where everything related to everything; nothing was done isolated on its own. We did our theme for the year was water, so everything we did some how related to water. We studied the Titanic and we bought fish for our fish tank and all the math was, you know we only have twenty dollars, what kind of fish do we want to buy? It was very, very related. So I thought, jeez, we should be doing this in our school, not realizing the teachers were not nearly as motivated as I was. Even though I was completely overwhelmed the first year, by the end I was getting the hang of it, but then I was moved to the Grade Six team and we had our own separate integration thing. So, then when we started watching these videos and I thought, well, those are good ideas and I can see some potential. From the beginning, I was very concerned with thinking who we're going to work with because, just looking at my Grade Six team, they're very motivated in their own classroom, but if you look at the Grade Six team, none of them really do very much extra-curricular activities for the school. And I got my hands on everything, I'm trying to do everything, so I was very concerned about us working with them just for the fact that they're not going to be as motivated. And I'm just as guilty as them, we go to an in-service and we sit in the back and we read magazines, we talk, we don't pay attention because I don't find it very interesting, one in particular though. Throughout this year where our consultant is really trying to push this integration and having me come and do a hands-on thing for all the Grade Six teachers and trying to get us this information and giving us literacy grant and our literacy grant was suppose to give us release time so we could plan this integrated frog unit. So I was thinking, well, we're trying and once we do it we can have a model that can adapt to Grade Seven. Cause if I'm really pushing it in Grade Six, I also work with the Grade Sevens so I can push it with the Grade Sevens if the Grade Sixes are doing it and the Grade

> Sevens are doing it, well then the Grade Eight's will have to do it. (August 22, Session #19, lines 960-1006)

Rachel has mixed experiences collaborating with others on curriculum-related activities. Rachel feels that other teachers she worked with were not as motivated as she was. She even felt that she had to "bribe" the teachers to become motivated by bringing treats to meetings so that they would attend. Rachel raises an important point with respect to integration. In Early Years, she is able to select themes and study each theme from a multi-disciplinary perspective. However, when she attempts to integrate with other teachers on a Frog Unit, for example, the process is much more difficult. Rachel suggests that just because one teacher may be motivated to integrate, that does not mean other teachers will be. She suggests that incentives such as grants to purchase teacher release time help to motivate teachers to integrate.

Another important point raised by Rachel has to do with professional development for teachers. She presents the notion that professional development opportunities that are not found to be interesting to in-service teachers may not be the best use of a teacher's time because teachers "tune out" the learning opportunity. Clearly, her point can be applied to student learning as well. If students do not find the topic they are studying interesting, they might tune out to learning opportunities.

Rachel has had a negative experience working with a researcher in the past. Consider Rachel's comment:

> Like I told you previously, I worked with another woman on her Masters. And it was—I learned a lot but I was also a little frustrated because there was a bit of a personality conflict collaborating with another researcher. And I didn't feel like she respected me enough and my knowledge and sort of my handle on the situation. And so, I was a little bit concerned because I didn't know what this would be like and if we had to work together it might be difficult if we didn't get along. And I

> thought you seem very well educated, you seem like a nice person. (August 22, Session #10, lines 943-948)

Rachel makes an important point with respect to collaboration. Rachel expects researchers that she collaborates with to respect her as a person, for her knowledge contributions, and for her "take" on the learning environment. Anything less is not effective collaboration, according to Rachel. Fortunately, Rachel overcame her bias towards me as a researcher because she saw me as a "well-educated, nice person."

Fullan (1982) argues that if a school or school division has had previous successes implementing innovations, programs, curricula, etc., chances are, they will tend to be successful. Unfortunately, the opposite is also true, "the more that previous attempts at change have been painful and unrewarding, the more skeptical people will be about the next change that comes along" (p.64). Given that argument, Rachel has every reason to be skeptical about collaborating with me to development the unit. She does not want to experience another "bad" researcher/collaborative teacher experience. However, after some deliberation and recognition that I am not the same person as the past researcher, she accepts the opportunity to work together with me to develop a unit designed for her classroom. She makes this transition because I respect her and her knowledge contributions considerably. Through our work together, we were able to create a curriculum unit that neither one of us could have created separately. We did so by being respectful and considerate to one another and by being motivated, engaged and inspired throughout our curriculum development process.

Rachel also experienced respect and positive support in my home as we worked together. I treated her with respect and so did my family. My husband and children were very supportive of Rachel and the work that she was doing with me. My children greeted

Rachel whenever she came to my house. They acknowledged and respected her as a teacher of a middle school. My children are both in elementary school and think highly of middle school teachers. My children also respected that we were doing very important work and consequently made few disruptions during our many sessions. My husband made Rachel feel at home by bringing us food as we worked, making conversation with her before and after our meetings, by talking to her about her wedding plans and other points of interest and by asking her opinion on current news issues. My husband often acknowledged how long and hard we were working and complimented us on our drive and considerable professional will.

Unfortunately, Rachel did not get the same level of acknowledgement and support at her home as she did in my home.

4.8.4 Acknowledgment and Support at Home

Rachel voiced her concerns about her lack of family support during our curriculum development process.

> I had a lot of support from Peggy to do this, but I mean it was all on my own time, so there really wasn't any other support other than Tony telling me to slow down and that was a constraint, my family life was saying, why are you doing this, why are you adding more to your plate, you're just going to kill yourself. (February 1, Teacher Interview, lines 963-966)

Rachel felt that her partner did not show support for our project and her involvement in it. He questioned her involvement in the project and questioned why she was taking on more than he thought she should. Her partner even suggested that Rachel might expire as a result of working with me. Although he probably exaggerated, his comments demonstrated to her that he was not supportive of our work together. The

following statement made by Rachel sheds more light on Rachel's perception of her acknowledgment and support at home.

> The thing is, I don't feel that I have the support that you do at home and that really bothers me because Tony, he says he remembers, but I think he forgets what it's like to work seven days a week. And he says, "Well Don't", but I have to. I just feel that I have to work at the pool because I have to pay for my car. Otherwise if I don't work at the pool, the money comes out of our joint money then we'll have less to pay for the wedding. So, the whole thing that bothers me — I'll come home after teaching all day, being with you after school and going to university and I'll come home at ten at night. I leave my house at seven thirty in the morning. And he'll be like — you haven't done dishes in like two days. And I'll be, like, "could you acknowledge what I've done today and the fact that I got an A+ in my university class on top of working with you, going to school and working seven days a week, three of which were at the pool. I'm frustrated still that he doesn't acknowledge that. And he says, "I know, I remember working seven days a week. I got my career and I'm happy where I am." Well, I got my career, too. But, what I think we have to do, we have to agree not to say — because he cleans and I work extra, so if I stop complaining about working and he stops complaining about cleaning. And I admit, I don't clean very much around the house and I work a lot more hours than he does and he does a good job at cleaning and he doesn't mind cleaning. Quit being a hero and saying you're cleaning and not acknowledge the other things I'm doing, too. And if I complain about being tired then he says, "Why are you doing it?" So, that was the biggest challenge was the time and not necessarily being here from five to seven, but not having that good support system at home. And if I had kids, I'd never see my kids and I'd be in big trouble. (August 22, Session #19, lines 1122-1147)

Rachel feels that her partner does not acknowledge her work and her accomplishments. The lack of support she faces at home is a constraint to her personally and professionally. Rachel feels bothered by her partner's lack of support towards the project and feels frustrated by his lack of consideration for her daily accomplishments. Rachel feels that her partner should acknowledge her teaching, her work on the project, her managing to get a grade of A+ in her University course and her swimming instruction rather than focusing on the fact that dishes have not been done for two days. All the former activities are important to Rachel - doing dishes is not important to her. Rachel also alludes to the idea that her partner might be frustrated with her being away from

home from seven in the morning until ten o'clock at night and his having to hold down the fort at home. Her statement also alludes to the idea that her partner might be self-centered in terms of wanting her to acknowledge the "cleaning" he does at home without acknowledging what she does outside the home. Rachel's frustration comes through in the above excerpt "loud and clear", but feels that she has few choices for changing her situation other than her boyfriend agreeing to stop "complaining" about cleaning and her agreeing to stop complaining about being tired and working outside the home.

Literature on educational changes does not indicate that family support is important to curriculum development processes. However, educational change literature does suggest that it is important for individuals to be recognized for their commitment and time invested in making a project work. Change literature further suggests that incentives for teachers are essential (Corbett, et al., 1984) and that this can include additional released time, adjustment of classroom responsibilities or positive evaluations. Firestone and Corbett (1988) suggest that the most crucial incentive to the change process is social support and recognition" (p. 331) by other teachers or the school principal. In line with that thinking, I argue that social support and recognition by family members is also of considerable importance (as was the case with Rachel). Ideally, Rachel's partner could have recognized that the time she is investing to the development of a unit would benefit her and her students. He could have made adjustments in her family responsibilities (i.e., not having to do the dishes at 10:00 at night) and could have acknowledged her dedication to the project and other activities she was working on. Had he done so, Rachel would not have been as frustrated with the amount of time she spent with me on the project. Given that time spent away from her home was an issue she constantly was

dealing with, it is clear to me that in Rachel's situation; her lack of family support and acknowledgement of her activities is a cause of considerable frustration for Rachel. Furthermore, in my own situation, had I not had considerable family support and acknowledgement of our work, the development process would not have been as successful as it was. In my case, my husband encouraged me to offer our home as the designated work site. He made us dinner when Rachel and I met in the evenings. He offered to look after our children during our work time by either playing with them outside so as not to disturb us or by taking them out of the home altogether to movies, to grandparents, etc. During our sessions, he often brought us bowls of strawberries, juice and other refreshments. He demonstrated his support in all those ways and more. Consider Rachel's statement:

> What made it easier to come here was probably your family support. When I saw you have two small children. I think our relationship is very unique. I can't imagine very many teachers could hook up in this sort of manner. (August 22, Session #19, lines 1047-1049)

Rachel felt that she had my family's support. Unfortunately for Rachel, she did not experience the acknowledgment and strong family support that I had in our work together, nor for the other activities she was involved in during our curriculum development process.

4.8.4 Other Responsibilities/Activities

During our sessions, Rachel often discussed other activities that she was involved in during the development process. The excerpt below sheds light on the many activities Rachel was involved in during our curriculum development process. Consider the following statement:

> When we first started working on this, I was going to university two nights a week, I was playing water polo one night a week, I was. Well I was working at the pool on the weekends and a couple evenings depending and I was doing something else and then throughout the summer when I was off work, I was still working at the pool, I was going on trips, I had to fit that in and planning our wedding and in the fall I was going to university one night a week. I'm also a member of our teacher's association of executives, so I go to meetings for that and counseling meetings. (February 1, Teacher Interview, lines 495-500)

During our curriculum development sessions, Rachel was teaching full time at her school (during the month of June), teaching swimming to children at a local pool, completing a university evening course, involved in committee work at her school, coaching duties and had home-related duties. She was also planning her wedding during the period in which the curriculum unit was developed and was planning summer vacations. Although we faced many obstacles during our journey, Rachel had enough supports to successfully lead us to our desired destination.

Of all the constraints that Rachel faced during our collaborative process, the time factor was the most prevalent, particularly in light of the other responsibilities and activities she was involved with during that time period. Given Rachel's schedule, in retrospect it was not fair to ask her to spend so much time away from her family to carry out the work associated with developing innovation. Most teachers would likely be in similar situations with respect to time constraints. Consequently, it is suggested that teachers should be provided with release time to carry out innovative practices. Researchers involved with innovative projects such as these should consider funding teachers (buying teacher time) through grant funding. However, for this to happen, grant funds must be made available to researchers for innovative projects and funded in a substantial way in order for collaborative projects to effectively take place.

4.9 Rachel Highlights the Support Systems

Rachel contemplated a number of supports that led us to our destination. The most important support was our working climate, followed by our access to learning resources/information; her administrator's support; her school's orientation, and finally, her pre-service training.

4.9.1 Our Working Climate

I was curious to find out more about what factors aided our curriculum development so I asked Rachel the following question, "What were the factors that aided the development of the curriculum unit?" To this question, Rachel responded:

> I think that the fact that we worked so well together, the fact that you were so completely organized and did have everything laid out in the beginning, even though it scared me, it turned out to be a really good thing. And um, I mean that I don't think that I am disorganized or unorganized but I am not nearly as organized as you. So it was really good to have someone that I am working with that actually had more control of the situation then me. Because usually I am the one in control. And I like being in control but I just can't stand other people not taking control. So, it was really good that you had everything set out, you collected a lot of resources and I didn't feel like I was doing all the work. (September 17, Teacher Interview, lines 305-311)
>
> I could be at the lake already today, but I want to do this, and I am glad that I am motivated to do this, because sometimes it's hard to motivate me. When I am motivated, then I really put everything into it. And I think that the one real benefit is the fact that we get along. If we didn't get along, then that would be a real problem because it would decrease the motivation and I don't think that I could be as honest because then I'd get nasty. I feel that I can tell you, you know, that word. (June 21, Teacher Interview, lines 210-215)
>
> You were using words and I said that's not realistic you can't put that on. No, I don't like that one either. And then, the same thing with you. I think that you have been pretty honest with me when I said things, so I think that a huge barrier to other teachers doing this would be just the relationship because you are spending so much time planning. If you if you can't be honest and you can't get along, that's a big problem. (June 31, Teacher Interview, Line 219-222)

Rachel considers the positive climate in which we worked supportive of the development of our unit. In support of this argument she gives several examples: (1) compatibility (we worked well together and "got along"), (2) organization (I was organized and in control), (3) preparation (I was prepared and was an active participant), (4) motivation (she was motivated), (5) honesty (we were honest with each other), and (6) openness to change (we were flexible to changes/recommendations).

Rachel also considers the manner in which we collaborated as an important factor. Consider her comments during our interview sessions:

> I felt extremely pleased with how much because there were some times that, that I didn't agree with what you were saying, and I explained it, and you were very quick to say, ya, I understand, as opposed to just dismissing my opinions. You were very; you were very respectful in listening. (September 17, Teacher Interview, lines 142-144)

Rachel feels that I listened to her and respected her views even though she was a beginning teacher. Rachel also considered how flexible we both were in terms of scheduling, each other's ideas and decisions made throughout the process. Rachel highlights this point in the following excerpt:

> It's hard to tell for me personally, because we were so flexible on times. I went away, then I came back. Then we worked for a couple of days, then we went for two weeks without anything, then three days straight, and then... (September 17, Teacher Interview, lines 382-384)
>
> From you, I never felt and pressure that I had to miss something important or I was really tired. I felt that if I really wanted to call and say I wasn't coming, you'd say well, I'm disappointed but have a nice evening anyway. (August 22, Session #19, lines 1048-1045)
>
> I felt, because it was your house, and I wasn't specially meeting you. If I was five minutes late or you were five minutes late, it wasn't a big deal… (September 17, Teacher Interview, lines 416-417)

Rachel appreciated the flexibility in our curriculum development process. She also considered our decision-making process as an important factor during our curriculum development process. Consider the following statements,

> Um, decision-making, I would say, the planning part I would say was more you. The organization and then when it came to ideas, I think it was pretty even. I think we both came to the table with our own information and I think that we both were able to get in what we wanted to get in to it. (September 17, Teacher Interview, lines 138-140)
>
> I would say that this unit is definitely a joint collaboration. (September 17, Teacher Interview, lines 144-145)
>
> I think it was pretty much fifty-fifty input, output, sharing, discussing. I don't even know if you had more resources that I did or if we — I think that it was pretty much fifty fifty except in the end you typed up more stuff than I did. (February 1, Teacher Interview, lines 738-740)

Rachel felt that she had an equal part in all decisions respecting the unit and its development, although she believed that regarding the planning part (planning to plan), we acknowledged that more of the decisions were made by me than by her. She felt that we equally contributed ideas, resources and information. She also feels that we both attained the outcomes that we expected to attain.

It is apparent that the positive working climate was a significant factor to the success of this project as Rachel repeatedly pointed out. The fact that we worked very well together, liked each other, trusted each other, were flexible, honest, enthusiastic, committed and motivated, were risk takers, solved issues constructively and were willing to put the time into the process are all important factors to the success of the curriculum development process.

Rachel also believes that she is became a better planner and organizer as a result of our collaboration. Although we spent a considerable amount of time focusing on meta

planning, Rachel viewed that experience, as a positive one that she felt would help her in future planning activities. Teachers involved in collaboration with others can view the experience as a professional development opportunity because collaborators will ultimately learn from each other. Sometimes, what is learned is unexpected learning, as Rachel expresses. When Rachel and I began our work, she did not set out to learn how to become a better planner and to become a more organized individual. However, these are the skills our collaboration developed.

In addition to the positive working climate, there were some unexpected outcomes that emerged from our collaborative work together. Besides learning from each other, Rachel appears to have changed her bias against working with a researcher in the future. She would "do it again" if given the opportunity. Consider her statement:

> I would do it again. I thought that it was really nice to have that finished piece of work and I really glad that we were able to work so well together. I think, I can't imagine anything different. I got good meals. (September 17, Teacher Interview, lines 408-410)

Rachel and I became good friends as a result of our collaborative process and agreed to spend more time together on other activities after the completion of our unit development. We collaborated on in-services for teachers related to the development of our unit and went to education-related conference together.

Rachel and I also did things together because we liked each other's company. We decided to go to an Environmental Children's Conference together near the end of the school year where we spent more time together. We also made plans while we were at the Conference to share the curriculum that we developed during our collaborative process with other teachers. Consider the following comment:

> I think that on the whole, it went really, really well... I am hoping that we are able to take the stuff that we have learned and share it with other people. (September 17, Teacher Interview, lines 403-405)

Rachel and I learned a great deal about the curriculum development process and agreed to share our experiences with other teachers. Our first sharing session was with the teachers' in her school. Our second was a teacher's workshop. The third was a session with provincial government curriculum developers and other educators.

During one of our interview sessions, Rachel said that she would not "change anything" about our experience. In retrospect, given the number of expected and unexpected outcomes, neither would I - because I made a good friend. Another unexpected outcome of our work together was that I made a friend with Rachel's principal who supported us every step of our journey together.

4.9.2 Her Administrator's Support

Rachel considered her principal's (Peggy) support as a positive factor in our curriculum development process. Consider the following comments:

> ... And they [Rachel's administration] wanted to know information on how we were doing and what we were doing. (February 1, Teacher Interview, lines 343-348)

Rachel felt that her administrator (in this case, her principal) took a strong interest in her work on the development of the new curriculum unit. Her principal's inquiries into the process demonstrated her moral support for Rachel's work. Rachel's principal also served as an advisor during our curriculum development process. Consider the following statement:

> ...I'm not sure how that would work. We could, I'll ask Peggy [principal of her school]. (August 20, Session #18, lines 118-119)

Rachel often sought the advice of her principal during the development of our curriculum unit. Having access to her principal during summer vacation was a huge support to Rachel, particularly when questions arose that she thought only her principal could answer. Sometimes, other people could have helped us, but Rachel would insist that her principal would know the answer. For example, during one of our sessions, Rachel and I had a humorous discussion about compost and whether dog waste could be composted. We attempted to build the concept into our curriculum, but were stuck on a word for dog waste. After making several humorous attempts to come up with terminology that would be appropriate for a Grade Six classroom, Rachel volunteered to ask her principal for the correct terminology because she was absolutely positive that her principal would know exactly what terminology would be most appropriate to use for Middle Years students, given that "she knows everything."

Rachel's principal was also a source of positive reinforcement. Consider the following teacher/researcher conversation:

> I showed her our wonderful thing, [our curriculum unit]. She was very, very impressed. She was amazed actually and she told us that we should sell it to Manitoba Education and Training, and I told her how we're going to teach it in university together, and she had a couple suggestions. (August 14, Session #17, lines 166-170)

Rachel felt that her principal was very impressed with the quality of our completed curriculum unit. Rachel was beaming with pride when she told me that her principal was so impressed with the unit that she suggested that we might sell the curriculum to the provincial government's education department. Rachel felt that her principal was also supportive of us teaching teachers about our unit and had suggestions to pass on to me.

The excerpt above clearly demonstrates the level of interest, encouragement and support Rachel's principal exhibited throughout our session.

Rachel's principal's name came up so many times during our sessions that sometimes I felt that her principal was a collaborator on the project even though she was not working side by side with us. Rachel's principal was accessible to us when we needed her. Consider the following teacher/researcher conversation:

> We had a really good meeting, she was completely impressed by this, she was very excited about the whole business thing. (August 14, Session #17, lines 430-431)

Throughout our curriculum development process, Rachel repeatedly shared progress reports with her principal and shared some of the ideas we had for student learning. Rachel always shared what her principal said about our work together and how her principal meeting went with me. Rachel was proud of our accomplishments and more importantly; she felt that her principal was impressed with her work and her ideas as well. Consider another teacher/research conversation:

Rachel: It's really good and Peggy was just amazed and I was going look at these curriculum connections, she's going, "Wow." I go, "There's more on the other page. She's going, "Oh my God."

Researcher: Like it's just two student learning objectives, or outcomes, objectives that we're actually going to try to get them to do, we've got half the curriculum in Manitoba in there.

Rachel: So she was just amazed.

Researcher: Good.

Rachel: And she liked the rubric, and actually what she suggested was that we send, that we give a copy of this to the parents (August 14, Session #17, lines 464-483)

Rachel was proud of our accomplishments. When she told me her principal's reaction to the curriculum unit, Rachel was beaming. She couldn't wait to tell me that her principal liked what we had developed. She shared with me the parts of the unit that her principal liked. For example, she cited the rubric and the identification of curriculum connections. The principal seems to have led Rachel to believe that the unit was so good that some components of the unit (the rubric) should be shared with the parents of the students.

The importance of a principal's support to the initiation and/or implementation of a new innovation in a school cannot be understated. Strong supportive leadership is crucial for the adoption/development of an innovation and implementation (Corbett, et al., 1984; Huberman & Miles, 1984). Educational change studies show that a principal's support is critical to the success of an innovation (Fullan, 1991/2001) and studies also show that the more actively supportive the principal is, the more successful the project and the more goals are achieved.

A principal's support can include obtaining resources such as funds, time for teachers, adequate facilities, etc. None of these supports were required of the principal, as we had enough resources, we had time given that we were working on the development of the unit outside of school hours and we had adequate facilities. However, more important than all these supports put together was the support, encouragement, acknowledgement and moral support that Rachel's principal gave to her (and to me) during the development of the unit. It was clear to me that Rachel had considerable respect for her principal and saw her as a "superwoman", her personal "very intelligent" advisor. Through Rachel's comments about how she thinks about her

principal, I also developed a good relationship with her principal and also viewed her as an intelligent, thoughtful, extremely helpful and supportive leader who motivated, engaged and inspired the people whom she led, particularly Rachel. During our work together, I considered myself very lucky to have found a research school with a principal who was such a positive role model and stated so at every possible opportunity. I was indeed lucky, but so is Rachel to have such a positive educational role model in her life.

Rachel's principal made me feel welcome in her school and demonstrated that in a number of ways. She invited me to all staff meetings and came into the office that she assigned for me during my stay at the school to personally invite me. She repeatedly asked me how things were going and if I needed any support. She repeatedly commented that she and her staff liked what I was doing for their school. She invited me to extra-curricular activities such as evening get-togethers, lunch festivities and other events. She also made a point of ensuring that I would be at her school's end-of-year award assembly where she commented on the collaborative work with staff in her school and designated me as an honorary staff member on behalf of her and her staff. I was deeply moved by her expression of support that I couldn't help but show my appreciation by giving her a hug in front of the entire school community and thanked her and her staff for making our collaborative work as successful as it was. Choosing Rachel's school as my research study school was a very good choice on my part, not only because of the support that I received from the staff, principal and students, but because the school environment was such that it supported the curriculum that was being developed.

4.9.3 Rachel's School's Climate

Rachel also considers her school's climate as a positive factor in our development process. Consider the following excerpt:

> Our administration has taken a leadership role and said we think this is what we think is important. We are not going to follow the other schools that have cut Outdoor Ed. (September 17, Teacher Interview, lines 396-399)

One of Rachel's school's priority areas focuses on the environment. Rachel told me that her school is one of very few in Manitoba that offers an Outdoor and Environmental Education Program at the Middle Years level. Rachel gives her school a lot of credit for taking a leadership role towards including outdoor education into the Middle Years program.

I was curious how the environmental focus of her school came to be, so I asked Rachel during one our sessions (Session #17). She told me that in 1998, when the school became a middle school, the Outdoor Education program was established. Prior to that, the school was a junior high school with no environmental program. The Outdoor Education Program consists of students going outside and playing games during two periods per school cycle. The program had no academic linkages. One year into the program, Rachel's principal attended a meeting with a representative from a local environmental not-for-profit organization that was seeking partnerships with schools interested in environmental issues. Her principal approached the representative after the meeting and consequently formed a partnership to plant trees in a tallgrass, wetland and partly forested area in close proximity to the school (now called "The Bio-reserve"). Rachel, formerly a science teacher, was asked to teach the Outdoor Education Program at the middle school one year after its establishment. One year into the program the time

teaching the program was increased to four periods per cycle and an academic component was added to the program. The school's focus began to change after the academic component was added to the program. Rachel taught her program to students in Grades Six and Seven and attempted to integrate as much as possible with other teachers teaching at that level. Themes then began to emerge with an environmental perspective. The program name recently changed to "Outdoor and Environmental Education" to reflect the themes that emerged over time.

Educational change literature suggests that a school's orientation or climate can also contribute to the initiation and implementation of an innovation, whether it is locally developed or externally acquired (Clark, Loto & Astuto, 1984; Cohen, 1987; Fullan & Pomfret, 1977). Climate can refer to the communication of interest and excitement, the celebration of effort (recognition of efforts, growth and accomplishment). In this case, the school's environment is supportive of the curriculum unit that Rachel and I developed. The school has an environmental focus that all teachers know about.

Teachers are encouraged to integrate environmental concepts into their teaching and student learning. Student are encouraged to practice sustainable and responsible acts such as reducing, reusing and recycling waste and conserving energy. The school also has facilities available that would support that learning such as recycle bins located in areas that were visible to all, signs on the walls that encourage students and staff to practice responsible behaviour with respect to waste management. Furthermore, the school has an environmental club for students and teachers in which students work during out of class time on the day-to-day activities associated with recycling glass, cans and plastics. Most important, the "environmental" focus of the school is deemed as important

as other subject-area foci (mathematics, science, social studies, language arts, etc.). The importance of the school's focus is demonstrated throughout the year in the morning and end of day announcements and at the end of year assembly where all subject-area teachers and students are honored for their past year's successes. The teachers and students that are involved in environment-related activities throughout the year are acknowledged and are given special certificates as with other subjects. For example, the students and teachers who participate in the environmental club are recognized. The students and teachers that are involved in developing an environmentally focused mural are recognized. The students and teachers involved in my research project are recognized. The students that attended an International Children's Conference on the Environment are acknowledged and are provided with special certificates. The teachers and students who worked together to build a school greenhouse are acknowledged. The students and teachers that developed a production focusing on the environment are recognized. It is apparent that the school environment strongly supports the implementation of sustainability-focused curricula.

I was curious to know what other supports, beside our positive climate and that of Rachel's school's and her administrator's support led to the successful development of our unit. Rachel commented that her pre-service preparation was also a big factor supporting the effective development of our unit.

4.9.4 Rachel's Pre-Service Education

Rachel considers her teacher preparation as an important factor. Consider the following statement:

> Yes. My first year of education no, my second year was an early years, and it's all about integration, doing units, teaching a grade one class and themes and everything fits into it. And I taught in a grade one, two, three class for my student teaching. And the theme for the year was "water" and everything somehow related to water.... And it's completely integrated. Like we were going to set up an aquarium. Well, what do we have to do? They did research a little bit on the types of fish and then they did the math unit on - they had twenty bucks to spend, how are they going to spend it? And so when it comes to Outdoor Ed and doing integration, I feel that my teacher training in early years totally relates. (February 1, Teacher Interview, lines 822-826)

Rachel feels that her teacher education in the Early Years' adequately prepared her for our interdisciplinary-based collaborative work, particularly her Early Years training focusing on the development of integrated theme-based units. Rachel feels that her Early Years teacher education program taught her how to develop and implement units taking into consideration all other disciplines. Rachel feels that her previously interdisciplinary education has provided her with the tools that she required to develop and implement the interdisciplinary unit in her Outdoor and Environmental Education classroom.

Rachel had previous experience developing units where "everything fit into it." She understood that an interdisciplinary unit begins with a central theme, problem or issue. She understood that issues should be understood from the perspective of all subjects (mathematics, language arts, etc). Had it not been for Rachel's pre-teaching experiences that focused on integrated learning, she may have not been in a position to successfully develop an interdisciplinary focused unit, as was the case in this study.

In summary, Rachel felt that she had the supports needed to achieve our goal. She felt that the strongest factors supporting our planning process had to do with collaboration in terms of teamwork, communication, cooperation, trust and respect for each other's perspectives (including worldviews, knowledge and skills), flexibility and

decision-making. Our ability to "get along well" was seen as the biggest factor in our curriculum development process.

Rachel overcame constraints/issues related to her students and other teachers not being involved in our curriculum development process. She overcame the time commitments associated with the development of the unit and the issue with respect to not having access to EfS-focused curriculum. She also overcame the issue of her previous experience with collaborative work with teachers and a researcher, her lack of family support and the number of other initiatives she was involved with during our process. Although these constraints were present, they did not stop Rachel from achieving her goal. Rachel suggested that our positive working climate and that of her school's, her principal's support and her pre-service Early Years education were among the factors that helped us to develop the unit successfully.

4.10 Chapter Summary

This chapter illuminates how Rachel collaboratively worked with me over several months to plan and design an interdisciplinary ecologically focused EfS curriculum unit. I delineate Rachel's disposition, thoughts and views on the environment and EfS. I then illuminate her eco-centric worldviews and her thoughts about the human/environmental connection/disconnection. I then highlight what Rachel means by EfS for children. She considers that appropriate knowledge; skills, values and attitudes will lead to sensible acts and acknowledges that not all students will become passionate about sustainability issues. Through example and instruction, she raises their awareness to make informed choices. My intervention about the idea that ecological principles can and should serve as guidelines towards understanding how we should be living responsibly and sustainably

with respect to waste is internalized by Rachel. I then focus on Rachel's practical perspectives, which include "hands-on," "student-centered," "experiential," and student empowered learning for EfS. I outline some important issues that Rachel raised regarding our trailblazing experience. Constraints include missing partners in interdisciplinary curriculum development, time commitment for collaborative effort, previous experience with collaborative work, acknowledgment and support at home, teacher responsibilities and non-existence of EfS curriculum. Support systems that helped in the development of the unit are explored. Supports include our positive working climate, her principal's support; her school's climate and supportive environment, and her Early Years pre-service training. The learning, the sharing, the friendships will be cherished always.

CHAPTER FIVE

PHENOMENOGRAPHIC CASE STUDIES OF HUMAN/NATURE RELATIONS

5.0 Introduction

This chapter, at the outset, discusses the phenomenographic research tradition that makes sense of Middle Years students' views of human/nature relations. A phenomenography of how Middle Years students view their relationship with the environment is described using researcher/student pre-instructional interview data gathered from all sixteen participating students.

Two case studies then elaborate the phenomenography. In the case studies, I highlight how the students' views develop with respect to their understanding of the relationship with the environment and what it means to live responsibly on the planet with respect to waste minimization. Evidence supporting students' views is taken from prior- and post-instructional interview excerpts, classroom observation transcripts, photographs and photo-essays, journal entries, drawings and essays. Details of the foregoing data collection methods and procedures are presented in Chapter 3.

5.1 Phenomenography

Phenomenography is a research tradition that describes how a certain phenomenon appears to individuals. It was founded and developed by Marton and his research associates (Marton, 1981). The purpose of phenomenography is to describe qualitatively different ways of experiencing various phenomena. It is concerned with the second-order

perspective, which looks at how individuals see the world around them. The outcome of the research is a description of the variation in ways of experiencing a phenomenon, which characterizes two faces (Marton & Fai, 1999). The first face refers to the study of variation between different ways of experiencing the same phenomenon, in which categories of descriptions and outcome space are derived to describe how people experience the reality. "What are the different ways of experiencing the phenomenon?" is the primary question asked. It has a methodological orientation. The second face addresses the question: "How do different ways of experiencing something evolve?" The dimensions of variation, as experienced by the "experiencer" is scrutinized within the framework of the anatomy of the awareness (Marton & Booth, 1997). The second face has an ontological status, a particular way of experiencing something, and emphasizes the theoretical concerns.

Any phenomenon can be experienced in a finite number of qualitatively different ways. When depicting the variations in ways people experience a phenomenon, it is important to understand what it means to experience a phenomenon in a particular way. In examining the anatomy of awareness of experiencing something, Marton and Booth (1997) focus on the frameworks of awareness, the <u>what</u> aspect and the <u>how</u> aspect. The what or the referential aspect refers to the object (e.g., human/nature relationship) itself, and the how or the structural aspect refers to the act of meaning (variations of meaning given to human/nature relation). Awareness or knowing something as something is grounded in the dynamic relationship between the what and the how (referential and the structural). When the structural aspect is considered, it is important to identify the delimitations of each of the qualitatively differing meanings and how it relates to the

whole. To consider something as something, we need to assign it a particular meaning. Hence, the structure and the meaning are dialectically intertwined, providing a theoretical framework for understanding a way of experiencing a phenomenon. In the case of human/nature relations, in this study, the eco-centric view is recognized as the assigned meaning, as discussed in detail in Chapter 2. While in this chapter, I outline the phenomenography and the case studies that characterize phenomena arising from the variations of meanings. In Chapter 7, I further interpret the methodological and theoretical frameworks of phenomenography, with particular reference to this thesis.

5.2 A Phenomenography of Middle Years Students' of Human/Nature Relations

The Middle Years students' diverse views are identified in Table 5.1. Also identified are the number of views each student holds and the number of students that hold a particular view. Students' views ranged from one to six.

5.2.1 Individual and Collective Eco-Action Towards Living Sustainably on the Planet

Fifty percent of the students hold an *Individual Eco-Action View*. This means an individual's environmental relationship is based on their individual sustainable practices/actions towards preserving, conserving, enhancing and rehabilitating the environment. June's expression best captures this view:

> I have a good relationship. I don't litter. I don't throw away things that I'm not supposed to throw away. I recycle.

Table 5.1 Students' Human/Nature Conceptions

Category	1 June	2 John	3 Rita	4 Krista	5 Lorie	6 May	7 Dave	8 Marie	9 Fred	10 Dan	11 Ruth	12 Sarah	13 Lena	14 Gil	15 Mia	16 Susan	Total	%
Eco-action	x					x			x	x	x	x		x	x		8	50%
Life-based Intrinsic Value	x		x		x					x			x		x		6	38%
Experiential Appreciation		x				x		x			x	x			x		5	31%
Self-Centered				x					x	x	x						4	25%
Non-Reciprocal View		x					x					x		x			4	25%
Basic Needs	x	x				x	x										3	19%
Safekeeping		x									x			x			3	19%
Biocentric View		x											x			x	2	12.5%
Reciprocal View											x	x					2	12.5%
Personal		x												x			2	13%
Technical											x						1	6%

June's relationship to the environment is based on her actions towards keeping the environment clean and attempting to not generate unnecessary waste. She feels that not littering or throwing away waste unnecessarily and recycling as having a good relationship with the environment.

5.2.1.1 Collective Eco-Action Towards Living Sustainably On The Planet

Thirteen percent of the students who hold an *Individual Eco-Action View* also hold a *Collective Eco-Action View*. This means an individual's environmental relationship is based on other people's sustainable practices/actions towards preserving, conserving, enhancing and rehabilitating the environment. Anna's expression best captures this view:

> [People should] not litter, carpool to work or take a bus, or bike or walk. Don't pollute!

Anna's relationship to the environment is based on other people's actions towards keeping the environment clean and attempting to not generate unnecessary waste. She feels that people who do not litter or pollute are seen as having a good relationship with the environment; as are people who demonstrate sustainable transportation behaviour to get to and from their work place. Anna is concerned with the behaviour of others in terms of being sustainable or not sustainable.

5.2.2 Life-Based Intrinsic Value: Nature "Lives" And We "Live"

Thirty-eight percent of students hold a *Life-based Intrinsic Value* (Robertson, 1998, p. 179) view. They convey the belief that non-human entities have value simply because they are living. Consider Lena's expression:

> Nature is sort of living, so we're living... The Earth is living, sort of because like, plants and stuff, and I'm living... so we're sort of connected.

Lena conveyed her view that she is a part of nature because "The Earth/nature is living" and "I'm living." The thread that connects nature and human beings is the notion that nature and humans are "living" entities.

5.2.3 Experiential Appreciation: I Just "Love" The Trees

Thirty-one percent of students hold an *Experiential Appreciation* view. This means an individual's environmental relationship is based on their experiences in the natural environment. The environment is not seen as something to "use," but rather to value the Earth unto itself - an inherent value. Sarah's expression best captured this view:

> I just love animals and I love trees and I just... I'm in heaven. I just love the forest. I just love going into them and love looking at the trees and rowing in the boat. We'll stop in the middle of the lake. And at my cottage we have this beautiful view when the sun is just at the right place...I love being there.

Sarah expresses her relationship to the Earth as a feeling of "love." She loves animals, trees, and the forest. She loves "being there" observing sunsets and sunrises while rowing a boat in the middle of a lake hear her cottage. She enjoys "beautiful views" nature has to offer and loves experiencing nature. The Earth has an inherent value that Sarah appreciates. Sarah is not "using" nature, but rather appreciating its beauty. Nature's beauty makes Sarah feel good given that she attributes "love" to her relationship with the Earth.

5.2.4 Self-Centered: Valuable Only To Humans

Twenty-five percent of students hold a *Self-centered* view which means protection of the environment is important in order to preserve individual health, safety or quality of life (Ballantyne, 1995). This argument is based on the view that humans have intrinsic

value, the non-human world (and its parts) is valuable only when it is seen to be valuable to humans (Fox, 1990, p. 149). Consider Fred's thoughts:

> We're actually lucky to have animals or then we'd just eat vegetables every single day...Then we'd have like hardly any protein.

