

ENVIRONMENTAL EDUCATION FRAMEWORK



Pathways to Environmental Literacy in
Alberta Schools, Supporting Alberta
Education's Curriculum Redesign



*Prepared by Dr. Liza Ireland for:
The Alberta Council for Environmental Education
for completion of a conditional grant with Alberta Education
September 9, 2013*

TABLE OF CONTENTS

EXECUTIVE SUMMARY	5
Terminology	10
1.0 INTRODUCTION	13
1.1 Environmental Education’s Contribution to Social, Cultural, Global and Environmental Responsibility	14
1.2 Defining Environmental Education and Environmental Literacy	15
1.2.1 Environmental Education	15
1.2.2 Environmental Literacy	16
1.3 Background	17
2.0 BENEFITS OF ENVIRONMENTAL EDUCATION	19
3.0 ENVIRONMENTAL EDUCATION AND LITERACY – THE PAST TO THE PRESENT	21
3.1 A Shift in Socio-ecological Perspectives	21
3.2 Complex Systems: Interconnected, interdependent and resilient	24
4.0 ENVIRONMENTAL LITERACY AND ITS COMPETENCIES	27
4.1 Three Key Organizing Elements of Environmental Literacy	27
4.1.1 Elements and Descriptors	27
4.1.2 Interconnections	28
4.1.3 Diversity	29
4.1.4 Responsibility & Citizenship	29
5.0 INDICATORS	32
5.1 Learning Indicators for Grade Grouping K-4	33
5.2 Learning Indicators for Grade Grouping 5-8	35
5.3 Learning Indicators for Grade Grouping 9-12	39
6.0 EXEMPLARY TEACHING PRACTICES	42
6.1 Introduction	42



6.2 Criteria for Exemplary Teaching Practices	42
6.3 Exemplary Practices	43
6.3.1 Elementary Schools	44
6.3.1.2 Glenbow Elementary School (K-6), Cochrane, Alberta:	47
6.3.2 Secondary Schools	48
6.4 Exemplars from the Galileo Educational Network	55
6.4.1 Primary Grade Projects	56
6.4.2 Middle School	56
6.4.3 Senior High	57
6.5 Integrated Programs in Ontario	58
6.6 Summary	59
7.0 ASSESSMENT PRACTICES	60
7.1 Effective Assessment for Environmental literacy and learning	61
7.1.1 Attitudes / Values	62
7.1.2 Skills or Competencies	63
7.1.3 Behaviour	63
7.1.4 Action	64
7.2 Weighting between and within Key Elements and Descriptors	64
7.3 Sample Case Studies	65
8.0 PATHWAYS TO ENVIRONMENTAL LITERACY	68
8.1 The Beginning	68
8.2 What is Next?	68
9.0 LITERATURE REVIEW ON ENVIRONMENTAL EDUCATION COMPETENCIES	70
9.1 Executive Summary	70
9.2 Scope	71
9.3 Incorporating EE in formal K-12 education	72
9.3.2 International	72
9.3.3 Australia	73
9.3.4 Vermont	73
9.3.5 Canada	74
9.3.6 Learning for Sustainable Future (LSF)	75
9.3.7 The Western and Northern Canadian Protocol	75
9.3.8 Alberta	76



9.3.9 British Columbia	77
9.3.10 Manitoba	78
9.3.11 Nunavut	78
9.3.12 Ontario	79
9.3.13 Saskatchewan	80
9.4 Schools of Thought in Environmental Education in Relation to Learner outcomes	80
9.5 Environmental Competencies	83
9.5.1 Instrumental Competencies	83
9.5.2 Intrinsic Competencies	84
9.5.3 Social Learning Competencies	85
9.6 An Integration of Competencies and Schools of Thought	86
9.7 Key Organizing Ideas and Descriptors of Environmental Literacy	87
10.0 LITERATURE REVIEW ON ASSESSMENT	91
10.1 Executive Summary	91
10.2 Scope and Criteria	92
10.3 Principles of 21st Century Standards and Assessment	93
10.4 Types of Assessment	95
10.5 Assessment Categories or Tasks	95
10.5.1 International: PISA	96
10.5.2 NAAEE	97
10.5.3 Environmental Education Council of Ohio	100
10.6 Evaluation Methods	101
10.6.1 Attitudes / Values	101
10.6.2 Skills or Competencies	102
10.6.3 Behaviour	102
10.6.4 Action	103
10.7 Assessment Criteria	105
10.7.1 Weight given to & within categories	106
10.8 Proficiency Levels	107
11.0 REFERENCES	110
12.0 APPENDICES	121
Appendix 1: Terms of Reference	121



Appendix 2: Framework for Student Learning	124
Appendix 3: A Framework to Advance Environmental Education in Alberta (ACEE, 2007)	125
Appendix 4: Multi-stakeholder Advisory Committee Members and Governance	126
Appendix 5: Literature Support for Environmental Education Categories and Descriptors.	130
Appendix 6: Guiding Questions for Developing an Environmental Literacy Assessment Framework (Hollweg et al, 2011)	131
Appendix 7: Pro's and Con's of Evaluation Instruments	138
Appendix 8: The Environmental Education Council of Ohio Guidelines for Success (EECO, 2000)	141
Appendix 9: Roth's Levels of Environmental Competency	143
Appendix 10: American Association for the Advancement of Science K-12 Benchmarks for Scientific Literacy – Systems Understanding	146
Appendix 11: NAAEE Environmental Literacy Learner outcomes for fourth, eighth and twelfth grades (NAAEE, 2010)	146
Appendix 12: Manitoba Life Practices Learner outcomes	159



Executive Summary

The Environmental Education Framework is a document to support Alberta Education's curriculum redesign work in developing competency indicators, assessment, and teaching practices for all future curricula.

Alberta Education is in the process of transforming education, with the goal of creating 'engaged thinkers who are ethical citizens with an entrepreneurial spirit.' To create this vision, Alberta Education consulted with Albertans to present a vision for education to 2030. The result of these consultations were captured in the 2010 *Inspiring Education – A Dialogue with Albertans*. From this work, the *Action on Curriculum* agenda was established and further research roundtables and symposiums ensured further dialogue to fine tune this plan. In 2011, Alberta Education drafted the *Framework for Student Learning* that described seven core cross-curricular competency groupings that students should demonstrate – including one entitled "social, cultural, global and environmental responsibility."

In early 2012 the Minister of Education, the Honourable Thomas Lukaszuk, invited the Alberta Council for Environmental Education (ACEE) to collaborate with his staff to help elaborate on this 'responsibility' competency and create the pieces that curriculum developers need in order to ensure that this competency will be manifested in all Alberta classrooms and realized by all Alberta students.

In early 2013, Alberta Education continued to refine the competency groupings and also incorporated the ones listed on page 26 of the *Inspiring Education* report. Environmental responsibility is no longer explicitly referenced but there are many references made in the report such as in the description for an ethical citizen, "As a steward of the earth, I minimize environmental impacts wherever I go." (*Inspiring Education*, 2010, page 19). The *Inspiring Education* report (page 12) also makes reference to the competition for natural resources and that a priority of the government is to "ensure Alberta's energy resources are developed in an environmentally sustainable way."

The Environmental Education Framework was developed to support the social, cultural, global and environmental responsibility competency. Even though this particular phrase is not specifically used in the *Inspiring Education* report, we believe that this 'responsibility' concept is implicit in the government's aspirations for education that supports stewardship and environmental sustainability, as noted above.

For this reason, the Environmental Education Framework continues to refer to the 'Environmental Responsibility' competency in many places. It was developed to build pathways for Alberta students to achieve environmental literacy. Environmental literacy crosses over many competencies that are needed for students to become engaged thinkers who are ethical citizens with an entrepreneurial spirit.



ACEE has worked jointly with Alberta Education staff through a collaborative Project Team, contracted Dr. Liza Ireland of Royal Roads University to conduct the research and writing of the Framework, and engaged a [Multi-stakeholder Advisory Committee](#) to help guide this initiative.



Multi-stakeholder Advisory Committee meeting, December 13, 2012. From left to right: Jesse Beaudry, Gareth Thomson, Kimberly Gray, Sherry Bennett, Kathryn Wagner, Dr. Liza Ireland, Bill Bagshaw, Renate Taylor Majeau, Joanne Barwise, Kathy Worobec, James Bartram

This document is the result of that work. The Environmental Education Framework details the key pieces that are necessary to develop curricula that delivers on the vision of Alberta Education through cross-curricular competencies. The Environmental Education Framework includes key elements for environmental learning, competency indicators for K-12, effective teaching practices, and relevant assessment techniques. The Framework outlines pathways that will achieve environmental literacy for Alberta students. Environmental literacy is achieved through a process of interdisciplinary environmental education.

The North American Association for Environmental Education (NAAEE, 2010) uses a broad definition of environmental literacy that incorporates literacy and competency, specifically recognizing:

- Knowledge of Environmental Processes;
- Questioning, Analysis and Interpretive Skills;
- Skills for Understanding and Addressing Environmental Issues; and
- Personal and Civic Responsibility

A review of the literature confirms that environmental literacy incorporates scientific, technological, political, economic, social and cultural principles and value systems, as well as the aesthetic, moral, ethical and spiritual understanding needed to create ethical, engaged entrepreneurial citizens.

As Dr. David Orr tells us: “Hope is a verb with its sleeves rolled up.” Environmentally literate students who are given the chance to ‘roll up their sleeves’ and engage in positive work to improve environmental quality feel a sense of agency; an education process that empowers them also brings with it that all-important attitude of hope that the quality of the environment can and will improve.



The literature tells us that environmental education has many other benefits:

- Development of 21st Century skills that contribute to healthier, more environmentally sustainable, and economically prosperous communities (NAAEE, 2008, p. 3);
- Improvement in reading, writing, math, science, and social studies (Lieberman and Hoody, 1998; Wheeler and Thumlert, 2007);
- Students exhibit increased pride in their accomplishments (Lieberman and Hoody, 1998);
- Greater engagement and enthusiasm for learning (Chawla and Escalante, 2007);
- Better ability to apply science to real-world situations (Lieberman and Hoody, 1998);
- Better application of systems thinking and increased ability to think creatively (Lieberman and Hoody, 1998);
- More advanced skills in applying civic processes to real-life situations (Lieberman and Hoody, 1998);
- Improvement in intergenerational relations and individual, community, and ecological wellbeing (Manion and Lynch, 2010); and
- Reduction in stress levels and increased feelings of well-being (Louv, 2005).

Sections 4-7 address how environmental literacy can be incorporated into cross-curricular competencies from K-12 identifying competency indicators, assessment and effective teaching practices. The competency indicators outline the direction needed in future curricula while the assessment and effective teaching practices provide examples to help guide teachers in achieving the transformation.

Competency indicators for environmental education and environmental literacy have been organized into three key elements:

1. **Interconnections** - This element incorporates learning about ecological systems and processes, how these are interconnected with social systems, technology and the economy, and how these interconnections influence personal wellbeing and healthy communities that are environmentally sustainable and economically prosperous.
2. **Diversity** - This element involves considering and honouring diversity environmentally and socially, recognizing diverse perspectives and worldviews regionally, culturally and globally.
3. **Responsibility and Citizenship** - This element incorporates investigative and evaluative skills and action to enable learners to understand and develop abilities in adaptation, change and emergence, as society and our socio-ecological inter-relations continue to adapt, change and emerge.

Indicators are provided for each element and are further divided into categories and show a K-12 learning progression using the grade groupings: K-4, 5-8, and 9-12.



The indicators cover the cognitive (thinking or knowledge and understanding), affective (feelings or attitudes and values) and psychomotor (doing or skills and processes) domains. Indicators relate to a learning progression of higher orders of thinking in each of these domains. The higher orders of thinking are categorized across three areas that were being used by Alberta Education in their original work. In addition, the indicators have been written to weave in intrinsic, extrinsic and social learning competencies identified from the literature search.

Exemplary teaching practices at elementary and secondary levels provide examples from individual classes

addressing single or multiple curricula to grade-wide or school-wide projects. These exemplify many of the Elements and Indicators outlined in Sections 4 and 5; experiential, place-based learning; student empowerment; transformative teaching and learning; and



effective community connections. Each example or 'story' has three parts incorporating what the teacher did, what the students did, and what changed as a result of the experience.

Section 7 on effective assessment for environmental literacy and learning emphasizes assessment *for* learning, assessment *as* learning as well as assessment *of* learning. Assessment also needs to incorporate assessment of affective and psychomotor as well as cognitive learning. Assessment methods range from tests and questionnaires to interviews, peer assessments, journal entries, focus groups and observing skills exemplified in carrying out action projects.

Assessments need to measure high level attitudes, skills and knowledge, be largely performance-based, and incorporate adaptability and the ability to cope with novel unpredictable situations.

Given the three key elements of environmental literacy, and the components within each, effective assessment incorporates weighting the various levels and components with respect to each other, and a few examples are provided. Authentic assessment rubrics are shown to be a valuable, effective tool to provide assessment criteria in relation to learning indicators.

From defining environmental education and literacy to identifying key elements, competencies, indicators, as well as exemplary teaching practices and assessment, this Framework is meant as a guide to identify multiple pathways, enabling educators to incorporate environmental education and literacy into the Alberta K-12 curricula. In doing so, it will help develop engaged thinkers that are ethical citizens with an entrepreneurial spirit.



Alberta Education has undertaken an in depth process to transform education. The Environmental Education Framework was developed as a tool to help guide this process. A successful transformation requires work in a number of areas:

- Alberta Education curriculum redesign
- Teachers having the time and resources to embrace the new direction
- A willingness for school administrators, teachers and the community to embrace and support the change

The Environmental Education Framework is a tool that can showcase and support Alberta Education, teachers, school administrators and the community in understanding the importance and benefits of environmental education in curriculum. The Framework's main purpose is to guide curriculum developers in creating new curriculum documents by providing the background research and direction needed to achieve environmental literacy for the 21st century. It also provides tools to guide teachers in creating the change in their classrooms and for the external community to understand the benefits and importance of environmental education.

ACEE is engaging a wide range of stakeholders to raise the profile of the importance and need for environmental education in future curriculum. The first session was held on April 25th in Canmore, Alberta where over 40 participants engaged in the work of Alberta Education, worked together to identify knowledge, skills and attitude statements they feel are important for Alberta students, and



began identifying action statements of what they will do to raise the profile of environmental education. The participants provided value input to ensure the competency indicators were aligning with stakeholders needs and helped refine the work needed to raise the profile of environmental education.

ACEE will continue to bring together a wide range of stakeholders in a variety of session during this important year of curriculum redesign. The work will continue to evolve in 2013 as Alberta Education continues its work on curriculum redesign. During this time, the Environmental Education Framework will be a living document that will continually be improved and enhanced. If you wish to engage in any of the stakeholder sessions, please check out the Champion Environmental Education web site at: <http://abcee.org/championEE/>. If you wish to provide comments on the Environmental Education Framework, please send an email to Kathy Worobec, ACEE's Education Director at Kathy@abcee.org.



Terminology

The following terms are used throughout the document:

Affective domain: The affective domain relates to the learner's feelings, attitudes and values that influence perceptions, understanding and behaviours.

Assessment: Assessment represents the interaction between learning and teaching that provides clear, timely information and feedback that can be effectively used by students, parents, teachers and other educational stakeholders as evidence of competence in a specified domain of learning.

The primary purpose of assessment is to improve student learning and classroom teaching as both students and teachers respond to the focused and timely collection and interpretation of evidence. This evidence provides an understanding of student progress towards the attainment of competencies, and helps to inform educational decisions.

- **Formative Assessment** -provides feedback that is ongoing and descriptive of the process of learning to improve learning and performance
- **Summative Assessment** - A culminating assessment of learner performance and provides feedback that is as immediate to the completion of the assessment as possible to support student learning and student achievement.

Cognitive domain: The cognitive domain relates to the learner's thinking, knowledge and understanding.

Competency: An interrelated set of attitudes, skills and knowledge that is drawn upon and applied to a particular context for successful learning and living (Alberta Education, Framework for Student Learning, 2011).

Curriculum A defined and prescribed course of studies.

Education: The formal act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life.

Element: A distinctive, key organizing idea, concept or area of environmental learning at the large granular size. This is also referred to as a 'category' in the literature search. The previous term used was 'key organizing ideas'.

Environmental literacy: Being knowledgeable about how natural systems function and how social-ecological systems interact; and being competent in interrelated attitudes, skills, knowledge, experience and motivation that is drawn upon and applied for social, cultural, global and environmental responsibility.

Environmental competency: Being competent in interrelated attitudes, skills, knowledge, experience and motivation that is drawn upon and applied for social, cultural, global and



environmental responsibility. Environmental literacy is the outcome of environmental education.