For Fred, the only kind of value that non-human entities have is to serve his ends. That is to provide animals for him to eat. Fred sees the environment as something to be used (Ballantyne, 1995) for his health and quality of life. If it weren't for Fred having "animals" to eat, he would be forced to "just eat vegetables every single day" which would result in a poorer quality of life for Fred.

5.2.5 Non-Reciprocal: Humans Need The Environment - But Does The Environment Need Humans?

Twenty-five percent of students hold a *Non-Reciprocal View*. This view means an individual's environmental relationship is based on a non-reciprocal relationship between human and non-human entities. When an individual thinks that non-human entities such as animals and plants are not dependent on humans for their survival and sustainability; when the individual also thinks that humans are dependent on non-human entities for their survival and sustainability, that individual holds a non-reciprocal (no give-and-take) point of view. John's expression best captured the essence of this view:

> Without animals, we would die.... They'd be alive. Trees have been around for billions of years and I don't think they're going to go away... without humans, life would really kind of be the same. It'd be even healthier.

John thinks that humans would die without animals. However, he acknowledges that they would be "alive" without humans, thus showing a non-reciprocal view. He acknowledged that trees have "been around for billions of years" and does not believe

that there is any threat to trees "going away." He suggests that without humans, life would be the same for non-living entities, and possibly "even healthier." His excerpt fully captures the essence of the non-reciprocal view in terms of human entities not requiring human entities for their survival and sustainability while human entities do require non-human entities for their survival and sustainability over time.

5.2.6 Basic Needs: We Live On Food And Water And So Do Plants And Animals

Nineteen percent of the students hold a *Basic needs* view. They express that non-human and human entities have the same basic needs requirement to survive. Consider June's thoughts:

> Every living thing has to live on food and water.... We live on food and water and plants and animals live on food and water.

In this manner, June conveys her belief that living organisms need to be nourished on "food and water", as do human beings. Consequently she draws a connection to humans and the environment based on their basic needs.

5.2.7 Safekeeping For The Planet's Survival

Nineteen percent of the students hold a *Safekeeping* view. This means protecting the environment is necessary for the planet's survival (Ballantyne, 1995). Consider Gil's views:

> Like you should respect everything that you have and I think that you should respect the Earth and then if you don't respect it then it's gone.

Gils thinks that the Earth and all its resources should be "respected." He cautions that if the Earth is not respected, it will be "gone,", suggesting that the survival of the planet is dependent upon the Earth and its resources being "respected" and protected.

5.2.8 Biocentric - Everything Is Equal!

Nineteen percent of the students hold a *Biocentric* view. This means that humans are seen as an equal part of the environment. The environment is seen to have inherent worth and a right to exist, not merely because of its necessity for human live. Humans are not seen as superior to other living things. Consider Susan's view:

> I think everybody is equal [living things includes "everybody"]. They [human beings] are equal to other living things. There are things that are as much important as others are, like people, animals, plants, trees.

Susan believes that humans are equal to other living things. She does not see people as superior to "animals, plants, trees." Her view of equality has to do with the concept of "importance." She does not believe that non-human entities are more or less important than human entities. She believes that non-human entities are equally as important as human entities.

Susan's response is surprising. Susan practices Christianity and is vocal about her beliefs during non-formal discussions. I learned during our non-formal discussion (while standing beside her in the cafeteria line-up) that Susan is a fundamentalist. I assumed that Susan's belief system would focus on all life forms being created by a deity, with mankind being more superior to other living things. For example, Genesis 1v26, 27 and 28 states:

> "26": And God said, Let us make man in our image, after our likeness: and let them <u>have dominion over</u> the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth.
>
> "27": So God created man in his own image, in the image of God created he him; male and female created he them.

> "28": And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth (The King James Bible)

I was surprised to find that Susan holds the view that all life has intrinsic value and classifies "everything" and "everyone" as equal.

5.2.9 Reciprocal - Humans Need The Environment And The Environment Needs Humans

Twelve and one half percent of the students hold a *Reciprocal view*. This view means an individual's environmental relationship is based on a reciprocal or "give-and-take" relationship between human and non-human entities. Consider Sarah's view:

> Equal to I'd say. I don't know how you'd put equal to. I wouldn't say that we're greater than animals or plants because they do a lot for the world, like a lot more than we do. Like plants and basically trees they give the air to breathe oxygen, so they're probably greater than us. And um, equal to, because we have to keep them alive by watering them. I would say that we're less like than the animals because we do a lot of bad things for the environment that animals don't.

Sarah feels that humans are *equal to* and in some cases *less than* non-human entities. She thinks that animals and plants are greater than humans are because "they do a lot for the world." Her examples include plants and trees that give off oxygen so that humans can breathe. She also thinks that humans reciprocate by keeping them "alive and by watering them." However, she points out that in some instances, humans are less than non-human entities because "we do a lot of bad things for the environment" whereas non-human entities don't.

5.2.10 Personal - Sometimes You Just Gotta Throw It Out!

Twelve and one half percent of the students hold a *Personal View*. A personal view means that sustainability issues are a direct result of individuals' behaviour and subject to individuals' choices and control (Wals, 1992). John's expression best conveys this view:

> You can't really help that because you have to eat, you have to package it to keep it good. What do you do with the package? Well, some stuff you just gotta throw out!

John feels that the waste generation and disposal issue is a direct result of humans practicing unsustainable behaviour, which to John is often unavoidable. He says, "You have to eat, you have to package it to keep it good" and "Some stuff you just gotta throw out!"

5.2.11 Technical - Invent Another Way!

Six percent of the students hold a *Technical View*. This view means that humans beings are expected to develop new technologies that provide solutions to sustainability issues (Wals, 1992). Consider Ruth's expression:

> I think I might change it…how…there's so much gas and stuff from all the cars and buildings that add to pollution…Maybe I could invent another way?

Ruth recognizes that emissions from cars and buildings contribute to air quality. She suggested "inventing another way" for cars and buildings to emit pollution as a solution to air quality issues.

5.3 Ruth

Ruth is an eleven-year old Grade Six student at Georgetown Middle School. Her disposition is generally happy. She is a committed and conscientious student who works

well individually as well as in group situations. She has many friends and treats others respectfully. She gets along well with her peers and demonstrates effective teamwork skills and in many cases takes on the leadership role. Ruth sometimes gets annoyed with group members who are not on task and do not participate and/or collaborate effectively. When in disagreement with her peers, she practices consensus decision-making skills. Academically, Ruth is strong. In classroom activities, she participates and pays close attention to teacher instructions. Ruth has a positive outlook regarding school, home and herself as a person.

Concerning her relationship to human-nature relationship, Ruth swings between three interactive views (a) self and reciprocal; (b) eco-action and earth's inherent value; and (c) personal and collective eco-system action. In the final section of the case study, Ruth's conceptual growth and personal commitment are narrated.

5.3.1 Self and Reciprocal

In the pre- and post-instructional interview, I asked Ruth to tell me whether she thinks human beings are equal to, less than or greater than other living things. Observe the following researcher (McDonald)-student (Ruth) pre-instructional dialogue for Ruth's view of human-nature relationship.

McDonald: Okay. Can I get you to do something for me? Put your name on this piece of paper, if you would, and there's a statement on there that says, "Are human beings greater than, less than, or equal to other living things?" Could you circle one that captures what you think?

Ruth: (writes and circles)

McDonald: Okay, great. Can I keep it? Okay. You circled, "equal to", that <u>human beings are equal to other living things</u>. Can you explain why you said that?

Ruth: Because nature gives us so many things, like trees give us oxygen, and like that and so we wouldn't really have anything. And we help living things to stay alive...like if we didn't care, they'd be all polluted so, I think we're all equal because we have to work together to make it...work.

McDonald: Okay. That's interesting. You said, "we're all equal because we have to work together to make it...work." What do you mean by that?

Ruth: Without the trees and everything we wouldn't have much oxygen and nature and if the trees and the grass didn't have us, people wouldn't water and take care of them. (Ruth, Pre-Instruction Interview, September 4, lines 136-143)

Ruth is certainly aware of the human-nature relationship. Ruth states that the nature "gives us so many things." As an example, she considers the trees giving human beings oxygen. This self-centered environmental relationship is based on the value of the Earth's resources for human benefit. The Earth's resources are seen as something to be utilized by humankind. This value not withstanding, Ruth is also conscious of what humans do for non-human entities (other living things). Ruth thinks that human beings reciprocate by helping non-human entities stay alive by "caring about things" and "working together" (referring to human beings and non-human entities). She suggests that without human beings caring about pollution, for example, other living things would be polluted. Further, without human beings watering the grass, the grass would die. These examples are suggestive of the reciprocal relationship between human beings and non-human entities.

Ruth's swing between self and reciprocal in regard to the human-nature relationship after participating in the EfS unit of instruction is clear in the following post-instructional interview.

McDonald: This is a question I asked you before. Are human beings greater than, and that means more superior, more important, equal to or less than other living things?

Ruth: Equal than.

McDonald: Equal to? Okay. Why do you think that?

Ruth: Because like, trees have oxygen and we need their oxygen and lots of things nature does. We need to survive. Like, we eat animals and (inaudible) we can take care of animals, too. So, it all goes around the circle.

McDonald: So, um…if we – basically you're saying then…I'm just trying to understand – we're equal because…

Ruth: Well, the things they do help us with the things we do and the things we do help them.

McDonald: Okay, so we're kind of like, connected to…

Ruth: Yeah…like if there wasn't nature, we wouldn't be able to survive. And I guess nature – they could maybe, but I don't know.

McDonald: Would nature survive without human beings?

Ruth: Yeah.

McDonald: Yeah. So, does nature need us?

Ruth: Not really.

McDonald: Not really? Okay. So do you want to rethink that? Are human beings superior or greater than, less than or equal to other living things?

Ruth: I still think we're equal, but I don't know how to say it.

Ruth: Yeah. (Ruth, Post-Instructional Interview, December 18, lines 85-109)

Ruth's response regarding using the resources of the Earth for human benefit (animals to eat and "we need to survive") again seems to be concerning self. Her response regarding taking care of animals (and animals taking care of human entities),

however, portrays a reciprocal view. Based on the Ruth's responses to both pre and post-interview sessions, Ruth tends to move between the "self" and "reciprocal."

Artifacts resulting from the EfS curriculum implementation shed more light on Ruth's views of the human/nature relationships. A drawing that Ruth drew in her Art classroom (Figure 5.1) captures her connection to nature as reciprocal. She drew a picture of herself smiling as she picks up garbage on the ground and places the garbage in a garbage bin.

Figure 5.1. Ruth's Artwork

Ruth's picture portrays a happy, sunny place consisting of green grass and a tree with a hole for an animal home against a blue sky with white puffy clouds. Litter is scattered all over the green grass. Ruth sees herself as helping the environment by picking up litter. She says, "I drew myself picking up garbage because it's doing something good for the environment." Her perception is that picking up litter is doing

something good (caring) for or helping the environment. The drawing depicts Ruth's reciprocal view of how humans can care for nature and how nature, in turn, can care for human beings.

5.3.2 Eco-Action and Earth's Inherent Value

The following pre-instructional interview excerpt reveals to what level Ruth feels she is either connected to or separated from nature.

McDonald: Okay. Tell me what your relationship is to the Earth or to the planet. What is your connection to it?

Ruth: I think I have a good one because I don't litter and pollute them...I try to.

McDonald: Okay. Do you see yourself as part of nature or do you see yourself separate from it?

Ruth: Um...I think more separate than the same, but close to.

McDonald: Why?

Ruth: I'm not sure, I don't really...

McDonald: It's just the way you think?

Ruth: Yeah.

McDonald: Okay. Now, I'm curious to see why, though. Why...because it's an interesting question for me. Some people see themselves as part of nature; some people see themselves as separate from it. You said that you see yourself as almost as both...separate and equal to. Can you think of why you would say that?

Ruth: Well, I guess because lots of things I do I do in nature and other things aren't.

McDonald: Like what?

Ruth: Like eating, well...sort of relates, but it sort of is because I get like vegetables and stuff like that and...other kinds of things I don't know;

> I can't think of any. (Ruth, Pre-Instructional Interview, September 4, lines 156-183)

In regard to the idea of "human connectivity to the earth," Ruth feels both separate from and connected to nature, although she admits that she is more separated from than connected to nature. She feels that she is connected to nature because she does a lot of things in nature, and separate because she does a lot of things outside of nature. She feels that her connection to nature is related to either unsustainable/ sustainable actions. In this case, she feels she is connected to nature because she doesn't "litter" or "pollute" non-living entities. This suggests that she is connected to the environment through eco-action, rendering that human beings are connected to nature based on their sustainable practices/actions towards preserving, conserving, enhancing, protecting, and rehabilitating the environment.

The eco-action view is also obvious in her reflective journal entry. Consider her words:

> Nature's 3 R's. "Reduce, Reuse, Recycle. Those are the 3 R's. Another good R is respect. Respect means you don't break off tree branches or reck (sic) animal's homes, you need to respect nature. (November 1, Reflective Journal, Ruth)

Ruth thinks nature should be respected. To her, respecting nature means not practicing unsustainable behaviour such as destroying living things and/or their home or even breaking tree branches. Her post-instructional interview also characterizes the dualistic views about how she is connected.

McDonald: Okay. Do you see yourself as connected to nature or do you see yourself as separate from nature?

Ruth: Sort of both, I guess.

McDonald: Okay. How so?

Ruth: Because, like I just said like, some of those things I do help the Earth, but then lots of things I do, aren't connected to the Earth.

McDonald: Like what?

Ruth: Actually, they are when you think about it. Because lots of things you use are made from trees and wood and a lot…like when you're playing outside, you're on the ground – so, yeah – I *am* connected.

McDonald: You *are* connected?

Ruth: Yeah. (Ruth, Post-Instructional Interview, December 18, lines 138-156)

In the above dialogue, Ruth's arguments for her connectivity to the Earth are clearly associated with her "doing things to help the Earth" and her use of the Earth's resources such as trees and wood, as well as her use of the Earth for her pleasure (playing outside). While these examples may be situated within the self-reciprocal view, Ruth considers the inherent value of the Earth when she talks about "playing outside," thus appreciating or experiencing the value of the Earth onto itself — an inherent value, not to "use" environmental resources, per se. She attaches experiential value to the Earth's inherent value. The experiential value is recognized when human beings are connected to nature based on experiences in the natural environment with non-human entities.

Ruth's view of the environment influences the way she interacts and behaves as a learner during the implementation of the EfS curriculum unit focusing on waste minimization. In the next section, I trace how Ruth considers "collective eco-action" with respect to the issue of waste minimization.

5.3.3 Personal and Collective Ecosystem Action

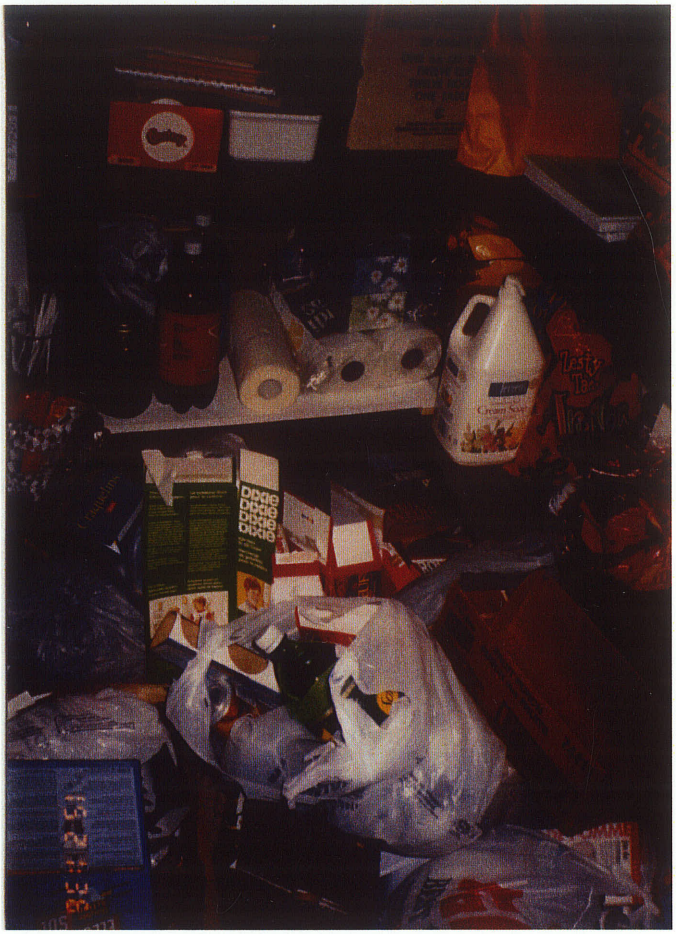
I wanted to know what Ruth already knew about waste before the implementation of the EfS curriculum unit, so I asked her during the pre-instructional interview what she

already knew about waste. She connected waste to "polluting." Recycling was important to Ruth because "if we didn't recycle, the world wouldn't be the same." She distinguished what can be recycled and what can't. To her, garbage is "bad."

During the EfS curriculum unit implementation, Ruth grows in her understanding about waste. She captures her own growth in her photoessay. Ruth takes a photograph of her family's storage room of recycled materials (see Photograph 1). Consider what she writes:

> This is a picture of our storage cupboard where we keep our recycling. The reason that I chose this picture was I wanted to show people how much, and often my family recycles. This photo showed a good example of recycling as much as you can. When I look at this photo it makes me feel proud because it shows how much my family recycles.
>
> In our waste unit, we learned that recycling saves a lot of things from going to the dump, which is a good thing. I wanted to show that recycling was important in the whole process of waste management with respect to waste because waste can destroy the environment.
>
> It shows that is a solution and I learned that recycling is very healthy for the environment and our well being, although it costs money.

Ruth chooses this picture because she wants to show that she and her family practice waste minimization strategies - in this case, recycling products. She also wants to show that recycling is important to her. The notion of recycling fits in with her eco-action view identified earlier. As I discussed earlier, "doing something to help the environment" is important to Ruth, consequently she feels proud that her family recycles, thus taking an action towards helping the environment to sustain itself. To Ruth, recycling is a solution to the waste issue. She suggests that recycling is good for both the environment and human beings. Her linking of sustainable actions (recycling) to the



Photograph 1

benefit of both human beings and the environment suggests that Ruth is to see the interrelationships between nature and the environment. In this ecosystem-based interrelationships, human beings are seen as equal to other living things (non-human entities). The environment has an inherent worth or value and the right to exist, not for humans, but for all living things on the planet. People and the environment live together in harmony for the survival of human and non-human entities. The interrelationships between human beings and the non-human entities are sought to address complex sustainability issues.

Also consider the researcher/student dialogue about Photograph 1:

Ruth: Okay, this one – it looks kind of crappy – this is our storage cupboard, but in here we throw all our recycling. And then on the day…the recycling day…my Dad puts it all in the recycling bin and takes it outside.

McDonald: Okay. Where is this?

Ruth: In our storage cupboard.

McDonald: In your kitchen?

Ruth: It's downstairs in the basement and we have a big area.

McDonald: Okay. So could you tell me some of the reasons why you chose this picture – what it means to you?

Ruth: I chose it because it's a good example of people recycling.

McDonald: Okay.

Ruth: And it shows some of the things that are recyclable.

McDonald: Mmhm.

Ruth: And…and it shows how recycling is a good solution to some of the things in there. And it shows…and it feels good to show that my family recycles – that we don't just throw everything away.

McDonald: And why does it make you feel good?

Ruth: Because it's saving all these things from going into the dump and not take up space in the landfill and pollute the Earth.

McDonald: Mmhm.

Ruth: And recycling – that means it can be made into something again. (Ruth, Post-Instruction Interview, December 18, lines, 180-219)

Ruth explains how her family manages its waste and recyclables. Her family stores the recyclables in the basement of her house in a storage cupboard. Then, on the "recycling day", her dad takes the recyclables out to the curb for pickup. She adds that it

"feels good" to her to be able to show that her family recycles and do not throw everything away. She feels "good" that her family recycles because it minimizes the waste that ends up in landfills, thus polluting the Earth.

Another photo that Ruth takes is a photo of her family's two garbage cans in their back lane (Photograph 2). Consider what she writes:

> This is another picture of our two garbage cans in the back lane. The reason that I chose this picture was to show the little amount of garbage that my family uses. This photo showed a good example of something being put in the garbage that is recyclable. When I look at this photo it makes me feel just a little mad because that pizza box could've been put in a blue bin.
>
> In our waste unit, we learned that many things can be put in compost or recycled, and a pizza box is one of them. I wanted to show that garbage was important in the whole process of waste management with respect to waste because garbage is taking up space on land and hurting the environment.
>
> It shows that garbage is a continual problem and I learned that we need a better system for things that can't be reused, recycled, or put in compost.

Ruth chooses to take this photo and write about it because she wants to communicate to others that generating a minimum amount of garbage is important to her. She also wants to show that her family practices waste minimization strategies such as reducing the amount of garbage that is produced. She feels good about her family's responsible action with respect to waste. Ruth communicates through this photo that something that could have been diverted from the landfill through recycling was not (in this case, a "pizza box"). The photograph makes Ruth feel "mad" because the recyclable container could have been put in a blue bin and consequently recycled instead of being placed in the garbage to be taken to the landfill site which takes up space on land (negative impact for people) and hurts the environment (again, a negative impact). Here

again, Ruth sees the interrelationship between humans and the environment, which suggests an ecosystem-action.

Photograph 2

Consider the researcher/student dialogue about Photograph 2:

Ruth: This is our garbage can. And you don't have a lot of garbage…my Mom and Dad throw out their pizza box and that could be recycled.

McDonald: Mmhm.

Ruth: So, that's why I chose that.

McDonald: You chose that? Okay. Why did you – okay, you chose this picture because it represents your garbage but it also represents a pizza box that could be in there – that you could be doing differently if you thought of it? Okay.

Ruth: Like, it's just a pizza box, but when you think about it, like it could be recycled.

McDonald: Yeah. Yeah. Okay. Okay. Um…how does this picture make you feel, now that you see that pizza box in there?

Ruth: Well, good, because we do – we don't have a lot of garbage – but not really bad, but sort of bad because that should be in the recycle, not in the garbage.

McDonald: Okay. I guess now that you know…

Ruth: Yeah. (Ruth, Post-Instruction Interview, December 18, lines 222-243)

Although Ruth acknowledges her family's good waste minimization practices given that there is very little garbage in her family's garbage can, she also acknowledges that her family could do better in terms of minimizing the waste that goes to landfills. She suggests putting all recyclable products, such as the pizza box in the recycling bin instead of in the garage bin. Her point is that even though her family practices good waste management behaviour, she feels that there is room for improvement.

Another photo that Ruth takes is a photo of a recycling drop-off site (Photograph 3). Consider what she writes:

> This is a picture of a drop-off site for recyclables. The reason that I chose this picture was I think it is a good idea to have a drop-off site for recyclables, especially for people who don't have recycling bins. This photo showed a good example for people who live in apartments and can't have recycling bins or compost. (For other people too!) When I look at this photo it makes me feel good because the people who created this place are trying to make it easier for other people.
>
> In our waste unit, we learned that there are lots of drop-off sites around the world. I wanted to show that a drop off site was important in the whole process of waste management with respect to waste because without drop-off sites, some people who drop-off their recyclables there, might stop recycling.
>
> It shows that drop-off sites is a solution and I learned that people in apartments can't have a compost or a recycling bin.

Ruth chooses to take this photograph because she thinks that having a drop-off site is a good strategy for minimizing waste at landfills. She thinks that having a drop off site for recyclables is particularly important for people who don't have recycling bins such as

Photograph 3

people who live in apartment blocks. This photograph makes Ruth feel good because she believes that the individuals that developed the drop-off site are trying to make it easier for other people to divert waste from the landfills. The notion of recycling drop-off centers makes Ruth feel good because eco-system action is taken. However, in this case, it is not about Ruth directly doing the action. The action is directed towards other people, who do not have opportunities to recycle onsite. Ruth's view of waste minimization issues and the way she thinks about them suggests that collective eco-system action is in order. Collective eco-action occurs when sustainability issues are created by all people who practice unsustainable behaviour and subject to solutions that require all people to practice sustainable behaviour. Consider also what Ruth told me about Photograph 3:

Ruth: Oh! This is at the business. You were there when I…

McDonald: Mmhm. So that's the drop off site for the recyclables that you went on…that…to the project for the waste…. Okay….can you tell me about that picture?

Ruth: Well, I took it because I think it's a good idea because people who can't have recycling and composters where they live, they can put their things here.

McDonald: Mmhm.

Ruth: They – I guess it doesn't cost them money, so lots of people probably do drop their stuff off there.

Ruth implies that when it doesn't cost people money, people would recycle. She recognizes that "recycling" is a social activity that has some costs associated with the activity. She is beginning to link economic factors with social ones. She already discussed previously how recycling benefits the environment (minimizes waste at landfills thus causing less pollution), however until now, she does not tie the economic factors in with the social and environmental factors. Ruth is beginning to see the interconnections between these factors and how one factor will affect others in the decision-making process. Her implication that people would recycle if it didn't "cost them money" suggests that economic factors are important in other people's decision-making process. Her view is that having access to recycling drop-off centers encourages people to recycle, particularly if no costs are associated with recycling.

Ruth also takes a photograph of her neighbor's outside compost bin (see Photograph 4). Consider what she writes:

> This is a picture of my neighbour's compost, in his back yard. The reason that I chose this picture was it shows what a compost bin looks like. This photo showed a good example of someone who composts. When I look at this photo it makes me feel good because I know that someone is composting, so they won't have to throw out so much.

> In our waste unit, we learned that it is very easy to build a compost, and we learned most of the things you can put in it. I wanted to show that composting was important in the whole process of waste management with respect to waste because a compost saves lots of things from going in the garbage.
>
> It shows that composting is a solution and I learned that it doesn't cost much, when you're saving the environment.

Throughout the EfS curriculum unit, Ruth experiences building an outside composter and learns that living responsibly means composting food and yard waste. She learns what can and can't be put into outside compost bins. Ruth views composting as a means of diverting waste from landfills, which to her is important for living responsibly. She communicates through this photograph that she is impressed with the notion of composting and is particularly impressed with the fact that her neighbour, someone that she knows, owns and uses a composter and is living responsibly with respect to waste.

Again, this is another example of Ruth's view of eco-system action. Consider what Ruth tells me about Photograph 4:

Ruth: This is my neighbor's compost bin.

McDonald: Mmhm.

Ruth: And we don't have one, but I've never really seen one before. So, I just thought it would be neat to have a picture of it.

McDonald: Okay.

Ruth: And what it looks like.

McDonald: Would you like one?

Ruth: If my parents would – <u>it would be different – I don't know. I'm so used to throwing out all my tea leaves and things; it would be weird to get used to something...</u>

McDonald: To something else?

Ruth: To throwing them in the composter, yeah.

McDonald: Okay.

Ruth: But it would be good for the environment.

Photograph 4

McDonald: Mmhm. So, this is your neighbour's composter and it shows what a compost bin, I guess, looks like.

Ruth: Yeah.

McDonald: Okay. And you actually built one in this unit so you know all about how it looks and that sort of thing.

Ruth: Yeah.

McDonald: And you said…and here you wrote that this compost…this photo makes you feel good – why?

Ruth: Um…I can't remember what I wrote.

McDonald: Okay. You said that, because somebody's composting…

Ruth: Oh yeah…I know…that someone's composting and you feel good that someone's trying to do something good for the environment.

McDonald: Mmhm. Good. And this is a solution or is this a problem?

Ruth: It's a solution.

McDonald: It's a solution. Okay. (Ruth, Post-Instruction Interview, December 18, lines 252-301)

Ruth recognizes the life-style changes that would be required to begin to practice composting behaviour in her home. She expresses that "it would be different." She claims that she is "so used to throwing out all my tea leaves and things" that "it would be weird to get used to" changing behaviour or habits and placing the tea leaves and things in the compost bin instead of the trash can. Ruth's acknowledgement that the new practice (composting) would be good for the environment tells me that she would be interested in pursuing the idea with her family.

5.3.4 Ruth's Conceptual Growth and Personal Commitment

As a result of the learning associated with the EfS curriculum unit, Ruth extends her knowledge with respect to the learning of new waste minimization strategies. Ruth's photoessay captures what she learns through the unit: (a) Recycling saves a lot of things from going to the dump, which she perceives as a good thing; (b) Many things can be diverted from the landfill through composting and recycling; (c) There are many recycling drop-off centers around the world; (d) It is very easy to build a composter; (e) It doesn't cost much, when you are saving the environment.

In her reflection journal, Ruth writes:

Vermi-compost. I think vermi-compost is a very neat idea for whoever came up with it. It is a very good idea, plus a great way not to pollute. I have heard about compost before, but never actually seen one. My dad told me that our neighbor has

> a compost. With the cameras that you gave us, I am going to take a picture of it. I have never heard of red-wrigglers before. They look really cool! It would be a good idea for my family to get a compost so that we wouldn't have to throw out some of the things we do. It is really cool when you think about it, that leftover fruits and vegetables can be turned into fertilizer! (Ruth, Reflective Journal, November 9)

Ruth seems impressed with her new knowledge regarding the composting process. She thinks the idea of composting is a good way to divert/reduce the waste that her family produces in her home and expresses her desire for her family to obtain a composter. Ruth, through her journal, identifies that it would be a good idea to commit her family to "getting a compost" so that they could practice more sustainable behaviour with respect to waste (throw out less).

The essay that Ruth writes to the Conference Board also illuminates what she learned through her participation of EfS unit activities. The letter, in itself, is committing Ruth to participate in other learning EfS-oriented learning opportunities. Consider her words:

> From this unit I learned a lot! Here are parts of some of the things that I learned: I learned what I can and can't recycle. How to reuse, and what I can reuse. How to reduce, and what I can reduce on. How a landfill works. <u>How human, and nature reducing, reusing, and recycling all relate or don't relate</u>. How the water cycle works.
>
> These are just parts of the things we learned. We also went on field trips and played games to help us understand what we were learning. For example, here is what we did: we went to Brady Landfill. We build compost bins at school. We went to the bioreserve, and we often played games.
>
> Next, our teacher Ms. [name of teacher] told us about the project.
>
> The main idea of our project was to choose a business and interview them. From the questions we asked and the information they gave you, we had to come up with a plan for the business that could reduce their amount of garbage or that could make them recycle more etc. The reason we had to do this is because it could save things from being thrown out, or could make you reduce more or recycle more etc. Doing this would help the environment.

> My group consisted of six people including me. The business my group chose was Water and Waste. The business cleans the city water, and take care of the cities waste.
>
> After interviewing the business, and reading over the information, my group came up with a plan. Our plan was that we thought that there should be a shoe drop-off center in the city, basically a center where people can drop off their old shoes. From there workers who are experienced in this profession can take the shoes that are dropped off and turn them in to sports turf. My group got this idea from watching a show called "Popular Mechanics for Kids."
>
> This plan affected the environment because it would save a lot of shoes from going in to the garbage, which helps the world to be healthier.
>
> This unit was important to me because I learned how what we do affects the Earth, and lots of interesting facts. For example, I learned that slowly, the more the Earth is being polluted the Ozone layer is starting to get smaller! Going on the field trips, and playing games helped me understand the environment better. Ms. [name of teacher] taught me lots through many ways, in a short period of time.
>
> I think if my group and I could be sent to this conference, it would be amazing. It would help us to see, and understand even more than we already know! Even though we are already done our project this would be an awesome experience, and who knows, maybe even help us with future projects! Thank-you for taking the time to read my essay and I hope you consider my group for going to the conference. (Ruth, Conference Application Essay, December 2001)

In her essay, Ruth expresses her learning about how to live responsibly with respect to waste and to mimic ecosystems' management of waste through reducing, reusing, recycling and composting waste thus diverting waste from landfills. In particular, she again highlights her ecosystem-based conceptualization of the interrelationship between human beings and the environment with respect to reducing, reusing and recycling. Again, this highlights the notion that she is beginning to understand the interrelationships in real ways in terms of notions that make sense to her and ones that she understands. Ruth's essay also highlights her interest in learning about sustainability issues. She finds the visit to a local landfill site and bioreserve, playing games, building composters and

other hands-on learning experiences meaningful. Particularly meaningful to Ruth is the business project and the learning experiences (problem solving, creative thinking, decision-making) associated with that activity. Ruth demonstrates, through the writing of the essay that she is interested in participating with others of like mind and is eager to learn more about human/environmental relationships and how to live more sustainably on the planet.

Evidence of Ruth's collective eco-system action view and her commitment to more sustainable behaviour is found in her response to a question in the post-instructional interview regarding what she has learned through the implementation of the EfS curriculum unit. Ruth's response is that she learned that our ozone layer is starting to get thinner. She didn't know that before, she says. She learns many things she didn't know before like "how lots of animals reuse their things and we looked at that and compared it to how people reuse their things." Her comment provides evidence that she is learning to see the interrelationship between human beings and nature. "I learned about the things you can recycle and the things you can't." "I learned how a business recycles." (Ruth, Post-Instruction Interview, December 18, lines 361-364). Ruth states that because of what she learned, she now thinks twice before throwing something in the garbage. "I put my recyclables in the recycle bin now instead of in the garbage," she states (line 537). Her comments provide more evidence regarding the impact of the EfS unit in terms of changing her behaviour to be more responsible and sustainable.

Clearly, Ruth has increased her awareness of waste issues and the identification of possible solutions towards living more responsibly on the planet. Although it is difficult to provide written evidence of changing behaviour with respect to living sustainably,

Ruth's words communicate that indeed her behaviour has already changed in relation to waste as a result of learning through the EfS curriculum unit. Ballantyne and Packer (1996) suggest that learning involves not only a change or growth in understanding, but also a willingness to depart from previously held attitudes and beliefs and to make commitments to new ways of interacting with the world (p. 6).

Let's now highlight John's views:

5.4 John

John is an eleven-year old Grade Six student at Georgetown Middle School. John has a positive outlook regarding school, home and himself as a person. He is a popular child in his school. John likes to be recognized by his peers and craves attention. He likes his fellow classmates and wants them to like him. John is generally seen smiling, making jokes and "bugging" other people. He is a student who works well individually. However, in group situations he becomes easily distracted and is argumentative at times. Although he is nice to others most of the time, he sometimes speaks disrespectfully to his peers when in disagreement. John is immature for his age, compared to his peers. He likes to get his way in terms of having others agree with his perspectives. When that does not happen, he chooses not to participate and "fools around." Academically, John could be strong. However, because he constantly does not participate in group activities, his grades suffer in terms of participation and completion of work (including homework). In classroom activities, particularly in teacher-led activities, John participates and volunteers often to provide answers to questions asked. His answers are often conceptually correct. The teacher recognizes John for his insightful responses. This is obvious when he discusses human-nature relationships as follows: (a) Biocentric—animal's right to live;

(b) Non-reciprocal; (c) Safekeeping the environment; (d) Earth's inherent value; (e) Technological; (f) Watching collective eco-system action; and (g) Industries overcoming unsustainable practices; Interdependent eco-system action. Subsequently, John's conceptual growth and personal commitment is narrated. He comes out of the project feeling empowered about dealing with sustainability issues.

5.4.1 Biocentric-Animals' Right to Live

In both pre- and post-instructional interview, John tells me whether he thinks human beings are equal to, less than or greater than other living things. Observe the following researcher (McDonald)-student (John) pre-instructional dialogue for John's view on the human-nature relationship.

McDonald: I have a piece of paper here. I'd like you to put your name on it.

John: Okay.

McDonald: It asks you a question. It says, "Are human beings greater than, less than, or equal to other living things." Could you circle one that you think is what you think?

John: I think <u>they're equal to</u>.

McDonald: Why do you think that?

John: Because, well, I'm not sure if this really makes sense, but I think each person has like, <u>each person/animal has like a living right</u>. So, I may think....say we threw a the bear into a garbage place – it's not...<u>I think bears should be on a healthy planet the same as every other animal</u>, except little pests that bite you or mosquitoes or that. But I'd like animals, like maybe gorillas or anything...just like, <u>they don't deserve a bad planet and we don't, so I think we're equal</u>...that...I don't think we're greater than them because mankind is a lot smarter. <u>I think we have the same equal rights</u> – that's why that I picked we're equal. (John, Pre-Instruction Interview, September 4, lines 153-175)

John is aware of the human-nature relationship. John states, "Each person/animal has a living right." As an example, he considers animals deserving a healthy planet to live as opposed to an unhealthy planet, like human beings. Although he recognizes that human beings are "smarter" than animals, he does not consider human beings as being "greater than" other living things given that both human and non-human entities have "the same equal rights." Further, John suggests that human beings should consider the notion that animals have rights similar to humans when taking actions. His example is a human being relocating a bear to a landfill site (garbage place), which has a biocentric worth. This means each living thing (e.g., bear) has inherent value and humans must consider this value when choosing actions (relocating the bear to a landfill site). The focus of the value is placed upon the interests of each individual member of a species (in this case, human beings and species—an individual and the bear) as opposed to the individual member of the species themselves (Robertson, 1998).

5.4.2 Non-Reciprocal

Now let us see what view John has concerning the human-nature relationship after participating in the EfS unit of instruction.

McDonald: The next question has to do with a question I've asked you before. Are human beings greater than, less than, or equal to other living things? And why do you think so?

John: Well, actually I think they're greater at throwing out things, 'cause when you think about, giraffes – they can't eat garbage, they can't eat candy or something like that, so well, they're greater – well, I think they're worse if that's what you're talking about.

McDonald: Okay, I'm talking about a sense of importance.

John: Oh, I think they're just as much because without the animals we would die, not just because…we can't just breathe to be alive, you've

got to eat and you've got to drink, but if those animals died, like the plankton and there'd be mould in the ocean or the lakes and you couldn't really filter it out properly. Or if all the animals died, where would we get our food from? Then if all the, like plants died, where would we get our vegetables from? So, basically it'd be – we'd just die – I think they're just as equal.

McDonald: Okay, so if we died, what would happen to all the plants and animals?

John: Anything. They'd still be alive except for weather conditions. Like if it rains too much, well then the plants would die. But the animals really – they would kind of have what they wanted, like they've always had the trees, 'cause if humans died, the trees have been around for billions of years and I don't think they're going to go away, so – all the animals – the herbivores would have their food and if the carnivores would have their food…other animals…so I think that if humans were gone, unless a big asteroid hit the planet, the animals and plants would be alive.

McDonald: …would still be alive. Okay, so if I ask you the question again, given what you just said: Are human beings greater than, equal to, or less than other living things? Would the answer be the same?

John: I think it would be less.

McDonald: They would be less than?
John: Well, yeah. I don't really understand the question.

McDonald: Okay, are humans…

John: Less important?

McDonald: There's a sense of more important – or superior…

John: Oh, okay. I think they're really less important.

McDonald: They are?

John: Because like, even without humans well, sure we won't be ready for an asteroid to hit, but without humans really life would really kind of be the same. It'd be even healthier in a way because there would be no garbage. Animals would still roam the Earth and fish would still be alive, so I think they're in a way, less important.

McDonald: That's interesting that you say that. There's no right or wrong answer to that. I'm just asking you; I'm trying to get what you mean by some of the things that you say. What is your relationship to the Earth?

John: I just try to keep it clean. (John, Post-Instructional Interview, December 17, lines 124-182)

John now views that human beings are both less than, and equal to other living things to some extent. He thinks human beings are less than other living things because of the unsustainable life practices human beings engage in, such as "throwing things out," whereas other living things do not. He feels human beings are equal to other living things in terms of their vulnerability to death. John now recognizes that whereas human beings need the Earth to be sustained and nurtured, the Earth does not need human beings to sustain it. When he stated, "Without humans really life would really kind of be the same. It'd be even healthier," he is even suggesting that the Earth would be healthier without human beings present. John's view of human relationship with the environment seems to be non-reciprocal. The non-reciprocal human-environmental relationship refers to the non-human entity (species, ecosystems) is non-dependent from the human entity. However, the human entity is dependent upon the non-human entity.

5.4.3 Safekeeping the Environment

Artifacts resulting from the EfS curriculum unit instruction further highlight John's perception of the human/nature relationship. A drawing (Figure 5.2) that John draws in his art classroom captures his connection. John draws a picture of an undisturbed environment in the background and a disturbed environment (a landfill) in the foreground. The background is a beautiful prairie landscape with birds flying in the sunny sky. White, puffy clouds appear in the distance. In the foreground, John draws a

landfill site that shows bags of garbage strewn about with large hills representing where the garbage will be eventually buried. Observe the following researcher (McDonald)-student (John) dialogue regarding his drawing:

Figure 5.2. John's Artwork

John: If we keep on living the lifestyle that we do right now... like, it's pretty good but if we keep on throwing out as much as we're going to, beautiful prairie grasses are going to end up into landfill sites. Those are going to get covered with garbage, garbage bags, shredded leaves and stuff, 'cause they want to make it into compost, but what about the bags? Because they don't bother to take off the bags before they shred the leaves! They shred the bag with the leaves! And then they said, well you can use this for compost. What about the bags? Like I'm sure they didn't just go like 'that' and disappeared into air. There's little tears of bags with the compost, so that's polluting it. There was like – I'm just saying that if there's too many…too much garbage in there, beautiful scenes are going to get turned into black and stinky rotting garbage and that we need to try to save what we have right now, like scientists are saying there's already a big hole in the ozone layer down at the South Pole and the ozone layer protects us. The ozone layer is like one big, big blanket and if there's a bunch of holes in it, the heat gets through easier and you're going to fry the whole planet. I don't really want that to happen.

McDonald: No.

John: So, it just showed that we can't really stay polluting how much we are at the moment.

McDonald: Okay. So this picture then, represents the way you want it or the way you don't want it?

John: No, like in the background – this is the way I want it. But then I don't want this to be covering all that! (emphatically pointing at picture in the foreground)

McDonald: Okay.

John: Like, I don't want that to turn out to be mounds and mounds and mounds.

McDonald: So this is representing the landfill site [pointing to the foreground]

John: Yeah, and then…but eventually all the beautiful prairie grasses is going to mandatory. They'll have to turn them into landfill site because there's not enough room on the planet. When you think about it, like all the oceans or like eighty percent of the planet, but then when you think about, okay, we can't throw the garbage into the…into the water, but that's like already eighty percent. And then think! Every block is like fifty building. You can't fit…how much more prairies do they have? So like, there's cities – what I'm just trying to say is so many building are already on the planet, and the water already takes up eighty percent – there's just not going to be enough room in so many years ahead.

McDonald: Okay. (John, Pre-Instruction Interview, September 4, lines 41-52)

John feels strongly about maintaining the beautiful prairie landscape the way it is now. He wants society to change its lifestyle to lessen the amount of waste that is generated. He cautions that if society doesn't change its consumptive lifestyles that result in the generation of waste, the planet may eventually be covered by mountains of garbage jeopardizing the future. His view is that the planet will run out of sufficient space for garbage given that 80% of the planet is covered by water and much of the remaining area is already built up into cities. John's view that the environment should be protected so

that garbage doesn't end up on 100% of the planet is an interesting notion. Further, his view that the lifestyles of people on the planet have to change to one wherein people generate less waste is also interesting. These views contribute to the "safekeeping" of the environment, which means protection of the environment is necessary for the planet's survival.

5.4.4 Earth's Inherent Value

The following post-instructional interview excerpt reveals to what extent John feels he is either connected to or separate from nature.

McDonald: Do you have…what is your connection or relationship to the Earth?

John: Okay. Well, in a way like, I love the Earth kind of way.

McDonald: Mmhm.

John: I like basically what the Earth has to offer, 'cause like…

McDonald: Okay. What does it have to offer?

John: Well, trees for oxygen – not only is that give out oxygen, it breathes in our carbon dioxide that we breathe out – exhale. That is bad, well not bad, but if you get too much of the carbon dioxide it can kill us.

McDonald: Mmhm.

John: And um, the grass – just to make it look extra-nice. And not just the trees, but just like everything like if I took a walk through Bird's Hill, you see like plants and animals and beautiful oak trees and nests and birds everywhere, so that's what I like. I feel like special when I'm in a forest or something like that.

McDonald: Okay. It's because of your connection to it?

John: Yeah. And I just love camping and stuff like that and being out there with it, too. And my family likes that too, like my whole family loves camping.

McDonald: I like camping, too. Do you see yourself as connected to nature or do you see yourself as separate from nature?

John: Well, we are pretty separate from nature in ways, but as we consider ourselves, we're all part of nature in a way. But um, I think we're pretty separate because like plants don't have arms and like, they're not – nothing compared to us. We have actually like, brains that can read and are smart and we're 50,000 times smarter than all the animals, but in some ways we're the same.

McDonald: Okay. The same but different.

John: Yeah. (John, Post-Instruction Interview, December 17, lines 197-235)

With respect to the notion of "human connectivity to the earth," John feels both separate from and connected to nature. He feels that he is separate from nature due to the notion that non-human and human entities are similar to some extent but not comparable in others. An example he gives is that "plants don't have arms," "humans have brains that can read are smart" whereas plants have no brains and can't read. John also feels he is connected to the Earth. He "loves" the Earth and likes what the Earth has to offer. For example, "trees...gives out oxygen," implying that oxygen is for human survival.

John also likes what the Earth has to offer in terms of aesthetic value and for pleasure. An example he provides is taking a walk through a local park to see plants, animals and "beautiful oak tress and nests and birds everywhere." John feels "special" when he is in an environment such as the one he describes. With respect to what the Earth has to offer in terms of pleasure, John comments, "I just love camping and stuff like that and being out there with it," implying again that notion that he loves the outdoors and "being" out there. The Earth's inherent value provides experiential appreciation to the human beings when they are connected to nature based on feelings related to experiencing the natural environment.

What are John's views about human/nature relationships when he studies an EfS unit on waste minimization?

5.4.5 Technological

I wanted to know what John already knew about waste before the implementation of the EfS curriculum unit so I asked him during the pre-instructional interview: What do you already know about waste? Consider his comments:

> Waste? I think it'll be about how to save the environment and try to help the environment. Like Mrs. [name of teacher] – we had a spider in our class last class and everyone was like, "Kill it, kill it, kill it!" And Mrs. [name of teacher] said, like, "No. You don't kill bugs. You try and save them." They have the same…they're just like us, you know…So one of the girls took it outside. So I think it'll just be about saving the environment and help to control waste and to recycle a little bit more. (John, Pre-Instruction Interview, September 4, lines 231-236)

John thinks the waste unit will be about saving and/or helping the environment through activities such as controlling waste and recycling. His idea of helping/saving the environment is to not destroy living things within the environment, such as bugs. He also thinks the waste unit will involve learning where garbage goes. He asks, "There are six billion people or more on this planet and each person throws out a candy wrapper each day probably – where does it go?"

During the EfS curriculum unit instruction, John grows in his understanding of waste minimization. He captures his own growth in his photoessay. John takes a photograph of his family's car exhaust polluting the environment (see Photograph 5). Consider what he writes:

> This is a picture of my car's exhaust at my house. <u>It is polluting the environment</u>. The reason that I chose this picture was I think it is <u>a real big problem that cars exhaust is destroying the ozone layer and the environment</u>. <u>We have to start</u> using <u>electric cars before it is too late</u>. This photo showed a good

example-of what goes into the air every day. When I look at this photo it makes me feel sad because car developers will not use electric cars because they make more money off of cars that run on gasoline.

In our waste unit, we learned that we have to try to make a difference in our environment. I wanted to show that this is important in the whole process of trying to reduce what we throw out every day. It shows that if we had electric cars that would be a solution and I learned that we have to realize how bad we are polluting the environment.

Photograph 5

John chooses this picture because he wants to show that car exhaust is a "real big problem" because car exhaust is destroying the ozone layer and the environment. "We have to start using electric cars before it is too late" John cautions. He wants to also show a good example of what goes into the air every day. The photograph makes John feel sad because "car developers will not use electric cars because they make more money off of cars that run on gasoline." John identifies an economic link with respect to the development of energy efficient vehicles. John wants to show that this is important in

the whole process of trying to reduce what we throw out every day — car exhaust is one of the things we throw out into the air every day. John thinks that electric cars would be a solution to the pollution issue.

Consider the researcher/student dialogue regarding Photograph 5.

John: Picture One was my Dad took a picture…well I tried, but my Dad got a better angle…We took a picture of car exhaust. You can sort of see here but then in the background you can see really well. This car exhaust is a major, major part of polluting the environment. Millions of cars every single day polluting the environment with car exhaust! And that's like one of the major – most major things that has happened and makes me real sad because I know inside me that people do have the brains to think of a different thing. I think if everyone puts their heads together, they could think of a thing, like…why can't they burn steam? Like, they can…they did it with trains – how come they can't do it with cars? I think the first car ran on steam.

McDonald: Mmhm.

John: And why can't they do it – like it only went like two miles an hour, but how come they can't like compress the water and then steam it and then it can actually go and make the car go forward? (John, Post-Instruction Interview, December 17, lines 287-296)

John's notion that people are smart enough to be able to come up with solutions that would mitigate against car exhaust can be labeled "technological." In this view, human beings are expected to develop new technologies that provide solutions to sustainability issues.

5.4.6 Watching Collective Eco-System Action

Another photo that John takes is a photo of a landfill site (Photograph 6). Consider what he writes in his photo-essay:

> This is another picture of humanity polluting the environment at a city dump. The reason that I chose this picture was when I was at the dump I really started to understand how bad we are polluting the environment. I am going to try my best to

> not pollute the environment. This photo showed a good example of what we have to try to reduce. When I look at this photo it makes me feel sad because this shows how much garbage we are throw out.
>
> In our waste unit, we learned that we have got to watch what we throw out. I wanted to show that was important in the whole process of waste minimization because we have to throw out stuff or else it would be all over the street. It shows that it is a continual problem and I learned that we can't throw out more than what we need to.

John chooses this picture because he wants to show that, as a result of attending a field trip to a local landfill site, he really starts to understand how badly human beings are polluting the environment through the generation of garbage. As a result of participating in the field trip, John writes that he is going to try his best to not pollute the environment. The photo makes John feel sad because the photo demonstrates how much garbage people throw away. John wants to show through the photograph that visiting landfills and seeing how much waste is generated is important for people to know. The photo shows that waste generation is a continual problem. In order to live more responsibly with respect to waste, John suggests "watching what we throw out" and "reducing" the amount that is thrown away.

Also consider John's comments about Photograph 6.

> And then on my second picture, I had picture of the landfill and it really makes me feel sad because this is just…this is probably from the first day…it's probably just from the fresh day we were there and all of this is about a hundred feet maybe a hundred feet...maybe not that much, but about fifty feet of compact garbage over the years. Now if you think of this much compacted probably would come to about this much, if that adds up every day it gets really, really high and that's…but that's really…you can't…you can't really help that because you have to eat, you have to package it to keep it good. What do you do with the package? Well, some stuff you just gotta throw out! (John, Post-Instruction Interview, December 17, lines 306-314)

John acknowledges that waste generation and disposal is an issue. He also acknowledges that the issue is a direct result of human beings practicing behaviour that is

unsustainable, which, to John is unavoidable. He says, "You have to eat, you have to package it to keep it good" and "some stuff you just gotta throw out!"

Photograph 6

5.4.7 Industries Overcoming Unsustainable Practices

Another photo that John takes is a photograph of a natural environment with a tar barrel on the ground (Photograph 7). Consider what he writes:

> This is a picture of the old Domtar site with a tar barrel. The reason that I chose this picture was that people discard barrels that sometimes have hazardous material in the barrel. I found the barrel at the Bio-reserve. This photo showed a good example a business polluting the environment around them. When I look at this photo it makes me feel sad because they did not even have the decency to even clean up one barrel.
>
> In our waste unit, we learned that we have to be more careful not to throw away recyclables. I wanted to show that being careful was important in the whole process of recycling with respect to waste because lots of people throw out recyclables because they are lazy. It shows that waste is a continual problem and I learned that I must be more careful what I throw out.

Photograph 7

The reason John chooses to take this photograph and write about it because he wants to show an example of a business not being careful about what is discarded and consequently polluting the environment with the discarded item. In this case, John profiles a barrel that contains hazardous material. John thinks the unsustainable practice that the business engaged in (discarding barrels) can be attributed to a lack of "decency" on the part of the business. Also consider John's comments about Photograph 7:

> And then, with this picture, I showed that when they were cleaning up the Domtar site, I guess they just sort of got rid of the building and kinda cleaned up the…just like maybe…they just sterilized the area, but me and my Dad went for a walk in the forest and found about five barrels just laying there rotting and, um, you know, those barrels rust through there might still be some chemicals in there and then we went a little bit further in there and we saw the old railway…the old railway um, boards, and there were…and like because they would dip them in the tar and there would be stuff….there would be railway boards still sitting in the way back in the boughs, so I just took a picture of this to show that they really didn't clean up the place that well other than the place where everyone sees it, but then in the forest – that like…ah, the most important other than this, but in the forest it's kind of really polluted. (John, Post-Instruction Interview, December 17, lines 314-323)

John views that sustainability issues are also caused by industries' unsustainable practices

5.4.8 Inter-Dependent Eco-System Action

John also takes a photograph of illegal dumping (Photograph 8). Consider what he writes:

> This is a picture of illegal dumping. The reason that I chose this picture was this is illegal dumping and it was just laying beside a road. This photo showed a good example of what people should not do. When I look at this photo it makes me feel sad because instead of going to the dump they dumped it on the side of a road. In our waste unit, we learned that we should never litter and always recycle.
>
> I wanted to show that recycling was important in the whole process of waste minimization with respect to waste because people that do this should pick it up and put it in a designated area for garbage. It shows that dumping is a continual problem and I learned that I will never do this and I hope people will stop.

Photograph 8

John chooses to take and write about this photograph because he wants to show that people illegally dump waste in undesignated places. In John's case, the undesignated place is beside the road. This photo shows a good example of what people should not do, according to John. He wants to show that people should not dump waste illegally. Instead, they should pick it up [their waste] and put their waste in designated waste areas. The photograph shows that illegal dumping is an issue to John. Because he sees an issue with illegal dumping, he commits to never dumping illegally. He also hopes that people will stop dumping garbage illegally.

Consider the researcher/student dialogue about this particular photograph:

John: And this picture we um.... My Dad, I guess when he was younger...he was driving by [name of street] and he saw a bunch of mattresses there and whoa! Great luck. But we went there and he said, "You know, John that would be a great picture to take a picture of this illegal dumping of these great mattresses." Well, they've been there for about five years and the day that we went there, they were gone!

McDonald: Oh! You're kidding!

John: So, we searched and we searched and finally in the middle of bush we found someone that dumped a bunch of stuff, like tires...

McDonald: Where is this?

John: This is just on [name of street] near the Prairie Grasses....So they dump like a hubcap, an old chair, um...

McDonald: Just garbage.

John: Yeah, just plain old useless garbage like this tire. Why couldn't it have gone to the dump? Because they recycle them there. But then <u>on the way there, you're polluting the environment by the car.</u>

McDonald: Why do you think they put it there?

John: Probably just so...they just wanted to put it there, like they probably came there late at night and just threw it there.

McDonald: Why do you think they didn't take it to the dump?

John: It's either they didn't want to pollute the environment, which I highly doubt, or they were just too lazy and they just wanted to dump it there. And that's basically…

McDonald: Does it cost money to put something in the landfill site?

John: Yeah. But, it's still like, I think the highest is like twenty bucks, but that's for like over a tonne of garbage.

McDonald: Like a carload would be four bucks.

John: Yeah, exactly. So that's like, pretty cheap, but then here, you're just…and 'cause I guess a front end loader came to pick it up. I bet you that cost more than four bucks.

McDonald: Mmhm.

John: To make…to get a front end loader and get it and pick up the mattresses and put it into a garbage truck and then you go all the way to the dump, so I'm sure it costs more to do that than it is to go to the dump. So they were just being lazy.

McDonald: But they're not going to pay for that, though, are they?

John: No. They got away just free. But then, I'd feel guilty if I were to do that. It really made me feel sad because like, seriously, who would dump a bunch of garbage just right there? In the middle of a prairie grass?

McDonald: You said like, "Who would?" What do you think about the values and the attitudes that those people would have?

John: Well, okay. Like, they might still be nice people…like in social ways…they still might be nice people but in the other way – like being lazy and like just not doing anything, maybe not taking their own garbage to the dump and like some people might even throw it into their neighbours' yards sometimes. 'Cause I know my neighbour, he…there were some old newspapers in his backyard and they all blew across our yards and there was old newspapers like, everywhere and um…my um…other neighbour, well – his Dad…we had an argument about this with the Dads, but um….he put a bunch of garbage, like oil, tires, basically anything – the most hazardous, not like hazardous as in chemical-wise, but the most hazardous, useless

> garbage you can ever think of behind....because I live in the back field....And there's beautiful reeds, and you can hear the frogs there...he dumped them right by the field. And my Dad talked to him and he said, "No, a guy's going to come a pick it up." It sat there for years and years. And over the years, things fell over into the water. And one day when I was there, I saw a tub of oil, like a little tub of oil fell in there, and it was all oily all over the water and just all rainbow colours and the oil and gas. It really made me feel sad that he had to do that...

McDonald: Mmhmm.

John: ...because why wouldn't he just easily take it...like take the oil to the hazardous material place and just take the rest of the garbage to the dump? Maybe a few could be recycled; like that tub that he threw out that was made out um...like a plastic that you can recycle...

McDonald: Mmhm.

John: So that he was just...worse...that was just careless there. That was all my pictures, but I had one more, but a lot of them didn't turn out. Well, they all did, but I found those as the most important ones that I could find. (John, Post-Instruction Interview, December 17, lines 330-421)

John demonstrates that he understands the interrelatedness of environmental, social and economic factors. He raises the notion that human-nature relationships are complex and do not always have answers all would agree with. He argues that to some individuals, illegal dumping in a field is less environmentally destructive than driving the waste to a landfill site. John is aware of the economic costs associated with an individual choosing to take waste to a landfill versus an individual relocating the waste to a landfill site. He realizes that there are more costs associated with relocating the waste than locating the waste on site in the first place.

John does not understand why individuals choose to not practice sustainable life choices instead of unsustainable ones. He questions why his neighbour (a socially nice person) chooses to dump hazardous waste in a field close to his home instead of recycling

what can be recycled and/or taking the hazardous material to a recycling drop off centre. John thinks that people who do not choose to make good choices with respect to waste disposal are either "lazy" or "careless." John's recognizes that concerns about the effects of unsustainable waste practices to the environment are interrelated with social and economic factors and are complex sustainability issues. Economic, environmental and social factors are all interconnected in a web of relationships. Impacts in one factor have consequences for the other factors. The preservation of ecosystems is dependent upon decisions and actions by humans that lead to ecosystem sustainability recognizing that costs are associated with actions.

During instruction associated with the EfS curriculum unit, students had opportunities to debate waste issues within their groups and with other groups about the impacts of landfill sites. In the following excerpts, it is clear that John and other students are considering environment, economic and social factors in their decision-making and acknowledge the complex interrelationships among these factors. Consider the student group (Gil, John, Fred, Sarah and Ruth) dialogues:

John: I think they should just light the thing on fire and let it burn.

Ruth: Why though?

Gil: Then you are polluting the air!

John: Yes. But there is really no way around it. (October 25, Classroom Observation, lines 214-217)

John thinks the landfills should be set on fire and let burn so that less space is taken up by landfills. Gil argues that burning the landfill would eventually pollute the air — an environmental factor, thus causing another issue. Consider another excerpt:

John: Okay.

Ruth: Okay. It takes away garbage.

John: Takes away garbage?

Ruth: Gets rid of your garbage.

John: What?

Sarah: That's not really good.

Ruth: It gets rid of your garbage!

John: No, no. What's that? It's something. Like they use, at PMK they use the landfill to feed pigs and stuff.

Ruth: They don't do that everywhere. The good thing is they get rid of your garbage. The bad thing is that it is filling up somewhere else.

John: I am not sure. What's good? What's good?

Ruth: Like, its good if it gets rid of your garbage.

John: That's not that good because then it just fills up

Ruth: It's good though. It's good for people.

Sarah: But then its bad because.

Sarah. It's positive and negative.

John: Okay. [hesitantly]

Ruth: Gets rid of garbage at home. [writes this comment down in Journal]

John: Kills the environment.

Ruth: Pollutes the environment.

Ruth: What else?

John: Okay. [thinking]

Ruth: Hmm. [thinking]

John: This is hard. You'd think this would be so easy.

Sarah: Sometimes they burn off the garbage but effects the air.

John: Well, not necessarily. It depends on what kind of garbage.

Ruth: Doesn't sometimes, eventually just goes into the ground. [writes in journal)

John: It disposes. It just breaks down.

Sarah: A good thing is that eventually it disposes. And the bad thing...

John: You know what. My mom brought home this piece of paper. Do you know how many years it takes for glass to break down? About a million years, before glass turns into dust.

Ruth: You know what we should write?

John: And it takes like one hundred years for paper to dispose.

Ruth: You, what we should write, eventually it disposes and that's a good thing, but the negative thing... [writes in journal]

John: It eventually all breaks down.

Sarah: That's a good thing?

Gil: Yep.

Ruth: A negative thing is that it pollutes the soil.

Sarah: It pollutes the soil [writes in journal]

John: Yep. It pollutes the soil

Ruth: And then they could burn it, like Gil said.

Ruth: So we can we write, we can burn it.

John: So. Ya.

Ruth: Burnable.

Sarah: Burnable!

Ruth: All we have for negative is it pollutes... ah [thinking]

John: But that's good. [everyone laughs]

John: Okay.

Ruth: No it's not good! It pollutes the air.

John: Can be made into food.[everyone laughs]

Sarah: Can be reused.

Ruth: Can be reused. [writes in journal]

John: And can be made into food.

Ruth: And we could put... might not be safe.

John: Ya.

Ruth: Might not be safe. [writes in journal] Like it can be reused but it might not be safe.

John: Can be used as food. Can be used as compost.

Ruth: Why don't we... you know, really...

John: No, no. But like, um, okay. You go to the dump and there is stuff. There is lots of it. There is gushy mushy mud.[at the same time Gil is talking]

Gil: Okay. I've been to a dump site. There are chairs. There is not just food at a garbage site.

John: There is vegetable. I know, but they can be used for compost.

Sarah: Couches, beds, everything.

Ruth: Toilets, sinks.

John: I know but they can be used as compost. I think they should just light the thing on fire and let it burn.

Ruth: Why though?

Gil: Then you are polluting the air.

John: Yes. But there is really no way around it.

Sarah: It turns into a hill. After it is tall enough, it turns into a hill.

John: You made the dump. You burn it. It pollutes the air. If you let it dispose it just pollutes the soil. And if you just leave it there it is a big eye sore. So...

Sarah: Wait. No no. But after... Wait. After a couple of years, it turns into a hill. They put grass over and in the wintertime you can go sledding.

John: Ok, I don't think sledding, tobogganing. I don't think tobogganing is a good thing.

Sarah: Seriously.

John: We are talking about the environment. We are not talking about having fun here!

Sarah: I know. But it still get turned into hills.

John: They get turned into playthings.

Sarah: No.

John: They can be turned into parts.

Ruth: Garbage smells

Sarah: Landfills can be turned into hills. They just take grass and put it over it.

John: Is that it? [sarcastic]

Sarah: Ya, that's it. It's a hill.

John: No, that's not it. It's garbage. Do you know what gas does? It produces gas. And you know what the gas goes if it doesn't vent. It explodes.

Gil: Ya, but to an open flame

Ruth: We could put that in the negative stuff.

Gil: It smells. It has a bad fragrance.

Rachel: Okay. Stop please. [referring to all group discussions] (October 25, Lesson 3, Classroom Observation, lines 142-238)

As the group works through an assignment to identify the positive and negative impacts associated with landfills, they take into consideration environmental factors and social factors in their decision-making. These students do not always agree with their peers. John suggests that the garbage at the landfill should be burned given that the garbage at the site is an eyesore (social negative impact). Others debate that comment by suggesting that his option will pollute the air (environmental negative impact). Another student (Sarah) suggests that landfills are okay given that they are eventually turned into hills that children can use to go sledding (social positive impact). John counters her argument by suggesting that the environment is still at risk because of gases that can "explode" (social and environmental negative impact). He further argues that making a hill out of a landfill and "having fun" (social positive impact) should not be considered at the expense of hurting the environment. Students also express other social negative impacts associated with landfills such as the negative smells and the idea that food coming from landfills might not be safe for animals. Students also identify negative environmental impacts such as soil contamination as a result of landfills. Interestingly, John's comment "What's good? What's good?" shows that he is questioning whether a particular solution benefits the environment or people or both. In his own mind, he is not convinced that if something is solely "good for people" it is a good solution. He seems torn between the benefits to people and to other living things including the air, in this case. John is really concerned with respect to the interdependence of the environment, the economy, and social decision-making and action taking.

5.4.9 John's Conceptual Growth and Personal Commitment

The instruction associated with the EfS curriculum unit provides learning opportunity for students to discuss, debate and listen to another student's perspectives. Possibly the experience of sharing and debating with other students help raise John's awareness and see the complexity and interrelatedness of social, environment and economic factors.

As a result of the EfS unit instruction, John also extends his knowledge with respect to the learning of new waste minimization strategies. John's photoessays capture what he learns through the EfS unit instruction: (a) We have to try to make a difference in our environment; (b) We have to realize how bad we are polluting the environment; (c) We have got to watch what we throw out and that we can't throw out more than what we need to; (d) We have to be more careful not to throw away recyclables; (e) He must be more careful regarding what he personally throws out; (f) We should never litter and always recycle; and (g) Illegal dumping is a problem that he would never contribute to.

During my post-instructional interview, John shares his learning through the EfS curriculum unit. Consider his comments:

> I think it was to kind of prepare us for either that when we get older if we want to become environmentalists, or if we're going to have this big project in like Grade 8 or Grade 7, that we have to actually involve business again – except it would be a little bit more major than this... We learned more some stuff than I knew. We're gonna…I'm gonna ask my Dad if I can get some worms from Mrs. [name of teacher] so that I can get a vermi compost because usually if we had banana peels or stuff, we'd just threw it in the garbage and wouldn't think about it…doesn't really matter because they still all disintegrate very quickly. Except that you don't want like, grade A soil going to waste in a landfill and just not in a compost that you actually use into your garden. So that's basically what she said and I think it really got through to the class and myself. (John, Post-Instruction Interview, December 17, lines 575-582)

John feels that what he learned through the EfS curriculum unit has prepared him for Grade 7 and 8 in terms of working on similar business projects. His teacher "got through" to him in terms of composting practices. As a result of what he learned in the classroom, he plans to start composting at home to apply what he has learned in the classroom. John finds learning about sustainability issues meaningful. He is demonstrating that he learned something at school that he is now willing and committed enough to transfer his knowledge to practical experience at his home.

As a result of participating in a garbage audit in the EfS unit, John realizes that he has to be a lot more careful about what is thrown away and what is recycled. Consider his comments as written in his journal:

> Title: Digging up the Dirt. We were trying to find ideas about how we can reduce the amount of garbage that we throw out. I had to rummage in the garbage and look at all of the rotting food. It the smell almost made me puke. And I tried to gross out the girls in the class. We had to take all of the recyclables in the garbage bag from the lunchroom and it had been sitting in Outdoor Ed for an extra long weekend. It was moldy and we measured how much not waste was in the bag with Ms. [name of teacher] and she is 160 and with not waste she was 163 and with waste she was 161 so we have to be a lot more careful about what we throw out. And try to recycle more!!!." (John, Reflective Journal, October 9)

John participates in a classroom activity where he and two other classmates' sort through a garbage bag separating waste from recyclables. He finds that from a three pound bag of garbage, one pound is actual waste whereas two pounds could have been diverted through recycling efforts. He draws the conclusion that people should be a lot more careful about what they throw away. He learns through this activity that he and his peers should recycle more than they do now.

The essay that John writes to the Conference Board also illuminates what he learned through his participation in the EfS unit instruction. Consider his words:

For the past 4 1/2 months we have been studying waste minimization. During indoor class time we discussed pollution, what causes it, and what we can do to stop it. We also spent a portion of the class time outdoors. Outdoor class time was usually spent at the Bio-reserve.

Ms. McDonald joined our class. She is a student at the University of Manitoba who is working on her Ph.D. degree. She videotaped our class activity. She also interviewed selected students and asked them what they thought was a healthy planet. Ms. McDonald provided each student with a camera. We took pictures of things that help the environment and those things that pollute it. Each student took 12 pictures and we pasted them on a sheet and wrote a paragraph about the pictures.

Later in the term, [name of teacher] introduced our class to a "Mega Project." This project involved the participation of a local business. We visited the business and marked them on how environmentally friendly their business was. After we finished our assessment, we invited the business to our school for a presentation on what we thought the business was doing wrong and what they could do to be more environmentally friendly. I feel that the presentation was successful.

We also went on a field trip to the [name of landfill] site. There we took pictures of the garbage. It inspired us to stop littering and to try to recycle as much as possible.

Ms. [name of teacher] is a wonderful job teaching us about waste minimization.

I would like to attend the conference in Victoria, British Columbia because I would like to learn more about waste minimization and to help find ways to minimize pollution. I really think it would be a great experience for our group.

Thank you for taking the time to read my essay. (John, Conference Application Essay, December 2001)

Based on his essay, John learns how to mimic ecosystems with regard to waste minimization and consequently learns who generates waste and how to minimize the waste that ends up at landfills. It is evident that John thinks of waste as pollution, given paragraph one of his application letter. John is inspired by what he calls the "Mega Project" and by the visit to the local landfill site. He felt that conducting the business waste audit is a useful endeavour and it is clear that John thinks that he has the power,

along with his peers, to effect real change in a local business with respect to waste. The field trip to the local landfill also inspires John. He states that seeing the landfill first hand inspires him to stop littering and try to recycle as much as possible.

Clearly, John increases his awareness with respect to waste and learns to identify solutions with respect to waste minimization. It is, however, difficult to determine if learning will affect lifestyle practices with respect to waste generation and disposal and for living sustainably, in general.

5.4.9.1 The Cattail Event

There is also evidence that might indicate that John's behaviour does not always fall in line with his conceptions. For example, in the pre-instruction interview, John makes several references to the idea that the environment should be respected. He even shares with me a personal experience that would have one believe that he truly cares for and respects the environment. Here is an example of a personal experience that he shares with me:

> I've seen people just throwing stuff on the street. Like, I was surprised at my friend when we went camping and I brought him out boating with us and I bought him a Slush. And I see him throw it on the ground! And me and my Dad are like, "Anthony!" and he goes like, "What?" And I was thinking to myself, "What was he thinking?" This is like nature. There's nature here, why would you just chuck a piece of wax and some cardboard and wax…and so he ended up just picking it up, but I was really surprised. (John, Pre-Instruction Interview, September 4, lines 380-387)

John is surprised that his friend, Anthony, would throw a drink container on the ground during a camping trip with his dad. John's reaction to his friend might provide evidence to suggest that John respects his environment and disapproves of others disrespecting the environment by littering. The notion that John would scold his friend in

front of his father also might demonstrate that he is willing to stand up for what he believes in terms of respecting the environment.

However, during an outdoor activity associated with the EfS unit instruction, John's actions show that he does not have respect for the environment. Consider the student (John)/students (Fred, Ruth, and Sarah) dialogue during the outdoor discovery activity:

Ruth: Look everyone! [comes back to look at a dried up cattail]

Fred: Hey, birds could use some of this stuff for the nesting [referring to cattails].

Ruth: Ya, birds could use that stuff for their nesting. [Fred gently touches the cattail]

Sarah: Don't touch it. [talking loudly to Fred - referring to his touching of the cattail]

John: [joins the group] This is called cattails. [touches it, hits it] It does not matter if we touch it. It's marshmallows! [walking away laughing to himself]. (November 1, Classroom Observation, lines 291-297)

John demonstrates his conviction towards respecting the environment by touching (disturbing) the cattail even though his peers recommends that he not touch the cattail. John's actions provide evidence that he does not always behave according to his held convictions. However, we must note that one "observed" action should not indicate that John does not always behave in this manner. In my interpretation, John's attempt to be humorous in front of his friends caused him to lose sight of the convictions he holds. In other circumstances (particularly on outdoor outings with his father), I do not visualize John behaving in such a disrespectful manner.

After the completion of the EfS curriculum unit instruction, John feels empowered with respect to living sustainably himself and making changes in the his world.

5.4.9.2 Feeling Empowered

The EfS curriculum unit was designed to instill in students the idea that they have the power to effect real changes in their world with respect to living sustainably on the planet. Although it is difficult to ascertain whether students hold this notion at the completion of learning about a particular topic (in this case, waste minimization), John's views suggest that he thinks he could effect change. Consider the researcher/student dialogue.

John: And she makes it a lot of fun in Outdoor Ed.

McDonald: Okay. What's "fun" to you?

John: Fun is learning lots but having fun at the same time.

McDonald: Okay.

John: So, like if we're having math. Like a lot of kids think that math bingo is fun, like someone shouts out…the teacher says, "2 x 8 = 14" and do you have the answer on the board…on the bingo board and you put a chip there. Like, it's not really that fun. Where like you've got these answers and you just put it there and you don't learn anything.

McDonald: Mmhm.

John: Either that you already know that the answers are. So, I think that the fun in my way is that you learn lots but that you still have fun in a ways.

McDonald: So, is building composters fun to you?

John: Yes, it was. It was very, very fun thing to do.

McDonald: Okay. Was going to the businesses fun to you?

John: I loved it. Not only the reason that I got to meet different people. I got a free drink.

McDonald: Oh, cool.

John: And um…but I liked it because it's an experience I never thought I would have to have in school. That you go to a business in school time to talk to these masters of engineering about what they're doing about the planet. It's sort of like, "Wow!" Because they're fifty thousand times smarter than my teacher is probably and we're talking to these guys about the environmental stuff that we only know.

McDonald: Mmhm.

John: But it turns out that they didn't know a lot of stuff that we were talking about.

McDonald: Okay.

John: So, I think it was really, really good.

McDonald: Why is it important then, for the kids to go to the businesses?

John: It's important for them to understand that…

McDonald: Are these adults?

John: Yes. Well, it's important for them to understand that I think when Mrs. [name of teacher] started the topic, she…a lot of the kids went, "Oh, like we know about this stupid stuff! And we know all about this waste minimization thing." But then, they actually…then when we go to a business so…there's these really, really, really, really smart people that don't even know about what we're talking about sometimes. That, like they don't even know what to do in recycling situations. That we might know for five years, and they haven't learned/thought of it at all!

McDonald: Yeah. Yep.

John: So, and that makes them feel…saying, "Wow! I knew we knew this, but that's really good! That we actually did that!" So, I think that we actually talked to these masters of engineering and they actually like looked at us and actually understood what we were talking about and it makes them feel smarter. (John, Pre-instruction interview, September 4, lines 608-671)

John's perception is that he did think he could make real changes in the world and had something to offer. John draws attention to the idea that he, as a child, has something to offer adults in the way of learning. Although he thinks that the adults he worked with

are very smart, he also thinks that in some capacity he and his group of students are smarter than the adults in terms of identifying waste minimization strategies. This notion excites John and makes him feel that he can contribute to the learning of adults. From this excerpt, it is evident that John thinks he has the power to effect real change in world, particularly with respect to helping a local business be more sustainable with respect to waste minimization practices. The notion that John thinks he has something to offer adults in the way of learning and can make a difference in his world and effect real change highlights that John feels empowered.

John is so excited about his ability to "make a difference" and contribute that he suggests the unit be taught to other students in the future. Consider his enthusiastic comments:

> McDonald: Now that you've had an opportunity to reflect back on this unit that just ended on Friday, What do you think about your experiences?
>
> John: I think the experience was unbelievable! I think Mrs. [name of teacher] should do this with every single grade, every single class she has from her new grade. I think you learn lots, you have fun, and it's a great project that you can do!
>
> McDonald: I will be certain to share that with her, then.
>
> John: Yes, because she should share with every single Grade 6 class. (John, Post-Instruction Interview, December 17, lines 1029-1039)

John's perception of his learning is "unbelievable." He recommends that the EfS curriculum unit be implemented in "every single grade," in "every single class." He learned a lot, had fun and enjoyed the project.