Environmental education: A learning process that helps us:

- Understand how ecological and social systems and processes are interdependent and influence personal and collective wellbeing;
- Value the significance of biological and cultural diversity as well as diverse perspectives in developing social, cultural, global and environmental responsibility;
- Contribute positively in furthering a sustainable society through social, cultural, global and environmental responsibility by fostering attitudes, motivation, and commitment to make informed decisions; and developing investigation and evaluation knowledge and skills and action competence through systems thinking and futures and design thinking

Evaluation: The process of interpreting the evidence and making a judgment of a performance to make informed decisions, such as assigning a grade or promoting a student to a higher performance level.

Grain size: used metaphorically to represent moving from larger concepts to smaller concepts.

Indicator: Statements of attitudes, skills and knowledge, against which student performance is assessed. Indicate the anticipated attitudes, skills, knowledge, values or behaviours that are used to identify what to assess. The statement indicates the learning intentions (What the learner is able to demonstrate) at a specific point in time. In essence it is a statement that provides specificity as to the ability of the student for a particular developmental level.

Inquiry-Based Learning: A form of active learning, where progress is assessed by how well students develop experimental and analytical skills rather than how much knowledge they possess.

Key Organizing Ideas: Describe the large grain-size categories that group appropriately the attitudes, skills and knowledge incorporated in environmental education, and required to be socially, culturally, globally and environmentally responsible (the previous term that was used for this was categories and descriptors).

Place-based education: the process of using the local community and environment as a starting point to teach concepts across the curriculum

Psychomotor domain: The psychomotor domain relates to a learner's actions, skills and processes.

Scope: The vision of what students should have achieved at the end of their entire school experience.

Sequence: A series of age-appropriate achievements that students succeed at during their school experience in order to master the scope.



Socio-ecological systems: The dynamic interplay and interdependence between social and ecological systems.

Sustainability: The goal to be achieved through integrating ecological, social and economic imperatives recognizing all three are interdependent in a complex adaptive system that is continually adapting and emerging. As such, the environment, society and economy are not separate, so one cannot be weighted in opposition or over another. It implies changes in behaviour and practices by individuals and organizations.

Sustainability education: The learning process that integrates social, environmental and economic imperatives. Also referred to in this Framework as environmental education.

Systems thinking: Understanding and thinking in systems, recognizing the interconnections within and between society and the natural environment. It incorporates the diverse ways in which local and global socio-ecological issues are interconnected and practices associated with comprehending and working rationally with complexity, uncertainty and risk so they can be managed effectively.



1.0 Introduction

Alberta Education is in the process of transforming education, with the goal of creating ‘engaged thinkers who are ethical citizens with an entrepreneurial spirit.’ To create this vision, Alberta Education consulted with Albertans to present a vision for education to 2030. The result of these consultations were captured in the *Inspiring Education – A Dialogue with Albertans*. From this work, the *Action on Curriculum* agenda was established and further research roundtables and symposiums ensured further dialogue to fine tune this plan. In 2011, Alberta Education drafted the *Framework for Student Learning* (Appendix 2) that described seven core cross-curricular competency groupings that students should demonstrate – including one entitled “social, cultural, global and environmental responsibility.”

In early 2012 the Minister of Education, the Honourable Thomas Lukaszuk, invited the Alberta Council for Environmental Education (ACEE) to collaborate with his staff to help elaborate on this ‘responsibility’ competency and create the pieces that curriculum developers need in order to ensure that this competency will be manifested in all Alberta classrooms and realized by all Alberta students. In early 2013, Alberta Education continued to refine the competency groupings and also incorporated the ones listed in *Inspiring Education* (page 26).

ACEE has worked jointly with Alberta Education staff through a collaborative Project Team, contracted Dr. Liza Ireland of Royal Roads University to conduct the research and writing of the Framework, and engaged a Multi-stakeholder Advisory Committee (Appendix 4) to help guide this initiative.

The Environmental Education Framework will ensure that education in Alberta prepares students with essential competencies to become engaged thinkers and ethical citizens with an entrepreneurial spirit that contributes to a healthier, more environmentally sustainable and economically prosperous Alberta. Alberta Education, 2011, identifies an entrepreneurial citizen as “...someone who creates opportunities and achieves goals through hard work, perseverance and discipline. It is someone who strives for excellence and earns success; who explores ideas and challenges the status quo; who is competitive, adaptable and resilient; and who has the confidence to take risks and make bold decisions in the face of adversity”.

The Alberta Council for Environmental Education received a conditional grant from Alberta Education to conduct this work and the Terms of Reference (Appendix 1) outline the parameters for the work to be conducted with the following outcome:

“In collaboration with a multi-stakeholder advisory group, the environmental education community and Alberta Education staff; ACEE will create an Environmental Education Framework that will support Alberta Education in developing its Curriculum Development Framework. The Environmental Education Framework will be developed in a manner that is parallel to and complementary to Alberta Education’s work.”

NOTE:

“All education is environmental education...by what is included or excluded we teach the young that they are part of, or apart from, the natural world”, David Orr.



In supporting Alberta Education in its curriculum redesign process, the Environmental Education Framework will guide curriculum developers in creating new curriculum documents by providing the background research and direction needed to achieve environmental literacy for the 21st century. It also provides tools to guide teachers in creating the change in their classrooms and for the external community to understand the benefits and importance of environmental education.

The Environmental Education Framework is based on research from two Literature Reviews: Environmental Education Competencies and Environmental Education Assessment. The Literature Review documents are incorporated in this Framework in Sections 8 and 9. Sections 3, 4, 5, 6 and 7 incorporate the key findings from the Literature Review and provide:

- An overview of the key elements/organizing ideas and indicators for environmental literacy,
- Indicators at various learning stages
- Exemplary teaching practices for environmental literacy
- Assessment practices for environmental literacy

The fourth draft of the Environmental Education Framework has been presented to Alberta Education. The fourth draft will also be used as a draft to garner further discussion and input to ensure the curriculum redesign process will help create environmental literacy in Alberta schools.

1.1 Environmental Education's Contribution to Social, Cultural, Global and Environmental Responsibility

As Alberta is dependent on a natural resource based economy, by creating an enhanced environmentally aware and conscious citizenry, we can also help ensure an improved balance among the three key elements of a healthy province: the environment, society and economy.

“Environmental education prepares all citizens with essential 21st Century skills that contribute to healthier, more environmentally sustainable, and economically prosperous communities” (NAAEE, 2008, p. 3).

Environmental education provides an integrating context for learning, improves academic performance and school attendance, improves children's health, is strongly supported by Alberta families and is an excellent vehicle to deliver on and the development of competencies (ACEE, 2007).

Environmental education can assist the transformation of education to help Albertans deal with complex challenges and ensure Alberta has strong communities with a healthy environment, bringing prosperity to future generations of Albertans (ACEE, 2007).

Environmental education is a powerful, effective vehicle to help create healthy, engaged, ethical and entrepreneurial global citizens (ACEE, 2011). This connects well with Premier Redford's comment on environmental education provided in an ACEE survey of the 2011 PC Alberta Leadership candidates:



“Environmental education makes kids into ethical, engaged thinkers, which is exactly what the ‘Inspiring Education’ Report found Albertans want. Environmental education encompasses non-traditional, hands-on, experiential learning, which is becoming increasingly important. It teaches kids about foresight and consequences, inspiring them to think creatively about their effect on the Earth. I want to set Alberta on the road to a greener future, keeping our province beautiful as the economy grows. Environmental education is critical to achieving this goal.”

-Alberta Premier Alison Redford

There is much research and work that has been done in the area of environmental education and education for sustainable development but this work needed to be reviewed and placed in an Alberta context to help support Alberta Education in their work.

1.2 Defining Environmental Education and Environmental Literacy

“What is the difference between environmental education and environmental literacy?” is a question that is often asked. It is important for people to understand the connection between the two and a variety of definitions have been provided from the research. In this framework, environmental literacy is identified as the outcome of environmental education.

NOTE:

Environmental literacy is the outcome of environmental education.

1.2.1 Environmental Education

Bill Stapp’s (1982) definition of environmental education has been used consistently in the field since the 1980s. He defines environmental education as:

[Education] to develop a citizenry that is aware of, and concerned about, the total environment, and its associated problems, and which has the knowledge, attitudes, motivations, commitment, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones (Stapp, 1982).

Environmental education's guiding principles, and those that Stapp has exemplified in his work, include a focus on education that:

- Considers the environment in its totality: natural and human made, ecological, political, economic, technological, social, legislative, cultural, and aesthetic
- Is a continuous life-long process, both in-school and out-of-school
- Is interdisciplinary in its approach
- Emphasizes active participation in preventing and solving environmental problems
- Examines major environmental issues from a world point of view, while paying due regard to regional differences
- Focuses on current and future environmental situations
- Examines all development and growth from an environmental perspective
- Promotes the value and necessity of local, national and international cooperation in the solution of environmental problems (Stapp, 1982).



Albertan environmental education stakeholders have rallied around a classic definition of environmental education as a learning process that:

- Increases peoples' knowledge and awareness about the environment and associated challenges;
- Develops the necessary skills and expertise to address these challenges, including critical thinking skills; and
- Fosters attitudes, motivation, and commitment to make informed decisions and take responsible action.

The above definitions and guiding principles exemplify the broad nature of environmental education and its relevance as a vehicle for social, cultural, global and environmental responsibility. Through consecutive Summits on environmental education, Albertan stakeholders have given environmental education a more contemporary context as they consistently insisted that environmental education show varying perspectives on issues, showing learners how to think, not what to think; and that environmental education should take place in a way that allows the learner to understand the interconnections between environment, society, and economy, learning the social, economic, and political implications of decision making in connection with the environment and the use of natural resources. A more complete explanation of Alberta's environmental education definition is in Appendix 3.

NOTE:

Environmental education helps students learn how to think, not what to think in becoming socially, culturally, globally and environmentally responsible citizens.

1.2.2 Environmental Literacy

The North American Association for Environmental Education (NAAEE) uses a broad definition of environmental literacy that incorporates literacy and competency, specifically recognizing:

- Knowledge of Environmental Processes;
- Questioning, Analysis and Interpretive Skills;
- Skills for Understanding and Addressing Environmental Issues; and
- Personal and Civic Responsibility

in its *K-12 Environmental Education Guidelines* (NAAEE, 2010).

Roth (1992) also uses a broad understanding of environmental literacy that incorporates both literacy and competency. He identified three levels of environmental literacy: Nominal, Functional and Operational literacy; and defined knowledge, affective, skills and behaviour outcomes for each level. These levels have been helpful in designing a scope and sequence for environmental competency indicators to achieve environmental literacy. As David Orr (2004, p. 1) notes,

...the goal of ecological literacy is not a passive kind of literacy to be confused with reading, as important as that is, but rather the active cultivation of ecological intelligence, imagination, and competence, which is to say design intelligence.



The challenge to us as educators is to equip our students with the practical skills, analytic abilities, philosophical depth, and moral wherewithal to remake the human presence in the world.

Stables and Bishop (2010) concur with Orr’s interpretation, arguing we move beyond a weak conceptualization of environmental literacy associated with reading and writing and a limited view of what constitutes ‘text’ to be read for a strong conceptualization of environmental literacy, which incorporates an engagement with the environment as text. In other words a strong conceptualization of environmental literacy “[utilizes] various forms of environmental understanding and insight in the cause of resolving problems generally posited by scientific ecology.” (Stables & Bishop, 2010, p. 10). Furthermore,

A model of environmental literacy (or ‘literacies’) involving the functional (the ‘facts’), the cultural (the socially significant) and the critical (the ability to critique and to reconstitute an argument) has the potential to draw together different subject disciplines with respect to the environment without denying their differences as discourses or ‘language games’ (Ibid, p. 10).

1.3 Background

This Framework is informed by the work ACEE and the ATA conducted in the “Creating a Legacy” curriculum symposium in 2010. They involved over 250 educators to capture their vision for the future education system vis-à-vis environmental education and citizenship. Alberta teachers characterized the ideal competencies of environmentally literate students, outlined what teachers need to learn, and described an education system similar in many ways to that described through *Inspiring Action in Education* (Alberta Education, 2010). According to this vision:

- The education system offers students authentic inquiry-based learning experiences.
- Students learn by doing, engaging in collaborative real-world project-based learning that is guided by their interests and relevant to their life.
- Teachers have abundant time, opportunities, and resources to create these learning experiences.
- Teachers teach the curriculum using environmental and global topics as an integrating context for learning, and ‘walk the talk,’ teaching through modeling appropriate behaviours.
- The education system is characterized by a rich web of connections between the learner, their teachers, and the community.

NOTE:

Environmental literacy (an outcome of environmental education) incorporates scientific, technological, political, economic, social, and cultural principles and value systems, as well as aesthetic, moral, ethical and spiritual understanding as well as local and global contexts that are needed to be ethical citizens, engaged thinkers with an entrepreneurial spirit.



The Framework is also informed by the following work of Alberta Education:

- Principles, standards and guidelines for content and process
- Content of new Ministerial Order
- Education Act
- Inspiring Education – A Dialogue with Albertans
- Framework for Student Learning (Appendix 2)
- Alberta Education’s development of competency indicators

NOTE:

To achieve good environmental education the following characteristics are needed:

- **Authentic inquiry-based learning experiences.**
- **Students learning by doing, engaging in collaborative real-world project-based learning that is guided by their interests and relevant to their life.**
- **Teachers having abundant time, opportunities, and resources to create these learning experiences.**
- **Teachers teach the curriculum using environmental and global topics as an integrating context for learning, and ‘walk the talk,’ teaching through modeling appropriate behaviours.**
- **A rich web of connections between the learner, their teachers, and the community.**



2.0 Benefits of Environmental Education

In conducting the literature reviews, it is clear that there are many benefits of environmental education. It is important to illustrate this work to ensure that as curriculum development moves forward in Alberta, that everyone is aware of these benefits and that these do not get overlooked when looking at all of the competencies outlined by Alberta Education.

The North American Association for Environmental Education (NAAEE) (2008, p. 3), provides an overarching statement about the skills that students develop through environmental education, “Environmental education prepares all citizens with 21st Century essential skills that contribute to healthier, more environmentally sustainable, and economically prosperous communities”.

Chawla and Escalante (2007) summarized numerous studies on the benefits of using the environment as an integrating context across disciplines. Lieberman and Hoody (1998, p. 1) note, “Using the environment as an integrating context is interdisciplinary, collaborative, student-centered, hands-on and engages students in learning”. Their research shows that students in schools and classrooms that use the environment as an integrating context for learning show improvement in reading, writing, math, science, and social studies; exhibit increased pride in their accomplishments; greater engagement and enthusiasm for learning; better ability to apply science to real-world situations; better application of systems thinking and increased ability to think creatively and; more advanced skills in applying civic processes to real-life situations.

The government of Washington State provides research by Wheeler and Thumlert (2007) that supports the above findings. Their research looked at the impact of Environmental Education on K-12 students in terms of academic achievement; career development; graduation requirements; self-esteem, engagement and motivation; and civic-responsibility and service learning. The research examined 76 studies from state, national and international sources, ranking them according to the rigorous nature of their methodology and their outcomes. Overall they found:

- Environmental Education to be an effective means of achieving a number of desirable student outcomes. There is strong evidence that environmental education increases math and science achievement; some evidence that it increases social studies achievement; and mixed evidence that it increases language arts achievement;
- Environmental Education allows for the ready integration of many techniques that are thought to define good education; and
- The multi-faceted nature of Environmental Education is a key component of its effectiveness.

Manion and Lynch (2010) found that environmental or place-based education that incorporates children and adults learning together improves intergenerational relations and individual, community, and ecological wellbeing. It includes passing on values and ethical practices and creating new ones. It enables learning skills, knowledge and understanding; and an exploration of values and attitudes, sensory learning, and environmental sustainability and community well



being. It recommends schools encourage intergenerational learning, contextualize curricula in the environment, and embrace outdoor learning.

A vast amount of research has shown direct links between access and interaction with nature to reduced stress levels and increased feelings of well-being. These findings have been popularized through Luov's book "Last Child in the Woods", in which he coined the phrase 'Nature Deficit Disorder' to describe the negative effects of children not spending time in Nature. Kaplan (1995) introduced *attention restoration theory* (ART) and proposed stress and attention fatigue were related, and that both could be reduced through increased exposure to nature. Since the introduction of ART there has been a large body of research further supporting the restorative effects of natural environments on both psychological and physiological wellbeing (Berto, 2005; Hartig et al, 2010).

Physiological benefits play a further supporting role to psychological benefits by directly influencing brain and immune-system stress responses (Li et al, 2007; Thayer & Sternberg, 2006). Li et al (2007) also found walking in pine forests increased immunity to certain cancers and a reduction in stress.

NOTE:

The research is clear that environmental education that allows students to spend time in nature provides diverse benefits such as improved academic achievement, attention, improved health and personal wellbeing.