5.4 Discussion

Regarding students' views of the human/environment connection/relationship, Robertson's (1998) *Instrumental Value*-based conceptualization/theory is useful in further understanding students' *self-centered* conceptions with respect to their human-nature relationship. Robertson's (1998) theory is based on the view that while humans have intrinsic value, the non-human world (and its parts) is valuable only when it is seen to be valuable to humans (Fox, 1990, p. 149). From this standpoint the only kind of value that non-humans can have is instrumental – that is, they serve as a means to human ends. Along the same lines, Ballantyne (1995) refers to this concept as "egocentric." Protection of the environment is important to preserve individual health, safety, or quality of life. Concerns about environmental problems are immediate and local. The environment is seen as something to be used (p. 5). Ruth's argument for why the environment is important to humans *(provides trees and oxygen for human beings)* is an argument formerly described by Fox (1990). He calls this argument the psychogenetic argument and includes it within the *instrumental value theory*. In terms of this psychogenetic argument, we "ought to preserve the nonhuman world because it provides us with a range of contexts and experiences that are essential to our healthy psychological survival and development" (p. 49).

Existing literature can also help to further understand students' experiential appreciation views regarding their connection with the environment. Frankena (1973) describes *inherent values* as referring to "things that are good because the experience of contemplating them is good or rewarding in itself" (p. 82). Armstrong and Botzler (1993) describe *inherent value* as "value which requires the presence of a valuer who can

appreciate the object or experience" (p. 53). Armstrong and Botzler (1993) describe the experience as ."..an interest that is non-practical and non-utilitarian. Aesthetically, an object is valued for its own sake, rather than for its potential use" (p. 104).

Ballantyne and Packer (1996) sheds further light on students' perceptions regarding people-environment interactions. Ballantyne and Parker's (1996) *ecocentric* conception is similar to what I classify as *biocentric views*. His *guardianship* conception is similar to what I classify as a *safekeeping view*. The *ecocentric* conception is based on the notion that "humankind is seen as an equal or interdependent part of the environment." The environment is seen to have inherent worth and a right to exist, not merely because of its necessity for human life. People are not perceived as superior or separate from the environment but rather, harmony and balance in people-environment interactions are emphasized as essential for ensuring the future survival of both people and the environment. Concerns about the environment are complex issues of interrelationships, as John points out. The *guardianship* concept is based on the idea that protection of the environment is important for the future of one's children and the survival of the plant. Individuals have a responsibility to ensure that future generations will be able to enjoy the environmental benefits that exist at present. Concerns about the environment are long-term and global. The environment is seen as something to be managed to ensure a sustainable future.

Wals' (1992) *personalistic* and *technocratic view* further highlights John's perceptions of waste minimization and his ways of thinking about sustainability issues. An individual who holds a *personalistic view*, according to Wals (1992) thinks that environmental problems are mostly physical problems that are a direct result of

individual polluting behaviour and subject to individual control. An individual with a *technocractic view* perceives environmental problems as an inevitable result of industry and modern lifestyle, to which new technologies are expected to provide a solution.

Robertson's *life-based intrinsic value* conceptualization is based on the notion that non-human creatures have value simply because they are living. His notion also has to do with an ethical position that living organisms deserve to be treated with respect simply because they are living.

My classification of human/nature relationships and those identified in the literature suggest that there is a range within which students view their human/nature relationships. Also evident is the notion that students hold more than one view. As this study highlights, some students can hold six different human/nature views, while others may only hold one. These views, undoubtedly "influence how students interact with the natural world" (Robertson, 1998, p. 185).

These views beg the question, "Which views of human/nature relationships are being promoted, whether explicitly or implicitly, within a program or curriculum?" (Robertson, 1998, p.185). As Robertson (1998) points out, there is little in the literature to inform educators of how their students, in this day and age, think about this relationship. Educators' knowledge of their students' thought processes about their human/nature relationships would increase understanding between educators and students and result in a knowledge base which, being derived from students' expressions, would likely have more meaning to peers than perspectives derived from other means (p. 186).

To conclude, students' views should be incorporated within the process of instruction (Robertson, 1993). Students should be encouraged to explore and develop

their thinking on human-nature relationships; they should be encouraged to consider associations between their personal standpoint and actions beyond the academic setting (p. 186).

5.5 Chapter Summary

This chapter highlights how Middle Years students view their relationship with the environment. I begin the chapter by discussing the phenomenographic research tradition that I used to make sense of students' views. Then, using researcher/student pre-instructional interview data gathered from all sixteen participating students, I describe how Middle Years students view their relationship with the environment. My classification of students' human/nature relationships include the following views: Eco-Action (individual and collective); Life-based Intrinsic Value; Experiential Appreciation; Self-Centered; Non-Reciprocal; Basic Needs; Safekeeping, Biocentric; Reciprocal; Personal and Technical. The views of students' range between 6% and 50%. The Eco-Action View is the highest view held by students (50%); Technical View is the lowest view held (6%). Some students held six different views, whereas others held only one view.

I conclude this chapter by presenting two case studies of two representative students to highlight how students' views develop with respect to understanding their relationship with the environment and what it means to live responsibly on the planet with respect to waste minimization. The evidence supporting students' views is taken from prior- and post-instructional interview excerpts, classroom observation transcripts, photographs and photo-essays, journal entries, drawings and essays. The chapter concludes with a discussion of the existing literature that serves to further the

understanding of students' views regarding their connection with the Environment and argued for incorporating students' views within the process of instruction.

CHAPTER SIX

MEANING MAKING OF RACHEL'S EFS TEACHING

6.0 Introduction

This chapter is an interpretive account of how Rachel teaches the EfS unit that she and I collaboratively developed. Some of Rachel's own sense-making of how she teaches is also included. Because Rachel is so practice-oriented, she sometimes misses opportunities to forge the link between the lived experiences of the students and the fundamental principles of ecology that underpin the EfS unit. My troubled-self is obvious in this chapter. A story is also related how *Star Building Supply* donated wood for the construction of composters to denote the community support in worthwhile school projects.

6.1 Rachel's Teaching of the EfS Unit

Rachel brings an awareness of human/nature relations to students. She interprets students' values by dialoguing with them. She empowers her students. Rachel is a "leader from within." She inspires students to make a difference through storytelling. She uses the world as her extended classroom connecting the school to the environment and surrounding community.

6.1.1 Fostering Student Awareness of Human/Nature Relations

Concerning waste issues, Rachel deals with incinerators (see next section) and landfill sites in the same class. She carries out interpretive dialogues with her students to

think about waste issues. Rachel asks students to identify the negative aspects of landfill sites.

Rachel: Okay. Any more negatives to landfills? Gil.

Gil: Takes up space.

Rachel: Thank you. Any more negatives. Dave.

Dave: You're not safe.

Rachel: What do you mean, "you're not safe?"

Dave: As you were saying with the chemicals and stuff, it's not safe for you.

Rachel: Okay. So you are saying that it is not safe for humans.

Students: And animals.

Student: And the environment.

Student: Everything. (Teacher-Students' Dialogue, lines 377-391, Classroom Observation, Session 3 [October 25])

In the above dialogue, Dave reiterates the point Rachel may have made about the emission of bad chemicals when garbage is burned. In making this statement, Dave utters "it's not safe for you." Rachel interprets Dave's utterance with respect to the notion of human entities before non-human entities. Some students are able to decipher this rather quickly when they state, "and animals," "and the environment," and "everything." The aim of the EfS unit is to instill in students a sense of the relationship between human and nature. The notion that landfills are unsafe for more than human entities is what Rachel is attempting to capture. Students seem to readily accept this notion. When the opportunity presents itself, Rachel seems to be able to identify and acknowledge students' alternative perspectives on a particular issue. Rachel's consideration of students' views and bringing their ideas forward for discussion is even more prominent in

the next section that focuses on Rachel's discussion about the positive and negative aspects of incinerators.

6.1.2 Interpreting Students' Values

Students' responses to Rachel's questions on the issue of incinerators evokes her to interpret their values in the following teacher/student dialogue:

Rachel: Any more negatives to incinerators? Now, I will give you one more positive for incinerators. There are some incinerators... They are called, I think, "waste to energy"— energy from waste facilities. And what they do is they capture the heat from the incinerators and they convert waste into heat energy. So, that's a good thing. But here's the downside. They need lots of garbage to give off that heat. So, does that make people want to recycle if they know they are going to get energy from

Students: No/yes/one tin can burn energy for three hours.

Rachel: Okay. You are right. The energy is used from recycling instead of making it again. But, I'm saying, if we burn that tin can, that tin can is gone.

Student: Ya.

Rachel: So we can't recycle. We have to make a whole new one. So now, what I am saying is that if we take all the stuff, even the stuff that we can recycle. The more garbage we have the more energy we can get from here. So, is it better to burn our recycling or is it better to recycle our recycling?

Students: Recycle. Recycle our recycling.

Rachel: Who thinks that you should recycle your recycling?

Students: [all but two students raise hands].

Rachel: Who thinks you could get more energy from burning it?

Students: [two students raise hands]

Students: Well, that's bad for the environment.

Rachel: Okay Chris. Do you think that is true? Can you explain why?

Chris: Well. Um.

Rachel: Cole. You and Chris disagreed with the class. Can you explain that?

Cole: Um. Um.

Rachel: Okay. I'll try to explain. The more garbage we have to burn. The more heat energy we get. But the bad thing is - the more negative things we get too. So, yes, it is nice to get energy from our waste but is it worth getting all these bad things instead of just recycling them and not getting all these bad things?

Student: It's worth it!

Rachel: That's up to you to decide.

Student: I changed my opinion.

Rachel: That's okay. You are always welcome to change your mind as long as you know the reason. (Teacher-Students Dialogue, lines 738-777, Classroom Observation Session 3 [October 25])

Students state the positive and the negative aspects of incinerators. In this dialogue, Rachel draws students' attention to the two-faces of an issue: (1) incinerators convert waste to heat energy and (2) the magnitude of material needed to produce heat energy. Because of the latter argument, she ponders with her students whether or not burning garbage to produce heat is really worthwhile. Rachel brings this issue to students' awareness and allows them to "think" about the arguments. In particular, she calls upon the two students who disagree with the class in terms of the second argument to explain their positions. However, these students hesitate to come forth with explanations for their beliefs that burning recyclables is a better solution than recycling recyclables. Rachel offers a more powerful argument for not burning recyclables. Not only is the amount of waste material needed enormous, but also "getting all these bad things" is not good.

Rachel refers to the "chemicals" that are emitted as a result of burning (see evidence for this in the student statement in the next teacher-students dialogue). While one student remains firm in his original position after Rachel's explanation, the other student changes his mind. Rachel acknowledges each one's position. But she states that their stand on a position needs to based on a well-reasoned argument.

It is clearly evident in the above teacher-students dialogue excerpts that Rachel scaffolds students thinking. Often students' responses are in phrases, but Rachel is able to decode the underlying meaning and interpret it for them with respect to their own ways of viewing the waste issue. Simultaneously, she also presents them with alternative ways of thinking about an issue. While she wants her students to take their own position in an issue, Rachel gives persuasive arguments to shift students' thinking to a more plausible way. In line with this, consider her comments:

> I think that they're starting to understand that I'm not the sage on the stage, that I'm not going to sit up there and tell them everything, that they have to figure things out for themselves and learn from each other <u>and I'll just supply additional information</u>. But I think they're realising that it's them and not me. (Teacher interview on November 10, lines 667-669, about Session 4 [November 1][4]

What Rachel means by "I'll just supply additional information" is that she intends to not only add to their comments and provide information, but also to interpret the information that they provide and extend it for better student understanding.

Doll (1993) suggests that there is no issue more important to teachers, particularly beginning teachers, than the one of who has authority, who is in control. He argues that in a post-modern, transformative curriculum, a teacher's role ought to be "first among

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[4] After every second EfS curriculum unit teaching session, I interviewed Rachel to obtain her reflections about her teaching and student learning. In this case, the reflective interview took place on November 10 and focused on her teaching of Session #4 that took place on November 1.

equals," in which the teacher's role is not abrogated; it is rather restructured and resituated from being external to the student's situation to being one with that situation. The authority, too, he argues, moves into the situation. The teacher is not an "enforcer" but rather an "interpreter of others' values." The teacher is "a leader from within, not a dictator from without" (p. 169). The key ingredient in this situational frame is the establishment of community — making operable that "fascinating, imaginative realm where no one owns the truth and everyone has the right to be understood. He suggests that through dialogue within a caring and critical community students' values need to be developed from everyday life experiences. Rachel clearly fits Doll's vision of what the role of authority ought to be — an "interpreter of other's values."

6.1.3 Leading from Within

Rachel teaches as though she is "one" with students. She does not position herself "outside" their situation. She presents herself as a leader from within, not a dictator from without. Her position is obvious when another teacher is in the classroom instructing students on opening camera packaging with scissors and then proceeding to demonstrate how the cameras operate. Meanwhile, Rachel is collecting the packaging waste—a leader from within. Consider the following student/teacher dialogue:

Rachel: Okay. I'm coming around with a garbage bag to pick up the plastic only. Don't put any paper in this garbage bag, just the plastic.

Student: Where do we put the paper?

Rachel: The paper will go in the recycling.

[a student drops the paper into the recycling bin]

Rachel: Good.

Student: Does this go in the recycling?

Rachel: Yeah. You want to actually just go around and collect all of those?

Student: Yeah.

[Student approaches a group of students carrying the paper recycling bin]

Student: You guys — papers. (Teacher-Students' Dialogue, lines 164-182, Classroom Observation Session 2 [October 17])

Rachel circulates around the classroom collecting plastic material generated from the camera packaging. She models recycling behaviour and takes the initiative to collect and sort the waste into recyclable and non-recyclable waste. She encourages a student that has completed his activity to assist her in collecting the waste from the rest of the students. The student obliges eagerly.

Although Rachel demonstrates good waste recycling behaviour during classroom activity, she also communicates that she does not always practice good recycling practices. During an activity where students are asked to work in groups to determine which items (placed near the front of the room) could/could not be recycled, then share with their classmates, Rachel admits in her dialogue with students that she is sometimes "too lazy" to recycle.

Rachel: Okay. Re-using is a good idea. Let's go to the next one. Paper towel tube. Okay. Gil

Gil: Ya, because it has to be crushed.

Rachel: It's better if we flatten it. Because this takes up a lot of open space. What about toilet paper rolls? <u>How many of you actually recycle toilet paper rolls</u>?

[three students raise their hands]

Student: I do.

Rachel: Okay. So it's not very common to think about it in other areas. In the kitchen, sure we will recycle lots of stuff, but in the bathroom? That would mean having to take the toilet paper roll off and walk all the way to where your recycling is. That might be difficult you know.

[Rachel presents a sarcastic tone]

Student: It is still saving the environment!

Rachel: I know, I'm being facetious, Gil. You know, sarcastic! 'Cause you know, for me, it would mean walking all the way downstairs to the recycling or walking all the way five steps to my computer room, putting it in my recycling bin there. But, my fiancée doesn't do it and sometimes, neither do I.

Students: Huu.; oooh; We're gonna tell! (November 2, Classroom Observation, Session 5, lines 346-365)

Rachel conveys to her students through this excerpt that good recycling behaviour takes effort and time. In this case, the effort required means "having to take the toilet paper roll off and walk all the way to where your recycling is." In a sarcastic manner, Rachel shares her view that the effort might be difficult for some people. When a student takes her sarcastic comment seriously/literally and comments "It is still saving the environment," it is ironically what Rachel wants her students to conclude. Rachel shares with students her personal experiences in a non-sarcastic manner. She tells students that in her case, the effort would mean "walking all the way downstairs to the recycling or walking all the way five steps to a computer room putting it in my recycling bin there" which her partner does not do. She also admits that sometimes she doesn't do it either. The students react in a humorous manner by chiding her that "they will tell." In essence, the point that Rachel manages to get across to her students is that recycling behaviour takes conscientious effort and time. She also passes on to her students that sometimes, she herself does not make the conscious decision and take the necessary action on her

part that she knows is required. She does not excuse herself for not practicing required recycling action, but rather shares with students the notion that she is not infallible with respect to recycling.

As an observer, it is possible for me to interpret a teacher's thinking or behaviour based on my own theoretical perspectives and ways of doing things. However, it is more convincing when the reasoning comes from a student. Consider John's views about his teacher, Rachel:

> She tries to teach us, I think, what she knows. Like, personally, when she says, "Well, I do this and I do this, too" after every sentence, that you should do, I don't think she's saying, "I do" because she's just trying to set a good example for the class. I think she actually does it! Like from the bottom of her heart, saying that like she's had all this education about environmental, cleaning up the environment, so I think she does it like on her own time. Sure, her husband or fiancée isn't too happy about having worms in his house in the basement... I think that she's really teaching us stuff that she really does and she says, "Well, I've got a vermi compost...you should really start taking care of the environment" 'Cause I know she already does. She's got a bag and whenever we're going places, when we're not looking, she'll pick up garbage and put it in her backpack or something like that. So, she's a good teacher. (John, Post-Instructional Interview, lines 498-516)

John makes known to me that his teacher "walks the talk." His view is that Rachel "tries to teach us (them) what she knows" and "stuff that she actually really does" herself. He suggests that she teaches "from her heart" and practices what she teaches "on her own time," even if it means upsetting her fiancée in the process. According to John, her partner isn't particularly happy with the notion of having a vermi composter in the house.

John thinks Rachel is a good teacher. He tells me that when Rachel takes her students out on a classroom activity, she picks up garbage and put it into a bag in her backpack when she thinks nobody is looking. Obviously, John is observing!

Besides modelling appropriate behaviour and sharing her personal experiences with respect to recycling, Rachel also relates stories that convey to students that children can make a real difference if they make a conscious decision and take actions to make a difference.

6.1.4 Telling a Story: Children Can Make A Difference!

Some students in another Grade Six classroom express their concerns about the business project assignment to Rachel. The students conceive the project being too hard for Grade Six students to complete. Rachel wants to find out if her research group also has similar concerns. Rachel takes the opportunity to read a passage from David Suzuki's book, *Sacred Balance*. Through a true story, she creates the context to encourage her students that they (children) can make a difference in their world. Suzuki's story is part of the teacher-students dialogue:

Rachel: How many of you think that this project is too hard for Grade Six students?

[some students raise hands]

Rachel: There are a couple of kids being honest. And you know what, I would like to share something with you.

[Rachel takes the book off her desk, moves over to the counter in the front of the room, and hops onto the counter facing the students.]

Rachel: 6-2 class came in and they were here talking about the project. One of the boys put his hand up and said, "I was talking to my mom and we both decided that this project is too hard for Grade Sixers. I mean, we are only kids. Do you expect us to go to a business and have adults listen to us?" How many of you think that that is probably true?

[a few students raise hands]

Rachel: You're right! Sometimes it's hard to get your point across to adults and it's a little bit harder when you are a child trying to do that to an

adult, and sometimes it's hard as an adult to another adult. I want you guys to listen to this little, this quick story. This book is by David Suzuki. I just finished reading it and um, at the end... The beginning of the book is really scientific and it talks about the planet and how the planet was developed. And in the middle it talks about what we are doing to the planet and how we are destroying it. Then, at the end it talks about some people that have really done a good job trying to help the planet. And I was reading it, and most of the people that are making a big difference on the earth are adults. And that makes sense because they have been around longer and they know more. But here is an interesting story that might relate to you guys. It's called the child's reminder at the Earth's Summit. And this is written by David Suzuki. You all know who David Suzuki is, right?

Students: Yes. No. The nature channel guy.

Rachel: He is a nature guy. He is a naturalist. He also is a scientist and a journalist. That means he writes articles for newspapers too. And this is by him.

[Rachel reads from the book]

My family's 10 day visit to the village of Operin, the Brazilian Rainforest took place in 1989 when my daugher's Severine and Serika were nine and five years old. As we flew away from the village, we could see the encroachment of gold miners who are polluting the rivers and destroying the river banks and the farmers who are burning the forests down in a desperate search for land to grow food on. Severine became alarmed about the future of her newfound friends in Operin. Upon her return to Vancouver, she started a club called ECO (Environmental Children's Organization). Five, ten year old girls began speaking out about the beauty of tropical rainforests, the animals, the plants and the people who inhabit them and the need to protect them. Over time, they were invited to visit classes and give talks gaining some local notoriety. In 1991, Severine told me she wanted to take ECO to the Earth Summit in Rio De Janerio in June of 1992. This conference would bring together the largest gathering of heads of state in history.

[Rachel stops reading from the book]

Rachel: So basically all the presidents and prime ministers and environment ministers and all of the big government people go to this meeting and talk about the planet. They all get together. Over 300 of these people.

[Rachel continues to read from the book]

Severine said, I think all those grown ups will be talking about our future and they need us there to act as their conscience. I vigorously protested that it would be

expensive, that Rio was dangerous and polluted, and besides, it was unlikely that children would be heard.

[Rachel stops reading]

Rachel: Even David Suzuki said to his daughter, "You know what, you're only a kid and it's gonna cost too much money to go, so no, you shouldn't go."

[Rachel continues to read from the book]

I promptly forgot about the conversation. Two months later, Severine proudly displayed a cheque made out to ECO for 1,000 dollars from an American philanthropist to whom she had spoken about her dream. My wife, Karen and I realized that the perspective of children was critical for people meeting at the Earth Summit to hear. So we offered to match every dollar that the club raised with another. And up for the challenge the girls about making ornamental salamanders, selling used books and organizing bake sales. They attracted the attention of another philanthropist and Raffi, the well-known children's singer. Both donated generously. Finally, the girls held a public event to show slides and describe their goals. To our amazement, ECO raised over $13,000 dollars, enough with our matching funds to take five children and three adults to Rio.

[Rachel stops reading]

Rachel: How many of you are 10 right now?

[some students raise hands]

Rachel: How many of you are 11?

[some students raise hands]

Rachel: How many are 12?

[no students raise hands]

Rachel: At 11 years old, this girl and her five friends raised 26,000 dollars to go on this trip. Pretty amazing huh? A lot of money.

[Rachel continues to read from the book]

ECO enlisted the help of a youth group that published three different kinds of newspapers which they took along to Rio. At the Earth Summit, they registered as a non-governmental organization and rented a booth at the global forum along with hundreds of other adult groups. They set a display of pictures and posters,

handed out their newspapers and brochures about ECO and talked to many people. Soon reports and television cameras appeared to interview these five little girls from Canada. The Environment Minister, Jean Cherais made an appearance with cameras in toe. Eventually, William Grant, US head of Unicef heard the girls speak and urged the organizer of the Earth's Summit to invite Severine to the plenary session, and he did. Severine was 12 years old, she wrote her speech with input from her fellow ECO members and rehearsed it over and over in her Taxi ride to Rio Centro, the site of the conference. She was the last to speak in a huge auditoria that swelled a few hundred delegates. Some of what she said was this, "I am only a child and I don't have all the solutions, but I want you to realize neither do you. You don't know how to fix the holes in the ozone layer, you don't know how to bring up the salmon up a dead stream, and you don't know how to bring back an animal now extinct. You can't bring back a forest where there is now desert. If you don't know how to fix it, please stop breaking it. In my country we make so much waste. We buy and throw away, buy and throw away, yet northern countries will not share with the needy. Even though we have more than enough, we are afraid to lose some of our wealth, afraid to let go. You teach us how to behave in the world. You teach us not to fight with others, to work things out, to respect others, to clean up our mess, to not hurt other creatures to share and not be greedy, then why do you go out and do the things that you tell us not to do. My dad always says, you are what you do not what you say. But what you do makes me cry at night. You grown ups say you love us, I challenge you, please make your actions reflect your words. I am only a child, yet I know that if all the money spent on war was spent on ending poverty and finding environmental answers, what a wonderful place this earth would be.

[Rachel stops reading from book]

Rachel: At 12 years old, the age of some of you, this girl had already gone to a huge Conference in front of presidents and prime ministers and spoke. Now that's pretty amazing, that's really amazing. But, I want you to understand that at 10, 11 and 12; adults will listen to you if you know what you are saying, if you have a right message. So, you're right, this project is very hard for kids, but it's also a very real project.

Student: Sometimes when I phone a business saying, like if we can inspect it, they sometimes say "no" because they sometimes say, "you're too young to come in my business."

Rachel: You're right! And that's true. And that's why you can't give up though. If you guys make a difference. Think about it. We have five groups in this class. How many Grade Six classes do I teach?

Students: Six.

Rachel: So, how many businesses are probably going to be affected by this project?

Students: Six, thirty.

Rachel: Thirty. Now if half of those businesses actually listen to the kids, how many businesses are going to start doing a better job of recycling and stuff?

Students: Fifteen. Half.

Rachel: Hey, there's a chance that we could maybe only 15 businesses. Is that a good start?

Student: Yes, that's lots.

Rachel: That huge, and that's just in [location]. We're not even conquering the rest of the city, so there is a chance that you guys can make a difference, but it is going to be hard. Because you're kids, so you have to be really, really sure of what you are talking about. And that's why we are going to talk about, learn about things in class so we can take it outside to the businesses.... (Teacher-Students' Dialogue, lines 79-189, Classroom Observation Session 4 [November 1])

Rachel uses the experiences and accomplishments of Severine in the story to communicate to students that they too can make a difference as children and that adults will listen to them if they have the "right message." When one student communicates to Rachel that a business has turned him away because the business representative feels that he is too young, Rachel agrees with the student and then creates an opportunity to emphasize once again that if students "don't give up," they could "make a difference." Rachel bargains with her students that if only half of the businesses listen to students with respect to better managing their waste, that is a "good start" and a "huge" difference has been made.

Doll (1993) advocates the use of narrative in teaching, yet points out that the narrative mode requires interpretation. He says, "a good story induces, encourages,

challenges the reader to interpret, to enter into dialogue with the test" (p. 169). To make his argument, Doll (1993) quotes Wolfgant Iser (1978, p. 24), "It is the element of indeterminacy that evokes the text to 'communicate' with the reader," and in turn that induces the reader "to participate" in the story (p. 169). Doll (1993) stresses, teachers need to present lessons in enough narrative form to encourage students to explore the possibilities that can be generated from dialogue with the text. Atkinson, (1998) also states, "Story provides the parts — motifs, plot, connections, feeling — that make understanding and meaning possible" (p. 74). Through her story and the intermittent student/teacher dialogue that follows, Rachel attempts to inspire and motivate her students to want to participate in the business project. She challenges her students to do what the character in the story was able to do — that is, to make a difference in the world.

Rachel also draws a parallel regarding the concerns that students' parents have about the business projects. A legitimate concern that business will not listen to children is also brought out vividly in Suzuki's story. For example, when Rachel explains that the parent in the story is hesitant about his daughter going to the Conference to communicate her message to world leaders (Even David Suzuki said to his daughter, "You know what, you're only a kid and its gonna cost too much money to go, so no, you shouldn't go"), she attempts to draw a parallel between the concern and hesitation of the parent in the story and the concern and hesitation of the parents' of the Grade Six students she is teaching. Rachel makes this connection because she wants the students to relate the twelve-year-old child in the story to them and to believe that they can "do it too."

Rachel also wants to help the students to understand that they do not have to wait to become adults to make a difference. They can translate what they are learning now and "do things" as children to make a difference in the world. Consider her reflections regarding how her storytelling message might impact her students:

> Well, by reading that little thing about David Suzuki, I think that might help them realise that what they're learning now can impact them even now, not just waiting for them to become adults. But also looking at the bio reserve and seeing how valuable nature is in taking care of itself that maybe we need to be a little more aware about how we're taking care of ourselves and nature. We don't really have to take care of nature, it does it itself. We just have to make sure that what we're doing doesn't impact on nature. (Teacher interview on November 10, lines 605-609, about Session 4 [November 1])

Sarah, one of Rachel's students internalizes that children can make a difference. She doesn't think that she has to wait for adulthood for her to make a difference in the world. This belief is clearly evident in Sarah's response when I ask her why adults should listen to kids more:

> Yeah. So if they listen to children, because children are the ones who are getting taught about what the world's going to be like and grown ups aren't – they're just doing their jobs, like whatever they do. And so, most of them don't even know what's going to happen and so they should be listening to children 'cause we're the ones learning about it. (Sarah, Post-Instructional Interview, December 17, lines 832-850)

Sarah feels that children have important views to which adults should listen. Her argument is that adults do not continue to learn about the world and what the world will be like in the future because they are too busy working at their "jobs." Consequently, she thinks that because they are no longer learning and children are, children should be listened to. Rachel's own perception regarding the notion that children can make a difference has obviously been internalized by some of her students.

6.1.5 Empowering Students

Rachel describes the "business action project" and provides the details of the process. In this event, Rachel empowers her students and helps students learn to think. She does so by emphasizing the *process*, not the product. Note what authority Rachel places on her students with respect to carrying out the requirements of the project:

Rachel: Your next project. You're going to have a huge, huge project for this class. Every Grade Six group is going to be doing this. I'm so excited. When I was planning this, this summer with Ms. McDonald we were just having a blast, super exciting. We've already talked about what we think this unit is going to be about. We talked about recycling. We talked about less litter. We talked about not creating so much garbage. All those things are really important but it's one thing if we learn about it. How are we going to take that information and share it with the rest of the world? So we came up with a project, and I'm so excited about this project. What you're going to do and you're going to start this now, but you're not going to have all the information until I've done all the lessons, is you're going to go find a business in [location]. Maybe it's somewhere where your parents work. Maybe it's where your cousin, or aunt or uncle or grandma or grandpa works. Or maybe it's just a friend or maybe you don't know anyone there but you think it's a good idea. You're going to go to a business and you're going to talk to them about their waste. How they're going to interview them. You're going to go there and take a tour of their facility. Maybe you choose an office and you're going to see what they throw out. And then you're going to come back with your group. You're going to do a whole big presentation of how this business can make it better. So you might have some recommendations on recycling or you might have some recommendations on what they should be buying. So it's not so much garbage. So all these ideas are super exciting...okay. I'm going to explain the project a little bit more and I'm going to give you couple minutes today to come up with ideas of where you might go. This is what's going to happen. In order for you to go to that business you need a few things. Number one, you need consent from the business. You can't just show up and say, "Hey, we're going to check out your business." You need to contact someone there. You need to have permission. Just like all these other consent forms, the ones that your parents sign, the ones you signed, the ones the photographs are going to have to sign. And maybe you might want to take pictures of your business in relation, so these are all ideas. So, what you're going to have to do is have the consent form and then you're going to need to go

there. Now I can't just send off twenty-seven Grade Sixers into [location] for eighty minutes and say, "See you at the end of the double period." "Bye." Not going to happen! What you're going to need to do is you're going to need an adult to be with you. And I'm looking at a parent. Unfortunately there will be a few groups that no parents are going to be available so we're gong to have to come up with a strategy then. But we need an adult to be with each group and I'm not asking the adult to drive you 'cause if it's in [location] you might be able to either walk there or take a bus. It's not very far. I'm not asking you to go downtown. I'm asking somewhere in our community. Somewhere around here.

[Gil raises his hand]

Gil: My uncle owns a pizza place, but it's not in [location].

Rachel: Where is it?

Gil: Well, he has two of them. One's on [a name of a street in the area] and the other one's by [a name of a street in the area].

Rachel: Okay that's something we can discuss. The only problem is I'm looking more for [location]. When we come up with our plans then that's something we can discuss though, Gil. We can discuss locations, but not right now, though Sarah?

Rachel: In your group, you're going to take five minutes to come up with some brainstorming ideas. Where might you be able to go? And for each one of those places, whose going to contact that place. So, this is your homework. Your homework will be to come up with at least three places and at least three phone calls. Or go in there to see if you can talk to someone to see if you can do a waste audit. Now, we'll give you much more information later. This is just for you to start brainstorming. So for next class, you need to make sure you have at least one place that says you can go there and we'll talk more about that. So, what are you going to say when you phone there? [name of a student]?

Student: "Hi, my name is [a name of a student]. I go to [name of his school]. We're doing a project. I'm wondering if we can interview your work and see how your work looks like, for the waste.

Rachel: [name of a student], that's excellent! Identify yourself. Identify the school. Identify what you're doing a project on and what it's about. We just want to check out what kind of waste you produce and then maybe have some recommendations. Okay? Very straightforward. So

> right now two things: Number one, discuss where you might go. Number two, whose going to make those calls by next week'. Okay. You need to write this down in your book and in your agendas. (Teacher-Students' Dialogue, lines 602-671, Classroom Observation Session 2 [October 17])

Rachel introduces the business project to students. She shares her excitement about the project and describes to her students the process including what they will be required to do to complete the project — to share what they have learned with others. Rachel empowers students to make their own decisions. By making statements such as "just to let you start thinking about who you might be able to contact, where you might be able to go," she holds students accountable to carry out the tasks of the business project. She communicates to students that she has high expectations of all of them. Through the business action project work activities (identify a business, contact the business, get permission to conduct a waste audit, ask questions, take a tour, recommend better options regarding purchasing and waste disposal, present ideas to business) Rachel has students making many important decisions about their project. Rachel places the onus on her students when she makes comments such as "You're going to go find a business in [location]," "You're going to go to a business and you're going to talk to them about their waste"; "You're going to interview them"; "You're going to do a whole big presentation of how this business can make it better." By making these comments, she communicates to her students that she is giving them full authority to make their own group decisions. She sanctions them to take action. For example, Rachel does not dictate which business the student groups choose — student groups must decide as a group on which business they will conduct a waste audit. They have full authority to make their decisions and take appropriate actions.

Through the business project activity, Rachel also enables her students to think. Thinking is an important function of learning (Doll, 1986). A generally accepted principle of learning is that "learners think when they encounter obstacles or challenges to action that interest them. In thinking, they design and test plausible ways of overcoming the obstacles or challenges" (Doll, 1986, p. 58). In the excerpt above, Rachel presents a challenge to the students about an activity that interests them. When Rachel asks students questions such as, "How are we going to take that information and share it with the rest of the world" and "Where might you be able to go?" she is asking students to use higher-order thinking.

The product (presentation to business) is not as important as the process. Rachel has her students solve a "real-life" problem related to the production and disposal of waste. She encourages students to identify the problem and has them use appropriate understanding, knowledge, and skills. For example, she poses the question: "According to what we are about to study, what options would you provide your business with respect to waste production and disposal?" She requires students to think about ways of solving the problem in light of their conscious knowledge about recycling and less waste, so that they can eventually describe the step-by-step process by which they might help the business to solve the problem. For example, students' thinking is waste generation and disposal is a very important sustainability issue in the world. Businesses may generate too much waste and dispose of it in a less than sustainable means. What can we do about that? Rachel also has students work together to generate ideas that would have them solve the problem with respect to the business' waste production and disposal. For example, students are asked to develop a presentation that identifies options for their

particular business with respect to waste minimization. Student groups must also make a choice regarding which option they will propose to their business based on the impacts on environmental, economic and health related factors, then develop an action plan for the business to follow in relation to the option(s) presented.

When I shared the notion of choosing the businesses for students instead of having the students choose their own businesses, in case they are not successful, Rachel objected to it. She felt that students should be empowered to make their own decisions even at the expense of not being successful. Rachel believes that students can and will make mistakes and view those mistakes as learning experiences. She also believes that students can learn as much from their successes as from their failures.

One of Rachel's students, John, communicates his sense of empowerment (see Chapter 5) with respect to the business project and provides evidence that Rachel is correct in her views. Recall that John's perception is that he could make real changes in the world and has something to offer to adults with respect to their learning. John's perception provides further evidence that John feels empowered as a result of carrying out the tasks associated with the business project (see details in chapter 5).

After a number of EfS teaching sessions, I asked Rachel to reflect on her teaching:

> I think that it really empowers them because they get to come up with the answers. I'm not feeding them the answers. They're discussing. And whether they're relaying previous knowledge or just coming up with new ideas, it's them not me. (Teacher interview on November 10, lines 329-331, about Session 3 [October 25])

Student empowerment, according to Rachel, is achieved through student dialogue. Rachel doesn't believe in true knowledge, or she would come up with the right answers. Instead, she provides learning opportunities where students, through collaboration and dialogue, come up with the answers by relaying previous knowledge. Rachel does not

assume that her knowledge "sits out there" and the students should be prepared to receive that knowledge as it is transmitted. She demonstrates that meaning is made through dialogue. By saying "It's them not me," she implies that it is their dialogue and meaning-making that is important, not hers. She sees her job as "keeping the dialogue going."

When Rachel says, "it's them not me," she is referring to students experiencing things for themselves, something students had ample opportunity to do throughout the implementation of the EfS curriculum unit. Throughout instruction, Rachel uses a practical perspective towards teaching. As we saw in Chapter three, she designed the EfS to ensure that the unit was student-centered and oriented towards problem-solving and decision-making. As the unit played out in the classroom, students have ample opportunities to make their own choices and decisions. Students identify their own questions, conduct the site visit on their own and ask business representatives their questions. Students work together in their groups to identify a business in their community in order to conduct a waste audit and determine a better way that a particular business could manage their waste. Students identify their business, make arrangements for site visits and information sessions, develop waste-related questions for business representatives to answer, do research and develop action plans including the identification of a number of options businesses could consider in improving their waste practices.

In addition to working on their business projects, students built wooden composters as part of the EfS curriculum unit. They went on excursions that had them investigate their environment. They inspected recyclables and made decisions with respect to what can and can not be recycled. They conducted a garbage audit that required the separation

of recyclable, compostable and non-recyclable products from a four-day-old garbage bag. They explored composters and vermi-composters, including the worms and feeling the dirt. They took pictures of waste at the landfill site. They played a game outside that had them fetch recyclables from their peers. Students were empowered through their involvement in experiential learning activities throughout the implementation of the EfS curriculum unit.

Rachel also used the example of visiting the bioreserve as an opportunity for students to see the inherent value of the environment and its capacity to sustain itself. She concluded that nature does not have to be taken care of, but suggested that human beings ought to ensure that they do not impact nature in a negative way so that nature can continue to sustain itself over time. By respecting nature's inherent value and not destroying or disturbing the environment, Rachel felt that students could make a difference now as children.

It is apparent that Rachel sees the environment as an extension of her classroom and sees the world as a resource for learning. In the section that follows, I present how Rachel views her world: as a classroom.

6.1.6 Seeing The World as her Classroom

Rachel uses the community as her classroom. She dissolves the classroom walls and makes use of the resources in the wider community and strengthens the link between the school and the community. She creates linkages between her school and the surrounding community through excursions and research projects that involve local businesses and their representatives. Through excursions and research projects, Rachel attempts to increase awareness and knowledge about the environment and human beings'

impact on it in terms of waste management practices. She also attempts to have students develop the necessary skills and expertise to address waste issues, and attempts to foster the motivations, attitudes and commitment to make informed decisions and take responsible waste related actions and to have others (especially the business in question) take more responsible waste-related actions.

Rachel organized several excursions during the course of the EfS curriculum unit. One excursion had students visit a local landfill site to observe a solid waste management system. Another had students visit a natural environment to observe how nature recycles and reuses waste from a population of plants and/or animals. In both cases, the excursions were organized because students needed to visit a particular site to further some aspect of research they had undertaken with respect to the EfS unit. The landfill site excursion was carried out because students had to determine what kinds and how much waste is generated in their city. The visit to the landfill site addressed that requirement. The purpose of the visit to the bioreserve was to foster in students a willingness to care for the environment and to discover how nature recycles and reuses resources.

Rachel sees the bioreserve as a natural extension of her classroom. She sets the stage for learning and then lets learning take its course. Consider the student/teacher dialogue and student/student dialogue before and during the excursion to the bioreserve:

Rachel: So, today <u>we are going to talk a little bit about nature</u>. Think about nature and the three R's. First of all, what are the three R's. Hands up please.

Student: Reduce, reuse and recycle.

Rachel: Reduce, reuse and recycle. <u>Now can you think of any way that nature does one of those 3 R's on its own</u> (inaudible)? Gil.

Gil: Reduce.

Rachel: In what way? This is a hard question. Think about the three r's and think about nature. Yes, Tracey.

Tracey: It reuses. If a tree dies, it turns back into soil so that another tree can grow.

Rachel: Okay. Very good example. If a tree dies, it starts to rot right? And eventually over many, many years with a tree eventually will turn into compost like soil and then things can grow. Can you think of another example? Reuse is probably the easiest one with nature. Geez where's John when we need all the answers, huh? And what do birds make their homes of Gil?

(Steven answers the question instead of Gil)

Steven: Twigs, sticks.

Rachel: Exactly Steven, sticks. And where do these birds find these sticks?

Steven: On the ground.

Rachel: On the ground. So, twigs fall off a tree, birds fly down pick them up and use them. Is that reusing?

Students: Ya.

Rachel: Do the birds go to the tree and break off twigs and try to kill the tree so that they can do that?

Students: No.

Rachel: They use basically the trees garbage or the trees waste ... the twig could have fallen off. Very good, Steven. Any other ideas? Have you guys been to the bioreserve before?

Students: Yes.

Rachel: So, what's going to happen today is you are going to go with your groups and I am going to give you a short time to explore around an area and your going to look at which ways nature does the three R's. Now there might be some recycling, there might be some reusing and there might be something related to reduce... I'm sure we discussed this in the beginning of the year, but I am just reminding you. Before

we leave, can you think of any other R's that we can add on, besides the regular R's that would be related to this topic? We have reduce, reuse, and recycle. Can you think of other R's? Cole.

Cole: Respect.

Rachel: In what way, respect?

Cole: Like don't like pull branches and break the branches off, they are still living and the tree is still living.

Rachel: Thank you, Cole. Respect is a good one.

Rachel: While we are walking we will think of other R's we can come up with. So your two jobs for today, your two jobs for today are, once you get to the bioreserve to find evidence of how nature recycles itself, or reduces or reuses and to think of other R's. (Teacher-Students' Dialogue, lines 189-224, Classroom Observation Session 4 [November 1])

Before leaving the classroom for the bioreserve, Rachel stresses to students that they should care and respect the environment while they are visiting. So, during a teacher-led discussion, she reminds students of their discussion at the beginning of the year. She asks them if they can think of any other "R's that they can add to "reuse" and "reuse." Based on the student's response, "respect," Rachel asks the student to elaborate what is meant so that all students can be reminded of what behaviour/actions are expected of them when they visit the environment: "Like don't like pull branches and break the branches off. They are still living and the tree is still living." Additional reminders are not required. She attempts to create a student culture that cares about the environment.

Smith (1998) argues those educational goals such as increasing knowledge and awareness about the environment, developing skills to address issues, fostering attitudes.... are necessary, but insufficient, if they are not accompanied by the willingness to care. Caring is likely to emerge only if one experiences connectedness. Rachel uses

the excursion to the bioreserve to foster in her students a willingness to care and also to experience and reconnect with the environment as a precursor to addressing her educational goals. What happens when the students arrive at the bioreserve?

Rachel: Guys, [name of student] is showing us something. Come on over here.

[students gather around a tree that has a nest on it]

Rachel: Okay. What does it look like it's made of, Gil?

Gil: Mud, metal.

Rachel: Mud and branches.

Student: And some leaves.

Rachel: And some leaves. Good. Okay. Let's just go there a little bit. I'll tell you where I want you to go. Okay. We are going to be exploring around this area again. What's going to happen is exploring around this area? You can go a little bit into the trees but not too far. You have to be able to see me at all times. I will be whistling in about 10 minutes so you don't have a lot of time. Now, I want you to come up with 10 R's from nature, but you have to be with your group so get with your group.

Students: Do we have to look for nature R's?

Rachel: No, no. Not nature R's, but 10 ways nature reduces, reuses and recycles. Okay. Get with your group and go to an area.

[Videographer following small group.]

...

Ruth: Look.

[comes back to look at a dried up cattail]

Fred: Hey, birds could use some of this stuff for the nesting.

Ruth: Ya, birds could use that stuff for the nesting.

[Fred touches the cattail]

Sarah: Don't touch it.

[Sarah talking loudly to John] [John joins the group]

John: This is called cattails.

[John touches the cattail]

John: It does not matter if we touch it. It's marshmallows.

[John walks away][Students are walking around some grassland [Susan and John are walking on the marsh].

...

John: Sarah. Did we even start finding something that started with an 'R'?

Sarah: Reuse. Reuse. Recycle.

Susan: I found a can.

Gil: See if you can find a regurgitating bird's nest or something like that.

[Gil runs ahead of the group and turns to the right.]

Gil: Let's go this way guys.

Sarah: Reduce, reuse, recycle, respect, restore.

...

Sarah: How is a tree reused. A bird makes a nest. That's one example. But we can't use it because Ms. [name of teacher] told us that one.

John: You know what would be really cool?

Sarah: If we don't use it the bees can. (Classroom Observation, lines 257-315, Session 4 [November 1])

In the natural environment (the bioreserve), students are able to view for themselves first hand the ideas discussed in the classroom with walls. Ideas such as the ones presented in classroom (*if a tree dies, it turns back into soil so that another tree can grow)* can be observed in the natural environment where dead trees, old trees, new trees

are located. The "meaning" of how nature recycles and reuses can be interpreted first-hand by the students in concrete ways.

Let us now look at how Rachel links the school with the rest of the community to facilitate learning. Rachel further strengthens the link between the school and the community by creating linkages between her school and local businesses and their representatives. She has students participate in an "action project" that entails student groups visiting local business, touring business facilities, conducting waste audits, then conducting oral presentations to their respective businesses. The purpose of the presentation is to have students share with the business and other local businesses and other community members the types of waste and the amount a particular business generates, and how the business currently disposes of their waste. Students identify and present waste reduction strategies that include recycling, composting and other waste-related strategies.

Completing the business research project gives students the opportunity to learn about waste minimization in a context of a real organization — a business. Students actively involved in the business projects are motivated when they see real applications for the content that they are learning in and outside of the classroom. Students learn that their new ideas and information about waste minimization could be translated to their own homes, their school and to their business. The activities that the students are involved in are "real." The product (the formal presentation) is seen as something relevant and useful to the business. Business representatives take time out of their busy schedules to listen to the waste management solutions that their businesses could adopt. There is a "real" purpose surrounding the project. The project is "real" for the students,

"real" for Rachel, and "real and informative" for the businesses that are involved, given that a number of businesses arrive for the student presentations. Through the activities that are required in the project, students set their own personal and group goals to work towards them. They identify the business, arrange a visit through the businesses facility, schedule a meeting to ask business representatives questions, conduct research surrounding the solutions they are proposing for the business and attempt to convince the business to carry out their solutions in "real-life." Students are also able to take advantage of the expertise in their community. For example, if a student group needs information about the cost of recycling bins, students make connections with other areas of their community by contacting local recyclers. They contact the recycling companies by telephone during or after school hours to find out the costs associated with the procurement of recycling bins. If they need information from university academics, they contact them. If they need information from other teachers in the school, they called upon them for assistance. If students want their business to compost food waste, they build wooden composters and present them to the business. If they want the business to raise awareness within their organization, they create posters and identify information for the businesses to post and circulate. The students make connections with their community businesses and others so that they can make informed decisions and recommend good solutions and options to their respective businesses.

Through the business project activity, Rachel creates a context for student learning wherein they make meaningful links with their community and create an opportunity for hands-on learning. The site visit which students participate in is a context that the students create for their own meaningful learning experience.

After the student groups participate in a guided tour of the Water and Waste Department for the City and arrive in the Boardroom, they ask representatives questions regarding their waste practices. The following excerpt depicts some of the discussions that ensue between the Water and Waste Department's Recycling experts and the student group:

Business Rep #1:	Every office has at least one of these rooms, so we can sit down and discuss things; so today we're talking about the program. So is there any questions about the office environment?
John:	We got lots.
Business Rep #2:	Go for it.
Sarah:	We have a whole sheet. You said you recycle, how often?
Business Rep #1:	It's constant.
John:	Constantly?
Business Rep #1:	As you can see, we do produce a lot of paper and instead of it going to landfill, it gets recycled
Sarah:	Per week, how many numbers of bags?
Business Rep #2:	That's more difficult in an office than in a home to count bags. In an office, everybody has a blue bin to put his or her papers in.
Sarah:	Did you say everyone has their own blue bin?
Gil:	So it usually gets full by the week?
Business Rep #1:	I bet we produce about ten bags of paper?
Sarah:	A week?
Business Rep #1:	Yeah.
Ruth:	Where do you put the recyclables? Are you careful not to garbage them?
John:	Yeah. How careful are you?

Sarah: Do you make sure that every single piece of paper that you have is being recycled?

Business Rep #1: The simple answer to that is "no" because some of the stuff we have is confidential and it can't go in to recycling, so what we do is we put it through a shredder and then that goes in the garbage.

Business Rep #2: I think that is a "yes" and a "no" answer. "Yes" because we have to be good and lead by example and show everybody else to recycle.

John: Do you reuse?

Business Rep #1: In the office, sure. I've produced some paper here that I won't use today and instead of recycling, I'll probably cut it up in to four and put it in the blue box.

Business Rep #2: We also buy reused or recycled products.

Sarah: How often do you reuse?

Business Rep #1: Constantly. As Dave said we buy recycled products

John: Do you have a compost?

Business Rep #2: Not for the office.

Business Rep #1: I take my stuff home to compost it.

Sarah: Do you use anything harmful? What kind of system do you have to clean the water?

Business Rep #1: We have water fountains and that water comes from the city's water supply.

Sarah: They clean the water as they go through?

Business Rep #1: Yeah. We treat the water with chlorine and we add fluoride. Later on we'll be adding a water treatment system

Sarah: So the water comes from the drains?

Business Rep #1: No, water comes from a lake. Do you know where Falcon Lake is? Our water comes from Shoal Lake, which is connected to

Lake of the Woods. It comes through a pipe, which flows into Winnipeg. It flows into three different open reservoirs and then we pump it from there into the city.

Sarah: Again, I want to ask - Do you use anything harmful?

Business Rep #1: In the water?

John: Do you use anything harmful that you had to use?

Business Rep #1: We use chlorine to treat the water and chlorine is good and bad. It's good because it kills off all the bacteria that might be in the water. But when chlorine gets converted with organics then it could be cancer causing.

Sarah: What do you do with the waste?

Business Rep #1: Water or solid waste?

John: The water

Business Rep #1: I think your teacher helped you with these questions.

Sarah: No, *we* made up these questions. (Classroom Observation, lines 225-279, Session 9 [November 20])

The linkage between the community and the school that Rachel helps to create gives students an opportunity to ask their personally developed questions in a "real-life" boardroom meeting. Although Rachel is not part of the students' experience, she facilitates the experience by creating the linkage between the school/students and the community/business/parent.

6.2 Researcher is Troubled over Rachel's Teaching

In this section, I illuminate two important areas that Rachel missed in her teaching of the EfS unit. I carried out extensive phenomenographic individual interviews with Rachel's students, exploring their views of human/nature relationships (see Chapter 5). My desire was that Rachel would incorporate these relationships in her lesson sequence

on waste minimization. Furthermore, Rachel and I designed the unit using the principles of ecology to help students analyze sustainability issues. Neither of the areas was adequately addressed in the EfS unit. Why is this so? I first examine Rachel's point of view on this curricular omission. Then I also reflect on my actions for possible reasons why this important omission in Rachel's teaching?

6.2.1 Drawing Upon Students' Views

Before Rachel began to implement the EfS unit, I interviewed her students to determine what their relationship with nature was and to find out what they knew about waste minimization, what they wanted to learn and how they wanted to learn it. I grouped the answers and provided the data to Rachel in the hope that the data would increase understandings between her and her students and result in a knowledge base, which, being derived from students' expressions, would likely be meaningful to her and to her students. I assumed that by providing Rachel with data and asking her to use their views in her instruction (to help students develop their thinking on human-nature relationships), I was encouraging her to help her students to consider their associations between their personal views and the views of their peers. I assumed that she would provide students, through instruction, with the opportunity to clarify their personal values and consider the arguments underlying their values. There was no evidence of my assumptions as she taught the EfS curriculum unit.

Consequently, during her implementation of the EfS unit, I asked Rachel if she had found the data I provided to her useful in her teaching. Some of her responses follow:

> <u>I read over it and, I think just sub-consciously, it was in my mind</u>. (Teacher interview on October 21, lines 324-325, about Session 1 [October 9])

> I don't remember the data, right now. (Teacher interview on November 10, Line 315, about Session 3 (October 25) I know that as I read through it, I sort of made mental notes for the future, when I was teaching it. Now that I'm thinking back, I can't think of what they might be. I think they're probably just in there somewhere. (Teacher interview on November 10, lines 317-319, about Session 3 [October 25])

> Yeah I'm going to have to look over that because like I said for the last question, I know I read over it and I thought about it and I think I just internalised it and I don't have it all. (Teacher interview on November 10, lines 656-658, about Session 4 [November 1])

Although she read the data, made mental notes for the future and internalized it, she does not recall what her students' views are. Clearly, Rachel does not find the data presented to her helpful. Why was that? Perhaps the data are not useful to her as presented. Perhaps Rachel does not know how to use students' views in her teaching. A combination of both answers is likely. These answers are only at the surface level. The problem, however, is more deeply embedded. It arises in the first stage of curriculum planning and design. Although the thought that students must be part of curriculum is constantly in both Rachel's and my mind (see Chapter 4), how to use the aspect of students' prior-instructional views of the human/nature relation is neither considered nor discussed. The curriculum design does not pay any attention to this missing link. As a graduate of an education faculty, I have always known that curriculum documents emphasize the role of student' prior knowledge in new learning. Most often, in non-current curriculum[5] this means that students' stored knowledge must be retrieved for further learning. The prior knowledge (what may have been learned in previous classes or in life) is used to identify the gaps and the deficits of a child rather than using the meaning that the child conveys in lesson sequences (Ebenezer & Erickson, 1996;

Ebenezer & Gaskell, 1995). I constructed a deeper meaning of the notion of using children's views only during the process of analyzing children's ideas using phenomenography in Chapter 5. Now I am aware how children's views may be incorporated within sequence of lessons.

In fact, I carried out the interviews to answer my second set of research questions, rather than intentionally using part of the curriculum. Had I provided Rachel with the student data as presented in Chapter 5 instead of simply grouping questions together and analyzing students' answers based on the question raised, I imagine that she would have found the data much more useful in her teaching. Had I inquired whether Rachel knew how to use student's view in her teaching, I could have intervened. My assumptions were unfounded.

Student conception research suggests that teachers require education in using students' views in their teaching (Driver, Squires, Rushworth & Wood-Robinson, 1994). Additionally, new ways of collecting, analyzing and presenting data to teachers might also assist teachers in this important endeavour. More importantly, Ebenezer in her studies on students' conceptions reiterates that researchers should collaboratively work with teachers amidst classroom complexities to intentionally incorporate students' views in lesson plans (Ebenezer & Haggerty, 1999). Had I been more aware of the power of such teaching, I may not have opted to be simply a passive observer in Rachel's class. Besides collaborating with her on curriculum development, I would have continued to jointly experiment with the transformation of the curriculum as a result of using students' view in a systematic manner by linking these to major principles of ecology. In

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[5] Currently, Manitoba Education and Youth uses constructivist theory in Manitoba curriculum

retrospect, although an expert in using principles of ecology in sustainability curriculum, I missed the opportunity to provide professional development to Rachel in this area in her own classroom setting where curriculum transforms when the teacher and students come face-to-face.

6.2.2 The Missing Link: Principles of Ecology

Rachel does not adequately use the principles of ecology or teach those principles to students so that they could analyze issues regarding waste production and disposal issues. The main reason for this is that Rachel does not have an in-depth knowledge base about the principles of ecology and consequently misses several opportunities throughout the implementation of the EfS unit to help students to understand the principles and guide their decision-making process.

Rachel leaves out some important components of the EfS unit plan. For example, when the unit was designed, Rachel agreed to use a powerful analytical tool to help students calculate their "ecological footprint," thus raising their awareness of the ecological principle of sustainability. She was to do this because we wanted students to realize that humanity's ecological footprint is as much as 30 percent larger than nature can sustain in the long run. Wackernagel and Rees (1996) argue that "present consumption exceeds natural income by 30 per cent and is therefore partially dependent on capital (wealth) depletion" (p. 90). We also wanted students to figure out what this means to them and what they can do about it, hence the rationale for waste minimization and changes in our/their behaviour. Rachel was to have students calculate their

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(prior knowledge is used for scaffolding, not to identify deficits).

"ecological footprint" on the way to and from the landfill site. She did not do so and consequently, she missed out on an opportunity to use the principle of "sustainability" to help students understand that the Earth has a finite resource base.

During the classroom session immediately following the landfill visit, Rachel misses another important opportunity to use the principles of ecology in her teaching. During session 4, Rachel was to teach students what "ecological cycles" are and how waste is managed within an ecosystem. Then she was to take the students to a natural environment where they could observe first hand the ecological cycle. She did not do those activities. Instead she led a discussion about how "nature" reduces, reuses and recycles, and then had students visit a natural environment to observe how nature reduces, reuses and recycles (Susan pp. 26-32).

Upon review, the teaching session omits the ecosystem component and fails to relay to students what an ecological cycle is and why ecological principles are important. The most important segment of the unit is left out and replaced with a storytelling segment wherein Rachel communicates to students that they have the power to make a difference as children followed by a simplified version of "nature's ways of reducing, reusing, and recycling." The storytelling segment is powerful. However, the excursion to the bioreserve is not as powerful. Although the excursion is productive because the students are able to explore their environment, the primary intention behind the excursion is missed and an important opportunity is lost and not recaptured in later sessions. I was curious to find out why Rachel changed the lesson plan. Consider her response:

> Well, because the beginning of lesson took so long to deal with checking everyone's notes and the <u>lecturing them</u> and then <u>my reading</u> was just sort of a thrown in thing, but I thought it <u>was very important</u>. That all took away from time from the bio reserve, which I don't think they needed that much more time at the

> bio reserve but I think the really valuable thing would have been to come back, share ideas within the group and then do reflections, but I had to choose between sharing and reflections. And I wanted the writing done more than I wanted to share even though I wanted them to share, and they were sharing within their groups anyway. (Teacher interview on November 10, lines 594-600, about Session 4 (November 1) But I would have really liked to have heard all their ideas. (Line 602)

Rachel changes the lesson plan because the beginning of the session that focuses on the principle of ecological cycles is consumed by a lecture reprimanding a student for not submitting a parent consent form to participate in the business site visit. She asks each student individually if s/he has a parent consent form and records the answers on her lap top computer. A considerable amount of time is taken up by that activity. Rachel believes that her "lecturing" and her "reading" was more important than following the unit plan. She does not discuss the notion that she misses the teaching of the principles of ecology. I asked her another question: How did you teach the principles of ecology, particularly "sustainability" in this lesson? Consider the following researcher/teacher dialogue:

> Rachel: Well we discussed the 3 Rs and talked about how nature has sort of it's own version of the 3 Rs, came up with some examples in class and then went out and tried it in real environment situation.
>
> Researcher: Okay and how do you think that went?
>
> Rachel: Generally it went really well. Any time taking kids out to the bioreserve is usually a really positive thing, whether they're completely focused on their task or not. And a lot of them came up with at least a couple ideas, not as many as I would have liked, but I mean it's a difficult topic. (Teacher Interview on November 10, lines 508-511, about Session 4 [November 1])

Rachel teaches the principles of ecology by having students consider the 3 R's (reduce, reuse, recycle) as they explore the bioreserve and generates some examples afterwards in the classroom. She believes the lesson went well, and acknowledges that it

[using the principles of ecology] is a difficult topic. Still not entirely sure why she changed the lesson plan, I asked her another question: In this lesson, when you were talking about ecological, reduce, reuse, recycle, you used the word nature as opposed to ecosystem. Why did you do that? Consider her response:

Rachel: I think that the kids understand the word nature. I think talking about ecosystem, the amount of information that they've been getting and developing and showing is a lot.

Researcher: Uh huh.

Rachel: And not something that's very common. They're very used to having to read a novel or a book or reading text books, but I think this stuff has been a lot of information and quite frankly, I don't use the word ecosystem in everyday conversation as opposed to nature, so I think that, that's probably why it wasn't necessarily a conscious choice.

Researcher: I was just interested. I noticed that and I thought okay, that lessens the plan, kind of thing. But is that what you thought they would understand?

Rachel: Well, partially and it's not something that I use everyday. So I probably just forgot.

Researcher: Okay. What natural resources and technologies were used in this particular lesson? Or created?

Rachel: Basically going out to the bioreserve and using ecosystem.

Researcher: Yeah there you go. Everyday conversation.

Rachel: I'll work it in.

Researcher: Yeah. It wasn't a negative or positive comment.

Rachel: No, I know.

Researcher: I just wanted to know from your perspective why.

Rachel: And thinking about the ecological principles - it's hard for me to also keep everything trying to teach them everything without having to go back and read that over again. And I know that that's something you

need to have for your Ph.D., you also need to help remind me if there's certain things I need to be covering, that I haven't been.

Researcher: But if you're using different words to get that same message across, I mean that's all part of it. We're planning to do one thing and you do another for a good reason, then I'd like to know what that reason is, so then we can change what we had planned and so forth.

Rachel: Sometimes, I mean it was particularly for a good reason but also because I don't use that word all the time and I forgot. (Teacher Interview on November 10, lines 536-589, about Session 4 [November 1])

Rachel's comments as to why she changed the lesson plan demonstrates that she needs to be educated in how the principles of ecology can be used to analyze sustainability issues.

Rachel also neglects to introduce ecological principles in her teaching when she introduces composting to her students. The plan was to develop and have students write a quiz based on what compost means to them. Rachel was to introduce effective composting strategies and have student groups build their own composters using clear plastic bottles that they would later observe to help them understand the process of waste decomposing. That lesson did not happen. Again, I was curious to find out why she changed the lesson plan. Consider her response:

> Yeah, a couple things. First of all, the quiz, I actually the night before I did type up the quiz and then I changed my mind. I thought that we could discuss it more efficiently than to put up an overhead or hand out a sheet. It would be interesting to see their previous knowledge but I just thought that it would take too long. Also we didn't end up doing the composting jug activities for a couple reasons, number one, I think that just time constraints, it's not realistic and for me to have all the containers in the my classroom and the stink and I decided that probably it would be a really good hands on activity but I just didn't really think that it would fit in here. (Teacher interview on November 17, lines 447-453, about Session 6 [November 9])

Rachel's decision to eliminate the composting jugs caused a missed opportunity to teach students about the ecological cycle and how waste decomposes over time. She also

misses opportunities in later sessions to challenge students to write in their journals about the food biodegrading process they observe through the composting jug activity.

The missed teaching opportunities identified above translate into students not having the necessary information and skills that they require to use the principles of ecology in analyzing sustainability issues, particularly with respect to waste production and disposal.

I am not convinced that Rachel recognizes that she missed a number of opportunities to integrate the principles of ecology into her teaching. During one of our teaching reflection interviews, I asked Rachel what she thinks about focusing on the principles of ecology in her teaching. Consider her response:

> Focusing in on ecological principles and relating to sustainability is very important and I think that it's not done enough and I'm realizing that more as we're getting into this unit and working on our energy unit, that these principles can be transferred across every subject area and it would be nice to have, in every unit if not just a piece of sustainability and ecological principles, but if that was just the underlying thread. 'Cause I could see how that would relate and it's so important for students to be looking at their future and this is a major thing. If we continue to not be aware of these ecological principles, then we are going to have not a very good ecosystem. (Teacher Interview on October 21, lines 55-61, about Session 1 [October 9])

Rachel thinks that the principles of ecology should be the underlying "thread" that is integrated into every subject area in every unit in the formal education system. It is important for her students to be "looking at their future" and to become aware of ecological principles, otherwise, they may not have a "very good ecosystem."

After the completion of the EfS unit, I asked Rachel if she felt that she prepared students for life in the ecological and social systems of which they are a part. Consider her comments:

> I think with the waste minimisation unit, it's a practical thing that's leaped throughout everything that they do everyday and I was stressing the fact of cycles and how looking at an ecological cycle can be applied to their daily life. Don't throw out that apple, put it in a compost bin and something good will come of it as oppose to it going to the dump and causing problems. And I think that it was important for them to see benefits of choosing smart consumer products as opposed to something that's considered wasteful and just making better choices, informed choices. (February 1, Teacher Interview, lines 368-373, about Session 1-14)

Rachel feels that she prepared students to make better, more informed choices with respect to being more responsible consumers and being less wasteful. She supports her views with examples: (1) throwing apples into compost bins as opposed to waste bins; (2) choosing/purchasing products that are not considered wasteful. However, it is not clear that Rachel prepared students to live in the ecological system that they live in, given that they received no information as to how to use the principles of ecology to analyze sustainability issues. Rachel has the desire to use the principles of ecology in her teaching, however it is also evident that she needs further teacher education to carry out her aspirations.

6.3 *Star Building Supply* Funds Composter Construction

Funds are required to carry out particular aspects of the EfS curriculum unit. The activities associated with the unit require funds for wood and hardware to build composters, scales to weigh garbage, transportation to the landfill site, dirt and other material for the jug composter activity, procurement of cameras, film and development, recycling bins, etc. Consider Rachel's response when I asked her if she had enough funds available to teach the unit:

> Well, I would say "no" because you had to go beg for wood from Star Building. And I had to borrow a scale off you just to weigh the garbage and purchasing new recycling bins for the E team which is kind of an off shoot of this. No, I had to write grants. So. No. There's no funding to do the unit. And any resources that I

had I'd already purchased on my own or through grants. (February 1, Teacher Interview, lines 1011-1014, about Session 1-14)

Rachel feels that she had insufficient funds to implement the unit successfully. Examples she included are: having to "beg for wood"; having to "borrow a scale", having to purchase "recycling bins" by writing and successfully attaining grant funds. What Rachel meant by "you had to go beg for wood from Star Building" had to do with me intervening in her search for funds.

6.3.1 Star Building Supply Story

One particular day, while I was at Georgetown Middle School conducting the pre-instruction interviews with a group of Rachel's students, Rachel and I began to brainstorm how she might attract funds to purchase the wood that the students would require for the building of composters. We discussed a number of ideas for how we might attract funding including applying for grant funds, asking the school board, asking the Industrial Arts teacher and so forth. After our conversation, I thought about approaching a lumber supply company that was located on my drive home from the school. So, after I had completed all pre-instruction interviews for that particular day, I decided to stop off at the lumber supply company to talk to the donations manager about a donation of wood to the school. I arrived at the lumber supply company and asked to speak to the donations manager. I was told that the manager would be back in about a half an hour. I decided to wait. While I waited in the lobby, I noticed several plaques on the wall indicating that the company had made donations to Habitat for Humanity and other not-for-profit charitable organizations. When the manager and I sat down, I began by informing him that I was a researcher from the University of Manitoba focusing on a

study about sustainable development education. I told him that part of the study includes working with a school, teachers, students and businesses in his area and identified that the students would be working with business representatives on waste minimization strategies, they would be building compost bins, and other activities related to the unit. I informed him that I approached his company first because I wanted to give him the first opportunity, given that he is a prominent figure in his community, to donate to this very important initiative. I added that I knew that his company had previously provided donations to other charitable organizations such as Habitat for Humanity and others. I informed him that I thought this initiative might be something that he and his company might be interested in becoming involved in, particularly given that his company is actively involved in sustainable development practices and would want to communicate that to his clients. I added that if he would donate to the school, he and his company representatives would be invited into the school in a sharing session with other business representatives and other companies that donate to this initiative where they would formally get recognized for their contributions and linkages with the schools in their community. I told him that parents of the students would be invited, the Mayor, several Members of Parliament and other company representatives among others. After this long introduction, the donation manager said that he would be happy to donate lumber and hardware to the school and asked when the school needed the lumber. I said, "one week from Monday" (it was Friday). We arranged delivery and I was on my way.

One day while I was at the school collecting data for my research study, I learned from Rachel that the calculations that I had been given by the Industrial Arts teacher regarding how much wood and hardware student would require to build composters was

inaccurate. Rachel told me that she was short approximately six composters worth of material and consequently six student groups would not have the opportunity to build composters. I decided once again to visit the lumber supply company on my way home from school. I arrived at the lumber supply company shortly after 2:30 p.m. Again, I went to see the donation manager to ask him for another donation. When he learned that I was there to see him again, he jumped out of his chair, out of his office and greeted me in the lobby with a large handshake. I told him that I was there to formally invite him to the presentation I had told him about the first time we met and to discuss how the project was going. I presented him with a letter outlining the date and time of the presentation and the particulars associated with the project. Then he asked me how the building of the composters went. I replied that the building of the composters went very well for most students, however there were six student groups that were not able to build because of a shortage of wood and hardware. He immediately asked if he could donate more wood and hardware to the school. He told me that if I wanted, we could load up his truck right now and take the lumber and hardware to the school: that way it would be done. I agreed that this was a good idea and accepted his proposal. We loaded up the back of his three-quarter ton truck and proceeded to drive to the school. Within three-quarters of an hour from when I left the school, we came back with a load of lumber. I directed the donation manager where to park his truck and I walked into the school to see if I could find some helpers to carry in the lumber from the truck. I approached the Industrial Arts teacher who was teaching a group of grade eight students, told him my situation and asked for his help. Within ten minutes, the Industrial Arts teacher, his students, the donations manager and I unloaded the truck and piled it neatly in the Industrial Arts room. As we unloaded

the last pile of lumber, the donation manager asked to see the built composters that were located in the Industrial Arts room. The Industrial Arts teacher was pleased to show the donation manager the built composters and the jig that he created to guide the students as they built the unit. The donation manager was very impressed with what he saw and offered to donate to the school in the future if the opportunity ever presented itself. The donation manager was unable to attend the presentation held by students, but received a thank you letter.

Had Rachel had enough funds to teach the EfS unit, the community linkages and good will generated might have been lost.

6.4 Chapter Summary

This chapter provides an interpretation of Rachel's instruction of the EfS curriculum unit and the sense she makes about her teaching and student learning including some of her own sense-making of how she teaches. Rachel brings students' awareness of human/nature relations. She interprets students' values by dialoguing with them. She empowers her students. Rachel is a leader from within and an inspirer of students through storytelling. She uses the world as her extended classroom connecting the school to the environment and surrounding community.

In this chapter, I also highlight two important areas that Rachel misses in her teaching of the EfS unit. Because Rachel is process/practical-oriented in her teaching, she misses the opportunity to forge the link between the lived experiences of the students and the fundamental principles of ecology that underpin the EfS unit. Rachel also neglects to incorporate the students' views of human/nature relationships in her teaching. Curious as to why that is, I examine Rachel's point of view on this curricular omission

then looked at myself for possible reasons why these important areas are missing in Rachel's teaching.

CHAPTER SEVEN

ANSWERS, ISSUES, AND IMPLICATIONS

7.0 Introduction

Despite the advancement and implementation of sustainable development through education in the 1990s at the international, national, and regional scales (e.g., CDC, 1997; WSDEA, 1995; UNESCO, 1997; LSF 1999; CMEC, 1999), clarification of guidelines for curriculum is still an important research task (Lawrence, 1993; Williams, 1994). Within the broad scope of sustainable development, curriculum guidelines need to be developed to address how students view human-nature relationships and how they transform their thinking from an anthropocentric to an eco-centric worldview. In particular, the Education for Sustainability (EfS) curriculum requires an ecological approach to ensure that children develop a way of knowing to live sustainably. The principles of ecology infused EfS curriculum is interdisciplinary and thus it needs to be collaboratively developed, implemented, and assessed through research at the local level.

On the basis of the foregoing needs in sustainable development education, I pose ten research questions in Chapter 1 — questions pertaining to the teacher and the researcher developing an EfS unit collaboratively, educating students for sustainability, and the teacher and the researcher meaning-making about the nature of EfS teaching. Thus in this chapter, I re-state each research question and attempt to provide answers based on the evidence gathered in this study. I also discuss issues that arise from this study and corroborate previous research. I outline implications for teacher education.

Finally, I make statements about knowledge contribution to EfS curriculum development, and raise questions for further study.

7.1 Answers to Research Questions

Question 1. What dispositions, thoughts, and views does a Grade 6 teacher (Rachel) have about the environment and Educating for Sustainability?

During the EfS curriculum development, Rachel demonstrated that she is a "real Enviro Freak" given the stories she shared about her activist personality. Of particular interest is the personal experience she shared about how she responded to a driver who throws a cigarette butt out the window of her car. Rachel's conversations lead me to interpret that her views concerning her human/nature relationship are ecocentric. She does not think that humans are superior or separate from nature. She thinks that humans have become disconnected from nature because of cultural shifts, a loss of community, and by a communication breakdown.

As we collaborated on the design and planning of the EfS curriculum unit I learn that Rachel believes that "action" is most important when teaching students about how to live sustainably on the planet. She considers that appropriate knowledge, skills, values and attitudes leads students to make sustainable decisions and act responsibly. She values practical process oriented approaches to teaching and learning. Rachel also believes in empowering her students even at the risk of them failing in their attempts. Rachel's EfS curriculum unit had the characteristics that make for a quality environmental and sustainable action project/program, according to the International Joint Commission's Educators' Advisory Council (1993). The EfS curriculum unit has clear goals and objectives; a long term range vision; a strong, ongoing experiential

component; a strong action component with a clear context for action; a systematic process for assessing, planning, acting, reflecting, communicating and celebrating; a strong partnership and collaboration with agencies, institutes (e.g., a post-secondary institution) and volunteers; and a strong ecosystem and/or watershed approaches.

Question 2. How did the teacher and researcher develop a shared vision about the Educating for Sustainability unit?

As Rachel and I worked collaboratively to design the EfS curriculum unit, we each had our past experiences to contend with. My previous experience leads me to believe that curriculum development requires "meta-planning," whereas Rachel's experience leads her to believe that resources ought to be identified and then "some sort of synthesis" of the resources ought to take place. As we worked together, we developed a shared vision of what we were to do and how we were to do it. We discussed issues. We debated. We learned what was collectively important to both of us and why. The process of building a shared vision through collaboration provides an opportunity for Rachel and me to reflect on our respective mental models in relation to how we see the world, why we see it in a certain way, and what we do as a result. Senge (1990) emphasizes that mental models "shape how we act" and "affect what we see" (p. 175) and this was evident in our collaborative EfS unit planning.

As we collaborated, one particular issue that posed a considerable problem, particularly for Rachel, was how to integrate the principles of ecology into the curriculum unit. As we attempted to figure this out, we discussed how learning is not merely memorization and acquisition of ecological facts and associated vocabulary, but an understanding of how to attain ecological literacy to create and live a life in a sustainable

world (Ebert-May, et al., 1993). We came to realize that learning is a process of making sense of one's world, constructing meaningful representations and becoming skilled in the procedures that will allow taking action (Usang, 1992).

We discussed how the principles of ecology can and should serve as guidelines towards understanding how we should live responsibly on the planet. We discussed, in particular, with respect to waste production and disposal in an ecosystem, as one organism dies it becomes a resource for another organism and so the cycle continues. We discussed the ecological model presented by Arena (2000). Although we did not focus on all the principles, we did focus on those that could be used to help guide our unit development. We discussed how ecosystems are open systems that require the constant flow of energy and recycling of matter. We interpreted how the interdependencies among the members of an ecosystem involve the exchange of matter and energy. We talked about matter and energy flow. We discussed how all matter is continuously recycled in the natural environment, which is different in our social system where non-recycled waste is the norm. We discussed the importance of students learning the lessons derived from the ecosystem cycle to then implementing actions such as waste reduction, repairing, reusing, recycling and composting. As we discussed these ideas, we developed a shared understanding of the ecological cycle and how to get the students to understand particular principles of ecology.

Question 3. What issues does Rachel raise concerning the process of developing the EfS curriculum unit?

Rachel identified some significant obstacles in our journey. They were: missing partners in interdisciplinary curriculum development, time commitments for collaborative

effort, previous experience with collaborative work, acknowledgement and support at home, teacher responsibilities, and non-existence of EfS curricula.

A student-centered curriculum development process requires the input of student's ideas and interests in the development process (Ausubel, 1986). The reality is that Rachel does not know the students that she would be implementing the EfS curriculum unit with (it was summer holidays for students) and consequently could not attain their input. We tried to address this issue by relying on Rachel's previous experience teaching students at the Grade Six level and taking into consideration their interests and ideas about the topic to influence their learning.

Rachel and I also recognized that the lack of other teachers participating in the planning and design of our EfS curriculum unit would also pose an problem because interdisciplinary curriculum planning and design requires teachers representing other disciplines to work together cooperatively to develop a curriculum unit (Jacobs, 1989b). We attempted to overcome this problem by integrating subject-area *Student Learning Outcomes* and by making use of subject-area teachers in the implementation phase of our project.

The time factor was the most prevalent of all the constraints that Rachel faced during our collaborative curriculum development process and this is not surprising. Our collaborative curriculum effort needed time for coordinating, learning, planning, testing, reflecting, evaluating and document processing. This process took forty-five hours over a three-month period. Rachel does not think that other teachers would spend as much time as she did in planning a curriculum unit. Had we not taken the time to learn how to plan an EfS curriculum unit, time commitment of the teacher may not have been much.