3.0 Environmental Education and Literacy – the past to the present

Environmental education has continued to evolve and build on early emphases in nature study, conservation and outdoor education to incorporate social dimensions related to our relationships with the natural environment and socio-ecological system interactions. The early focus was on the environment and this led to a feeling of human interactions as separate from the environment. More recently, there has been a shift away from just focusing on environmental issues, to understanding social-ecological interactions. By understanding broader socio-ecological systems and futures thinking, environmental education is now encouraging a very positive, proactive systems thinking approach that encourages diverse perspectives in designing sustainable ways of living within our environment.

3.1 A Shift in Socio-ecological Perspectives

As we advance into the second decade of the 21st Century, it is important to highlight the conceptual shift that is taking place in our social-ecological understandings. Traditionally, the environment has been viewed and dealt with as if it is separate from the economy and society, leading to the many social-ecological issues we face (Dale, 2002).

As Einstein importantly recognized, “You can’t solve a problem with the same mindset that created it”. Early sustainability literature emphasized the need to balance environmental, social and economic concerns, typically showing this as three overlapping circles, which represented sustainability by the central area of overlap (Figure 1). This conceptualization was considered very useful as the segments correspond quite closely to other organizational divisions in society (Gough, 2002). However, the representative Venn or three-legged stool diagram has been criticized as it has the following implications:

- It reinforces the status quo, maintaining discrete circles that in many instances do not overlap (Gough, 2002; Bowers, 2002; Dale, 2002; Webster, 2004; Jickling, 2010);
- It reinforces fragmentary, mechanistic thinking or thinking in silos (Dale, 2002; Webster, 2004; Jickling, 2010);
- It still portrays the environment as something separate from the economy and society; and
- The economy appears to unrealistically exist in an unconstrained space where it could conceptually grow without recognizing environmental factors or limits (Dale, 2002; Webster, 2004).

Although this diagram does acknowledge society, economy and environment are interrelated; it does not show they are interdependent (Webster, 2004). Dawe and Ryan (2003) critique the three-legged stool model as it places humanity outside the environment. They state:

NOTE:

Environmental education has shifted to a positive, proactive systems and futures thinking approach that encourages diverse perspectives in designing sustainable ways of living within our environment. This is a shift from an issues based approach.



...humanity can have neither an economy nor social well-being without the environment. Thus, the environment is not and cannot be a leg of the sustainable development stool. It is the floor upon which the stool, or any sustainable development model, must stand. It is the foundation of any economy and social well-being that humanity is fortunate enough to achieve (p.1460).

A more interdependent conceptualization of society, economy and environment for sustainability is the nested circles diagram (Figure 2) that illustrates that a vibrant, healthy environment is needed to sustain a healthy society and a robust, healthy economy (Bowers, 2002; Dale, 2002; Webster, 2004).

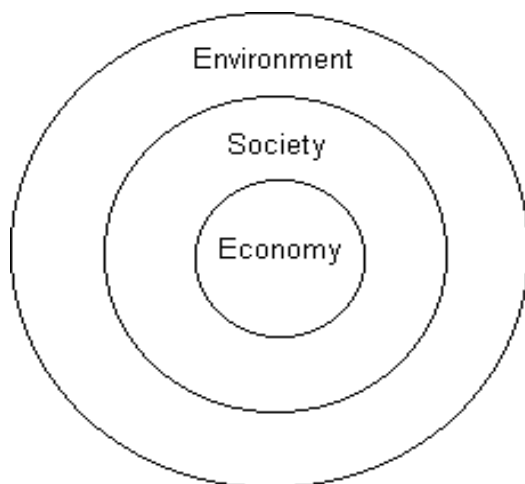


Figure 2: Integrating Economy & Society within the Environment

In presenting the above representations to the Multi-advisory Stakeholder Committee in June 2012, two new representations were also created. At this point, these illustrations are being shown to indicate the shift in perspectives without the need to agree on one representation.

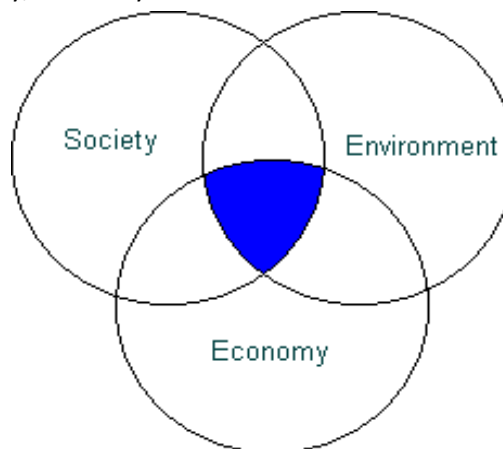


Figure 1: Balancing Environment, Society and Economy



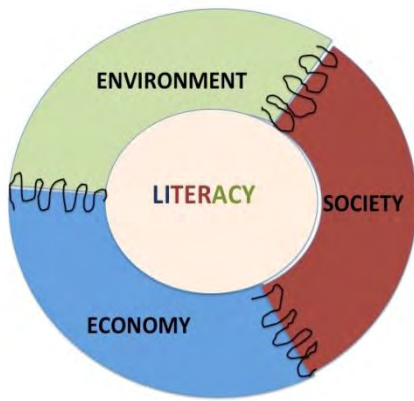


Figure 3: Literacy is at the center with the environment, economy and society the connections around literacy. Students need to understand and act in all three areas to be literate.

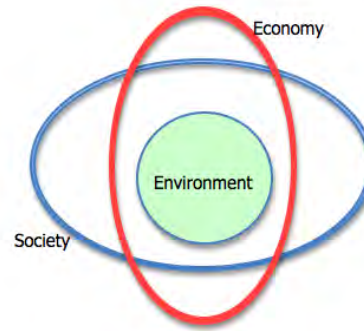


Figure 4: The environment is the center with the economy and society revolving around the nucleus.

New South Wales (2006, p.11) recognizes the shifting emphasis towards education for sustainability:

Many terms have been used over time to describe the thought and practice of learning about our relationship with the environment, and to reflect the changes in concepts and approaches that have occurred. For example, in the 1970s, earlier notions of 'nature studies' were succeeded by the concept of 'environmental education'. More recently, a number of international statements by UNESCO and the IUCN have introduced the terms 'education for sustainability' and 'education for sustainable development' to capture new understanding and concepts in environmental management and education. Essentially, this shifting focus signifies the re-orientation of environmental education to address the complexities of ESD. Table 1 outlines the key changes in thinking reflected by the shift towards education for sustainability.

Table 1: Shifting emphasis towards education for sustainability

Focus	Earlier approach	Emergent approach
Problem	Pollution	Causes of unsustainable resource use
Solution	Environmental protection and conservation	Collaborative solutions for sustainable development
Connectedness	Humans separate from ecosystems	Humans part of ecosystems
Goals	Individual awareness, knowledge and behaviour	Sustainable lifestyle and societies
Methods	Predominately information-	Participatory and experimental,



	based	community development and capacity building
Time and scale	Short-term, local and national	Long term systemic
Learners	Audience and target groups	Participants, stakeholders and partners
Implementation	Mainly top and bottom	Through partnerships and networks
Legitimacy	Technical and scientific expertise	Multiple perspectives – based on different ways of seeing, knowing and doing

(NSW (2006) Learning for Sustainability: NSW Government Environmental Education Plan 2007-10 11, p. 11)

The literature is suggesting that in order to become socially, culturally, globally and environmentally responsible we need to think systemically all the time rather than in separate spheres of the economy, society or the environment (Sterling 2001; Bonnett, 2002; Bowers, 2002; Dale, 2002; Webster, 2004; Sterling, Maiteny, Irving & Salter (2005); Sterling, 2010).

The implications of this shift in perspective are important as:

- It recognizes the interdependent relationship between society, the economy, and the environment as it illustrates that a prosperous economy is reliant on a healthy, educated society with a vibrant, diverse, healthy environment;
- It provides a foundational concept for environmental literacy and competency;
- It establishes a foundation for the need to develop systems thinking in everything related to environmental education, as there are environmental, social and economic implications in all our decisions and actions (Dale, 2002, Orr, 1994).

3.2 Complex Systems: Interconnected, interdependent and resilient

The historical understanding the environment as separate from humans, as a storehouse of resources that can be controlled, has led to socio-ecological issues from local to global scales; issues such as biodiversity loss, climate change and pollution that society is now trying to deal with (Dale, 2002; Gunderson and Holling, 2002). Recent literature in environmental education competencies stresses the importance of understanding nature as an interdependent, complex, adaptive system. This provides a foundation to further understand social-ecological interactions, how we can create sustainable social systems, and develop social, cultural, global and environmental responsibility (Sterling, 2010; Krasny and Roth, 2010; Plummer, 2010).

NOTE:

While no single model adequately depicts our socio-ecological understandings, in order to become socially, culturally, globally and environmentally responsible and sustainable, we need to think systemically all the time rather than in separate spheres of the economy, society or the environment.



This need to develop systems thinking, recognizing the total interdependence of the environment, our society and our economy, is indicated by Bonnett (2002) in emphasizing we need to develop sustainability “as a state of mind”. This systems perspective is reflected in the key organizing ideas in environmental education, in exemplary teaching practices and in how we assess in terms of authentic, real-world applications (Hollweg et al, 2011). Of equal importance is the emphasis on integrative systems thinking as a core organizing philosophy and principle of Alberta Education’s (2011) new *Framework for Student Learning: Competencies for Engaged Thinkers and Ethical Citizens With an Entrepreneurial Spirit* (Alberta Education, 2011). As NAAEE, in their framework for assessing environmental literacy, recognizes,

“Systemic and integrative thinking, collaborative deliberation, and decision making...will be called to the fore as individuals strive to create healthy built environments and vibrant and resilient social systems, and further the sustainability of Earth’s systems”
(Hollweg et al, 2011, p. 15)

In describing how sustainable, resilient systems function, Gunderson and Holling (2002) identify the ecological principles they are based on. Their research shows how natural systems are based on interdependence, community, cycling, diversity, adaptation, feedback and emergence. As such, natural systems are continually undergoing growth, collapse, reorganization, renewal and re-establishment at multiple scales: changes at any level can cause further changes by cascading up or down to other levels in the system.

As these natural living systems, that humans are part of, are constantly adapting, changing and emerging, they cannot be controlled and predicted as we previously thought (Gunderson and Holling, 2002). Understanding systems and developing systems thinking has been identified as an important competency (Sterling, 2010; Webster, 2004; CMEC, 2010; Australian Government, 2010; New South Wales Department of Education and Training (2009); British Columbia Ministry of Education, 2007; Shelburne Farms, 2011) in environmental education. It can help students understand how we interact with natural systems, how changes at one level in a system can have repercussions across social-ecological systems and how we can apply this understanding and systems thinking to being culturally, socially, globally and environmentally responsible.

As Appendix 5 exemplifies, many environmental education references incorporated in the supporting literature review support a grounding in understanding ecological principles and adaptive systems, as mentioned above. Lundholm and Plummer (2010), in their prospectus for environmental education, refer to sustainability as ‘a dynamic process that requires adaptive capacity in resilient social–ecological systems to deal with change’.

This understanding has implications for teaching environmental education and assessment. All teaching in relation to the environment, society or the economy should address interdependence, how changes in any one area will have repercussions in all three, at various scales; and how socio-ecological systems, and our social and economic systems are constantly adapting and changing. The environmental education and the 21st Century education literature supports this understanding of interdependent systems that emphasizes the need to become learners who are resilient, able to cope with unpredictability and change. As Binkley et al (2012,



p. 24) emphasize, education and assessment needs to incorporate adaptability and unpredictability,

“One hallmark of twenty-first century demands is the need to adapt to evolving circumstances and to make decisions and take action in situations where prior actions may stimulate unpredictable reactions that in turn influence subsequent strategies and options. Dealing with such uncertainty is essential, but represents a new challenge for curriculum and assessment.”

As the literature supports bringing the ecological principles across the K-12 curriculum, and teaching this as systems, this will have implications for teaching practices and assessment and this will be incorporated and further expanded upon in Sections 4, 5, 6 and 7. The Assessment Literature Review in Section 9 highlights the shift in assessment in the 21st Century to authentic real-world assessment that incorporates students’ ability to adapt to novel, unpredictable situations.

This systems perspective also has implications on how the information in this document is presented. For example, a typical scope and sequence, and the one incorporated in the literature review in Section 8 is very linear and perhaps further improvements can be made to show this in a more interdependent, interconnected, systems representation.

NOTE:

All teaching in relation to the environment, society or the economy should address interdependence, how changes in any one area will have repercussions in all three, at various scales; and how socio-ecological systems, and our social and economic systems are constantly adapting and changing. The environmental education and the 21st Century education literature supports this understanding of interdependent systems that emphasizes the need to become learners who are resilient, able to cope with unpredictability and change.



4.0 Environmental Literacy and its Competencies

In addressing environmental competency NAAEE (2010) identifies that The Tbilisi Declaration established three broad goals for environmental education that provide the foundation for much of what has been done in the field since 1978:

- To foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas;
- To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;
- To create new patterns of behavior of individuals, groups and society as a whole towards the environment.

NAAEE feels these goals still stand as a strong foundation for a shared view of the core concepts and skills that environmentally literate citizens need. Since 1978, the Brundtland Commission (Brundtland, 1987), the United Nations Conference on Environment and Development in Rio (UNCED, 1992), the Thessaloniki Declaration (UNESCO, 1997) and the World Summit on Sustainable Development in Johannesburg (United Nations, 2002) have influenced the work of many educators, highlighting the importance of viewing the environment within the context of human influences. This perspective has expanded the emphasis of environmental education, focusing more attention on social equity, economics, culture, and political structure.

Environmental education is rooted in the belief that humans can live compatibly with the natural environment and act equitably toward each other. Another fundamental belief is that people can make informed decisions that consider future generations. Environmental education aims for a democratic society in which effective, environmentally literate citizens participate with creativity and responsibility (NAAEE, 2010).

4.1 Three Key Organizing Elements of Environmental Literacy

The following elements were developed from the environmental education descriptors and indicators identified from the literature search. The frameworks of NAAEE, New South Wales, Australia Ontario and Manitoba, as well as Alberta Education have been particularly influential. The Environmental Education Framework is in line with Alberta Education as they are using two or three key elements for each cross-curricular competency.

4.1.1 Elements and Descriptors

Competency indicators for developing environmentally literate citizens have been organized into three elements that apply to each of the three broad grade groupings, K-4, 5-8, and 9-12. The three elements are:

- Interconnections
- Diversity
- Responsibility and Citizenship



These elements are interrelated, providing learners with the foundation necessary to become an engaged, ethical, entrepreneurial citizen. Each element identifies specific areas of competence necessary in developing environmental citizenship and stewardship.

4.1.2 Interconnections

This Element is characterized by the general indicator:

I understand how ecological and social systems and processes are interdependent and influence personal and collective wellbeing.

This element incorporates learning about ecological systems and processes; how these are interconnected with social systems, technology and the economy; and how these interconnections influence personal wellbeing and healthy communities that are environmentally sustainable and economically prosperous both locally and globally. This element incorporates knowledge, developed through a range of learning areas, which is applied in the learning process through developing a sense of wonder, curiosity, and oneness with the natural environment.

- **Ecological systems & processes** involves knowledge of the processes and interactions of the living and physical systems and processes that support the functioning of the Earth's biosphere and human systems, including knowledge of fauna and flora.
- **Social systems & technology** involves knowledge associated with social, cultural, global, political, economic and technical systems, structures, beliefs and actions that impact on the functioning of the Earth's biosphere and influence the capacity of people, both individually and collectively, to live sustainably.
- **Wellbeing & interconnections** involves the cognitive and affective development of a personal connection and sense of oneness with the natural world through nature immersion, experiential learning; and an understanding that our personal and collective wellbeing is dependent on healthy interconnections in all areas. Learning in this area incorporates developing:
 - ❖ Environmental sensitivities and connections: developing a sense of wonder in terms of intrigue, surprise, admiration and attachment to the natural environment; and from this a drive to learn more;
 - ❖ Wellbeing derived from healthy physical and emotional interactions with the natural environment, human and non-human communities, and understanding how our physical, emotional and spiritual wellness is affected by these interactions. The connections to personal health, wellness and nutrition, healthy schools and healthy communities can also be made with this element;
 - ❖ Responsibility and motivation to be an engaged, ethical, entrepreneurial learner actively participating in social, cultural, global and environmental issues through leadership and collaboration; and
 - ❖ A strong internal locus of control, through personal development of self-esteem, a positive self-image, confidence and efficacy.



4.1.3 Diversity

This Element is characterized by the general indicator:

I value the significance of biological and cultural diversity as well as diverse perspectives in developing social, cultural, global and environmental responsibility.

This element involves considering and honouring diversity: biodiversity and cultural as well as diverse perspectives and worldviews regionally and globally. This element is developed through reflecting on, comprehending, negotiating, and potentially challenging personal as well as others' fundamental beliefs, perceptual orientations, ethical principles and values. It incorporates identifying perceptions, feelings and values and clarifying beliefs, ethics and actions. Learners also explore and analyze the impact of perspectives and diversity on social, cultural, global and environmental issues in the later age groupings 11-17+.