Nevertheless, Fullan (2001) claims teachers have little time and energy outside their teaching duties for curriculum development.

The main reason that the curriculum unit took so long to develop was because of the lack of existing EfS curriculum models and development processes. Our biggest hurdle was to translate theory into curriculum development and design. Current models for curriculum planning and design do not address the requirements of EfS, although they are helpful as guidelines. For example, the models do not address EfS goals, perspectives, essential learnings and corresponding principles of learning. The models also do not address the need to identify a focus for the unit through the identification of essential questions and sub-questions using the principles of ecology as guides, although some models do include the identification of essential questions. The models do not take into consideration the need for teachers to build a shared vision for what and how constitute living sustainably and what students should be taught related to that vision. The models also do not specify that something in the existing curriculum must be given up to make way for the implementation of a new unit. Having stated the limitations of the current models, the models identified by Erickson (1998) and Jacobs and Borland (1986) do have something to offer in terms of a loose guideline. For example, both models focus on how to identify essential questions, raise the need to include students in decision-making, identify how to design lesson plans and identify curricular connections. Had an existing EfS curriculum planning and design model been available, our work would not have taken the amount of time as it did.

The lack of sustainability focused curricula has also been cited as an issue with respect to implementation of environmentally focused curricula (Samuel, 1991).

Although the development of the EfS curriculum unit took much time, it aided in our individual professional development. Berman and McLaughlin (1978) acknowledge staff development when they are actively involved in developing local materials. Furthermore, collaboratively developing the curriculum in the research context gave Rachel a sense of pride, ownership, and direction. She willingly put the teacher-researcher developed EfS curriculum into practice.

Besides not having access to curricula to guide her teaching, Rachel also expressed an issue related to her experiences with respect to her collaboration with other teachers and other researchers in previous curriculum development processes. Fullan (1982) raises "previous experiences" as possible constraints for curriculum development processes. He states, "the more the previous attempts at change have been painful and unrewarding, the more sceptical people will be about the next change" (p. 64). Given her previous bad experiences associated with working with a researcher and other teachers, Rachel had every reason to be sceptical about collaborating with a researcher and others again. However, Rachel quickly overcomes the foregoing issue because of our mutual trust and respect. In teacher-researcher collaborative efforts developing a trusting and caring relationship is key to success (Fullan & Hargreaves, 1996). Rachel also raised an issue with respect to not receiving acknowledgement and support from her partner at her own home. She felt that her fiancée did neither show support for her involvement in the project nor acknowledge her accomplishments. Literature on educational change does not indicate that family support is important for curriculum development processes. However, Corbett, et al., (1984) suggest that it is important for individuals to be recognized for their commitment and time invested in making a project work. The

literature mostly cited the importance of recognition from principals or other teachers, not family support. The lack of family support was a big issue for Rachel. She overcomes that issue to some extent by recognizing that she had the support and acknowledgement from her principal, from the researcher, and the researcher's family.

Question 4. What support systems did Rachel have in designing and planning the Educating for Sustainability curriculum unit?

Rachel and I were aware that EfS requires a high level of integration, cooperation and coordination. Rachel's school already had the structure in place to implement a transdisciplinary program within a disciplinary structure. Rachel was the Outdoor and Environmental Education teacher at her school. Her primary focus was to address EfS issues through a transdisciplinary (beyond the subjects) to all students at her school. Her ultimate purpose was to teach students how to live sustainably on the planet. Regarding integration with other teachers, she had built-in to her schedule time where she worked with all subject area teachers at the various levels (Grades 6, 7 and 8) to help, through their disciplines as appropriate, to extend the concepts she was attempting to communicate in her teaching. Rachel suggested that our positive working climate and that of her school's, her principal's support and her pre-service early years education were among the factors that helped to development the unit successfully.

A positive working relationship and climate is cited as an important factor for curriculum development processes (Manitoba Education, 1997). Rachel felt that the strongest factor supporting our planning process had to do with our working relationship and collaboration in terms of teamwork, communication, cooperation, trust and respect for each other's perspectives, flexibility and consensus in decision-making.

School administrative support has also been cited in the literature as an important aspect for successful innovation development (Corbett, et al., 1984; Huberman & Miles, 1984). At the local level, the principal is considered to be the most important (Fullan, 2001). Rachel considers her principal's support as a positive factor in our curriculum development process. Her principal took a strong interest in what Rachel was working on, asked questions about the process and provided her with moral support and served as an advisor throughout our process. Her principal provided public acknowledgement and recognition for her efforts. Bergman and McLaughlin (1978) found that when principals did not show support, projects were rarely successful. Strong supportive leadership is crucial for the adoption/development of an innovation and implementation (Corbett, et al., 1984; Huberman & Miles, 1984). Rachel considered her school's climate as a positive factor in our development process as well. One of her school's main priority areas focuses on the environment. The administration communicated that priority and encouraged students and staff to work together in many different capacities to make that priority "real" for students and teachers. Educational change literature suggests that a school's orientation or climate can contribute to initiation and implementation of an innovation whether it is locally developed or externally acquired (Clark, Lot & Astuto, 1984; Cohen, 1987; Fullan & Pomfret, 1977). Rachel highlighted the school's climate as a positive factor.

Rachel also considered her teacher preparation as another important factor. She felt that her teacher education in the Early Years' program adequately prepared her for our interdisciplinary-based collaborative work and for implementation.

Answers to the first four research questions addressed Rachel's disposition towards the environment, education for sustainability, the teacher-researcher collaborative efforts in developing a shared vision for EfS curriculum, and constraints and facilities she encountered during the curriculum development. The next two research questions focus on students' intellectual development concerning an EfS issue.

Question 5. What are Grade 6 students' views about their human/nature relationship?

I used phenomenography (Marton, 1981) to qualitatively describe how a group of Grade six students view their human/nature relationships. Students' human/nature relationships included the following views, and excerpts that captured those views are identified in Table 7.1.

The categories of students' views regarding their human/nature relationships suggest that there is a range within which students view their human/nature relationships. Also some students expressed more than one view. The Eco-Action View was the highest view held by students (50%); Technical View was the lowest view held (6%). Variations in views (intervariation) and some expressing more than one view (intravariation) are common in phenomenographic studies (Ebenezer & Fraser, 2001; Marton & Fazey, 1997; Runesson, 1999). Students' views, undoubtedly "influence how students interact with the natural world" and beg the question, "Which views of human/nature relationships are being promoted, whether explicitly or implicitly, within a program or curriculum?" (Robertson, 1998, p. 185).

Table 7.1. Students' Human/Nature Relationships

View	Verbatim Excerpt
Eco-Action	I don't litter
Life-based Intrinsic Value	Nature is sort of living... we're living
Experiential Appreciation	I just love animals and I love trees and I just... I'm in heaven
Self-Centered	We're actually lucky to have animals or then we'd just eat vegetables every single day...
Non-Reciprocal	Without animals, we would die... They'd be alive...It'd be even healthier
Basic Needs	We live on food and water and plants and animals live on food and water
Safekeeping	Respect the Earth...if you don't respect it then it's gone
Biocentric	I think everybody (everything) is equal... There are things that are as much important as others, like people, animals, plants and Trees
Reciprocal	Because we have to keep them (plants) alive by watering them
Personal	Some stuff you just gotta throw out!
Technical	Maybe I could invent another way

There is little in the literature to inform educators of how students, in this day and age, think about this relationship (Robertson, 1998). Hence, educators need to understand how their students think about their human/nature relationships so that they can incorporate these in curriculum. Robertson (1993) suggests that students should be encouraged to explore and develop their thinking on human-nature relationships and they should be encouraged to consider associations between their personal standpoint and actions beyond the academic setting. Robertson's notions are further developed in section 7.4, which advocates the use of phenomenography for EfS curriculum development.

Question 6. How do students' views develop with respect to their understanding of their relationship with the environment and what it means to live responsibly on the planet?

The case studies of John and Ruth qualitatively represent other Grade Six students who participated in the study. Both John and Ruth developed their understandings of their relationship with the environment. Table 7.2 summarizes the views these two students had prior to and post-instruction of the EfS curriculum unit.

Table 7.2. Conceptions of Human/Nature Relationships

View	John*		Ruth*	
	Pre-Instruction Interview	Post-Instruction Interview	Pre-Instruction Interview	Post-Instruction Interview
Eco-action			I have a good one because I don't litter and pollute them.	I drew myself picking up garbage because it's doing something good for the environment.
Experiential appreciation		I try to keep it clean. I love the earth kind of way.	I feel special when I'm in a forest... I just love camping ...and being out there with it.	I play outside.
Self-centered		If all the animals died, where would we get our food?	Because like, trees have oxygen and we need their oxygen and lots of things nature does, we need to survive.	

* Verbatim excerpts

View	John*		Ruth*	
	Pre-Instruction Interview	Post-Instruction Interview	Pre-Instruction Interview	Post-Instruction Interview
Non-reciprocal		Without animals, we would die... They'd be alive. Trees have been around for billions of years and I don't think they're going to go away.... Without humans, life would really kind of be the same. It'd be even healthier.	If there wasn't nature, we wouldn't be able to survive.	
Safekeeping	If we keep on living the lifestyle that we do right now... if we keep on throwing out as much as we're going to, beautiful prairie grasses are going to end up into landfill sites.			

View	John*		Ruth*	
	Pre-Instruction Interview	Post-Instruction Interview	Pre-Instruction Interview	Post-Instruction Interview
Biocentric	Each person/ animals has like a living right.... I think bears should be on a healthy planet the same as every other animal...they don't deserve a bad planet and we don't.	No. You don't kill bugs. You try and save them. They have the same… they're just like us, you know.		
Reciprocal			Without the trees and everything we wouldn't have much oxygen and nature and if the trees and the grass didn't have us, people wouldn't water and take care of them.	They do help us with the things we do and the things we do help them.
Personal	You can't really help that because you have to eat, you have to package it to keep it good. What do you do with the package? Well, some stuff you just gotta throw out!	I'm gonna ask my Dad if I can get some worms from Mrs. [name of teacher] so that I can get a vermi- compost because usually if we had banana peels or stuff, we'd just threw it in the garbage and wouldn't think about it.		Mom and Dad throw out their pizza box and that could be recycled It's just a pizza box, but when you think about it, like it could be recycled.

View	John*		Ruth*	
	Pre-Instruction Interview	Post-Instruction Interview	Pre-Instruction Interview	Post-Instruction Interview
Technical		But how come they can't like compress the water and then steam it and then it can actually go and make the car go forward.	I think I might change it…how…there's so much gas and stuff from all the cars and buildings that add to pollution…May be I could invent another way?	
Industrial		They (Domtar) didn't clean up the place... but in the forest, it's kind of really polluted.		
Inter-dependence		To make…to get a front end loader and get it and pick up the mattresses and put it into a garbage truck and then you go all the way to the dump, so I'm sure it costs more to do that than it is to go to the dump.		It shows [the photo] that recycling is healthy for the environment and our well being, although it costs money.

Both John and Ruth's views concerning their human/nature relationship change appreciably as a result of implementation of the EfS curriculum unit. In John's case, he develops a number of diverse views: Experiential *appreciation*, "I love the earth kind of way"; *Self-centered*, "If all the animals died, where would we get our food from?"; *Non-*

reciprocal, "Without animals, we would die... They'd be alive"; *Technical*, "but how come they can't like compress the water and then steam it and then it can actually go and make the car go forward"; and *Industrial*, "They (Domtar) didn't clean up the place... but in the forest, it's kind of really polluted." In Ruth's case, she developed a *Personal view*, "Mom and dad throw out their pizza box and that could be recycled; it's just a pizza box, but when you think about it, like it could be recycled." She also developed an *Interdependence view*, "It shows [the photo] that recycling is healthy for the environment and our well-being, although it costs money" that is not evident prior to instruction.

Both students also develop their conceptions of what it means to live responsibly on the planet with respect to waste minimization. Ruth's awareness of waste issues and the identification of possible solutions toward living more responsibly on the planet increases. The change is obvious in her behaviour pattern. Ruth's written words also communicate that indeed her behaviour is already changing in relation to waste as a result of learning experiences in the EfS curriculum unit. John's awareness of waste issues increases, and he learns to identify solutions to minimizing waste. It is, however, difficult to ascertain if learning will affect lifestyle practices of waste generation and disposal and for living sustainably, particularly, given John's demonstrated lack of respect for the environment during an excursion to the bioreserve (cattail event). What is positive about John is that he feels empowered to live more sustainably and to make changes because of the influence of the EfS curriculum. Ballantyne and Packer (1996) would concur that it involves "not only a change or growth in understanding, but also a willingness to depart from previously held attitudes and beliefs and to make commitments to new ways of interacting with the world" (p. 6).

Now I return to the teacher. The rest of the research questions focus on the teacher's implementation of the EfS curriculum in the classroom.

Question 7. What character traits does Rachel display when she teaches the EfS unit?

Rachel brings students' awareness of human/nature relations. She interprets students' values by dialoguing with them. She empowers her students. Rachel is a "leader from within." She inspires students to make a difference through storytelling. She uses the world as her extended classroom connecting the school to the environment and surrounding community.

Most notably, Rachel "walks the talk," practicing the behaviours she wants her students to demonstrate. Rachel's students also think that she models good waste reduction behaviour. John, in particular, points out that Rachel "tries to teach" him "what she knows" and teaches him "stuff that she actually <u>really</u> does" herself. He suggests that she teaches "from her heart" and practices what she teaches "on her own time, even if it means upsetting her <u>fiancée</u> in the process.

Rachel demonstrates good waste reduction behaviour during classroom activities. She also passes on to her students that she sometimes does not make the conscious decision and take the necessary action that she knows is required. She is honest with her students and does not excuse herself for not practicing recycling, but rather shares with students the notion that she is not infallible.

Question 8. How do Rachel's personal practical beliefs about the human/nature relationship about student learning translate into her real classroom practice?

Rachel's personal beliefs regarding the human/nature relationship and how students learn influences her classroom practice. Table 7.3 identifies Rachel's pre-practice beliefs and how they influenced her teaching of the EfS curriculum unit.

Table 7.3. Beliefs Translate into Practice

Pre-Practice Beliefs (Chapter 4) (verbatim)	In Practice (Chapter 6)
Reusing and recycling instead of throwing things out first, and trying to decrease the whole consumerism of the planet contributes to a healthy planet.	• Focuses her teaching on good waste minimization practices (reducing, reusing, recycling, composting). • Practices good waste minimization behaviour in and outside of the classroom.
It's about choices and making better choices and not necessarily giving up.	• Rachel has students work on business projects. Students make choices regarding businesses waste reduction.
Start at the grass roots level with the children.	• Inspires students through storytelling that they can "make a difference" in the world if they have an important message to convey to adults.
Humankind has a reluctance to develop a relationship with mother Earth.	• Rachel tells her students that she is reading David Suzuki's, The Sacred Balance," which is about human/nature relationships and what humankind is doing to destroy the planet that sustains all life.
The most important thing is action. I love to build things. I like the kids building things.	• Rachel has her students involved in business action projects. • Rachel "walks the talk" with respect to waste minimization actions. • Rachel has students build cedar composters.
We can't force attitudes on to the kids. We can show them, we can teach them, we can tell then how we feel, and we can give then the skills to make that choice, but we can't make then do that.	• Rachel does not agree with all of their ideas. She tells students that they don't have to agree with each others' ideas, and has students challenge each others' views. Rachel models good waste behaviours at school. She provides hands-on learning opportunities that help students to understand "how" to recycle properly.
But then you're taking the power away from the kids.	• Rachel has students contact businesses themselves even at the chance of some

Pre-Practice Beliefs (Chapter 4) (verbatim)	In Practice (Chapter 6)
	business may not be receptive to students.
Rachel believes in process-oriented and collaborative learning	• Rachel had students work together in a process-oriented project.

Rachel's views presented in Chapter Four indeed translate into her classroom practice. For example, Rachel says during one of our interviews that she believes that it is important to reuse and recycle instead of throwing things out. Consequently, her belief translates into practice through the development and implementation of an EfS curriculum unit focusing on those very ideas (waste reduction and recycling).

Rachel also conveys, "It's about choices and making better choices and not necessarily giving up." In practice, Rachel relays this message to her students in a number of ways. Most notably, she has all students work together to identify options (choices) that they would recommend to their business concerning waste reduction strategies. Students are encouraged to make informed choices based on research that they conduct.

Rachel also states that we should start at the grass roots level with the children, meaning that children should be given opportunities to work at home, in their schools, in their communities to make a difference in the world. In practice, Rachel inspires her students through storytelling that they can indeed "make a difference" in the world if they have an important message to convey to adults. She explains that if all Grade Six students participate in conducting waste audits with businesses in their local community and half of the businesses listen to the students' views, the students have in fact made a "huge" difference with respect to the reduction of waste at the local landfills.

Rachel believes that humankind is reluctant to develop a relationship with mother Earth. In practice, she sheds light around this notion by telling her students that she is reading a book by David Suzuki that focuses on the disconnection humankind has with nature and uses a storytelling approach to inspire her students to do "get connected."

During our planning sessions, Rachel continuously expressed that students should learn using "action-oriented" approaches. In practice, Rachel has students involved in such activities as business action projects, building composters, and conducting waste audits. Rachel also "walks the talk" with respect to actions that she initiated in her classroom such as collecting and sorting recyclables.

Rachel also has the belief that "we can't force attitudes on to the kids. We can show them, we can teach them, we can tell then how we feel, and we can give them the skills to make that choice, but we can't make then do that." During practice, Rachel tells students that she does not agree with all of their ideas, and conveys that students may not always agree with her ideas either. She communicates to students that she herself has disagreements with other teachers and tells students that it is "ok" if they have disagreements with their peers. She even uses her partner as an example of someone who disagrees with her on waste minimization practices. Rachel also has students challenge each other's views during classroom activities. Rachel models good waste behaviours at school, but never does she in any way force her students to practice good recycling behaviours.

Rachel believes in student empowerment. She does not believe that taking power away from students is to their advantage. Rachel would rather have students "try" to do something on their own, so that they learn about success and failure during the process.

In practice, Rachel has students contact business themselves to partner with them on a waste audit project. She does not interfere in their choices and sanctioned them to make their own decisions.

Rachel believes in collaborative and process-oriented learning. One of the main activities students were involved with as part of the EfS curriculum unit was participating in a process-oriented project wherein students visit a business in their local community, conduct a site visit, meet with representatives, conduct a waste audit, do research, choose an option to present to their business, create an action plan then conduct a presentation about waste issue to their respective businesses. The activities that Rachel identified and implemented as part of the EfS curriculum unit are in line with the literature and research about sustainability education. Hopkins and McKeown (2002) suggest that in order for students to address sustainability issues, they ought to be armed with the following skills and capacity: to communicate effectively both orally and in writing; to think in time — to forecast, to think ahead, and to plan; to think critically about value issues; to move from awareness to action; to work cooperatively with other people; and to use various processes - knowing, inquiring, judging, imagining, connecting, valuing, questioning, and choosing. Rachel armed her students with all of these skills and capacities as they carried out the process of their business project.

Rachel's students also worked collaboratively during the EfS unit implementation. Katz and Lawyer (1985) suggest that it is through the collaborative process that one might maintain the relationships essential to filling needs and meeting obligations and to gain experience in the use of democratic and participatory methods of decision-making.

Rachel creates a learning environment that encourages collaborative and participatory decision-making.

Question 9. How does Rachel involve the local community in her EfS teaching?

Rachel creates a strong link between her school and her community to facilitate EfS learning. She creates linkages with local businesses and their representatives, with parents and with industries that provide donations to her school. Regarding the linkages with the local businesses, Rachel's students participate in an "action project" that entails student groups visiting local business, touring business facilities, conducting waste audits, then conducting oral presentations to their respective businesses. The purpose of the presentation is to have students share with the business and other local businesses and other community members the types of waste and the amount a particular business generates, how the business currently disposes of their waste. Students identify and present waste reduction strategies that include recycling, composting and other waste-related strategies. Completing the business research project gives students the opportunity to learn about waste minimization in a context of a real organization - a business. In turn, businesses' representatives take time out of their schedules to listen to students regarding the waste management solutions that their businesses could adopt.

Rachel also creates linkages to other community organizations such as recycling companies, university faculties and stores. Students are sanctioned to contact any community organization that they think might provide answers to their questions. They contact the recycling companies by telephone during or after school hours to find out the costs associated with the procurement of recycling bins. If they need information from university academics, they contact them. If they need information from other teachers in

the school, they call upon them for assistance. If students want their business to compost food waste, they build wooden composters and present them to the business. If they want the business to raise awareness within their organization, they create posters and identify information for the businesses to post and circulate. The students make connections with their community businesses and others so that they can make informed decisions and recommend good solutions and options to their respective businesses.

To further facilitate learning, Rachel develops a linkage with lumber supply company to supply cedar and hardware to her students for the building of composters. The linkage to that industry was so positive that Rachel received confirmation that the company would continue to donate cedar for the project should Rachel wish for that to happen in the future.

Question 10. What might be the difference(s) of the intended and the implemented EfS curriculum unit?

Although the intended EfS curriculum unit was developed with the intention to be implemented in a general and flexible manner, the intended curriculum unit had some components in it (the piece on ecosystems and ecological cycles) that should have been addressed more carefully by Rachel. Rachel's reasoning for not addressing the intended curriculum was based on time constraints. Having a lack of understanding with respect to ecological cycles and ecoystems also had a bearing on the intended implementation.

Rachel did not have an in-depth knowledge base (or at least did not demonstrate that she did) about what lessons can be derived from ecosystems, particularly ecological cycles upon curriculum implementation. Consequently, Rachel missed an important opportunity to help her students to understand the ecological cycle, a principle that should

have helped to ultimately guide their decision-making with respect to waste production and disposal issues.

Regarding time constraints, the EfS curriculum unit was initially planned to take eleven sessions to complete. The unit took fourteen sessions to complete (that equals to three additional eighty-minute sessions). Due to time constraints, Rachel did not have students do the following activities identified in the EfS curriculum unit:

- Students participate in a class-discussion regarding their knowledge about ecosystems and ecological cycles.
- Students participate in a group discussion about how waste is managed in nature.
- To have students go through their lunch bags individually and record their scores (points for recycling, composting, reusing).
- Students write a quiz about composting.
- Students make composters with two litre drink containers using food waste.
- Students write out composting experiment in journal (what is happening to the food?)
- Students conduct another garbage audit, record measurements and compare results from first audit.
- Students, in groups, discuss how they can make a difference.
- Students, in class discussion, share about ecological cycles.

Although Rachel missed out on teaching some integral parts of the EfS curriculum unit, particularly the parts focusing on using the principles of ecology in her teaching, she does not feel bad about how the EfS curriculum unit played out. This is because she does

not feel that the EfS unit needs to be followed verbatim (nor did I). She considers the curriculum unit a plethora of activities from which she can pick and "choose" what she wants to deliver. Rachel and I both believe that the essential criterion in the examination of a curriculum is the "richness of its quality, not the precision with which its goals are stated or met" (Doll, 1993, p. 148).

The answers to the last four questions illuminate how Rachel taught the EfS curriculum unit and what sense she made about her teaching and student learning.

Based on the knowledge claims I have made, I focus on two important issues in the next two sections.

7.2 Drawing Upon Students Prior-Instructional Views – An After Thought

Before Rachel began to implement the EfS unit, I interviewed her students to determine what their relationship with nature was and to find out what they knew about waste minimization, what they wanted to learn and how they wanted to learn it. I grouped the answers to questions raised and provided the data to Rachel in the hope that the data would increase understandings and result in a knowledge base, which, being derived from students' expressions would likely be meaningful to her and to her students. I assumed that she would provide students, through instruction, with the opportunity to clarify their personal values and consider the arguments underlying their value. There was no evidence that my assumptions were correct based on the way she taught the EfS curriculum unit.

Although Rachel read the student data, she did not find the data helpful. Perhaps the reasons were the way the data was presented to her or she may not have known how to incorporate students' views in her teaching.

I initially did not recognize the power of intentionally incorporating students' views in lesson plans, and consequently did not discuss how Rachel might incorporate students' prior-instructional views of the human/nature relation in her teaching during our curriculum development sessions. Recall that I carried out the interviews to answer my second set of research questions, rather than intentionally using students' views as part of the curriculum development process. Had I provided Rachel with the student data as presented in Chapter 5, and coached her about how to incorporate students views in her teaching, I imagine that outcome would have been different. The next section focuses on phenomenography and how it can be used to develop EfS transformative curriculum.

7.3 Phenomenography for EfS Transformative Curriculum

In this section I argue for phenomenography as the basis for tranformative curriculum development, which readily became apparent during data analysis of students' views of human/nature relationships, in the process of critically analyzing Rachel's practice, and in reflectively thinking about my own views of curriculum development. First I provide a conception for what is meant by transformative curriculum, and then I continue to outline and discuss with examples from EfS the assumptions of phenomenography, which I began in Chapter 5.

Curriculum adopts a transformative process when it embraces learning that involves transformation in learners. A transformative process curriculum integrates rich open-ended mosaic of experiences, shifting its focus as the learner changes his/her thinking (Doll, 1993). For transformation to occur in learners, their multiple relations to the world — the way they experience the world – are encouraged and visibly acknowledged. Experiences are reflected in the statements that learners make, in the

actions they take, and the artifacts that they produce. The concern is with the various ways in which learners experience the world. The focus is not on the learners but on the variations of their collective responses. Conceptions may reflect individual differences (intervariation) or differences within the same individual (intravariation). Identifying the qualitatively distinct ways in which learners experience the given phenomenon is the emphasis. The variation in ways of experiencing phenomenon such as the human/nature relation is identified and revealed or explicitly made known to learners.

The next critical assumption in a transformative curriculum is enabling students' capabilities for experiencing a particular phenomenon in the world in certain ways — the learner comes "to experience the world, or aspects of the world, in particular ways" (Marton & Booth, 1997, p. vii). A way of experiencing something "is an internal relationship between the experiencer and the experienced" (Marton & Booth, 1997, p. 115). The change in internal relationship between the person and the world as a result of experience is what the foregoing authors refer to as learning. "A specific way of experiencing something may thus refer to the structural (how) and referential (what) aspects of a person's way of making sense of the phenomenon at a specific point in space and time " (p. 116). A critical aspect to teaching is to ask, "How did you arrive at that answer? How did you think about the problem? What does the problem mean for you?" (p. 118). A teacher can compare a student's response to a problem (human/nature relationships) to the theoretical structures (principles of ecology) or the same response can be the starting point for the teacher to explore in-depth the student's understanding of the problem (anthropocentric). Equally important is to be able to "find out the extent to

which learners have progressed toward the competence that the teaching aims to develop" (a move from the anthropocentric to the eco-centric).

In a transformative curriculum, students' views of human/nature relations — eco-action, life-based intrinsic value experiential appreciation, self-centered, non-reciprocal view, basic need, safekeeping, biocentric, reciprocal, personal, and technical — are bounded by purposiveness, discourse, and self-organization (Bruner, 1973). It is through collaborative inquiry and dialogue, learner makes his/her tacit understanding known to public—bringing understanding to conscious awareness and simultaneously going through change (Schon, 1983). Experience is taken and looked at it with others in the learning community. Experience is connected with others' experiences and to one's past to reconstruct self in terms of thought and action. Experience is negotiated with others. Such a process is transformative and the curriculum transforms experience. If so, curriculum is not totally pre-set and closed, rather it promotes learning that involves reflection, dialogue, and transformation (Dewey, 1963). In transformative curriculum, the process of reflection is "critical, public, and communal" (Doll, 1993, p. 142).

Some of these attributes of transformative curriculum seem to play out in Rachel's classroom when she teaches the EfS unit. For example, during session #1, Rachel has students work together in groups to identify categories of waste (things that can be thrown out; things that could be reused or recycled) then students challenge each other's ideas in terms of what can or can not be thrown out. Through dialogue and purposeful reflection, the students join Rachel in inquiry "into that which the students were experiencing" (Doll, 1993, p. 160). Students, through dialogue, reflection and negotiation help each other understand and make sense of what they are learning. They

"used their minds as instruments to make meaning" (Doll, 1993, p. 160). Students respectfully agree and/or disagree with their peers; Rachel respectfully agrees or disagrees with students. She does not force her own attitudes on her students. Instead, through dialogue, she illustrates how she and other students feel, then negotiates with students by providing alternative views, thus giving them the skills to make their own choices. Even after negotiations, if the desired response from students is not produced, she respectfully states that students are entitled to their own views if they have a logical way of thinking about them. Dewey (1916) and (1938) believes classrooms could be "communal, places where experiences could be openly analyzed and transformed; not a competitive environment where right is pitted against wrong, but one where, through mutual cooperation, students and teachers explore alternatives, consequences, assumptions. This communal and public exploration is done in a critical and rigorous yet sympathetic manner. Ideas are put forward for the purpose of exploration, to be part of the recursive process" (Doll, 1993, p. 142). Rachel has that type of classroom.

However, for the curriculum to be considered transformative, a teacher ought to take a more conscious effort in continuously exploring, assessing, and incorporating students' early and developing views as the unit progresses. For example, in a transformative curriculum, to know something as something means to know with more precision and generalization based on the discipline. This is why it is important to focus on students' understanding of the principles of ecology to interpret their human/nature relational experiences through intentional inquiry, reflection, and dialogue.

7.4 Knowledge Contribution to the EfS Curriculum Development Process

The answers to each research question more specifically contribute to knowledge towards EfS curriculum development. In this section I dwell on the general knowledge claims. The research is innovative because of its explicit attempt to discover the meaning making of one teacher as she works with a researcher to develop an EfS curriculum unit and then attempts to implement the unit to a group of Grade Six students. The development of a framework that emerges as a result provides entry points of the development and implementation of an ecological approach to educating for sustainability.

The focus on EfS teaching and learning in a classroom with a teacher and her students narrows the gap in the literature. Until now, no studies have identified a heuristic for curriculum development processes associated with EfS. Through our collaborative process, Rachel and I develop an approach to EfS curriculum development consisting of the following features:

1. Identifying Goals, Learning Outcomes and Principles of Learning
2. Identifying Curriculum Design Model(s)
3. Developing a Time Schedule
4. Selecting a Focus
5. Building a Shared Vision
6. Creating Action/Lesson Plans for Implementation
7. Identifying Curricular Connections
8. Adjusting the Existing Curriculum

The above framework for EfS-oriented interdisciplinary curriculum planning and design (EfS-ICPD), which incorporates both substantive and procedural components, may serve those who desire to collaboratively plan and design EfS curriculum units. (For an in-depth overview of the approach used, please refer to section 3.6 in Chapter Three.) However, I am not proposing a single model for effective EfS curriculum development, which may be universally applied, given the diverse range of sustainability issues. Rather, the EfS-ICPD heuristic form and function must be developed relative to local conditions and needs. The contribution of this study, however, is that it provides the basis for future comparison with other initiatives.

The ethnographic study also attempts to illustrate conceptually and empirically the difficulties of developing and implementing an interdisciplinary EfS curriculum in a country where the formal school curriculum is subject-based, student outcome-based and where teachers usually work unilaterally, and students are taught to learn to think based on epistemological tendency towards separation and a way of knowing that is characterized by "anthropocentric" thinking.

7.5 Implications for Teacher Education

This research provides evidence that a teacher does not necessarily have relevant education or experience in systematically using students' human/nature relationships in her lesson sequences or teaching strategies. The teacher in the study represents many teachers who possess little in the way of an explicit appreciation of the concepts, theories and personal understandings regarding human-nature relations which students might bring to the EfS unit of study. Thus, teacher education needs to take the initiative to help teachers learn how to explore and make sense of students' views of human/nature

relationships and how those relations might be incorporated into lesson sequences and ultimately their teaching (identifying how students' conceptions might have been used to enhance teaching and student learning) and why that is important. When students' views are explicitly considered and these are subjected to critical inquiry, the curriculum takes on a transformative process.

In the transformative process curriculum, the role of the teacher is very different and this should be brought to teachers' awareness. In a transformative curriculum, a teacher's role ought to be "first among equals." The authority moves into the situation. The teacher is an "interpreter of others' values," "a leader from within" (Doll, 1993). He suggests that through dialogue within a caring and critical community students' values need to be developed from everyday life experiences. Rachel clearly fits Doll's vision of what the role of authority ought to be - an "interpreter of other's values," although she did not use students' prior views in her teaching. Teachers who aspire to be successful in EfS teaching need to adopt some of Rachel's characteristics of teaching.

Through her story and the intermittent student/teacher dialogue that followed, Rachel attempts to inspire and motivate her students to want to participate in the business project. Doll (1993) stresses, teachers need to present lessons in enough narrative form to encourage students to explore the possibilities that can be generated from dialogue with the text. Atkinson, (1998) also states, "Story provides the parts - motifs, plot, connections, feeling — that make understanding and meaning possible" (p. 74).

Through the business project activity, Rachel enables her students to think and make informed decisions. Thinking and decision-making are important functions of learning — "learners think when they encounter obstacles or challenges to action that

interest them. In thinking, they design and test plausible ways of overcoming the obstacles or challenges" (Doll, 1986, p. 58).

Rachel uses the excursion to the bioreserve to foster in her students a willingness to care and also to experience and reconnect with the environment as a precursor to addressing her educational goals. In connection with this point, Smith (1998) argues those educational goals such as increasing knowledge and awareness about the environment, developing skills to address issues, fostering attitudes.... are necessary, but insufficient, if they are not accompanied by the willingness to care.

Teacher education programs should make available to inservice and practicing teachers courses, summer institutes, seminars that focus on education for sustainability through a transformative EfS curriculum. A course such as this would ultimately include students' views of human/nature relations and interpret these using the principles of ecology as a guideline for helping students how to live sustainably. The EfS transformative curriculum will also incorporate principles such as power sharing between the teacher and student, empowering students, thinking for decision-making and action taking, and learning taking within the ethics of caring.

In light of the issues presented concerning teacher education, there are implications for provincial and territorial governments, school divisions, principals, researchers and grant funders. It is suggested that teachers should be provided with teacher release time to take university classes that educate teachers to develop transformative EfS curriculum, and carry out innovative practices such as the one Rachel was involved with. Provincial and territorial governments charged with the mandate to work with teachers to create curriculum should provide funding to school divisions to encourage such innovative

practices. Researchers, involved with innovative projects such as this should consider funding teachers (buying teacher release time) through grant funding, thus reimbursing the school division for the costs associated with this practice. Grant providers should make funds available to researchers for innovative projects and ensure that funding is substantial in order for collaborative projects like this to effectively take place.

Through conversation inquiry and dialogue, Rachel and I reflected on our own understanding. Together, through out collaborative process, we brought these understandings to consciousness and then transformed them. Our understandings can now be studied further through critical inquiry, dialogue and more transformation.

7.6 Recommendations for Future Research and Developments

Any research of the scope and complexity as the one undertaken here necessarily leaves many questions unanswered. Possible directions for future research and curriculum development in EfS would include meaning making in the following areas:

- *To what extent do students internalize the principles of ecology and transform their human/nature views?* Follow up of the implementation of the EfS curriculum with these and other students to ascertain the degree to which students/teachers have internalized the principles of ecology and transformed their human/nature views.
- *What are the skills and processes students need to make sense of the principles of ecology?* Development of the attendant skills and processes students need in order to make sense of the principles of ecology as defined in this study and internalize them as part of their decision-making process with

respect to addressing and understanding sustainability issues and possible solutions.

- *How can EfS curriculum be planned, designed and implemented?* Further research conducted into how researchers collaborating with teachers develop and implemented EfS curricula would help to further develop the understandings and meaning making associated with the process. The EfS curriculum planning and design guidelines that have emerged as a spin-off of this study can be viewed as the beginning of a dialogue for EfS curriculum development processes.
- *What are the implications of EfS for teacher education in Canada?* An examination of the implications of EfS for teacher education.
- *To what extent does the EfS curriculum unit have a positive effect on improving student's problem solving skills or increasing thoughtful sustainability decision-making?* The importance of teaching problem-solving to facilitate the process of students becoming effective problem-solves and decision-makers has been stressed by Hungerford, Peyton and Wilke, 1980; Unesco-UNEP, 1989. Although the product (the EfS curriculum unit) was not evaluated in the present study, an indication as to whether the EfS curriculum unit would have a positive effect on improving student's problem solving skills or increasing thoughtful sustainability decision-making would be a valuable for curriculum evaluation.
- *Should the evaluation of the EfS curriculum be conducted in a real classroom setting?* Slavin (1989) has suggested that evaluation of innovative programs

and new curricula are conducted in real classroom settings. This study provided evidence that it is possible to develop and interpret teaching and student learning in real classroom settings, with input from teachers. Teachers are indeed willing to take the time to participate as collaborators in educating for sustainability research, and can provide invaluable reflections on their experiences about the curriculum planning, design and implementation process.

- *How can educators' best incorporate students' views into their teaching?*
- *How can educators collaborate on curriculum development processes for meaningful teacher professional development?*
- *How can phenomenography be used to develop a transformative curriculum?*
- *How do educators incorporate the principles of ecology into their teaching and student learning?*
- *How important is the issue of interpersonal relations and time among teachers?* Developing a harmonious relationship among teachers was of paramount importance in Arenas (2000) study. Given the need for teacher collaboration, if teacher do not get along well and if they do not have the time to develop, the whole curriculum development innovation may come to a halt.

7.7 Chapter Summary

This chapter provides answers to the ten research questions based on the evidence gathered in the study and identifies arising issues. In this chapter, I highlight how I missed the opportunity to provide professional development to Rachel regarding how to

incorporate the principles of ecology and student's prior views of human/nature relations within EfS implementation. Then, I discuss how phenomenography can be used to develop EfS transformative curriculum followed by the general knowledge claims that emerged from the study. Although the answers to the research questions specifically contribute to knowledge towards EfS curriculum development, I focus on the knowledge contribution related to the interdisciplinary EfS curriculum planning and design framework that emerged as a result of this study. I then outline implications for teacher education.

Corine Glesne (1997) noted that qualitative research rarely leads to a conclusion. "Conclusions suggest an ending, a linear progression that can be resolved in some neat way. I see no conclusion here" (p. 218). This study begs us to continue with new searches for meaning, consequently, I make recommendations for future study focusing on phenomenography as a based for transformative EfS curriculum development, teacher education, and teacher-researcher collaboration.