4.1.4 Responsibility & Citizenship

This Element is characterized by the general indicator:

I contribute positively in furthering a sustainable society by investigating and evaluating the need for change and designing, creating and implementing viable solutions that support our interconnected systems.

Responsibility and citizenship involves becoming an engaged, ethical, and entrepreneurial citizen. This element incorporates investigative and evaluative skills and action to enable learners to understand and develop abilities in adaptation, change and emergence, as society and our socio-ecological inter-relations continue to adapt, change and emerge. Through this element learners in upper age groupings investigate societal, cultural and environmental issues of local and global significance; and act and contribute ethically and positively to social, cultural, global and environmental issues and in local and global communities.

- **Investigation & Evaluation Knowledge & Skills** involves:
 - ❖ **Connect and Wonder - Making a Case for Change:** exploring a sustainability issue, assessing the current situation taking into account Interconnections and diversity, investigating sustainability concepts and ideas, drawing on the wisdom and learning from nature – known as 'biomimicry' or mimicking nature, and stating a case for change;
 - ❖ **Investigate - Defining the Scope for Action:** exploring options for making a change, identifying available resources and constraints, seeking consensus, and developing a statement of agreed direction for action;
 - ❖ **Developing a Proposal for Action:** generating and selecting ideas, developing and modifying these to make them ready for implementation, and preparing, communicating and agreeing on the proposal;
 - ❖ **Create - Implementing the Proposal:** turning the proposal into action,
 - ❖ **Evaluating and Reflecting:** assessing the degree of success of the action, and the efficiency of the process used, identifying possible future directions and the learning that has resulted from the action.



- **Action Competence** involves learning to take effective action that will result in people living more sustainably is a central goal of the Framework. Central to this is the ability to engage in systems thinking that incorporates local to global connections and vice-versa as well as futures and design thinking.
 - ❖ **Systems Thinking** involves understanding and thinking in systems. It incorporates the diverse ways in which local and global issues are interconnected and practices associated with comprehending and working rationally with complexity, uncertainty and risk so they can be managed effectively. New South Wales' (2009) conceptual framework for learning for sustainability, Earth Citizenship, identifies habits of a systems-thinker based on the Waters Foundation (2009). These are exemplified below in Figure 5.



Figure 5: Systems Thinking in Schools, Waters Foundation (2010)



- ❖ **Futures & Design Thinking** involves action learning and practices associated with visualizing, modeling, selecting and developing ideas, products, environments, processes and systems that contribute to preferred futures with the aim of formulating viable solutions. It incorporates nature as a great source of knowledge and wisdom for futures and design thinking. This component focuses on students identifying what they are for rather than what they are against.

These elements and descriptors, indicating the breadth and depth of environmental education shows its ability to address the needs of 21st Century learning in developing competencies across many areas. It supports a systemic, holistic educational approach that encourages systems thinking, adaptation, resilience and emergence. The work of Alberta Education, summarized in their *Inspiring Education – A Dialogue with Albertans (2010)*, supports this educational approach.

NOTE:

Environmental Education is seeing a shift from a focus on just issues and trying to reduce our footprint to including interconnections – a sense of oneness with the natural world, honouring diversity, and helping learners to think in the context of systems, futures and design thinking to envision and develop a sustainable world.



5.0 Indicators

ACEE has been aligning this work with the current process that is being used by Alberta Education.

The indicators are the statements that can be used to identify if students have mastered the various aspects of each element and category across a K-12 progression. The indicators were developed as targets for the grade groups: K-4, 5-8, and 9-12. The Australian Government (2010) curriculum framework has been a valuable resource in developing the following indicators.

An important step in doing this work was to ensure that the indicators cover the cognitive (thinking or knowledge and understanding), affective (feelings or attitudes and values) and psychomotor (doing or skills and processes) domains. The other lenses that were used to inform the indicators were a learning progression of higher orders of thinking in each of these domains. The higher orders of thinking are categorized across three areas that were being used by Alberta Education in their original work as outlined in the table below:

Cognitive	Affective	Psychomotor
1. Remember & understand	1. Become aware	1. Perceive and plan (identify)
2. Apply & analyze (information & context)	2. Respond (ethical approach)	2. Take action
3. Evaluate & create	3. Value (open-mindedness)	3. Adapt & originate

In addition, the indicators have been written to weave in intrinsic, extrinsic and social learning competencies identified in the literature search.

Alberta Education uses the following criteria in the development of indicator statements. The indicators begin with an 'I' statement followed by a verb and a target term (i.e., noun) such as an object or diagnosis including the element, category and domain context and explicit parameters for an age appropriate learning progression.

NOTE:

In recognizing that learning takes place concurrently, in a number of domains, incorporating the whole person, the learning indicators identified in all three elements incorporate cognitive, affective and psychomotor learning. Many of the indicators identified can be combined, but they have been identified separately in each of the three categories to ensure that all three domains are considered and addressed.



5.1 Learning Indicators for Grade Grouping K-4

Grade Grouping K-4			
Element 1: Interconnections			
Category	Cognitive	Affective	Psychomotor
1.1 Ecological Systems and Processes	<ol style="list-style-type: none"> 1. I describe how living and non-living systems work and interact. 2. I compare and contrast the similarities and differences between living and non-living systems. 3. I evaluate whether a local ecosystem is healthy in biodiversity and lacking pollution. 	<ol style="list-style-type: none"> 1. I accept the importance of diversity in ecosystems. 2. I cooperate with others in supporting living and physical systems. 3. I support all species and their need for survival. 	<ol style="list-style-type: none"> 1. I discover living and non-living systems and processes. 2. I investigate with others what species needs are and how they are provided for. 3. I create with others the conditions for wildlife in my community.
1.2 Social systems & technology	<ol style="list-style-type: none"> 1. I explain how human systems interact with non-human systems. 2. I dramatize/demonstrate how humans can live in harmony with non-human systems 3. I choose examples of social, cultural, global, political, economic and technical systems, structures, beliefs or actions that help people, both individually and collectively, to live sustainably. 	<ol style="list-style-type: none"> 1. I believe social systems need to interact positively with non-human systems for the health of the biosphere and all species. 2. I seek to learn how humans can improve their social systems and technology to adapt to the needs of humans and the non-human world. 3. I pursue new ways, individually and collectively, to improve human and non-human interactions. 	<ol style="list-style-type: none"> 1. I distinguish between social systems and technology, structures, beliefs and actions that support non-human life and processes and those that do not. 2. I develop new ways to interact socially, economically and technically based on learning how natural systems operate. 3. I imagine and create new ways to address human needs based on learning from the natural world.
1.3 Wellbeing & Inter-connections	<ol style="list-style-type: none"> 1. I explain how I am part of the natural world. 2. I demonstrate ways I improve my health through my interactions with the natural world. 3. I evaluate how to improve my and other's health and wellbeing through positive interactions with the natural world. 	<ol style="list-style-type: none"> 1. I am aware of how different environments affect me. 2. I respond positively with wonder to time spent in natural environments. 3. I seek out ways to connect with the natural world, individually and collectively. 	<ol style="list-style-type: none"> 1. I use all my senses in exploring my natural world, individually and with others. 2. I discover new ways to enjoy spending time in nature independently and with others. 3. I adapt my daily habits to include time spent in nature.



Element 2: Diversity			
Category	Cognitive	Affective	Psychomotor
2. Identifying and clarifying perceptions, feelings, ethics values and actions	<ol style="list-style-type: none"> 1. I identify diverse feelings, ways of knowing, perceiving and valuing the environment. 2. I compare and contrast the impact of diverse social and cultural perspectives on the environment. 3. I generate new understandings, ideas and values understanding that diversity leads to strength and resiliency social, culturally and environmentally. 	<ol style="list-style-type: none"> 1. I accept there are different perceptions, feelings and values in relation to the environment regionally, socially, culturally, and globally. 2. I defend biological diversity and diverse perspectives in relating to the environment. 3. I support biodiversity and new ideas from diverse perspectives and worldviews regionally, socially, culturally and globally in relation to the environment. 	<ol style="list-style-type: none"> 1. I distinguish & clarify differences between diverse ways of knowing, beliefs, ethics and actions. 2. I promote biodiversity and diversity in ways to interact in harmony with the environment. 3. I adapt and develop innovative ways of interacting in harmony with the environment in response to diverse perspectives in relation to the environment regionally, socially, culturally and globally.
Element 3: Responsibility & Citizenship			
Category	Cognitive	Affective	Psychomotor
3.1 Investigation & Evaluation Knowledge & Skills	<ol style="list-style-type: none"> 1. I identify ways to adventure safely in the natural environment, alone and with others, considering available resources and constraints. 2. I analyze the impacts of various options on others, both human and non-human. 3. I create new ideas based on what we experience and group discussions. 	<ol style="list-style-type: none"> 1. I appreciate the needs of others, human and non-human as well as others' wants and values. 2. I cooperate with others in exploring the natural world. 3. I build capacity with others and seek consensus. 	<ol style="list-style-type: none"> 1. I engage a diversity of senses to explore the natural world. 2. I discover new wonders through exploration of the natural world with others. 3. I create opportunities to explore and investigate the natural world based on sharing ideas within a group.
3.2 Action Competence			
3.2.1 Systems Thinking	<ol style="list-style-type: none"> 1. I identify parts of a familiar system at home, school or in the natural environment. 2. I explain how the removal or malfunction of part of the system affects the whole. 3. I assess potential desirable 	<ol style="list-style-type: none"> 1. I accept how my actions affect others, human and non-human and may need to change. 2. I believe my actions can have a positive effect in creating positive change in a larger system. 	<ol style="list-style-type: none"> 1. I identify a variety of elements in a system through exploration. 2. I discover new connections in the natural world through working in groups. 3. I adapt and develop with others new ways of



	and undesirable effects and risks of actions on others.	3. I facilitate working together peacefully to solve issues.	interacting as conditions change.
3.2.2 Futures & Design Thinking	<ol style="list-style-type: none"> 1. I identify continuities, trends, and patterns in relation to personal experience of events and places. 2. I predict events and changes based on trends and patterns that have been personally and socially experienced. 3. I generate ideas for products and environments that respond to people's needs and reflect a view of their personal future. 	<ol style="list-style-type: none"> 1. I appreciate the need for change in objects, places, and behaviour over the immediate past. 2. I demonstrate flexibility by adjusting designs and actions as a result of feedback. 3. I anticipate the impact of my designs and actions on people and environments in the immediate future. 	<ol style="list-style-type: none"> 1. I follow a systematic design process to realize designs and actions for change in the immediate future. 2. I envision, through group discussions, future events and places from a projection of personal experience by making drawings of what might be imagined for the future, and explain the need that would be met by key features. 3. I demonstrate flexibility by adjusting my designs and actions as a result of feedback.

5.2 Learning Indicators for Grade Grouping 5-8

Grade Grouping 5-8			
Element 1: Interconnections			
Category	Cognitive	Affective	Psychomotor
1.1 Ecological Systems and Processes	<ol style="list-style-type: none"> 1. I describe adaptations, roles and relationships among fungi, plant and animal species and their physical environment in local gardens and ecosystems; food chains, food webs and cycles of energy and materials. 2. I compare and contrast the features of local terrestrial and aquatic ecosystems, their change over time and indicators of their state of health. 3. I assess patterns, trends and longer term changes to climate and how that 	<ol style="list-style-type: none"> 1. I express my sense of wonder through describing different ecosystems at different times of the year. 2. I defend the importance of healthy living and physical systems for all fungi, plant and animal species. 3. I facilitate investigating how natural systems and species adapt and change. 	<ol style="list-style-type: none"> 1) I experientially discover adaptations, roles and relationships among fungi, plant and animal species and their physical environment in local gardens and ecosystems; food chains, food webs and cycles of energy and materials. 2) I conduct experiments with others to investigate the impact of changes in the physical systems on fungi, plant and animal ecosystems, both aquatic and terrestrial. 3) I create with others and care for bio-diverse aquatic and



	relates to changes in aquatic and terrestrial ecosystem health.		terrestrial environments that strengthen food chains, food webs and cycles of energy and materials throughout the year.
1.2 Social systems & technology	<ol style="list-style-type: none"> 1. I identify local and remote social, economic and environmental impacts of renewable and non-renewable energy sources, and various methods of water usage, natural resource extraction, and agricultural production. 2. I analyze relationships between lifestyle decisions and their economic, social and environmental costs from local to global scales. 3. I evaluate the sustainability of human interactions with the natural environment in terms of their addressing social, economic and environmental needs. 	<ol style="list-style-type: none"> 1. I accept social systems need to interact positively with non-human systems for the health of the biosphere and all species. 2. I advocate that groups and organizations need to take sustainability into account when making decisions and taking actions. 3. I seek to learn new ways, individually and collectively; to address issues associated with sustainable and non-sustainable water, agricultural, natural resource and transportation technologies. 	<ol style="list-style-type: none"> 1. I investigate individually and collectively socio-ecological issues to identify social, economic and environmental imperatives. 2. I develop with others ways the school can improve the sustainability (socially, economically and environmentally) its energy, resource, water, waste and transportation systems. 3. I initiate with others new ways the school and community can improve its socio-ecological systems.
1.3 Wellbeing & Interconnections	<ol style="list-style-type: none"> 1. I describe a variety of environments and my sense of connection with them. 2. I examine ways to improve my physical and emotional health through connecting to the natural environment through physical activity, healthy food sources, and time spent in healthy natural ecosystems. 3. I synthesize a variety of aggregated information regarding human needs, wants, happiness, health and wellbeing. 	<ol style="list-style-type: none"> 1. I identify how I feel when I experience damage to a natural environment. 2. I balance my negative feelings in relation to socio-ecological issues with positive interactions with the natural world. 3. I seek to learn more about ways to address negative socio-ecological issues individually and collectively. 	<ol style="list-style-type: none"> 1. I practice moments of solitude in a variety of built and natural environments. 2. I help build places at school or in the community to learn and spend time in nature. 3. I increase my physical activity in natural environments independently and with others.



Element 2: Diversity

Category	Cognitive	Affective	Psychomotor
2. Identifying and clarifying perceptions, feelings, ethics values and actions	<ol style="list-style-type: none"> 1. I identify where my own beliefs, values and ethical principles are different from others, and discuss possible reasons for this. 2. I employ alternative methods and ways of thinking required to measure ecological sustainability while recognizing differing values regarding the biosphere (economic, spiritual, sentimental, historical, cultural) of different stakeholders. 3. I generate new understandings, ideas and values that incorporate biological and social diversity, understanding that diversity leads to strength and resiliency social, culturally and environmentally 	<ol style="list-style-type: none"> 1. I appreciate how natural solutions may differ from human approaches. 2. I reflect upon and seek to learn about my own and others' values, ethical principles and the intrinsic value of nature when negotiating with peers or adults who have different viewpoints in regard to socio-ecological issues. 3. I facilitate common ground for collaboration on a project, by recognizing and accommodating differences of beliefs and values. 	<ol style="list-style-type: none"> 1. I spend time in nature to bring a sense of what would nature think, or potential rights of nature into discussions. 2. I build teams that incorporate diverse views, opinions and perspectives when addressing a socio-ecological issue. 3. I adapt to and develop consensus decision-making skills to encourage innovative ways of interacting in harmony with the environment in response to diverse perspectives environmentally, regionally, socially, culturally and globally.

Element 3: Responsibility & Citizenship

Category	Cognitive	Affective	Psychomotor
3.1 Investigation & Evaluation Knowledge & Skills	<ol style="list-style-type: none"> 1. I identify trends in family, school or local community relating to ecosystems and biodiversity; local water use; resources, products, waste and pollution; built environments, travel and transport; energy. 2. I combine assessments of family, school or local community sustainability in relation to the state of the biosphere and their ecological footprint and people's wellbeing. 	<ol style="list-style-type: none"> 1. I accept the views, interests and values of different stakeholder groups. 2. I seek to learn about and support views of others. 3. I support diverse perspectives to integrate needs, wants and values of nature and diverse stakeholder groups. 	<ol style="list-style-type: none"> 1. I prepare and communicate the proposal using appropriate means and media. 2. I implement the action plan by managing implementation activities, and adjusting activities to increase effectiveness given changing circumstances. 3. I evaluate the action in relation to success criteria; and reflect on success of the action in relation to potential impacts on the environment



	3. I research actions others have taken in similar situations, and evaluate the usefulness of their approach.		and stakeholders.
3.2 Action Competence			
3.2.1 Systems Thinking	<ol style="list-style-type: none"> 1. I identify and explain issues, goals, and/or problems within a system as a series of interrelated details or processes. 2. I explain some interdependent elements of a system including, stocks and flows, with at least one feedback relationship. 3. I use a systems model to identify major causes of observed trends and to evaluate existing or past responses to the issue. 	<ol style="list-style-type: none"> 1. I recount a personal experience of changed perception of an environment as a result of describing perceptions of environments in terms of developing systems understanding. 2. I believe my actions can have a positive effect in creating positive change in a larger system. 3. I justify future school or community actions based on qualitative assessment of risks and benefits. 	<ol style="list-style-type: none"> 1. I create a model of a system and use it to demonstrate how change to part of the system affects the whole system. 2. I dramatize causal feedback relationships as either positive (reinforcing) or negative (balancing). 3. Given a challenge, I represent how an action functions as leverage in a given system using system archetypes, stock/flow diagrams, or models.
3.2.2 Futures & Design Thinking	<ol style="list-style-type: none"> 1. I generate ideas for strategies, environments and products that reflect a preferred future in relation to emerging social and environmental issues. 2. I use a systems approach to identify and analyze potential future impacts of designs and actions on people and environments. 3. I envision preferred futures that respond to emerging social and environmental issues based on identified continuities, trends and patterns. 	<ol style="list-style-type: none"> 1. I defend 'why I care' in regard to various future scenarios and empathize with others who care about different things. 2. I reflect upon and discuss own and others' values and ethical principles when explaining why a particular action is right or desirable, including reference to sustainability. 3. I advocate future scenarios in images and text that reflect personal values and worldviews. 	<ol style="list-style-type: none"> 1. I envision, through group discussions, future events and places from a projection of personal experience by making drawings of what might be imagined for the future, and explain the need that would be met by key features. 2. I follow a systematic design process to realize designs and actions for change for a preferred future. 3. I adjust my designs to make provision for uncertainty and risk when designing and taking action for change as a result of feedback.



5.3 Learning Indicators for Grade Grouping 9-12

Grade Grouping 9-12			
Element 1: Interconnections			
Category	Cognitive	Affective	Psychomotor
1.1 Ecological Systems and Processes	<ol style="list-style-type: none"> 1. I describe how living things are generating/organizing/regulating systems that utilize energy and materials from their environment. 2. I analyze biosphere processes and the abiotic and biotic interconnections in ecosystems. 3. I integrate understandings to evaluate the health of physical and living systems at various scales. 	<ol style="list-style-type: none"> 1. I appreciate interconnected aspects of environmental issues of local, regional and global significance. 2. I pursue environmental investigations ethically without disturbing elements, system connections and processes. 3. I favour new ideas and approaches in understanding ecological systems and processes. 	<ol style="list-style-type: none"> 1. I utilize media to become aware of issues resulting in negative impacts on the environment. 2. I experientially investigate ecological systems and processes related to a local environmental issue. 3. I share my ecological insights, formally or informally in a public forum.
1.2 Social systems & technology	<ol style="list-style-type: none"> 1. I identify how human communities viewed as functioning parts of the biosphere impact on ecosystem health in defining human sustainability. 2. I analyze the influence of social subsystems (cultural, economic, political, legal) on the way society interacts with its natural environment and their critical importance for achieving ecological sustainability. 3. I propose new ideas in developing sustainable social and technological systems. 	<ol style="list-style-type: none"> 1. I accept systemic societal, cultural and environmental issues of local, regional and global significance. 2. I respond ethically and sensitively to others while investigating social, cultural and environmental issues locally, regionally and globally. 3. I encourage and seek out new ideas, potential and possibilities. 	<ol style="list-style-type: none"> 1. I identify societal, cultural and environmental issues of local and global significance from local hands-on experiential learning. 2. I use oral, print and digital resources to enlarge my understanding and perspective of a local, regional or global environmental and its influences across scales. 3. I create opportunities to inspire others about how we can develop sustainable social and technological systems.
1.3 Wellbeing & Interconnections	<ol style="list-style-type: none"> 1. I identify how our personal and collective wellbeing is dependent on healthy social and environmental interconnections. 2. I examine ways to improve environmental connections, 	<ol style="list-style-type: none"> 1. I appreciate a personal connection and sense of oneness with the natural world. 2. I prefer spending time developing healthy personal and collective 	<ol style="list-style-type: none"> 1. I identify personal, societal, and cultural wellbeing issues stemming from poor interconnections with natural and human environments. 2. I use oral, print and digital



	<p>personally and collectively, in daily living and working conditions.</p> <p>3. I propose practical ways to improve personal and collective interconnections and wellbeing.</p>	<p>social and environmental interconnections.</p> <p>3. I support the generative, creative time spent in the natural environment individually and with others.</p>	<p>resources to enlarge my understanding and perspective of how to improve interconnections and wellbeing.</p> <p>3. I adapt my personal habits and create opportunities for others to strengthen their environmental interconnections.</p>
--	---	--	---

Element 2: Diversity

Category	Cognitive	Affective	Psychomotor
2.1 Identifying and clarifying perceptions, feelings, ethics, values and actions	<p>1. I discuss diverse ways of knowing, perceptions, feelings, values, ethics and behaviours towards ecosystems and the biosphere.</p> <p>2. I compare and contrast the impact of diverse perspectives and worldviews related to social, cultural, global and environmental issues.</p> <p>3. I evaluate and create new ideas, understandings and solutions from a diversity of perspectives; understanding diversity leads to strength and resiliency socially, culturally and environmentally.</p>	<p>1. I appreciate my own and others' beliefs, morals, values, needs and wants in exploring and analyzing the impact of social, cultural, global and environmental issues.</p> <p>2. I seek greater understanding of the beliefs, ethics, values, needs and wants of others and the natural world in order to enrich my own understanding of the world.</p> <p>3. I facilitate the generative, creative nature of engaging diverse perspectives to negotiate agreement regarding issues and actions that have implications for biodiversity and sustainability.</p>	<p>1. I reflect on and share my own and others' beliefs, morals, values, needs and wants in exploring the impact of perspectives and diversity on social, cultural, global and environmental issues.</p> <p>2. I accept the value of diverse perspectives in exploring social, cultural, global and environmental issues.</p> <p>3. I seek out a diversity of perspectives and ways to enhance biodiversity in exploring and analyzing social, cultural, global and environmental issues.</p>

Element 3: Responsibility & Citizenship

Category	Cognitive	Affective	Psychomotor
3.1 Investigation & Evaluation Knowledge & Skills	<p>1. I identify the process and scope of action needed to investigate social, cultural, global and environmental issues.</p> <p>2. I analyze resources, options and implications of various</p>	<p>1. I seek to learn about the impact of diverse views from social, cultural, environmental and economic perspectives.</p> <p>2. I pursue a positive attitude and optimism in my and</p>	<p>1. I identify societal, cultural and environmental issues of local and global significance through questioning, discussions and experiential investigations.</p> <p>2. I consult with stakeholders</p>



	<p>actions related to social, cultural, global and environmental issue resolution.</p> <p>3. I develop a case for change, including criteria for success, by evaluating options and potential for change with various actions.</p>	<p>others' ability to affect change.</p> <p>3. I facilitate diverse perspectives in investigating social, cultural, global and environmental issues in local and global communities.</p>	<p>about their preferred futures in regard to the chosen issue(s).</p> <p>3. I make and present a case for change to relevant stakeholders or decision-makers.</p>
Action Competence			
3.2.1 Systems Thinking	<p>1. I identify significant processes and relationships in a system from a wide or big picture view of sustainability.</p> <p>2. I analyze probability, risk, benefit, and intended and unintended consequences due to interdependent feedback loops and relationships in a system over time.</p> <p>3. I envision a preferred future that responds to the case for change and that provides evidence of systems thinking.</p>	<p>1. I appreciate the need to incorporate multiple variables from social, economic and environmental imperatives</p> <p>2. I favour considering diverse social, economic and environmental perspectives and considerations in addressing social, cultural, global and environmental issues.</p> <p>3. I seek out diverse perspectives and effectively pursue, consensus decision-making.</p>	<p>1. I generate a systems model that represents significant processes and relationships in a system.</p> <p>2. I use a systems model to identify and provide reasons for the most concerning trends, to critically evaluate past policy and management responses to the issue, and to identify and evaluate possible leverage responses that address the trends.</p> <p>3. I propose a course of action to engage effective leverages for change considering social, economic and environmental parameters.</p>
3.2.2 Futures & Design Thinking	<p>1. I identify continuities, trends and patterns to construct preferred futures using systems thinking.</p> <p>2. I analyze from the preferred future back to the present to generate ideas for behaviours, strategies, environments and products.</p> <p>3. I envision preferred futures that anticipate developments in science, technology and design in relation to cultural, economic and environmental imperatives.</p>	<p>1. I appreciate diverse perspectives and needs in designing and taking action for change.</p> <p>2. I reconcile differing responses from stakeholders when designing and taking action for change.</p> <p>3. I build detailed future scenarios that support personal values in relation to global and intergenerational equity and ecosystem health.</p>	<p>1. I plan, implement, and manage systemic design processes to realize ideas and actions that support change for a preferred future.</p> <p>2. I accommodate changing circumstances and differing responses from stakeholders when designing and taking action for change.</p> <p>3. I align my personal actions with visions of a global future to promote behaviours and design strategies, environments and products.</p>



6.0 Exemplary Teaching Practices

6.1 Introduction

The focus on curriculum redesign is often on the curriculum that includes programs of studies, assessment and teaching resources. Another aspect of curriculum redesign is teaching practices. It is teachers that deliver curriculum for their students. For students to master the competency as outlined in the elements and indicators, there will be need to be a shift in teaching practices and also in how classes/schedules are structured.

Some teachers and schools are already exploring avenues to make this happen with opportunities in current curriculum. This is a result of their own professional development in regard to 21st century learning, a deeper understanding of environmental education, and schools looking at new ways of engaging students. It is important to share some of these examples to help teachers identify ways they can enhance their teaching practices.

Exemplary teaching practices in environmental education are present in countries around the world. A few have been incorporated into this Framework, but given our particular context, most of the teaching practices focus on Canadian and specifically Albertan examples. In 2011 Learning for Sustainable Future (LSF), a non-profit Canadian organization that was created to integrate sustainability education into Canada's education system, published *Connecting the Dots: Key Learning Strategies for Environmental Education, Citizenship and Sustainability*. This document focuses on seven learning strategies to help students become engaged, active citizens in achieving environmental, social and economic sustainability:

- learning locally;
- integrated learning;
- acting on learning;
- real-world connections;
- considering alternative perspectives;
- inquiry; and
- sharing responsibility for learning with students.

These learning strategies are consistent with this Framework's Elements and Learning Indicators. Keeping these in mind, the following criteria for identifying exemplary teaching practices for Alberta's Environmental Framework were developed.

6.2 Criteria for Exemplary Teaching Practices

As stated above, the criteria are based on the findings of the supporting literature, identified goals of 21st Century learning, and the learning Indicators identified in Section 5. As such, our criteria for exemplary teaching practice incorporates as many of the following as possible:

- Took place in the last five years;
- Exemplify curriculum-based projects;
- Address as many of the three Elements (Interconnections, Diversity, Responsibility & Citizenship, as identified in this Framework) as possible;



- Incorporate cognitive, affective and psychomotor domains and higher orders of thinking, as described in the Competency Indicators and identified by Alberta Education;
- Enable experiential, place-based learning;
- Empower students to apply their learning towards something they feel passionate about – and consequently discover citizenship, and feel more hopeful about the future;
- Exemplify transformative teaching & learning that may affect students' knowledge, skills, attitudes and behaviours, and benefit the human and natural environment/community;
- Develop effective school/community connections and cooperation; and
- Are well documented, with images/video and/or with on-line references or links.

Examples included in this Framework relate to the following four categories:

- Elementary - individual classes addressing single or multiple curricula.
- Elementary - grade-wide or school-wide projects. In these schools, teachers create a system in which taking action to help the environment is the norm, not the exception.
- Secondary - individual classes addressing single or multiple curricula.
- Secondary - grade-wide or school-wide projects.

Each example or 'story' has three parts:

- **What the teacher did**, why and how they brought this learning to fruition: *Brief description of the curriculum teaching practice; what preparation/planning, networks, accessing resources, etc. was needed to implement the teaching practice; Include any awards or recognitions.*
- **What the students did**: *outcomes were incorporated and a brief description of the student learning and their response, including their action activities.*
- **What changed**: *Demonstration of benefits to the environment and/or student learning: what knowledge, skills, attitudes and behaviours changed through the experience? Examples of how did they assessed student learning.*

6.3 Exemplary Practices

Listed below are examples from a variety of schools. Some of the schools have initiated the projects on their own, some have received grants to help them with their work (e.g. "BP A+ for Energy" grants, Energy in Action program), and some have worked with other organizations to support their work (e.g. Galileo Network). There are many more schools with innovative initiatives to incorporate project-based learning, inquiry learning, and cross-curricular learning with a focus on environmental education. This is just an initial list that will grow as more teachers begin the shift toward 21st century learning.

NOTE:

The shift from knowledge-based curricula and traditional transmissive teaching practices to competency-based, transformative learning has significant implications for teaching practices. Transformative learning engages the learner directly in constructing and personalizing their learning experiences. As such, it necessitates the engagement of all aspects of the learner: cognitive, affective and psychomotor in developing competency in all three elements of environmental literacy.



6.3.1 Elementary Schools

6.3.1.1 Vera M. Welsh School (K-3), Lac La Biche, Alberta:

An Outdoor Classroom and Garden

Competencies:

- Interconnections –Ecological systems & processes, Wellbeing & interconnections
- Diversity
- Responsibility and Citizenship –Investigation & evaluation knowledge & skills, Action competence (futures and design thinking)

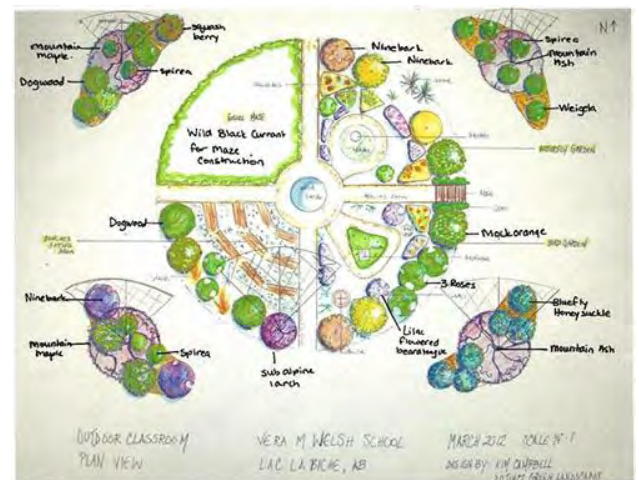
Teacher Lisa Vandendool tells the following story...

What the teacher did:

During the 2011-2012 school year at Vera M. Welsh School, I was working as a grade 1 teacher. We are a K-3 school, with a population of over 400 students. I believe that it is important to provide our learners with hands-on, authentic learning experiences in nature, even (and maybe most importantly) at a young age. Our school was built on an old potato farm, and we didn't have a single solitary tree on our grounds, and no gardens or interesting outdoor spaces of any kind for our students to explore and enjoy. What could we do to change this? I began researching and applying for school greening grants, and it didn't take long before CAPP (The Canadian Association of Petroleum Producers) agreed to organize an event where members from their industry would come up to Lac La Biche for the day, and help us to create our vision of an outdoor space where the children could explore and learn about nature. They were willing to donate up to \$5000 towards the project.

I wanted to ensure that our students felt they had ownership of this project, so I knew it was important to hear their ideas of what they wanted to see included in our outdoor space. Dana Robb, our school principal, was gracious enough to provide a substitute teacher for me for a day so that I could go around the school to each classroom and talk to them about our outdoor space. I used a Powerpoint presentation to explain some different elements that could be included in our outdoor classroom (i.e. water feature, weather vane, maze, gardens, shade, home for birds, etc). I then gave each student a survey and they ranked their top three choices of features to be included. After a long night of tallying their results, the top three components chosen by the students chose were a maze, a water feature, and a home for birds.

Next, I created our school garden committee. I asked three teachers and one educational assistant whom I knew believed in the cause, and who were energetic and efficient. One of these teachers, Kim Campbell, is a landscape designer. She agreed to put our landscape design



together so we sat down with the ideas from the students and began brainstorming. One thing that was very important to the students was culture, so with over half of our student population being FNMI, we chose the medicine wheel as the shape of our garden. We placed the water feature as the center feature, and included other elements in the 4 quadrants; maze, bird garden, butterfly garden, and seating area.

With the landscape design completed, we began raising awareness within the school and community regarding our plan. We set a fundraising goal, and used local media, and a fundraising thermometer displayed in the front hallway of the school to keep the public updated on our progress. We had many community members step forward eager to donate their time and resources to the project. Our plan as a garden committee was to use the event day scheduled with CAPP for May 9th, 2011 to launch our garden.