The quest continues.

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APPENDICES

APPENDIX A

Ethics Letter of Clearance

UNIVERSITY OF MANITOBA | Office of the President

Office of Research Services
244 Engineering Building
Winnipeg, MB R3T 5V6
Canada
Telephone: (204) 474-8418
Fax: (204) 261-0325

APPROVAL CERTIFICATE

03 August 2001

TO: **Christina McDonald**
Principal Investigator

FROM: **Lorna Guse, Chair**
Education/Nursing Research Ethics Board (ENREB)

Re: **Protocol #E2001:042**
"Engaging Middle Years Ssudents in Ecological Sustainability: A Teacher/Researcher Collaborative Case Study"

Please be advised that your above-referenced protocol has received human ethics approval by the **Education/Nursing Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement. This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

APPENDIX B

EfS Curriculum Unit:

Learning from Ecosystems About Sustainable Waste Practices

LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

What Can Ecosystems Teach Us About Waste?

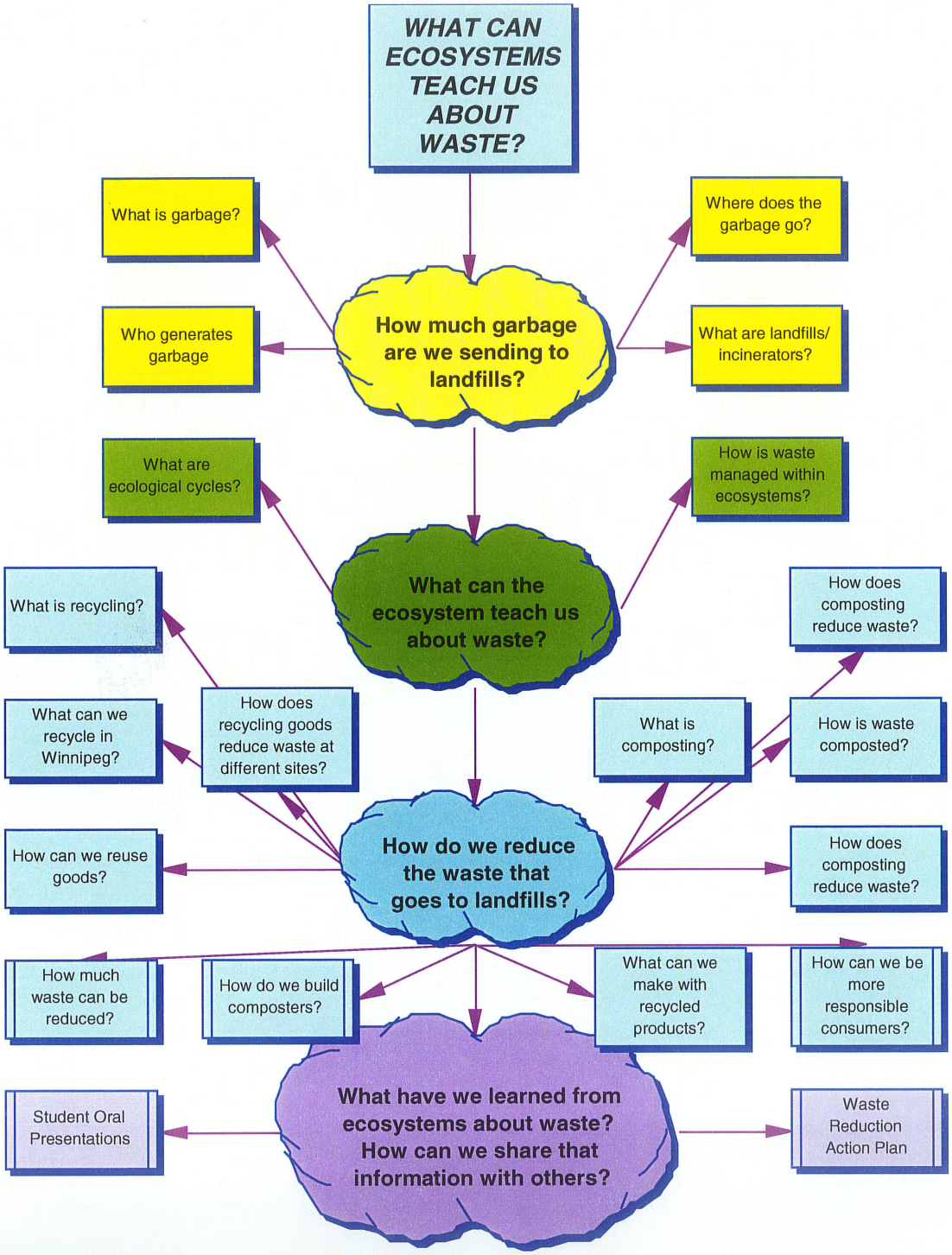
Sub-Questions:

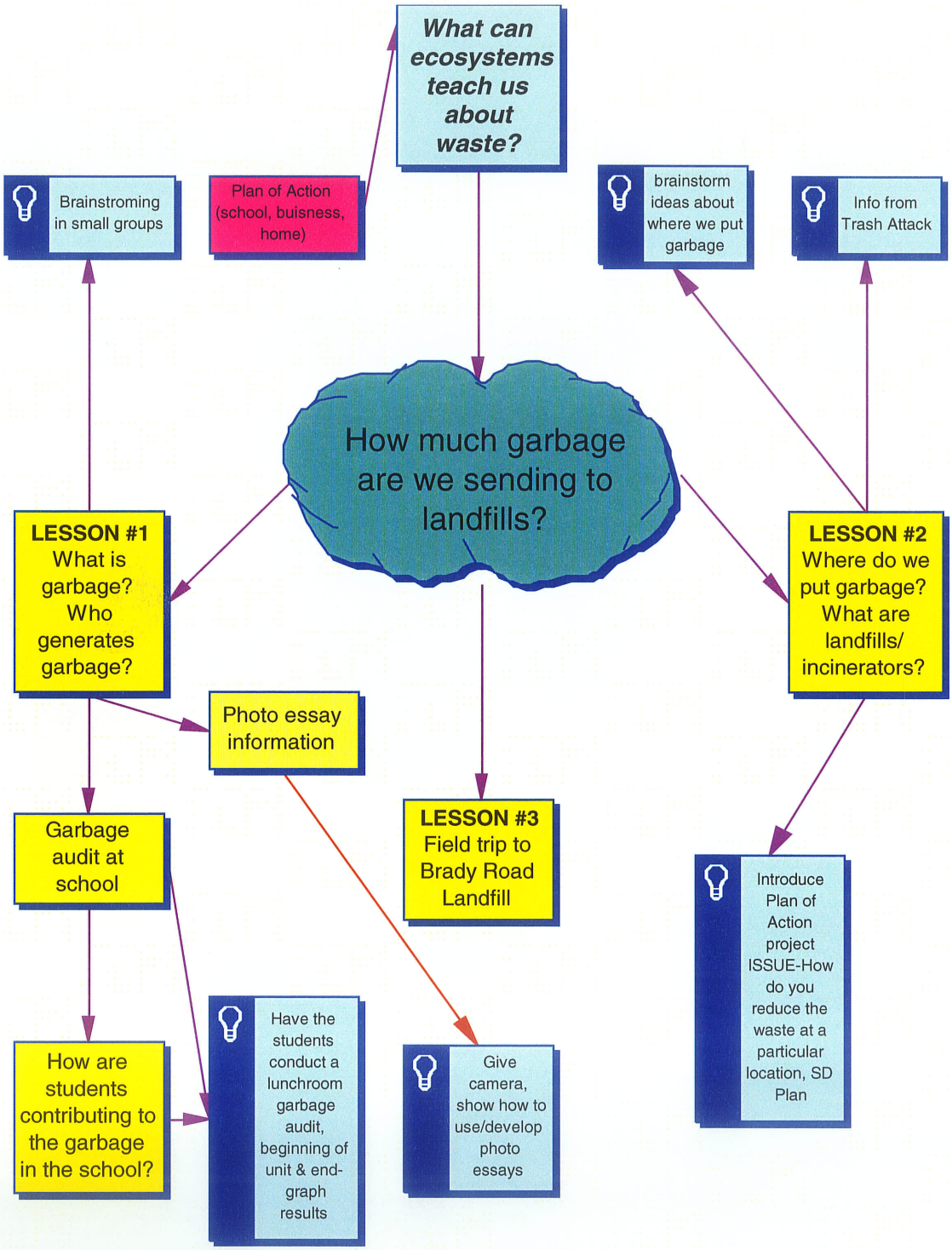
- How much garbage are we sending to landfills?
- What can the ecosystem teach us about waste?
- How do we reduce the waste that goes to landfills?
- What have we learned from ecosystems about waste and how can we share that information with others?

Educating for Sustainability
VISION

Students will become informed and responsible decisions-makers, playing active roles as citizens of Canada and the world, and will contribute to social, environmental and economic well-being, and an equitable quality of life for all, now and in the future.

Source: Manitoba Education, 2000, p. 4.


WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?
What is garbage?
Where does the garbage go?
How much garbage are we sending to landfills?
Who generates garbage
What are landfills/ incinerators?
What are ecological cycles?
How is waste managed within ecosystems?
What can the ecosystem teach us about waste?
What is recycling?
How does composting reduce waste?
What can we recycle in Winnipeg?
How does recycling goods reduce waste at different sites?
What is composting?
How is waste composted?
How do we reduce the waste that goes to landfills?
How can we reuse goods?
How does composting reduce waste?
How much waste can be reduced?
How do we build composters?
What can we make with recycled products?
How can we be more responsible consumers?
What have we learned from ecosystems about waste? How can we share that information with others?
Student Oral Presentations
Waste Reduction Action Plan


What can ecosystems teach us about waste?
Brainstroming in small groups
Plan of Action (school, buisness, home)
brainstorm ideas about where we put garbage
Info from Trash Attack
How much garbage are we sending to landfills?
LESSON #1 What is garbage? Who generates garbage?
LESSON #2 Where do we put garbage? What are landfills/ incinerators?
Photo essay information
Garbage audit at school
LESSON #3 Field trip to Brady Road Landfill
Introduce Plan of Action project ISSUE-How do you reduce the waste at a particular location, SD Plan
How are students contributing to the garbage in the school?
Have the students conduct a lunchroom garbage audit, beginning of unit & end-graph results
Give camera, show how to use/develop photo essays

PRINCIPLES OF ECOLOGY/PRINCIPLES OF EDUCATION
Key Ecological Concepts:

Interdependence: All members of an ecosystem are interconnected in a web of relationships in which all life processes depend on one another. The success of the whole system depends on the success of its individual members, while the success of each member depends upon the success of the system as a whole.

In a learning community, teachers, students, administrators, parents, businesses and community members are all interlinked in a network of relationships, working together to facilitate learning.

Sustainability: The long-term survival (sustainability) of each species in an ecosystem depends on a limited resource base.

Building learning communities around the issue of sustainability means that teachers see the long--term impact they have on students.

Ecological Cycles: The interdependencies among the members of an ecosystem involve the exchange of matter and energy in continual cycles. The ecological cycles act as feedback loops.

The teaching does not flow from the top down, but there is a cyclical exchange of information. The focus is on learning and everyone in the system is both a teacher and a learner.

Energy Flow: Solar energy, transformed into chemical energy by the photosynthesis of green plants, drives all ecological cycles.

Learning communities are open communities where people are moving in and out, finding their own niches in the system.

Partnership: All members of an ecosystem are engaged in a subtle interplay of competition and cooperation, involving countless forms of partnership.

All members of the learning community cooperate and work in partnership, which means democracy and empowerment because each part plays a very crucial role.

Flexibility: In their function as feedback loops, ecological cycles have the tendency to maintain themselves in a flexible state, characterized by interdependent fluctuations of their variables.

In a learning community, there is dynamic change and fluidity. Daily schedules are fluid; each time there is a change of theme, the learning environment is recreated.

Diversity: The stability of an ecosystem depends crucially on the degree of complexity of its network of relationships; in other words, on the diversity of the ecosystem.

Experiences that encourage students to use diverse modes and strategies of learning are essential in learning communities. Diverse learning styles are appreciated for the richness they bring to the learning situation. Cultural diversity is critical to establishing the school as a true community.

Coevolution: Most species in an ecosystem coevolve through an interplay of creation and mutual adaptation. The creative reaching out into novelty is a fundamental property of life, manifest also in the processes of development and learning.

As businesses, community groups and parents work more in partnership with the school, each better understands the needs of the other. In a true, committed partnership both partners change - they coevolve.

Source: Elmwood Institute (1993)

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Much Garbage Are We

Sending To Landfills?

LESSON #1

What is garbage?

Who generates garbage?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: How much garbage are we sending to Landfills?

Lesson #1: Introduction to Garbage

Discussion: We will be extending the students' knowledge of waste to applications in the school and at home.

Student Learning Outcomes:

- Students will describe what garbage is and who generates garbage.
- Students will conduct a garbage audit using lunchroom waste.
- Students will develop a photo-essay.
- Students will develop skills related to operating a camera.
- Student will use writing skills to express in words the photos they have taken and chosen.

Curriculum Connections:

Mathematics:
GLO Statistics Strand for analyzing and graphing (garbage audit)
GLO Number Strand with weighing garbage and determining percentages of each category (garbage audit).

English Language Arts:
GLO 1.1 Discover and Explore (purposeful and productive exchange of ideas, oral and written expression of opinions) (photo-essay)
GLO 3.1 Plan and Focus (record information) (photo-essay)
GLO 3.2 Select and Process (note making and key ideas) (photo-essay)
GLO 4.2 Enhance and Improve (word processing and peer editing) (photo-essay)

Science (Pan Canadian):
Skills:
205. Observe and investigate their environment and record the results.
205. Work collaboratively to carry out science-related activities and communicate ideas, procedures and results.

Knowledge:
301. Describe and predict causes, effects and patterns related to change in living and non-living things.

Attitudes:
416. Appreciate the importance of accuracy and honesty.
420. Show concern for their safety and that of others in planning and carrying out activities and in choosing and using materials.

Science (Manitoba 5-8 Curriculum):
C6. Employ effective communication skills and utilize information technology to gather and share scientific and technological ideas and data.
C7. Work cooperatively and value the ideas and contributions of others while carrying out scientific and technological activities.

C8. Evaluate, from a scientific perspective, information and ideas encountered during investigations and in daily life.

Objectives:

- To understand what garbage is.
- To determine who generates garbage.
- To conduct a garbage audit within the school.
- To determine how students contribute to the garbage in the school.
- To develop a photo-essay.

Materials:

- Fever Chart (to calculate garbage audit information)
- Information from Trash Attack
- 1 bag of garbage
- 3 pairs rubber gloves
- plastic to cover floor
- 25 cameras
- 25 camera film (12 pictures each)
- 25 photo albums
- labels/masking tape for camera

Procedure:

Introduction: What is garbage?
Group students into five groups.
Students will brainstorm for 30 seconds about the things they throw away.
Students will count the items. Each group shares five items that have not been stated. Teacher will record on the board.

Who Generates Garbage?

Students will discuss in a teacher led discussion where garbage comes from. Some examples are homes, industry, businesses, animals, people, etc.

Garbage Audit:

Select three volunteers to separate the garbage with the class giving directions.
Weigh total bag then each garbage component (composing, recycling, waste).
Record whole and part measurement on Fever Chart.

Photo-Essay:

1. Give each student a camera.
2. Show students how to use the camera.
3. Show students how to load film into camera.
4. Show students the Albums.
5. Demonstrate what the students will take pictures of and explain that they will be writing about pictures they chose.
6. Inform students that they will be given time throughout the unit to write about the pictures they take. Film will be handed in after lesson 3 (12 pictures).
7. Students will choose 3-4 of the photos and write about them in their own time.
8. Students will be asked to express the image that they took and why they took a particular photo.

My Waste Unit Photo-Essay **By:**_____

In the waste unit that we studied, we learned many different ideas about waste. We learned about ecosystems and waste. We learned what waste is and how it is generated. We learned about how much garbage we are sending to landfill sites. We learned how to reduce the waste that goes to landfills. We learned how to compost. We also learned how to recycle and reuse. We also chose a business to do a waste audit on. When we have finished our research we will share that information with our businesses.

While we were studying these ideas, we took pictures of people, places and things that we thought were important.

The following pictures were taken while studying a unit on waste and will show what I think is important about what I learned. I will describe my photographs and show what I thought was important. I will tell why I chose to this these photographs. I will show how these photographs were related to the waste unit and how my photographs help to communicate my ideas. Some of my pictures might show a waste related problem or solution.

PICTURE 1

This is a picture of _____
_____. (include the who, what and where) The reason
that I chose this picture was _____
_____
_____
_____. This photo showed a good example
_____
_____.
When I look at this photo it makes me feel _____
because_____
_____.

In our waste unit, we learned that_____
_____
_____. I wanted to show that _____
_____ was important in the whole process of _____ with respect to
waste because_____
_____
_____
It shows that _____is a solution/continual problem and I
learned that _____
_____
_____.

PICTURE 2

This is another picture of_____
_____. (include the who, what and where) The reason that I chose this picture was _____
_____
_____
_____. This photo showed a good example
_____
_____.
When I look at this photo it makes me feel _____
because_____
_____.

In our waste unit, we learned that_____
_____
_____. I wanted to show that _____
_____ was important in the whole process of _____ with respect to waste because_____
_____
_____
It shows that _____is a solution/continual problem and I learned that _____
_____
_____.

PICTURE 3

This is a picture of _____
_____. (include the who, what and where) The reason that I chose this picture was _____
_____
_____
_____. This photo showed a good example
_____
_____.
When I look at this photo it makes me feel _____
because_____
_____.

In our waste unit, we learned that_____
_____
_____. I wanted to show that _____
_____ was important in the whole process of _____ with respect to waste because_____
_____
_____
It shows that _____is a solution/continual problem and I learned that _____
_____
_____.

PICTURE 4

This is a picture of _____
_____. (include the who, what and where) The reason that I chose this picture was _____
_____
_____
_____. This photo showed a good example
_____
_____.
When I look at this photo it makes me feel _____
because_____
_____.

In our waste unit, we learned that_____
_____
_____. I wanted to show that _____
_____ was important in the whole process of _____ with respect to waste because_____
_____
_____
It shows that _____is a solution/continual problem and I learned that _____
_____
_____.

[name of school]
[name of City/Province]
****

To Whom It May Concern:

I am a grade six student at [name of school], in [name of City/Province]. I am studying two topics in my Outdoor and Environmental Education classroom. One topic is about garbage and the other is about energy. My school assignment requires me to take photographs of people, places or things in my environment that relate to garbage and/or energy.

I am asking your permission to take a photograph of you and/or your property (place or thing). My school assignment requires me to take a lot of photographs of different people, places and things. I will choose a few photographs and write about them. After I have written about the photographs, a researcher from the University of Manitoba might ask me questions about some of the photographs I have selected. I may choose the photograph of you and/or your property to talk about with the researcher. This is why I need your permission to take the photograph.

In the future, the researcher may wish to use the photograph that I have taken of you and/or your property for a presentation and/or for publication. If that is the case, she will ask you for your permission again. She will show you a copy of the photograph so that you can make an informed decision. If you give permission, the photograph will be used. If you do not give permission, the photograph will not be used. Your real name and your location will not be used in any publication or presentation.

If you are willing to have me take a photograph of you and/or your property, please show your consent on the space below and please provide your address and telephone number in case the researcher wishes to contact you in the future. Please return this letter and form to me as soon as possible. If you have any questions, you may contact the researcher at [phone number] (days) or [phone number] (evenings). The Education/Nursing Research Ethics Board has approved her research. If you have any additional questions, you may contact the Human Ethics Secretariat at 474-7122 or write to the following address: Office of Research Services, Human Ethics Secretariat, 244 Engineering Building, University of Manitoba, Winnipeg, MB, R3T 2N2. I appreciate your consideration of this request.

Photography Consent Form

Please check the appropriate statements:

YES
------I **do** grant you permission to photograph me and/or a thing on my property.

NO
------I **do not** grant you permission to photograph me and/or a thing on my property.

I understand that I can either agree or not agree to have you photograph me and/or a thing on my property. I understand that the University researcher will ask for your permission if she wishes to use the photograph that I take in future publications and presentations. I understand that my real name and location will not be used in any publication or presentation.

Person's Name: _____ Person's Address and Telephone Number:

_____

_____

Signature of Person: _____ Date: _____[year]

Photography Guidelines

To all students:

Before you take a photograph of a person, place or thing, please make sure that:

When photographing a person(s):

- You must first ask the person for permission to take his or her photograph. We must remember to not violate the privacy of other people. Taking a photograph of a person without first asking the person for his or her permission, violates that person's privacy.
- If the person gives you permission to take his or her photograph, have that person sign the "Person(s) Photography Consent Form", then take the photograph.
- You do not take the photograph if the person does not give you permission.

When photographing a place or thing:

- Before taking a photograph of something on someone else's property, you must ask for permission. Photographing a place or thing that is owned by another person without asking for permission first, violates that person's privacy. You cannot take photographs of anyone or anything that is identifiable. Identifiable means that the place or thing could be easy for others to recognize that the place or thing belongs to a certain person. For example, do not photograph your neighbor putting glass bottles into his or her recycling bin in front of your neighbor's house without first asking permission to do so.

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Much Garbage Are We Sending To Landfills?

LESSON #2

Where do we put garbage?

What are landfills/incinerators?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: How much garbage are we sending to Landfills?

LESSON #2: LANDFILLS/INCINERATORS

Student Learning Outcomes:

Students will identify where garbage goes after they throw it away.
Students will develop an understanding about landfills and incinerators.
Students will make an educated choice between landfills and incinerators.

Curriculum Connections:

Mathematics:
GLO Number Strand. Percentage of garbage reduction from an incinerator (Incinerators).

English Language Arts:
GLO 1.1 Discover and Explore (purposeful and productive exchange of ideas, oral and written expression of opinions) (photoessay)
GLO 1.1 Discover and Explore (purposeful and productive exchange of ideas, oral and written expression of opinions) (Landfills vs. Incinerators)
GLO 3.1 Plan and Focus (record information) (photoessay)
GLO 3.2 Select and Process (note making and key ideas) (photoessay)
GLO 4.2 Enhance and Improve (word processing and peer editing) (photoessay)

Science (Pan Canadian Science):

(STSE):
107 Describe applications of science and technology that have

Knowledge:
301 Describe and predict the causes, effects and patterns related to change in living in non-living things.

Science (Manitoba 5-8):
B1. Describe scientific and technological developments, past and present, and appreciate their impacts on individuals, societies and the environment, both locally and globally.
B3. Identify the factors that affect health, and explain the relationships among personal habits, lifestyle choices, and human health, both individual and social.
B5. Identify and demonstrate actions that promote a sustainable environment, society, and economy, both locally and globally.

Social Studies:
Topic 3 Life in Canada Since 1940 (significant developments and events – incinerators, landfills, amount of garbage, population (rice)

Lesson Objectives:

- To identify where garbage goes after students throw it away.
- To develop an understanding of landfills and incinerators.
- To make educated choices about whether garbage should be send to the landfill or to incinerators.
- To develop a photo-essay.

Materials:

- Information from Trash Attack
- SD Framework Overhead
- Assessment Ruberic
- 25 cameras
- 25 camera film (12 pictures each)
- 25 photo albums
- Action Plan Information Letter to Businesses

Procedure:

To identify where garbage goes:

1. Group students into their five groups.

2. Students will brainstorm amongst themselves where the garbage goes after the garbage person picks up the garbage. For example, what happens to the garbage?

3. Each group shares ideas in a whole class discussion. Teacher will record on the board.

Landfills and Incinerators:

1. The teacher will lead a discussion, based on info from Trash Attack about landfills and incinerators.

Students make choices about landfills/incinerators:

2. Students can listen to pros and cons and weight the options. Make a personal choice as to which they think is a more sustainable decision or choice. Students will vote on their preferences. A few students can explain their reasoning.

Intro to Plan of Action:

3. Teacher will show the SD Framework on overhead and explain how sustainable decisions are made and what is usually taken into consideration.

4. Each group of students will decide three potential locations for their plan of action project.
5. They will discuss the garbage that potentially is generated at each location and discuss ways to decrease the waste from each location by a minimum of 10%.

6. Hand out the Business Consent Letter. Groups will be asked to have the letter signed. Students can either visit the site, phone, fax, email the letter and return before the next lesson.

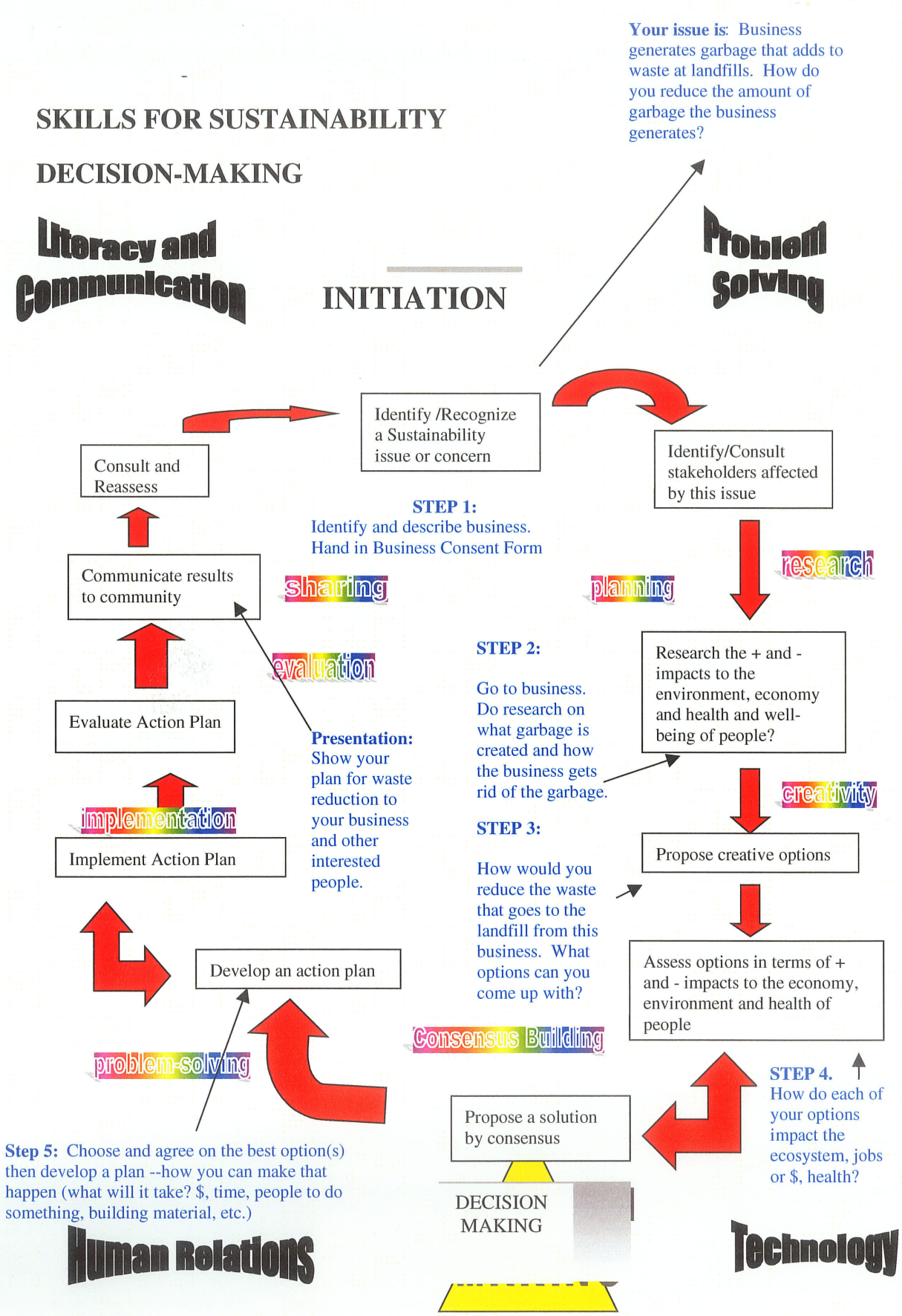
7. Provide each student with an assessment ruberic and discuss what will be expected from each/group student related to the decision making chart/action plan.

Assessment Rubric

Specific Requirements	4 POINTS	3 POINTS	2 POINTS	1 POINT
Complete decision-making Model	Complete model	Model missing 1-3 steps	Missing 4 or more steps	No model completed.
Step 1. Businesses signature sheet handed in	On time	One lesson late	Two lessons late	Not handed in.
Step 2. Going to Business and research their needs related to waste	Learned about four or more + and or - impacts the business has on the environment, jobs and health (people and other living things)	Learned about three + and or - impacts the business has on the environment, jobs and health (people and other living things)	Learned about two + and or - impacts the business has on the environment, jobs and health (people and other living things)	Learned about one + and or - impact the business has on the environment, jobs and health (people and other living things)
Step 3. Creative Options	Create options for four or more impacts (+ and -)	Create options for three impacts (+ and -)	Create options for two impacts (+ and -)	Create options for one impact (+ and -)
Step 4. Assess Options	Identify three or more + or - impact that may result from two options	Identify two + or - impacts that may result from two options	Identify one + or - impacts that may result from two options	Did not identify any + or - impacts that may result from two options
Step 5. Propose an option/develop Action Plan	Clear steps/actions business should take to reduce waste (must be realistic)	Limited steps and actions business should take to reduce waste (must be realistic)	Limited steps and actions business should take to reduce waste (not realistic)	No steps and actions for business to take to reduce waste.
Information Typed	Typed, grammar/ spelling correct	Typed, few spelling and grammatical errors	Typed, many spelling and grammatical errors	No typed
Use of pictures, charts, sketches, explanations	3 or more	2	1	None
Format/Organization (Title pages, signature letter, organized layout)	Very well organized (number pages, logical sequence,	Well organized	Poorly organized	Unorganized

SKILLS FOR SUSTAINABILITY

DECISION-MAKING



WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Much Garbage Are We Sending To Landfills?

LESSON #3

Where does the garbage go?

What are landfills/incinerators?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: How much garbage are we sending to Landfills?

LESSON #3: LANDFILLS – LANDFILL FIELD TRIP

Student Learning Outcomes:

Students will identify where garbage goes after they throw it away.
Students will develop an understanding about landfills and incinerators.
Students will make an educated choice between landfills and incinerators.
Students will observe a waste facility.

Curriculum Connections:

Mathematics:

GLO Strand. Percentage of garbage reduction from an incinerator (Incinerators).

English Language Arts:

GLO 1.1 Discover and Explore (purposeful and productive exchange of ideas, oral and written expression of opinions) (photoessay)
GLO 1.1 Discover and Explore (purposeful and productive exchange of ideas, oral and written expression of opinions) (Landfills vs. Incinerators)
GLO 3.1 Plan and Focus (record information) (photoessay)
GLO 3.2 Select and Process (note making and key ideas) (photoessay)

Science (Pan Canadian Science):

STSE:
107 Describe applications of science and technology that have developed in response to human and environmental needs.

Knowledge:
301 Describe and predict the causes, effects and patterns related to change in living in non-living things.

Science (Manitoba 5-8):
B1. Describe scientific and technological developments, past and present, and appreciate their impacts on individuals, societies and the environment, both locally and globally.
B3. Identify the factors that affect health, and explain the relationships among personal habits, lifestyle choices, and human health, both individual and social.
B5. Identify and demonstrate actions that promote a sustainable environment, society, and economy, both locally and globally.

Social Studies:
Topic 3. Life in Canada Since 1940 (significant developments and events – incinerators, landfills, amount of garbage, population (rice)

Lesson Objectives:

- To identify where garbage goes after students throw it away.
- To develop an understanding of landfills and incinerators.
- To make educated choices about whether garbage should be send to the landfill or to incinerators.
- To observe a waste facility.
- To complete an Ecological Footprint

Materials:

- Ecological Footprint Handout
- 25 cameras
- Bus ($133.00)

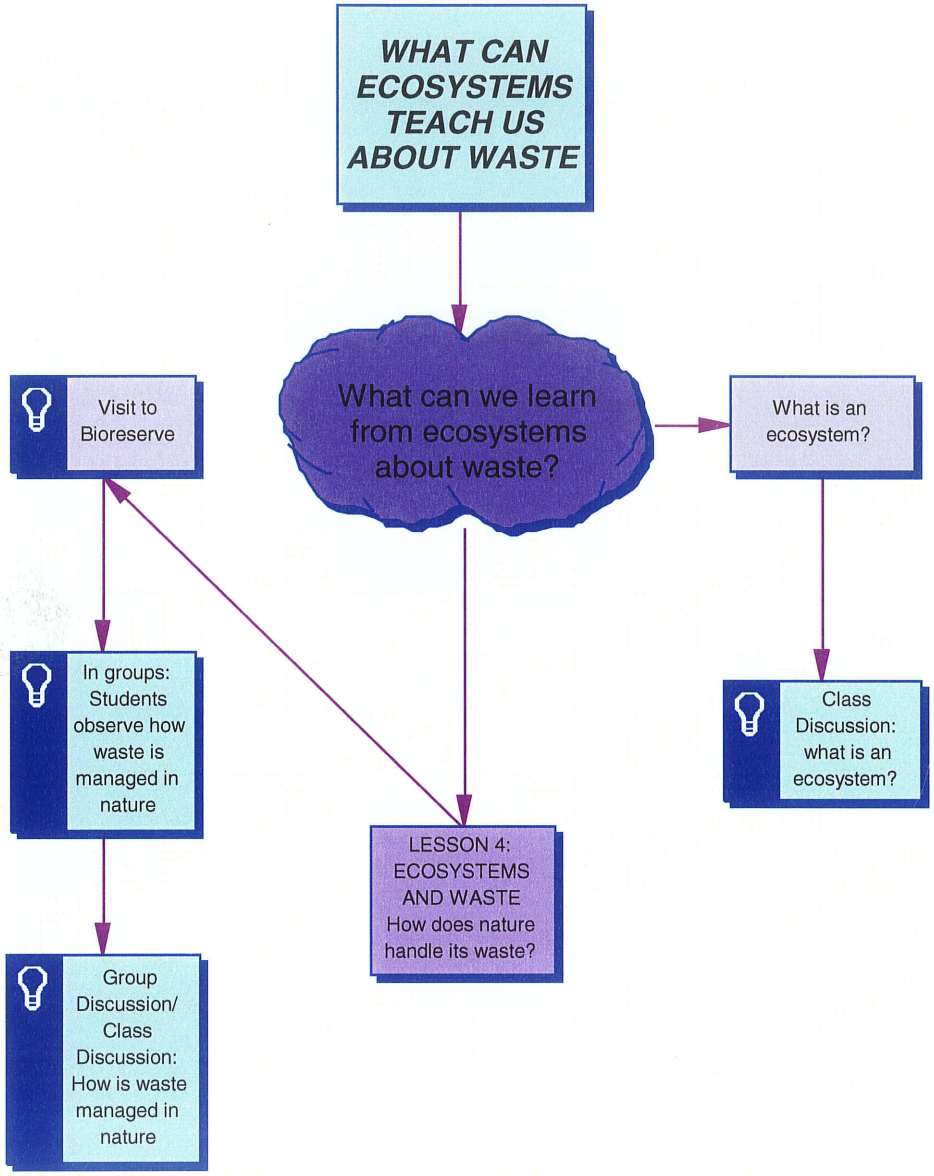
Procedure:

To identify where garbage goes:

Brady Road Landfill Field Trip

1. Students will participate in a field trip to the Brady Road Landfill Site.

2. Hand out the Ecological Footprint Handout. Have students make notes on the bus as they observe a landfill. Students must return Ecological Footprint Handout at next lesson.


WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE
What can we learn from ecosystems about waste?
Visit to Bioreserve
What is an ecosystem?
In groups: Students observe how waste is managed in nature
Class Discussion: what is an ecosystem?
LESSON 4: ECOSYSTEMS AND WASTE How does nature handle its waste?
Group Discussion/ Class Discussion: How is waste managed in nature

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

What Can Ecosystems Teach Us About Waste?

LESSON #4

What are ecological cycles?

How is waste managed within an ecosystem?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: What can the ecosystem teach us about waste?

LESSON #4: ECO-SYSTEMS AND WASTE

Student Learning Outcomes:

Students will identify different ecological cycles going on in the bioreserve.
Students will identify how waste is management in the bioreserve.

Curriculum Connections:

English Language Arts:

GLO 1.1 Discover and explore oral used in a purposeful and productive exchange of ideas.
GLO 3.1 Plan and focus, record information
GLO 3.2 Select and Process (notemaking and key ideas)
GLO 3.3 Organize, Record and Assess
GLO 5.2 Encourage, support and work with others.

Science (Pan Canadian):

Skills:
205. Observe and investigate their environment and record the results.
206. Interpret findings from investigations using appropriate methods.

Knowledge:
301. Describe and predict causes, effects, and patterns related to change in living and non-living things.
302. Describe interactions within natural systems and the elements required to maintain these systems.

Attitudes:
412. Show interest and curiousity about objects and events within different environments.
413. Willingly observe, questions, explore and investigate.
415. Consider their own observations and ideas as well as those of others during investigations and before drawing conclusions.
418. Work collaboratively while exploring and investigating.
419. Be sensitive to and develop a sense of responsibility for the welfare of other people, other living things, and the environment.
420. Show concern for their safety and that of others in planning and carrying out activities and in choosing and using materials.

Science (Manitoba 5-8 Curriculum)

STSE:
B3. Identify the factors that affect health, and explain the relationships among personal habits, lifestyle choices, and human health, both individual and social.

B5. Identify and demonstrate actions that promote a sustainable environment, society, and economy, both locally and globally.

Essential Science Knowledge:

D2. Understand various biotic and abiotic components of ecosystems, as well as their interaction and interdependence within ecosystems and within the biosphere as a whole.

Unifying Concepts:

E2. Describe and appreciate how the natural and constructed world is made up of systems and how interactions take place within and among these systems.

Scientific and Technological Skills and Attitudes:

C2. Demonstrate appropriate scientific inquiry skills when seeking answers to questions.

C6. Employ effective communication skills and utilize information technology to gather and share scientific and technological ideas and data.