Our project was coming together nicely, and we had everything organized from the donated excavation, to the plant lists and timelines, when we hit a very unforeseen snag. With only a few short weeks until

groundbreaking, our principal informed us that she had just found out that our school was scheduled to move to a new location within the next two years. This blow came close to devastating our committee, and temporarily took all wind out of our sails. We decided that we could not ethically go ahead with this \$10,000 project, and ask the community to support something that we would only be able to use for 2 years.



Through many hours of discussion and many meetings, we decided that we had worked too hard to just scrap the plan, and that we would continue to work toward our goal, but we would just construct the 'moveable' elements of the outdoor space for this school year, and create an outdoor classroom and 'mobile' garden.

Through discussions with CAPP, we agreed to build 15 benches, a tool shed, 6 raised beds, 2 obelisks and an arch. These elements can all be moved with us when our school moves to a new location. We commissioned the junior high YAP (youth apprenticeship program) students to build the garden shed for us, and the high school students to build the obelisks and archway. A father of one of our teachers built the 15 benches. These elements were all in place in time for the CAPP event day.

What the students did:

Although the outdoor space would be used by all of the students in the school, the Energy In Action day hosted by CAPP was geared towards the grade 3 students. With over 100 students participating, along with dozens of industry members and community volunteers, we were able to fill 6 planter boxes with soil and plant them with sunflowers and root vegetables, paint the





garden shed, build a bird house for each student to take home, pick up litter from the school property and surrounding area, and provide students with some education about local bird species while on a nature walk with the 'bird man'. Students also learned about renewable and non-renewable resources from teachers with Inside Education, who were travelling along with the Energy in Action crew.

After the event day, I was amazed at the degree to which the outdoor classroom was being used. We almost had to create a sign-up sheet because it was so popular with teachers and students! Students, with their parents, signed up to tend the garden as it grew through the summer, and watched with excitement as their vegetables and flowers grew.

This past fall, when students returned to school we had a harvest party. The students who planted the garden are now in grade 4 at a new school, so they were invited back to harvest their veggies. They all came, and were able to see what all of their efforts produced. They were also able to share their experience with the students who are now in grade 3. We made carrot cake with the carrots from the garden for the grade 4 students to enjoy, and they left the rest of their veggies behind for the grade three students to make vegetable soup.

What changed:

As soon as our outdoor space was constructed, I was amazed at how much it was used. Our students would beg to go outside and read on the benches, or to go water the plants. They became excited about composting, growing, and exploring their outdoor space. It was important that they were made to feel that they had a voice in this project from the beginning because they really felt as if it was 'theirs'. Many of our students have never been exposed to gardening, and had little understanding of how things grow.

This project met a number of curriculum outcomes in all grades from K-3, including science, social studies and art. The students built community within their own classes, but also made connections with students from other grades as they shared the space and worked together. They were also able to make connections with the local community on the event day. Adults had the opportunity to pass down knowledge to the students while they worked together to plant, build birdhouses, and learn about their local environment.

This project was made possible by the community partnership and sponsorship with CAPP's Energy in Action program. Energy in Action was awarded the "2011 Friends of Education" award from the Alberta School Boards Association and it was a 2012 Alberta Emerald Award finalist.



6.3.1.2 Glenbow Elementary School (K-6), Cochrane, Alberta:

Creating Environmental Stewardship in every classroom in the school

Past-Principal: Deb Rougeau-Bell

Competencies:

- Interconnections –Ecological systems & processes, Social systems & technology, Wellbeing & interconnections
- Diversity
- Responsibility and Citizenship –Investigation & evaluation knowledge & skills, Action competence (systems, futures and design thinking)

What the school did:

Deb Rougeau Bell, past Principal of Glenbow Elementary, and the environmental leadership team, Kim Kendal Knitter and Kara Vincent used a distributed leadership model to create a school-wide theme of environmental citizenship. School staff worked through four steps:

Setting the Direction and Vision. Using educational best practices and the school board's statutory documents to guide them, teachers and support staff worked together to build their own conceptual model for 21st century learning and created a common vision and mission for the school. Within this context, the staff collaboratively developed a common sense of purpose with respect to environmental stewardship: "to develop active, responsible ethical citizens who contribute positively both locally and globally with an active universal consciousness and essence of empowerment".

Building Capacity. Recognizing that ongoing professional learning is fundamental to improving teaching and learning, the Environmental Stewardship Leadership Team, which consisted of teachers, support staff and admin, developed a cross-school culture of professional learning, which included bringing in environmental science experts from the community to help teachers develop their knowledge and confidence. This new knowledge creation and support had a profound impact on infusing environmental stewardship throughout the curriculum.

Redesigning the Organization. To accomplish their goals, leadership was distributed across teachers, support staff and the administration team. With high involvement in decision-making, the staff was empowered to make significant decisions, which led to powerful outcomes. Job embedded professional learning took place during the school day, while teachers were fresh; and Inquiry coaches and teachers partnered to create a culture of collaborative professional inquiry.

Facilitating the Teaching and Learning. Using an inquiry learning focus under an 'umbrella' of environmental stewardship and citizenship, teachers created links to curriculum, collected data on student learning, and helped students develop skills that are directly applicable to real life. The student's inquiry studies into worthy issues, questions and ideas advanced their 21st Century competencies and they became critical, creative and complex thinkers.

What the students did:

Each year for the past several years, every student in Glenbow Elementary is involved in a real-life inquiry project that engages students in outdoor exploration and study over many weeks,



involves individuals and groups throughout the community, and encourages environmental stewardship activities.

Some examples of the inquiry studies the students became immersed were: Potatogate: A Native Grasslands inquiry; What we do to the Water we do to Ourselves; Native Flowers or Invasive Species?; Water is Life; and Can Bears and Humans Co-exist.

Elsewhere in the school, students: used a number of strategies to reduce waste by 71%; build 200 nesting boxes each year to create nesting sites for bluebirds and swallows; work with a local environmental group each year to help restore the banks of a local stream, planted a 'Tree of Care' in their playground, study and journal in the coulees of a local protected area, and partner with a community gardening group to create and sustain Cochrane's first community garden and the list goes on...

What changed:

To their everlasting credit, the school took the time to ask students about their learning, and that data shows that much has changed. In addition to the visible improvements to the environment, attitudes towards learning, stewardship, and the school itself are very positive. For example, in 2012 over 95% of Grade Four students agreed that ...

- the teachers use real-life meaningful activities to help them learn
- Glenbow School participates in environmentally friendly practices
- the school helps each of them become a better citizen

Polling of parents, students, and staff found that 96% of them feel that Glenbow School...

- provides students with activities that promote responsible citizenship, volunteerism and community service
- models practices that contribute to environmental sustainability



6.3.2 Secondary Schools

6.3.2.1 Rundle College Junior High School (7-9), Calgary, Alberta:

'Light of Hope:' Building solar lanterns for Nepal

Teacher: Samantha Woods

Competencies:

- Interconnections –Ecological systems & processes, Social systems & technology, Wellbeing & interconnections
- Diversity



- Responsibility and Citizenship –Investigation & evaluation knowledge & skills, Action competence (systems, futures and design thinking)

What the teacher did:

Rundle College Junior High combined grade 9 social studies and science using a solar energy theme and a humanitarian project. The goal was to build solar lanterns and send them to the village of Daya in Nepal. The project was made possible with a grant from BP A+ for Energy to purchase the solar lanterns and to provide a workshop from Star Eco Works Solutions. The grade 9 social studies, science and language arts teachers collaborated on the project. The project reminded the teacher of the importance of creating ‘real life’ learning in the classroom.

What the students did:

The project involved all 84 grade 9 students, and the students built 15 solar lanterns that were then sent to Nepal. A number of students formed a leadership group, that raised an additional



\$5500 to purchase school supplies and additional solar supplies for the village in Nepal. The leadership group educated their parents, community, and the primary and elementary students at the school. An individual student stepped forward to share this information with his Scout troop and continues to work with the teacher to build solar lanterns to send to Nepal.

What changed:

The students created a video documentary, a Prezzi presentation and a “Light of Hope” bulletin board. Students completed a personal reflection at the end of the project to assess if the learning outcomes were met. Teachers were also surveyed on whether the learning outcomes were achieved and also if students were inspired to apply their newly acquired knowledge, social and personal skills to improve the lives of families in another country such as Nepal.

6.3.2.2 Queen Elizabeth High School (10-12), Edmonton, Alberta:

Student Led Initiatives for Sustainable Education and Connect

Teachers: Aaron Dublenko, Terry Godwaldt

Competencies:

- Interconnections –Ecological systems & processes, Social systems & technology, Wellbeing & interconnections
- Diversity



- Responsibility and Citizenship –Investigation & evaluation knowledge & skills, Action competence (systems, futures and design thinking)

What the teacher did:

Student Led Initiatives for Sustainable Education (SLISE) started out as a club and is now a credit-based program that works on solutions to real world problems. There are seven different modules for students. The students choose to enroll in the modules; the modules use integrated themes focusing on a variety of topics and subjects. Students receive credits for completing the modules. The



number of ongoing projects and new initiatives undertaken by the SLISE students is impressive! SLISE teacher Aaron Dublenko ensures students receive the recognition for all of the student-led project work: “The teacher acts as a guide and facilitator with the students taking the lead. The teacher gets to sit back and watch the magic happen.” Aaron Dublenko is the recipient of the Excellence in Teaching award as well as a finalist for a 2012 Alberta Emerald Award.

Teacher Terry Godwaldt leads the Centre for Global Education, and Connect, a program to bring the global community into the school. The Connect students have also done a number of projects and some of these are tied in with specific areas of curriculum. Connect works with students from around the world and across Canada and Alberta, helping them work together on areas of global policy including climate change, national energy strategies, 21st century learning, student polling and much more.

What the students did:

Projects that have been completed by SLISE students include placing solar panels on the school roof, building solar lanterns for Haiti and Canada aboriginal communities, life straws for Haiti, building solar ovens, and building spice boxes for the school’s food program.

Connect and the Centre for Global Education have also done a number of initiatives by building connections with a global community. Students across Canada worked together to create the National Energy Strategy that was presented to the Senate Standing Committee on Energy and Environment, Senator Grant Mitchell and Members of the Legislative Assembly (MLAs) in the spring of 2012. Students delivered the presentation as a cross-Canada solar-powered videoconference at the Alberta Legislature. The students also worked with other Canadian students to create a “Canadian Youth Whitepaper on Climate Change”. This is a culmination of over a month of online teamwork, 2000 hours of student collaboration, 200+ hours of teacher



facilitation and a passion by Canada's youth to engage in the national debate. The paper was taken by a Canadian youth delegation to COP 18 United Nations Climate Change Conference (UNCCC) in Qatar, November 26 to December 7, 2012. Aaron is in Qatar and has posted photos from the COP 18 on SLISE's web site.

What changed:

Below are two testimonials from students involved in SLISE and Connect.

Thia Ma, founding member of SLISE: "You can plan something for so long but once you see it in action it is completely different. You realize that we did this, this is us, it was the students that wanted to make these initiatives happen and to present them outside of the classroom and to people across Canada. That's mind blowing, really!"

Akeel Khan, SLISE student: "Instead of just seeing my science class work I can actually do practical things more and beyond what I would be able to do in a classroom. I gain credits, knowledge and connection with community networks such as people from NAIT so I will know more about NAIT so if I choose to go there it won't be completely strange to me. It goes with my interests in science and environmental science."



For more information:

SLISE - <http://slisee.ning.com/>

Centre for Global Education -
<http://tcge.tiged.org/>

6.3.2.3 Jasper Place High School (10-12), Edmonton, Alberta:

InSight Education

Teachers: Dustin Bajer, Britt Petracek

Global Café Coordinator: Julia Dalman

Competencies:

- Interconnections –Ecological systems & processes, Social systems & technology, Wellbeing & interconnections
- Diversity
- Responsibility and Citizenship –Investigation & evaluation knowledge & skills, Action competence (systems, futures and design thinking)

What the teacher did:

Jasper Place High School has created a course called InSight Education – a creative exploration

September 9, 2013



of Social 20 and Biology 20. The course is offered as one course and for a complete morning block. The class is taught in the Global Café (see description below). The course design uses project-based learning and the learning outcomes from the Programs of Studies as the main tool for student assessment. The learning outcomes are listed on the InSight web site under the Passports so students have easy access to the learning outcomes. Outcomes are identified for all project work and students can bring forward their own projects and must indicate the learning outcomes that will be covered in the project.

Dustin Bajer is a science teacher at Jasper Place and has brought Permaculture into the school environment. Some of this has been done through a club and some of this has been through working with classes that support the work through curriculum objectives (science, special education, CTS classes). One focus of the Permaculture work has been to grow food for the cafeteria. Through this work, the idea of including more project-based learning in classes grew. Britt has a background in assessment and through their working together on various initiatives the idea grew to combine the two courses. Britt's background in assessment has been crucial in providing an alternative assessment practice.



The Global Café is a safe space that is run for students by students. It is a space that prepares youth to become intentional citizens by fostering relationships with the broader Edmonton community and has them actively engage in democratic processes. Julia Dalman, the Global Café coordinator is a student mentor and community resource person for the student led initiatives. Julia supports InSight by helping the students and teachers identify the community supports that are needed for their projects and learning.

The spark for this project came to fruition and was supported by administration wanting to explore better ways for engaging students in learning. The teachers and students are both learning through this process and will continue to fine-tune the teaching, learning and assessment practices.

What the students did:

The students that are enrolled in InSight are a diverse group with some students in IB or AP as well as students that have not been overly engaged in their school learning experience. The students have worked on a number of projects and these are a few examples that have been done by the whole class:

- Creating an eBook on the future of health care and medicine that impact the respiratory and digestive systems.
- Designing and creating a permaculture bed for the Shaw Conference Centre.



- Designing a Food Forest and an Aquaponic system.
- One challenge for students that wanted to take the course is scheduling. Some student couldn't take the course because one of the other classes they needed was also offered in the morning. This is a challenge that will need further discussion.

The Global Café has been a community support for the InSight class but is also a space for students to identify and lead their own projects. In starting the Global Café, no one knew what would attract students and which students would be interested. There is a diversity of students and it has provided a space for students that do not feel a connection with any other aspect of the school.

Each year, the students lead two large community events. One of the events for this year was a



Reskilling event. Students wanted to learn some skills such as knitting and canning. The students felt they could offer their skills in using technology. Students learned skills and helped share their skills. Another initiative is the Living Library – instead of taking out books from a library, a living person is booked to share their story/expertise. The Living Books are brought into the Global Café and

classes can also book time with the Living Books. Julia often takes students to conferences outside of the school as well.

The Global Café is open during the day and on a daily basis any number of things can be happening from “open mic” to cultural circles and smudging every morning.

What changed:

This is the first year of offering InSight so the impact on student learning is in the early stages. As with any new program, there is much learning on all fronts and improvements will continually be made to the program. Student learning is assessed by students demonstrating that they have mastered the learning outcomes. The teachers have developed a system for identifying this with various levels of achievement. Instead of grading individual projects and assignments, students are assessed on their level of competency around each of the outcomes outlined in the program of studies. In a typical classroom, each project is given a single mark. With InSight, students receive a distinct mark for each outcome that the project covered. In this way, cross-curricular projects become easier to assess and students have a better understanding of the outcomes they have covered and the ones they still need to master. Students can continually



improve on outcomes that have not been mastered. The teachers have incorporated this into the school marking system.

Dustin has had some feedback from parents “Some parents have indicated that their children are more engaged and interested in their learning. The parents are very appreciative of this. “ He has also seen some students replicating the projects in their own home (e.g. hydroponics).

Students involved with the Global Café can receive work experience credits or volunteer hours and through the various initiatives it helps students build their resume and Julia is often the reference person for their resumes.

For more information:

Global Café - <http://www.facebook.com/JPGlobalCafe>

InSight - <http://jpinsight.blogspot.ca/>

6.3.2.4 Forest Lawn High School (10-12), Calgary, Alberta:

Energy, Sustainability and Conservation: Another Look at Physics

Teachers: Helen Colburne, Isabel Lau

Competencies:

- Interconnections –Ecological systems & processes, Social systems & technology,
- Diversity
- Responsibility and Citizenship –Investigation & evaluation knowledge & skills, Action competence (systems, futures and design thinking)

What the teachers did:

Last year, Helen and Isabel piloted a program with their two science 10 classes for the Physics unit. The complete unit was based on authentic tasks and field trips that connected the curriculum to the real world. The eight-week unit also had cross-curricular connections to math and social studies. This year, all 500 science 10 students will be part of the project-based learning in the Physics unit.

Last year’s project had students create a Public Service Announcement that required them to suggest ways to increase the energy efficiency at their school. Students had to select one area of inefficiency that, if changed, would impact the school’s energy consumption. Rubrics are used for all assessment including the final project. During the pilot, students accessed family members and contacted many different corporations and community members. A field trip to the Sustainability House allowed students to meet architects and designers and provided ideas for the student projects. The school has received funding for the project from BP’s A+ for Energy grant. Some of last year’s students also participated in Inside Education’s Youth Summit on energy. The teachers anticipate that some students will participate in a Youth Summit this year as well.



What the students did:

The final project was a Public Service Announcement (PSA). For the pilot students created a variety of PSAs to focus on an issue related to energy loss/wastage at the school. Students interviewed staff and experts and developed compelling arguments to support their ideas to make changes in energy efficiency at the school. Some of the changes suggested by students have been implemented by the Calgary Board of Education facilities department. This year students will become experts in an area of energy efficiency and present their findings.

What changed:

From one of the student presentations last year, the school custodial learned about a new efficient boiler for the school. School board employees followed up with two students to learn more about their suggestions and how they thought their idea could be implemented. One teacher stated, “Outside interest in their work, enhances student learning and desire to become involved in their school and the larger community and global issues.”

To assess student understanding and to improve the quality of student work, the teachers developed rubrics with the students using exemplars to specifically target the criteria for high quality work. Feedback loops were used throughout the unit to move student understanding forward. Students received feedback from their teachers, from each other and from experts before the final presentation of their PSA.

6.4 Exemplars from the Galileo Educational Network

The Galileo Educational Network is an independent, charitable organization that creates, promotes and disseminates innovative teaching and learning practices through research, professional learning and fostering external collaborations. Galileo works with students, teachers and policy makers across Canada both onsite and online.

Working alongside Galileo professional developers, teachers have created a number of inquiry-based studies. When designing and developing these studies, teachers work collaboratively through the Intelligence Online design process with their mentor and colleagues. As teachers design tasks for and with their students, they are asked to consider how the task is:

- situated in a larger context of a discipline and body of knowledge;
- allowing the students to see themselves as designers; and
- allowing the students to engage in work that is personally important and meaningful.

There are many exemplars on the Galileo Network web site (www.galileo.org). All of the exemplars can be found at: www.galileo.org/tips/inquiry.html

We have selected ones that connect with the three elements outlined in the Environmental Education Framework.



6.4.1 Primary Grade Projects

Exploring Kainai Plants and Culture – Grade 4

The first thunderclap of spring tells us that the Thunder Medicine Bundle may be opened. Sipatsimo (sweetgrass) and aakiika'ksimii (sage), our most sacred healing herbs of mind and spirit, grow at the Belly Buttes, a sacred Sundance site.

It is all here: the land, the plants, our ancestors and our future. One is held within the other. You cannot know the land without knowing the plants. You cannot know the plants and their healing powers without hearing the stories. It is one and the same.

<http://www.galileo.org/plants/kainai/>

Waste in our World – Grade 4

Garbage day used to mean pitching out old newspapers, bottles and soup cans with the rest of the trash. Today many Canadian households are now choosing to dispose of their junk in other ways. The students are tasked with determining how typical their home is by keeping track of what happens to the following waste products: paper, metal cans, glass bottles, plastics, and products that require special disposal such as used oil, paint, tires, etc.

<http://www.galileo.org/tips/waste/index.html>

6.4.2 Middle School

The Blue Planet – Grade 8

The blue planet is unique because it is where water exists as a liquid. It is because of this fact that life in all its diversity thrives. When the number of human beings was small their effect on the planet was also small. But over the past 100 years the number of people on earth has exploded.

What happens when human waste can no longer be absorbed by our natural systems? Are there other choices humans can make to change or even reverse our growing impact on our overburdened water systems? How are the oceans, the atmosphere, land and life connected? How do these connections affect us?

<http://www.galileo.org/schools/crowther/science/blueplanet/index.html>

Bears! Avoiding Conflict with Humans – Grade 6

Bears have presumably wandered out of the protected areas of Waterton Lakes/Glacier International Peace Park and several provincial parks and wilderness areas. The population of Cardston and the surrounding area is increasing, as more people are attracted to living in more rural settings. Conflicts between bears, who are looking for an easy food source, and humans, who want to protect their livelihood, are bound to increase.



This project asked the following questions:

- Is it that people's food (gardens, farms) or garbage becomes bear attractants that bring the bears in conflict with humans?
- Should we find out why this is occurring?
- Certainly we are grateful bears are still on the landscape. Would we respect our wilderness as much and value its beauty as a place of hallowed solitude if the great bear was no longer with us?
- Would the forest ecosystem itself be effected by the lost of this amazing animal?
- Are there other reasons we need to explore?

What the students did...

- Gathered as much information as possible from all sides of the issue – invited guests such as Fish and Wildlife Officers and collected opinions from the community by conducting a telephone survey.
- Summarized the information and published several pamphlets guiding people to avoid conflicts with bears and wrote to Ted Morton, Minister of the Environment.

<http://www.galileo.org/initiatives/bears/index.html>

Know the Bow – Grades 3, 5, 7, 8, 9, 11

Students in six different schools conducted this collaborative water study of the Bow River Watershed across three school jurisdictions.

<http://www.galileo.org/projects/water/index.html>

Mokakioyis-Meyopimatisiwin – Grade 6 to 12

The Mokakioyis/Meyopimatisiwin project is an ethno-ecological inquiry that seeks to digitally preserve traditional Aboriginal knowledge in an interactive online environment. Students, Aboriginal elders, cultural and spiritual advisors, eminent scholars, teachers, new media artists and educational mentors collaborated to conduct this ethno-ecological study. This site contains photographs, video and sound recordings, maps, and text-based information resources.

<http://www.galileo.org/initiatives/moka-meyo/english/intercept.html>

6.4.3 Senior High

High School Science Field Study

The study was designed for students to uncover relationships between biomes, energy and climate. The question was: “Knowing that going up 300 meters is like going 950 kilometers north, can we learn anything about northern biomes by making observations as we walk up a slope?”

The high school study was collaboratively designed by:

- High school science teachers



- The Biogeoscience Institute of the University of Calgary in Kananaskis
- Biologists
- Galileo Educational Network

<http://www.galileo.org/tips/field-study.html>

Global Interdependency – Social and English 20

Students explored the demands of a growing population on Earth's resources and the inequality in distribution of these resources. The students were required to participate in a model United Nations assembly representing a specific country. Each country was asked to prepare a debate on the five resolutions: the environment; industrialization and urbanization; fair trade practices; the status of women, foreign aid and debt forgiveness; and peace and security.

http://www.galileo.org/schools/strathmore/social/social_20/index.html

Energy Use and Abuse – Chemistry 30

Students are challenged to become chemical researchers representing different energy sectors to come together to negotiate a recommendation for the Canadian government to reduce its emissions of greenhouse gases. Each energy sector group is asked to develop a group recommendation and then to come together with the other groups to share information.

<http://www.galileo.org/schools/drumheller/energy/index.html>

6.5 Integrated Programs in Ontario

The da Vinci Arts & Science Environmental Leadership Program

An interdisciplinary program open to all grade 11 students from across the Upper Grand District School Board in Ontario. Students have the opportunity to obtain 4 Grade 11 credits (English ENG 3U, Biology SBI 3U, Visual Arts AVI 3M and Psychology, Sociology and Anthropology HSP 3M) in a natural setting nestled amongst hiking trails, forests and ponds of the Arboretum at the University of Guelph. Students explore the environment through a unique combination of the arts and sciences. Students develop their leadership and interpersonal skills while experiencing a five day wilderness canoe trip, leading an Eco Artist Elementary program, enhancing their science while participating in various University Science labs and with guest speakers, creating their own art show and with various other activities. Throughout the course students develop the communication, critical and creative thinking skills necessary for success in academic and daily life.

<http://www.ugdsb.on.ca/jfrx/Davinci/>

The Community Environmental Leadership Program [CELP] is available to Grade 10 students and focuses on fostering environmental and outdoor leadership skills. Students earn credits in English, Civics, Outdoor Activities, and Interdisciplinary Studies. The CELP model is also used at Norwell District Secondary school in Palmerston, Ontario and Wellington North Secondary School in Mount Forest.



<http://www.ugdsb.on.ca/celp/index.aspx>

6.6 Summary

Each teaching example highlights the empowerment of students and teachers as a major motivational factor in transformative learning. These projects show a continuum of incorporating environmental education from individual classes to school-wide projects. Throughout each example students were involved in cognitive, affective and psychomotor learning at various levels. These exemplary teaching practices demonstrate how effective experiential, place-based learning is in bringing the curriculum to life through real-world, authentic learning experiences. By incorporating the key elements of environmental literacy, (interconnections, diversity and responsibility and citizenship), environmental education becomes an effective vehicle for transformative, competency based learning.

Throughout the above examples, community partnership is a key ingredient to enabling innovation and exemplary teaching practices. Laura Perry, past manager of Energy in Action, noted:

Every year that I managed Energy in Action, it became more and more apparent that our environmental projects would cost far less and become much more sustainable if we got members of the local community and the parents' councils involved. At [a] school in Lac La Biche, through a parent, we were able to engage the local lady's Kinsmen group, the Kinettes, to work with the students over the summer and show them how to water, weed and harvest the community gardens that we'd helped them plant. Communities are a great source of environmental skills and expertise that schools can draw upon for any number of activities, including gardening, ornithology, forestry, geology, water management etc. For example, reaching out to the broader community via Jasper High's Global Café would be a great way to "engage" marginalized students. You're bound to find someone who has a skill that these students would find interesting.

NOTE:

These exemplary teaching practices demonstrate that brilliant teaching in environmental education is already happening at all levels across Alberta. It is hoped that these will provide encouragement and examples for designing further innovation with the aid of this framework.



7.0 Assessment Practices

Teachers are the professionals in student learning and they will always be the decision maker in what assessment practices are appropriate for assessing student learning. This section will provide some examples to assist and support teachers. It will also include the type of assessment reporting that will best illustrate student proficiency of the elements and indicators of environmental literacy and learning. According to the Alberta Teachers' Association (2009) the primary purpose of student assessment is to support student learning. As such, assessment is seen as a verb as well as a noun, as an aid to learning and skill development. Alberta Teachers' Association (2009), Manitoba (2010) and Ontario (2010) make distinctions between assessment *for* learning, assessment *as* learning and assessment *of* learning. The use of assessment for the purpose of improving learning and helping students become independent learners requires a culture in which student and teacher learn together in a collaborative relationship, each playing an active role in setting learning goals, developing success criteria, giving and receiving feedback, monitoring progress, and adjusting learning strategies. The teacher acts as a "lead learner", providing support while gradually releasing more and more responsibility to the student, as the student develops the knowledge and skills needed to become an independent learner (Ontario, 2010).

Ontario (2010, p. 12) has outlined seven fundamental principles as foundations of effective assessment. To ensure that assessment, evaluation, and reporting are valid and reliable, and that they lead to the improvement of learning for all students, teachers use practices and procedures that:

- are fair, transparent, and equitable for all students;
- support all students, including those with special education needs, those who are learning the language of instruction (English or French), and those who are First Nation, Métis, or Inuit;
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
- are communicated clearly to students and parents at the beginning of the school year or course and at other appropriate points throughout the school year or course;
- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement;
- develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps for their learning.

Ontario (2010) also recognizes as essential steps in assessment *for* learning and *as* learning, teachers need to:

- plan assessment concurrently and integrate it seamlessly with instruction;
- share learning goals and success criteria with students at the outset of learning to ensure that students and teachers have a common and shared understanding of these goals and criteria as learning progresses;



- gather information about student learning before, during, and at or near the end of a period of instruction, using a variety of assessment strategies and tools;
- use assessment to inform instruction, guide next steps, and help students monitor their progress towards achieving their learning goals;

7.1 Effective Assessment for Environmental literacy and learning

Effective assessment for environmental literacy and learning needs to incorporate assessment of cognitive as well as affective and psychomotor learning. Assessment methods range from tests and questionnaires to interviews, peer assessments, journal entries, focus groups, and observing skills exemplified in carrying out action projects. Assessments need to measure high level attitudes, skills and knowledge, be largely performance-based, and incorporate adaptability and the ability to cope with novel unpredictable situations. The emphasis is on assessment for and as learning as well as of learning.

The North American Association of Environmental Education (NAAEE, 2010) emphasizes the need to assess the competencies of identifying an environmental issue, analyzing and environmental issue, evaluating potential solutions to environmental issues, and proposing and justifying actions that address the environmental issue. How you demonstrate these competencies requires and is influenced by:

- Environmental knowledge of environmental and sociopolitical systems, environmental issues and strategies for addressing them; and
- Dispositions towards the environment in terms of interest, sensitivity, locus of control, responsibility, and intention to act.

Assessment, then, needs to focus on competencies and skills through cognitive, affective and psychomotor learning.

As the Alberta Education's curriculum redesign process emphasis is on competencies and learning indicators, both formative and summative assessment is relevant. Both formative and summative assessments rely on the provision of clear and meaningful feedback to provide learners with guidance on how to potentially improve their performance or how to apply the information gained from the assessment to future learning and assessment situations. As curricula is structured around cognitive, affective and psychomotor learning indicators, assessment focuses on far more than content.

Both formative and summative assessment can incorporate a rubric that recognizes stages in growth from emergent to proficient. When they are learning in any area, students make connections and move along a continuum from emergent to proficient. Learners at the emergent stage are generally uncertain, and rely heavily on direct instruction, modeling, and whatever "rules" may exist to give them direction about how to proceed, with little sense of underlying patterns. As learners become more competent, they develop more complex schemata of understanding, gain in confidence and independence, and become efficient in problem-solving within new contexts. They are able to apply the new learning independently and direct their own learning. When teachers understand this emergent-to-proficient process as it relates to curriculum outcomes, they can use assessment as the mechanism for helping



students understand and value their own learning and predict what comes next. The ongoing cycle of assessment and feedback can guide students and scaffold their learning as they move along the learning continuum (Manitoba Education, Citizenship and Youth, 2006; Ontario, 2010).

Learners need an understanding of how their work associated with a specific outcome compares to a *standard*. In order to achieve this understanding, learners require a clear appreciation of the *criteria* that are being used to evaluate the student evidence related to the attainment of the specific learning outcome and the assessment tasks that enable learners to provide this evidence. Authentic assessment rubrics are shown to be a valuable, effective tool to provide assessment criteria in relation to learning indicators. Developing a rubric showing levels of learning for each of the methods discussed in this section can provide the necessary standard and criteria for assessing cognitive, affective and psychomotor development in both formative and summative assessment.

To help teachers assess where a student may be on a learning continuum indicated by a rubric, a variety of assessment tools can be helpful. These vary depending on the learning domain and specific competencies and learning indicators. The following sections highlight a variety of tools relevant to cognitive, affective or psychomotor domains. Many of the assessment tools such as questionnaires, focus groups, interviews or peer reviews noted in Tables 4 and 5 below are commonly used to assess programs. However, when focusing on transformative learning these tools are also effective ways to assess student learning. The Alberta Teachers' Association (2009) and Ontario (2010) recognize teachers can obtain assessment information through a variety of means, which may include formal and informal observations, discussions, learning conversations, questioning, conferences, homework, tasks done in groups, demonstrations, projects, portfolios, performances, peer and self-assessments, self-reflections, essays, and tests.

7.1.1 Attitudes / Values

In measuring attitudes and values, assessing attitude or value shifts is important in assessing environmental literacy and social, cultural, global and environmental responsibility. The following table summarizes some of the measurement instruments and associated outcome indicators for measuring a values shift.

Table 3: Measuring A Shift In Values (Thomson et al, 2006, p. 30-31)

Measurement instrument	Pre and Post Test?	Outcome Indicator
Questionnaires (Likert scale or multiple choice)	✓	Quantitative shift in individuals or group for questions pertaining to values
Interview		Student responses reveal a higher appreciation of natural values
Focus Group		Unprompted, at least 15% of students will comment that their values are more supportive of the environment



Review of Peers		Students comment on changes in the values of their peers
Journals	✓	Students make written reference to changes they feel have occurred in their own beliefs, attitudes, or values
Student art work	✓	Students' drawings of their schoolyard give more emphasis (using colour and perspective) to natural objects
Feedback form (ex. an unsolicited email or letter to your organization)		Unsolicited, students comment on how the program influenced or changed how they feel about some aspect of nature

7.1.2 Skills or Competencies

Authentic or performance-based assessment is used to assess students' skills or competencies in 'real-world' contexts. Authentic assessment focuses on students' analytical skills; ability to integrate what they learn; creativity; ability to work collaboratively; and written and oral expression skills. It emphasizes process and performance and can incorporate assessment activities such as performance assessment, short investigations, open-response questions, portfolios peer or self-assessments, journaling, webbing, mapping and interviewing (OECD, 2011). The learning indicators outlined in Section 5 provide a framework to identify skills and competencies in the three elements of environmental literacy.