C7. Work cooperatively and value the ideas and contributions of others while carrying out scientific and technological activities.

Objectives:

- To understand what an eco-system is.
- To observe and describe "ecological cycles" in nature.
- To observe how waste is managed in nature.

Materials:

- Option: students bring camera's
- Appropriate weather clothing
- Journals, pen/pencil

Key Ecological Concepts:

Interdependence; sustainability; ecological cycles; energy flow; partnership; flexibility; Diversity; Coevolution

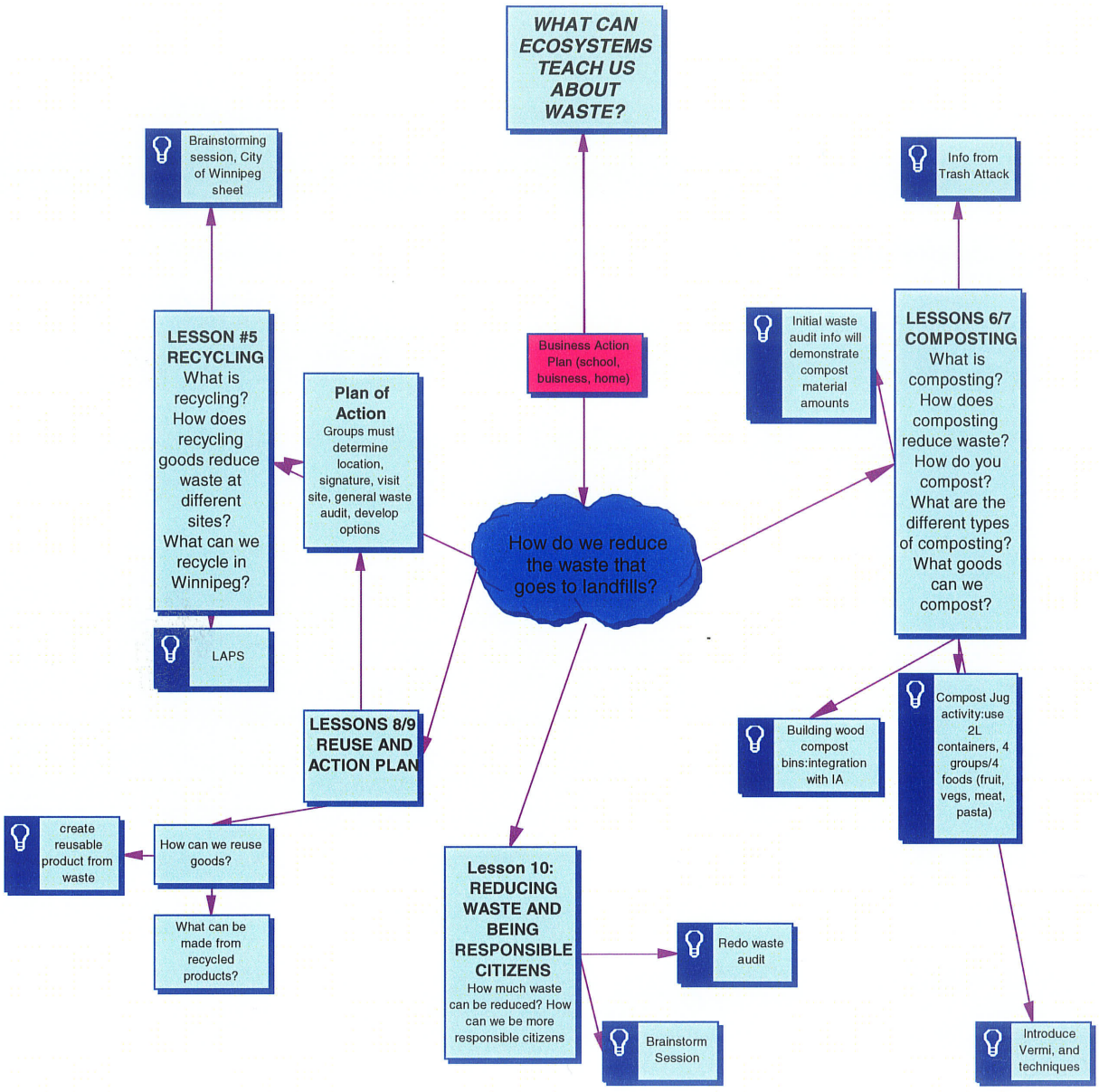
Procedure:

Introduction: What is an ecosystem?

1. Class discussion: Students will participate in a class discussion and share ideas about what their previous knowledge of ecosystems is.

Visit Bioreserve:

2. Activity: Student will visit bioreserve. In groups, students will observe how waste is managed in nature. Student will record information in their journals.
3. Group Discussion: Student will participate in a group discussion and share ideas about how waste is managed in nature.
4. Class discussion: Students will participate in class discussion and share their observations with respect to how waste is managed in nature.


WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?
Brainstorming session, City of Winnipeg sheet
Info from Trash Attack
LESSON #5 RECYCLING What is recycling? How does recycling goods reduce waste at different sites? What can we recycle in Winnipeg?
Business Action Plan (school, buisness, home)
Initial waste audit info will demonstrate compost material amounts
LESSONS 6/7 COMPOSTING What is composting? How does composting reduce waste? How do you compost? What are the different types of composting? What goods can we compost?
Plan of Action Groups must determine location, signature, visit site, general waste audit, develop options
How do we reduce the waste that goes to landfills?
LAPS
LESSONS 8/9 REUSE AND ACTION PLAN
Building wood compost bins:integration with IA
Compost Jug activity:use 2L containers, 4 groups/4 foods (fruit, vegs, meat, pasta)
create reusable product from waste
How can we reuse goods?
Lesson 10: REDUCING WASTE AND BEING RESPONSIBLE CITIZENS How much waste can be reduced? How can we be more responsible citizens
Redo waste audit
What can be made from recycled products?
Brainstorm Session
Introduce Vermi, and techniques

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

What Can We Do To Reduce Waste in Landfills?

LESSON #5 RECYCLING

What is recycling?

How does recycling goods reduce waste at different sites?

What can we recycle in Winnipeg?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: What can we do to reduce waste in a landfill?

LESSON #5 RECYCLING

Student Learning Outcomes:

Students will describe what recycling is.
Students will identify how recycling and rethinking reduces waste in the school lunch room.
Students will identify what goods can be recycled in their community.
Students will identify how "recycling goods" relates to "ecological cycles".

Curriculum Connections:

Mathematics:
GLO Sorting (bag lunch)
GLO Statistics (recording components of garbage from lunch bag)
GLO Number Strand (percentage of waste from the lunch bag)

English Language Arts:
GLO 1.2 Discover and Explore (oral used in a purposeful and productive exchange of ideas)
GLO 1.2 Clarify and extend (sort and select information for particular purposes)

Science (Manitoba 5-8) :
B1. Describe scientific and technological developments, past and present, and appreciate their impacts on individuals, societies and the environment, both locally and globally.
B3. Identify the factors that affect health, and explain the relationships among personal habits, lifestyle choices, and human health, both individual and social.
B5. Identify and demonstrate actions that promote a sustainable environment, society, and economy, both locally and globally.

Objectives:

- To understand what recycling is.
- To identify how recycling reduces waste in the school lunch room.
- To identify goods that can be recycled in Winnipeg.
- To describe how "recycling" relates to "ecological cycles" in nature.

Materials:

- One recycling bin (blue box)
- Variety of recycleable materials such as pop bottles, glass, paper, plastics, cans...
- Variety of non-recycleable materials such #5 plastics, broken glass, hazardous waste, batteries..
- Video
- 5 lunches
- City of Winnipeg Recycle Sheet

Key Ecological Concepts:

Interdependence; sustainability; ecological cycles; energy flow; partnership; flexibility; Diversity; Coevolution

Procedure:

Introduction: What is recycling?

5. Class discussion: Students will participate in a class discussion and share ideas about what their previous knowledge of recycling. Discuss what can be recycled? What do students recycle at home and at school? What could be included in a waste reduction strategy? (paper recycling; paper reduction; school composting; garbage free lunch
6. Activity: To get five students to bring down their lunch bags, go through each lunch bag individually and record on a chart on the blackboard the student's' score (how many points they get for recycling, reusing, composting.
7. Class discussion: Students will participate in class discussion and share ideas about where the recycled goods go once they are placed in the recycle bin.

Ecology and Waste:

8. Video: Bill Nye the Science Guy - Garbage and Ecological Processes.
9. Action Plan Continued: Homework from last class: Students to have determined location; signature of business participation.
10. Group Work: Students to work in their groups to develop a general waste audit and a waste reduction strategy for their selected business.
11. Homework: Bring in 2 litre clear pop bottle and food from their assigned food group (fruit, vegies, meat, pasta/break, all of the above)

Do Your LAPS

For the next few minutes, you will a. watch a video called "Biodiversity; Garbage" by Bill Nye, the Science Guy.

Listen:

Ask yourself questions (record them in your journal).

_____

_____

_____

Picture what you hear (and draw it in your journal).

Summarize what you heard (write a paragraph or two in your journal).

_____

_____

_____

Source: Do your LAPS: adapted from Success for All Learners: A Handbook of Differentiating Instruction (6.108)

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Do We Reduce The Waste

That Goes To Landfills?

LESSON #6: COMPOSTING

What is composting?

How does composting reduce waste?

How is waste composted?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: How do we reduce the waste that goes to landfills?

LESSON #6: COMPOSTING

Student Learning Outcomes:

Students will identify what composting is.
Students will describe and demonstrate how composting reduces waste.
Students will demonstrate how to compost waste.
Students will identify the different types of composting.
Students will identify the goods that can be composted effectively.
Students will experience diverse strategies of learning

Curriculum Connections:

Mathematics:

GLO Shape and Space (sketch 3-D objects, volume, angles (build compost bin)

English Language Arts:

GLO 3.1 Organize, record and assess (building composter)
GLO 5.1 Develop and celebrate community (personal contributions of individuals)
GLO 5.2 Encourage, support and work with others.

P.E/Health:

5 Healthy Lifestyle Practices (Strand A: Application of Decision-making/Problem-solving to physical activity and healthy lifestyle practices).
S.5.2.A.3A Sort/classify a variety of foods into the food groups according to Canada's Food Guide to Healthy Eating.

Science (Pan Canadian):

Knowledge:
302 Describe interactions within natural systems and the elements required to maintain these systems.

Science (Manitoba 5-8):

B1. Describe scientific and technological developments, past and present, and appreciate their impacts on individuals, societies and the environment, both locally and globally.
B3. Identify the factors that affect health, and explain the relationships among personal habits, lifestyle choices, and human health, both individual and social.
B5. Identify and demonstrate actions that promote a sustainable environment, society, and economy, both locally and globally.

Objectives:

- To identify what composting is.
- To describe and demonstrate how composting reduces waste.
- To demonstrate how to compost waste.
- To identify the different types of composting.
- To identify the goods that can be composted effectively.

Materials:

- Trash Attack Composting Information
- Quiz
- LAPs Frame Overhead (Success for all Learners - attachment 15, p. 6.108)
- Composter Jugs
- Food
- Vermi Composter
- Parental consent form to go to business

Key Ecological Concepts:

Interdependence; sustainability; ecological cycles; energy flow; partnership; flexibility; Diversity; Coevolution

Procedure:

What does composting mean to you?

1. Quiz: What does composting mean to you? Do you have a composter at home? If so, do you use it. Can you compost (t/f: a) carrots; b) steak; c) weeds; d) bread; gum wrapper; banana peel; dog poo;
2. Discuss student answers.
3. Activity: Composter Jug Activity: In their groups, students will make a composter with two litre drink containers using the assigned food group as waste. Discuss effective composting strategies.
4. Class discussion and presentation: Show and discuss Vermi composter and discuss different types of composters. Use LAPS frame.

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Do We Reduce the Waste

That Goes To Landfills?

LESSON #7: COMPOSTING

How does composting reduce waste?

How is waste composted?

How do we build composters?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: How do we reduce the waste that goes to landfills?

LESSON # 7: COMPOSTING

Student Learning Outcomes:

Students will describe and demonstrate how composting reduces waste.
Students will demonstrate how to compost waste.
Students will experience diverse strategies of learning
Student will build a composter.

Curriculum Connections:

Mathematics:

GLO Shape and Space (sketch 3-D objects, volume, angles (build compost bin)

English Language Arts:

GLO 3.1 Organize, record and assess (building composter)
5.1 Develop and celebrate community (personal contributions of individuals)
5.2 Encourage, support and work with others.

P.E/Health:

5 - Healthy Lifestyle Practices (Strand A: Application of Decision-aking/Problem-solving to physical activity and healthy lifestyle practices).
S.5.2.A.3A Sort/classify a variety of foods into the food groups according to Canada's Food Guide to Healthy Eating.

Science (Pan Canadian):

Knowledge:
302 Describe interactions within natural systems and the elements required to maintain these systems.

Science (Manitoba 5-8):
B1. Describe scientific and technological developments, past and present, and appreciate their impacts on individuals, societies and the environment, both locally and globally.
B3. Identify the factors that affect health, and explain the relationships among personal habits, lifestyle choices, and human health, both individual and social.
B5. Identify and demonstrate actions that promote a sustainable environment, society, and economy, both locally and globally.

Objectives:
- To demonstrate how to compost waste.
- To experience making a composter

Materials:
- Compost building material and building plan

Key Ecological Concepts: Interdependence; sustainability; ecological cycles; energy flow; partnership; flexibility; Diversity; Coevolution

Procedure:

Build composters - one/group

1. Homework: make arrangements to visit their business site. If planning to use classtime to visit the business, must get signed parental consent before next class.
2. Homework: bring one recycled product from home for next class.
3. Housekeeping: Students informed that they must have their film to researcher by end of next class.

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Do We Reduce The Waste

That Goes To Landfills?

LESSON #8: REUSE

How can we reuse goods?

What can we make with recycled products?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question What can ecosystems teach us about waste?

Sub-question: What can we do to reduce the waste that goes to landfills?

LESSON #8 REUSE

Student Learning Outcomes:

Students will describe how to reuse goods.
Student will identify what can be made from recycled products.
Students will identify products that have been made from recycled materials.
Students will create a usable product from waste.
Students will be able to describe positive and negative effects that result from applications of science and technology in their own lives, the lives of others and the environment.

Curriculum Connections:

Mathematics:
Statistics (collecting data related to project)
Number strand (problem-solving)

English Language Arts:
GLO 1.1 Discover and Explore (oral used in a purpose and productive exchange of ideas) Different point of view (compare own ideas with another)
GLO 1.2 Clarify and Extend (sort and select information for particular purposes)
GLO 3.1 Plan and Focus (record information, group interactive and discussion skills.
GLO 3.2 Select and Process (notemaking, key ideas)
GLO 3.3 Organize, record and Assess (reference)
GLO 4.1 Generate and Focus (as they work on Action Plan)
GLO 4.2 Enhance and Improve (word processing, interaction skills, and peer editing)
GLO 4.3 Attend to conventions (editing)
GLO 5.2 Encourage, support and work with others (project)

Physical Education/Health Education:
GO 5 Healthy lifestyle practices - skills (Design an action plan for active living on a daily bais for self and/or others.

Science (Pan-Canadian):

STSE
108 Describe positive and negative effects that result from applications of science and technology in their own lives, the lives of others and the environment.

Skills
204 Ask questions about objects and events in the local environment and develop plans to investigate those questions.
205 Observe and investigate their environment and record results.
206 Interpret findings from investigations using appropriate methods.
207 Work collaboratively to carry out science-related activities and communicate ideas, procedures and results.

Science (Manitoba 5-8):

C2. Demonstrate appropriate scientific inquiry skills when seeking answers to questions.
C3. Demonstrate appropriate problem solving skills while seeking solutions to technological challenges.
C4. Demonstrate critical thinking and decision-making skills when choosing a course of action based on scientific and technological information.
C5. Demonstrate curiosity, skepticism, creativity, open-mindedness, accuracy, precision, honesty and persistence, and appreciate their importance as scientific and technological habits of mind.
C6. Employ effective communication skills and utilize information technology to gather and share scientific and technological ideas and data.
C7. Work cooperative and value the ideas and contributions of others while carrying out scientific and technological activities.
C8. Evaluate, from a scientific perspective, information and ideas encountered during investigations and in daily life.

Objectives:

- To describe how to reuse goods.
- To identify products that have been made from recycled material.
- To create a usable product from waste.

Materials:

- lab open
- SD Framework

Key Ecological Concepts:

Interdependence; sustainability; ecological cycles; energy flow; partnership; flexibility; Diversity; Coevolution

Procedures:

Independent Group Activity:
1. Students go to business. Students not going to business will work in groups on their written project.

Housekeeping:
Students will provide parental permission form if visiting businesses during this class time.
Student to hand in film by the end of class today.
Students will show their recycled object;

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Do We Reduce the Waste

That Goes to Landfills?

LESSON #9: REUSE

How can we reuse goods?

What can we make with recycled products?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: What can we do to reduce the waste that goes to landfills?

LESSON #9 REUSE

Student Learning Outcomes:

Students will describe how to reuse goods.
Student will identify what can be made from recycled products.
Students will identify products that have been made from recycled materials.
Students will create a usable product from waste.
Students will be able to describe positive and negative effects that result from applications of science and technology in their own lives, the lives of others and the environment.

Curriculum Connections:

Mathematics:
Statistics (collecting data related to project)
Number strand (problem-solving)

English Language Arts:
GLO 1.1 Discover and Explore (oral used in a purpose and productive exchange of ideas)
Different point of view (compare own ideas with another)
GLO 1.2 Clarify and Extend (sort and select information for particular purposes)
GLO 3.1 Plan and Focus (record information, group interactive and discussion skills.
GLO 3.2 Select and Process (notemaking, key ideas)
GLO 3.3 Organize, record and Assess (reference)
GLO 4.1 Generate and Focus (as they work on Action Plan)
GLO 4.2 Enhance and Improve (word processing, interaction skills, and peer editing)
GLO 4.3 Attend to conventions (editing)
GLO 5.2 Encourage, support and work with others (project)

Physical Education/Health Education:
GO 5 Healthy lifestyle practices - skills (Design an action plan for active living on a daily bais for self and/or others.

Science (Pan-Canadian):

STSE
108 Describe positive and negative effects that result from applications of science and technology in their own lives, the lives of others and the environment.

Skills
204 Ask questions about objects and events in the local environment and develop plans to investigate those questions.
205 Observe and investigate their environment and record results.
206 Interpret findings from investigations using appropriate methods.
207 Work collaboratively to carry out science-related activities and communicate ideas, procedures and results.

Science (Manitoba 5-8)

C2. Demonstrate appropriate scientific inquiry skills when seeking answers to questions.

C3. Demonstrate appropriate problem solving skills while seeking solutions to technological challenges.

C4. Demonstrate critical thinking and decision-making skills when choosing a course of action based on scientific and technological information.

C5. Demonstrate curiosity, skepticism, creativity, open-mindedness, accuracy, precision, honesty and persistence, and appreciate their importance as scientific and technological habits of mind.

C6. Employ effective communication skills and utilize information technology to gather and share scientific and technological ideas and data.

C7. Work cooperative and value the ideas and contributions of others while carrying out scientific and technological activities.

C8. Evaluate, from a scientific perspective, information and ideas encountered during investigations and in daily life.

Objectives:

- To describe how to reuse goods.
- To identify products that have been made from recycled material.
- To create a usable product from waste.

Materials:

- lab open
- SD Framework

Key Ecological Concepts:

Interdependence; sustainability; ecological cycles; energy flow; partnership; flexibility; Diversity; Coevolution

Procedures:

Independent Group Activity:

1. Further development of Action Plan; Students go to businesses (if applicable)
2. Groups will show business waste audit and waste reduction strategy to teacher.

Housekeeping:

Students will show their recycled object

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

How Do We Reduce the Waste

That Goes to Landfills?

LESSON #10 REDUCING WASTE AND BEING

RESPONSIBLE CITIZENS

How much waste can be reduced?

How can we be more responsible consumers/citizens?

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: How do we reduce the waste that goes to landfills?

LESSON #10 REDUCING WASTE AND BEING RESPONSIBLE CITIZENS

Student Learning Outcomes:

Students will identify what it means to reduce waste from the waste stream
Students will determine how much waste can be reduced from the school lunch room.
Students will identify how they could be more responsible citizens through reusing, reducing, recycling and composting waste at school.
Students will demonstrate recycling and composting practices.
Students will conduct a garbage audit using lunchroom waste.
Students will develop a photo-essay.

Curriculum Connections (Garbage Audit):

Mathematics:
Statistics Strand for analyzing and graphing
Number Strand with weighing garbage and determining percentages of each category.

English Language Arts (photoessay)
GLO 1.1 Discover and Explore (purposeful and productive exchange of ideas, oral and written expression of opinions)
GLO 3.1 Plan and Focus (record information)
GLO 3.2 Select and Process (note making and key ideas)
GLO 4.2 Enhance and Improve (word processing and peer editing)

Objectives:

- To identify what it means to reduce waste from the waste stream.
- To determine how much waste can be reduced from the school lunch room
- To identify how students could be more responsible citizens through reusing, reducing, recycling waste at school.
- To identify how students could be more responsible citizens through reusing, reducing, recycling waste at home.
- To demonstrate recycling practices.
- To conduct a garbage audit within the school.
- To determine how students contribute to the garbage in the school.
- To develop a photo-essay.

Key Ecological Concepts:

Interdependence; sustainability; ecological cycles; energy flow; partnership; flexibility; Diversity; Coevolution

Materials:
1 bag of garbage
3 pairs rubber gloves
plastic to cover floor

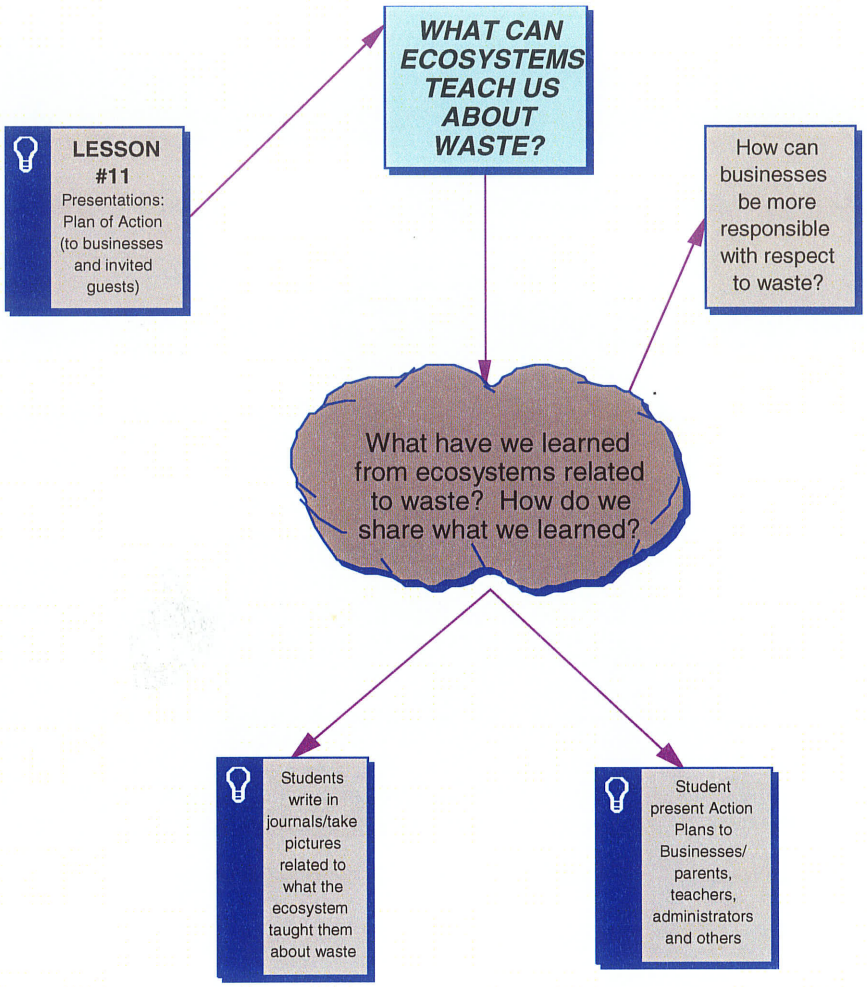
Procedures:

Composting Jug Activity:
1. Students write out a brief explanation of their composting experiment in their journal. What is happening to the food?

Garbage Audit Activity:
1. Select three volunteers to separate the garbage with the class giving directions.
2. Weigh each garbage component (composing, recycling, waste).
3. Record each measurement.
4. Students to compare measurements from earlier audit.

Group Activity:
1. In their groups, students discuss how they can make a difference. Examples may be letter writing, consumer choices, etc.
2. Class discussion - students share ideas developed in groups.
3. Photo-essay: film should be returned. Students begin writing about their pictures (in LA?).

Photo-Essay
9. Inform students that film will be handed in during this class (12 pictures).


WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?
LESSON #11
Presentations: Plan of Action (to businesses and invited guests)
How can businesses be more responsible with respect to waste?
What have we learned from ecosystems related to waste? How do we share what we learned?
Students write in journals/take pictures related to what the ecosystem taught them about waste
Student present Action Plans to Businesses/ parents, teachers, administrators and others

WHAT CAN ECOSYSTEMS TEACH US ABOUT WASTE?

What Have We Learned From Ecosystems About Waste?

How Can We Share What We Have Learned?

LESSON #11: COMMUNICATION AND SHARING

Student Oral Presentations

UNIT 1. LEARNING FROM ECOSYSTEMS ABOUT SUSTAINABLE WASTE PRACTICES

Essential Research Question: What can ecosystems teach us about waste?

Sub-question: What have we learned from ecosystems about waste? How can we share what we learned?

LESSON #11: COMMUNICATION

Student Learning Outcomes:

Students will present "Action Plans" to members of the community and invited guests.
Students will communicate waste minimization practices to others.

Curriculum Connections:

English Language Arts:
GLO 4.4 Present and share (project)
GLO 5.1 Develop and Celebrate community (Presentation)
GLO 5.2 Encourage, support and work with others.

Objectives:

- To present "Action Plans to members of the community and invited guests.
- To communicate waste minimization practices to others.

Materials:

- Student presentations
- Small gym
- Seating
- Chairs

Procedure:

Student Presentations:

1. Students make presentations to business representatives, senior administration (superintendent), principal, vice principal, parents, teachers, and invited guests.

APPENDIX C
Landmarks of Our Curriculum Planning and Design Journey

Session Discussions	Resources
Session #1: Sunday, June 3 (5:45-8:30 p.m.) ▪ Discussed our goal to develop a new EfS-focused unit ▪ Talked about our needs and intentions regarding the project, models/resources available and potential results ▪ Discussed curriculum integration ▪ Discussed Rachel's teaching strategies ▪ Talked about Rachel's curriculum development experience ▪ Discussed the lack of teaching resources for sustainability education ▪ Discussed my research objectives and methods (data collection procedures) and potential outcomes	▪ Manitoba Education (19) *Vision to Action* ▪ *Senge (2000) Schools that Learn* ▪ Manitoba Education (1999). *Education for Sustainable Development: A Resource for Administrators and Educators* Green Teacher (19) ISIS Program (Lincoln College, USA) ▪ Manitoba Education (1994).*Success for all Learners* ▪ *School's Year at a Glance*
Session #2: Monday, June 4 (5:00-6:45 p.m.) ▪ Revising our planning schedule ▪ Discussed topics, themes, problems and issues related to sustainability we could potentially focus upon. ▪ Discussed what students should know, value and be able to do at the end of our unit. ▪ Made connections with other school curricula ▪ Discussed how to design the unit and how to select our topic ▪ Identified existing curriculum resources	▪ Manitoba Education. Middle Years Social Studies Curriculum Guide ▪ Learning for a Sustainable Future (Ottawa). Sustainable development education Framework. ▪ Manitoba Conservation (2000) Draft Sustainability Indicators and Reporting ▪ *It's Electric* video produced by Green and Growing ▪ Green Teacher journals ▪ Georgetown Middle School *Year at a Glance* ▪ School Naturalization teaching resources
Session #3: Wednesday, June 6 (5:45-6:45 p.m.) ▪ Reviewed teaching resources ▪ Reviewed an Interdisciplinary curriculum design and planning Kit	▪ *Pembina Institute. Climate Change Teacher's Guide* ▪ Centre for Ecoliteracy. Internet information about ecological education. (list web sites) ▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit
Session #4: Saturday, June 16, 2001 (1:00 - 4:00 p.m.) ▪ Reviewed the Interdisciplinary curriculum design and planning kit (videos and planning guide) including selecting an organizing center, brainstorm associations, establishing guiding questions and writing activities for implementation ▪ Discussed whether our unit would be discipline-based, multi-disciplinary or interdisciplinary	▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit (Video's, planning guide)
Session #5: Sunday, June 17, 2001 (1:30-5:00 p.m.) ▪ Shared teacher resources we had brought to the session ▪ Brainstormed topics for the unit ▪ Discussed middle years students might be interesting/topics we were interested in ▪ Decided on "Waste Minimization" as our unit topic ▪ Brainstormed activities students would be interested in learning about related to waste minimization ▪ Discussed experiential hands-on teaching strategies ▪ Discussed the logistics regarding some of the activities identified ▪ Raised potential curricular connections to science, mathematics, language arts, art, social studies and home economics	▪ Teacher resources focusing on climate change, waste minimization, fisheries, environmental science, environmental education ▪ Manitoba Education Science Curriculum ▪ Manitoba Education Social Studies Curriculum ▪ Manitoba Education Health and Physical Education Curriculum ▪ Manitoba Education Language Arts Curriculum ▪ Manitoba Education Mathematics Curriculum ▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit (Video's, planning guide)

Session #6: Monday, June 18, 2001 (5:00-7:00 p.m.) ▪ Discussed the logistics regarding my data collection requirements (student interviews/classroom observations, video camera set up) ▪ Discussing how to use student interview data to assess students' prior knowledge about waste minimization ▪ Deciding when the unit would be implemented and the unit length ▪ Reviewed the school timetable (PD days, holidays, reporting periods) ▪ Began to identify essential questions	▪ School timetable ▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit (Video's, planning guide)
Session #7: Friday, June 22, 2001(5:00 - 6:45 p.m.) ▪ Discussed which other teachers might implement some components of our unit ▪ Made curricular connections with other subject areas (science)	▪ Teacher resources focusing on climate change, energy, waste minimization and sustainable development ▪ Pan Canadian Science Framework of Student Learning Outcomes (STSE section). ▪ Manitoba Education (1999). *Education for Sustainable Development: A Resource for Administrators and Educators*
Session #8: Sunday, June 24, 2001(4:00 - 6:00 p.m.) ▪ Identified curricular connections ▪ Linked our topic to other disciplines ▪ Developed a conceptual map of our ideas	▪ Manitoba Education *Science surrounds Us* ▪ *Green and Growing. It's Electric (video).* ▪ Manitoba Education Science Curriculum ▪ Manitoba Education Language Arts Curriculum ▪ Manitoba Education Mathematics Curriculum ▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit (Video's, planning guide) ▪ Inspiration Software Inc. Inspiration (Version 6). (Computer Software Program.
Session #9: Monday, June 25, 2001 (5:00-6:00 p.m.) ▪ How to get Rachel's lap top to work in order to use Inspiration software to develop our conceptual map ▪ Identification of congruent student learning outcomes within the Grade Six Manitoba Language Arts and Social Studies Curricula. ▪ Identified strategies/activities students could be involved in during the course of our unit (students doing debates, developing photo-essays, conducting presentations and participating in field trips).	▪ Manitoba Education Language Arts Curriculum ▪ Manitoba Education Social Studies Curriculum
Session #10: Wednesday, June 27, 2001 (5-7 p.m.) ▪ Identified the essential question and sub-questions: How do we generate less garbage? How much waste are we sending to landfills? How do we reduce the waste that goes to landfills? What goods can we recycle or compost? What goods can we reuse? ▪ Developed a conceptual map of our ideas using *Inspiration* software ▪ Identified activities that students could participate in that would help them address the essential question (and sub-questions) such as a field trip to a local landfill site, brainstorm activities about what garbage is and who generates garbage, conducting garbage audits	▪ Teacher resources focusing on waste minimization. ▪ Policy documents: Manitoba *Conservation (1999). Draft Sustainability Indicators and Reporting;* Manitoba Round Table for Sustainable Development strategies (Waste Reduction Prevention Strategy; Solid Waste Minimization Strategy; Manitoba State of the Environment Report). ▪ Solid Waste and Recycling Magazine, *Composting in Canada.* ▪ Learning for a Sustainable Future's *Cross-Curricular Planning Guide* ▪ Internet web resources printed from Manitoba Conservation's and the U.S. Department of Energy's web sites related to climate change and energy. ▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit (Video's, planning guide) ▪ Inspiration Software

Session #11: Monday, July 9, 2001 (5:00 – 8:00 p.m.) ▪ Identified activities that we thought might best address each of the essential questions for our unit activities ▪ Discussed activities such as: dumping garbage on a large table at school and having students sort the waste; having the students discuss what garbage is and who generates garbage; conducting garbage audits; having students build composters; having students bring to school items made from recycleable material; discussing ways to reduce the use of products; having students build something out of recycleables; and having students conduct a waste audit at a local business of their choosing. ▪ identified sources of backup information (Trash Attack) for teachers related to some activities identified. ▪ Using computer software, *Inspiration*, we transferred our decisions into a conceptual map.	▪ *Inspiration* software ▪ *Trash Attack.*
Session #12: Tuesday, July 10, 2001 (1:00 - 3:00 p.m.) ▪ We discussed the development of lesson plans ▪ We developed lesson plans (1-4) that included an introduction, goals, objectives, student learning outcomes, material, the ecological principles and procedures.	▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit (Video's, planning guide) ▪ Ebenezer and Connor's (1999) *Learning to Teach Science: A Model for the 21st Century. P. 19.* ▪ Jacob's (1989) Step by Step Model. (pg. 64). ▪ *Word97* Software
Session #13: Tuesday, July 31, 2001 (6:00 - 7:00 p.m.) ▪ Shared "Photography guidelines" prepared since our last session related to the students photoessay activity ▪ Discussed how we might include the ecological principles in our unit ▪ Developed lesson plans (5-10). ▪ Discussed having students determine the location for the business project and obtain a signature from their respective business and work in groups to develop a general waste audit and a waste reduction strategy for their businesses. ▪ Identified teaching material	▪ *Success for All Learners: A Handbook of Differented Instruction (Manitoba Education, p. 108).* a *DO Your LAPS* sheet ▪ Bill Nye the Science Guy ▪ http://www.key.ca/resources/Recycle/indext.htm. (teaching material information) ▪ Trash Attack ▪ *Word97* Software
Session #14: Wednesday, August 8, 2001 (5-7 p.m.) ▪ Discussed logistics associated with activities we had identified in the lesson plans ▪ Identified curricular connections and recorded congruent student learning outcomes within our lesson plans	▪ Manitoba Education Language Arts Curriculum ▪ Manitoba Education Mathematics Curriculum ▪ Manitoba Education Physical Education and Health Curriculum. ▪ *Word97* software
Session #15: Thursday, August 9, 2001 (5:00 - 7:00 p.m.) ▪ Discussed the logistics regarding curriculum unit implementation (the dates for teaching the unit), student interviews and how to involve other teachers in the implementation process ▪ Discussed how to change the focus of the unit from a waste unit to an ecologically focused unit taking into consideration the principles of ecology when creating and generating waste. ▪ Changed the essential question ▪ Developed a new lesson plan using Word97 ▪ Discussed where the lesson would fit into the unit ▪ Revised lesson plans accordingly ▪ Modified the conceptual map using Inspiration software to reflect changes to the unit. ▪ Identified the curricular connections for all lesson plans and recorded congruent outcomes on relevant lesson plans throughout the unit.	▪ *Word97* Software ▪ *Inspiration* software ▪ ELA curriculum ▪ *Pan-Canadian Science Framework* and *the Manitoba Science Framework* at the grade six level. ▪ *Word97* software

Session #16: Saturday, August 11 (10:30 – 1:30 p.m.) ▪ Identified resources for our unit (video tapes, information) ▪ Identified and recorded curricular connections ▪ Discussed teaching strategies ▪ Developed a student assessment rubric ▪ Adapted the sustainability decision-making chart	▪ Manitoba Education (1999). *Education for Sustainable Development: A Resource for Administrators and Educators* ▪ Manitoba Education Science Curriculum ▪ Ebenezer and Connor's (1999) *Learning to Teach Science: A Model for the 21st Century. P. 19.* ▪ *Decision-making in Science document* ▪ Jacobs (1989). Interdisciplinary Curriculum Design and Planning Kit (Video's, planning guide).
Session #17: Tuesday, August 14, 2001 (5:00-7:00 p.m.) ▪ Discussed teaching and instruction of the unit Discussed the involvement of other teachers in the teaching process ▪ Discussed how Rachel can use student data in her teaching ▪ Discussed how Rachel can assess and reflect on her own teaching of the unit ▪ Revised lesson plans to include components of Ebenezer and Connor's lesson plan model ▪ Discussed how to involve parents in unit activities, particularly the business project ▪ Discussed logistics regarding unit activities and further revised lesson plans	▪ Ebenezer and Connor's (1999) *Learning to Teach Science: A Model for the 21st Century. P. 19.* ▪ *Word97* software
Session #18: Monday, August 20, 2001 (6:00-8:00 p.m.) ▪ Discussed the time schedule for unit implementation taking into consideration division and school PD days, student reporting periods and data collection requirements (student interviews) ▪ Discussed research ethics (when letters of consent would be distributed to students) ▪ Rachel's pilot project ▪ Modified decision-making chart ▪ Discussed a meeting with teachers previously scheduled regarding including other teachers in the implementation of the unit and planned our agenda and preparation for our teacher meeting ▪ Discussed potential teacher constraints related to the implementation of the unit ▪ Discussed the student photo-essay activity and logistics	▪ Manitoba Education (1999). *Education for Sustainable Development: A Resource for Administrators and Educators* ▪ Rachel's school calendar
Session #19: Wednesday, August 22 (5:30-6:30 p.m.) ▪ Reviewed implementation schedule and made changes based on our discussion ▪ Discussed changes to rubric and decision-making chart and consent letters suggested in previous meeting ▪ Collated eight copies of unit into binders in preparation for teacher meeting	