7.1.3 Behaviour

Many similar tools for assessing attitudes and values can be used to assess behaviour. Thomson et al (2006) suggest the following instruments and outcome indicators for measuring behaviour change:

Measurement instrument	Pre/Post?	Outcome Indicator
Questionnaires	✓	Respondents list behaviours that they began after the program
Interviews		Open-ended questions prompt interviewees to remark on changes to their behaviour
Observations	✓	Observer tests for the presence or absence of a number of behavioural criteria (e.g. classroom recycling program)
Focus Group		Over a quarter of students agree that their behaviour has changed in a specific way
Student art work		Students depict behavioural change through art



Feedback form		Students report on how a program has affected their behaviour
---------------	--	---

Table 4: Measuring Behaviour Change (Thomson et al, 2006, p. 37)

7.1.4 Action

Table 5 provides a discussion of the five kinds of environmental action and their evaluation (Thomson et al, 2006, p. 38).

Type of environmental action	Ease of evaluating benefits to the environment
Persuasion: educating or lobbying other members of the public	Benefits may never be demonstrable, and/or may not exist. The possibility exists that this persuasion may not in fact change anyone's behaviour.
Consumerism: either changing one's own consumer habits or encouraging others to do so	Several measurement instruments can be used to identify changes in consumerism, and resources documenting the relationship between consumer habits and environmental impact are readily available*
Political Action: action that is aimed at influencing a decision-maker	Decision-makers may never respond to pressure – or a pro-environmental decision they make may be due to other factors. Interviews of decision-makers can be helpful to determine this.
Ecomanagement: action to restore, remediate, or improve a natural area	This is easily measured. Funders who emphasize easy accountability, such as EcoAction, place high emphasis on activities of this sort. See below.
Legal Action: action taken through legal avenues	Action of this sort can be easily documented, through such things as judicial decisions.

Table 5: Measuring Action

NOTE:

These diverse assessment tools, used in conjunction with rubrics can help teachers as they engage in assessment *for* learning, assessment *as* learning as well as assessment *of* learning. Throughout, the emphasis is on using assessment to aid transformative, competency based teaching and learning.

7.2 Weighting between and within Key Elements and Descriptors

Given the 3 key elements of environmental literacy, and the components within each, effective assessment incorporates weighting the various levels and components with respect to each other. The following is an example of how the key elements and descriptors could be weighted:

Distribution and weighting for Key Elements and Descriptors



Interconnections			Diversity	Responsibility & Citizenship		Total
Ecological systems & processes	Social systems & technology	Wellbeing & interconnections		Investigation & Evaluation Knowledge & Skills	Action Competency (systems & futures/ design thinking)	
10%	10%	10%	30%	20%	20%	100%

7.3 Sample Case Studies

The Galileo Educational Network (2012) is a valuable online source for teacher-designed units of study that exemplify authentic assessment. Working alongside Galileo professional developers, teachers have created a number of inquiry-based studies, designing tasks for and with their students. These two examples were provided in the exemplary teaching practices.

The unit, *Can Bears and Humans Co-exist?* For Grade 6 (<http://www.galileo.org/initiatives/bears/index.html>) involved students in examining this real-world issue by developing and carrying out a survey with the public, developing a poster and brochure for public education, writing a letter to a cabinet minister, and demonstrating their speaking skills by educating younger students on the issues. Further tasks that enable authentic assessment include: journaling, debating, creating a podcast, identifying appropriate actions and then taking action. Actions range from creating a poster and translating it into different languages for tourists, creating an interpretive program or art show, making a documentary and showing it in the community to planning and enacting a bear attractant reduction action.

Another example, *Know the Bow*, for Grades 3,5,7,8,9,11 includes a cross-curricular study that incorporates science, language arts and social studies. It incorporates research and action leading up to presentations at a community water symposium. This particular activity outlines the tasks as well as an assessment rubric for this activity that may be helpful in designing similar rubrics. Further details of this unit can be found at <http://www.iostudent.com/3139>. The rubric is included below.

Task 1: Water We Doing - Cayley's Water Symposium

	1	2	3	4
Research - Content	Information is inaccurate or contains significant gaps	Information is accurate but not always complete	Information offers a comprehensive and accurate picture of the topic	In-depth research calls on a wide variety of resources



	1	2	3	4
		Limited research		
	Information comes from few sources	Information comes from a limited scope	Adequate research scope	Content is fresh, original, insightful
		Some interpretation of facts	Ideas, themes or patterns are developed	Ideas and interpretations are insightful
Organization	May contain many facts, but they are not developed as ideas, themes or connections	Connections with larger contexts are not always clear	Makes connections with larger contexts	Connections with larger contexts are sophisticated creative and comprehensive.
	Student relied heavily on one source.	Student used a limited number of sources.	Student used a variety of sources.	Student used an extensive variety of sources representing different perspectives.
Information Gathering	The source (text and graphics) is documented but not in the desired format.	Most sources (text and graphics) are documented but many are not in the desired format.	All sources (text and graphics) are accurately documented, but few are not in the desired format.	All sources (text and graphics) are accurately documented and in a recognized standard (such as APA) format.
Recommendations out of the study	Identifies no issues, questions or recommendations for further study.	Identifies limited but appropriate issues, questions or recommendations for further study.	Issues, questions or recommendations identified for further study are interesting and appropriate	Issues, questions or recommendations identified for further study are intriguing and worth serious consideration for follow-up
Oral Presentation	Student mumbles, incorrectly pronounces terms, clarity, expression, and speaks too	Student's voice is low. Audience members have difficulty hearing	Student's voice is clear. Most audience members can hear	Student uses a clear voice so that all audience members can hear



	1	2	3	4
eye contact	quietly for students in the back of class to hear. Student reads all of report with no contact.	presentation. Student occasionally uses eye contact, but still reads most of report.	presentation. Student maintains eye contact most of the time but frequently returns to notes.	presentation. Student maintains eye contact with audience, seldom returning to notes.
Technology	No use of technology during the study to research or present.	Limited use of technology during the study to research or present.		



8.0 Pathways to Environmental Literacy

8.1 The Beginning

The Environmental Education Framework is a beginning step in building the pathways to achieve environmental literacy in Alberta schools. Transforming education is an in depth process that takes time, resources and the will to create change in education.

Alberta Education has accomplished a lot in this process but there is much more work to complete. Alberta Education has a three-year plan for curriculum redesign. This is no easy task and the process that they have embarked on goes far beyond just updating or changing programs of study (curriculum documents). The Education Act was passed on November 19, 2012. The Ministry will now work to develop the supporting regulations and policy over the next 18 months and once these are ready, the Act will be proclaimed (anticipated date September 2015).

A new [Ministerial Order](#) that outlines the goals and standards for the provision of basic education in Alberta has been announced. As well, “Guiding Principles for Curriculum Development” and “Standards for Curriculum Development” are also being created. These are in draft format with more input and work to be done in 2013. These will be the overall guides for future curriculum development changes.

Alberta Education has begun work on creating literacy and numeracy benchmarks as well as the cross-curricular competency indicators. The Environmental Education Framework supported the work of Alberta Education in developing indicators for the cross-curricular competencies.

In the next year, Alberta Education will be working with school jurisdictions to co-create new, competency-focused programs of study for K-12 subjects (mathematics, sciences, social studies, language arts, wellness education and arts education). Classroom-based assessment and learning and teaching resources will also be developed. There is no established date for the completion of this work.

Assessment practices will also change. Alberta Education is creating a new provincial assessment model (K-9) and prototyping is scheduled to begin at the lower elementary level in 2014-2015. Provincial Assessment Test replacement will be phased in, starting in Grade 3.

8.2 What is Next?

As stated, transforming education is an in depth undertaking and the Environmental Education Framework was developed as a first step. A successful transformation requires work in a number of areas:

- Alberta Education curriculum redesign
- Teachers having the time and resources to embrace the new direction
- A willingness for school administrators, teachers and the community to embrace and support the change



The Environmental Education Framework is a tool that can showcase and support Alberta Education, teachers, school administrators and the community in understanding the importance and benefits of environmental education in curriculum. The Framework's main purpose is to guide curriculum developers in creating new curriculum documents by providing the background research and direction needed to achieve environmental literacy for the 21st century. It also provides tools to guide teachers in creating the change in their classrooms and for the external community to understand the benefits and importance of environmental education.

ACEE has begun work to engage with teachers, education leaders, Alberta Education, environmental educators, the environment community, the corporate social responsibility and sustainability community and others to ensure that environmental education becomes an even more central component of future curriculum. The engagement process will also help a much broader community become champions of environmental education.

A community engagement session was held on April 25th in Canmore, Alberta. Participants helped further identify competency indicator statements and to refine key messages that the community needs to share regarding the importance and need for environmental education. The work in this session helped guide the work for future engagement sessions.

Future engagement sessions will be held on:

- July 10 – Calgary – 12:00 – 4:30 [REGISTER](#)
- July 18 – Edmonton – 12:00 – 4:30 [REGISTER](#)

ACEE will also continue to work closely with Alberta Education as it continues its work on curriculum redesign. The focus will on the work Alberta Education will be doing with school jurisdictions to co-create new curriculum. ACEE will also continue to engage a broad stakeholder community in this work as well.



9.0 Literature Review on Environmental Education Competencies

9.1 Executive Summary

This literature review specifically addressed the “social, cultural, global and environmental responsibility” competency in Alberta Education’s new *Framework for Student Learning* and the connection to other competencies is also clearly delineated. The Literature Review does not draw any boundaries between areas but due to time and budget constraints and the expertise of ACEE, the work has more of a focus on environmental responsibility.

The purpose of the literature review is to know what is happening in the realm of environmental education internationally, nationally and in Alberta. This review identifies literature relating to the leading research, policies, and recommendations in the field of environmental education, using the broad definition of environmental education and literacy defined in Appendix 3. The literature review summarizes what the research is stating and does not make any recommendations or suggestions regarding the direction of environmental education in Alberta. The literature review answers the following questions:

What does research say about the benefits of and need for environmental education in relation to formal education and developing social, cultural, global and environmental responsibility?
What has already been done with regard to incorporating environmental education in formal K-12 education internationally, nationally, and provincially?
What does current research say about environmental literacy and competency?
What does research say about schools of thought in environmental education in relation to competency and learning outcomes?

What are the main categories and descriptors incorporated in environmental education that lead to developing social, cultural, global, environmental responsibility?

The research supports the claim that “Environmental education prepares all citizens with 21st Century essential skills that contribute to healthier, more environmentally sustainable, and economically prosperous communities” (NAAEE, 2008, p.3). It has shown to improve student health, wellbeing, academic performance, engagement in learning, and developing social, cultural, global and environmental responsibility.

A variety of schools of thought in environmental education as well as competencies are identified. These tend to emphasize either instrumental or intrinsic types of learning. Recent literature emphasizes the need to incorporate social learning and suggests environmental education has a mandate to incorporate all three types of learning. The literature review highlights the scope of environmental education and informs the development of competency categories and descriptors important in developing social, cultural, global and environmental responsibility. The research identified the following 6 key organizing ideas:

- Understanding ecological principles (ecological foundations), processes



- and systems.
- Environmental sensitivity (empathy and connections); Build identity
- Understanding systems & issues: ethical mind; be aware of, develop
- and discuss attitudes and values.
- Investigation and evaluation knowledge and skills.
- Action competency.
- Social Responsibility; Citizenship.

This document cross-references these organizing ideas and their descriptors to the Alberta Education Framework for Student Learning cross-curricular competency groupings as well as instrumental, intrinsic and social levels of learning. As such, they provide a strong foundation for developing a Framework for Environmental Education for K-12 learning.

9.2 Scope

The literature review will look at environmental education as defined in “A Framework to Advance Environmental Education in Alberta” (ACEE, 2007) and listed in Appendix A:

Through consecutive summits on environmental education, Albertan stakeholders have consistently insisted that environmental education show varying perspectives on issues, showing learners how to think, not what to think; and that environmental education should take place in a way that allows the learner to understand the interconnections between environment, society, and economy, learning the social, economic, and political implications of decision making in connection with the environment and the use of natural resources.

Appendix A also illustrates the connection between environmental education and education for sustainable development. As well, it outlines the evolution of sustainable development from the 1980s to the present.

The literature review uses the broad definition of environmental education (above) and this connects very well with the Framework for Student Learning competency wheel (Appendix C). The work ensures that the “Social, Cultural, Global and Environmental Responsibility” competency is well covered in the literature review and the connection to other competencies is also clearly delineated. The competency is very broad and the research overlaps many areas. The Literature Review will not draw any boundaries between areas but due to time and budget constraints and the expertise of ACEE, the work will have more of a focus on environmental responsibility.

The Framework for Student Learning (Alberta Education, 2011) provided a description for “Social, Cultural, Global and Environmental Responsibility” as follows:

Alberta students are responsible and contribute positively to the quality and sustainability of their environment, communities and society. They appreciate social, cultural, economic and environmental interconnectedness and diversity, demonstrate stewardship, and respect the rights and beliefs of others within local and global communities. Their potential to contribute to their communities, including as volunteers,



is enhanced through their personal understanding of place and their ability to value fairness, equity and the principles of a democratic society. As active participants in their local and global community, they act responsibly and ethically in building and sustaining communities. In developing their identity, learners see themselves as individuals and as active agents of a broader world.

The literature review summarizes what the research is stating and does not make any recommendations or suggestions regarding the direction of environmental education in Alberta. The literature review answers the following questions:

What does research say about the benefits of and need for environmental education in relation to formal education and developing social, cultural, global and environmental responsibility?
 What has already been done with regard to incorporating environmental education in formal K-12 education internationally, nationally, and provincially?
 What does current research say about environmental literacy and competency?
 What does research say about schools of thought in environmental education in relation to competency and learning outcomes?
 What are the main categories and descriptors incorporated in environmental education that lead to developing social, cultural, global, environmental responsibility?

9.3 Incorporating EE in formal K-12 education

This section deals with policy that supports the incorporation of environmental education into formal K-12 education internationally, nationally, and provincially, identifying numerous ways of categorizing and describing necessary competencies and learner outcomes.

9.3.2 International

Environmental education has strong international support is recognized as an essential process to bring about sustainable development (UNESCO, 1975; UNESCO, 1977; UNCED, 1992; CMEC, 2010). The proclamation of the United Nations Decade of Education for Sustainable Development (2005-2014) recognizes there is no universal model of education for sustainable development. It does, however, recognize it must promote:

- respect for human rights and a commitment to social and economic justice for all;
- respect for the human rights of future generations and a commitment to intergenerational responsibility;
- respect and care for the greater community of life in all its diversity, which involves the protection and restoration of the Earth's ecosystems; and
- respect for cultural diversity and a commitment to build a culture of tolerance, non-violence and peace, both locally and globally.

The Bonn Declaration (UNESCO, 2009) supports environmental education, recognizing Education for Sustainable Development (ESD) is based on values, principles and practices necessary to respond effectively to current and future socio-ecological challenges. It contributes to creating resilient, healthy and sustainable societies through a systemic and integrated approach. ESD is underpinned by principles of environmental protection and restoration, natural resource conservation and sustainable use, addressing unsustainable production and consumption patterns, and the creation of just and peaceful societies. ESD emphasizes creative and critical



approaches, long-term thinking, innovation and empowerment for dealing with uncertainty, and for solving complex problems. ESD highlights the interdependence of environment, economy, society, and cultural diversity.

9.3.3 Australia

The Australian Government (2010) has developed a Sustainability Curriculum framework to provide information and guidance on how education for sustainability may be structured to support a progression from Kindergarten to year 10. It uses the 3 organizers of: knowledge of systems; repertoires of practice; and sustainability action process.

New South Wales Department of Education and Training (2009) has developed a conceptual framework for Learning for Sustainability. It outlines what citizens should know, be able and motivated to do to create an ecologically sustainable society. The framework is built on 4 concentric circles. From inner to outer these are:

Wellbeing (personal, family, community)

Citizenship (global citizen, biosphere custodian, change agent)

Sustainability Skills (world viewing and valuing, systems thinking and testing, futures thinking and designing)

Knowledge (ecological systems and processes, social systems and technologies)

9.3.4 Vermont

Shelburne Farms, Vermont is a National Historic Site and environmental education centre that has been central to developing environmental education in Vermont through their Sustainable Schools Project. The Shelburne Farms' Sustainable Schools Project (2011) builds on the 2004 edition that was developed and funded by Vermont Education for Sustainability. It is designed to introduce education for sustainability (EFS) to educators and administrators, highlight Vermont as a case study in EFS, and provide a framework and scope and sequence for incorporating education for sustainability and environmental education into the K-12 curriculum. Learning is through the lenses of key ecological concepts or principles: community, systems, diversity, interdependence, cycles, change, limits, equity, sense of place, self-efficacy & responsibility, and long-term effects. As these concepts are the basis of sustainable natural systems, using these lenses to structure curricula develops environmental literacy and competency to achieve the intertwined goals of economic prosperity, environmental integrity and social equity. Below is their scope and sequence based on these ecological lenses.



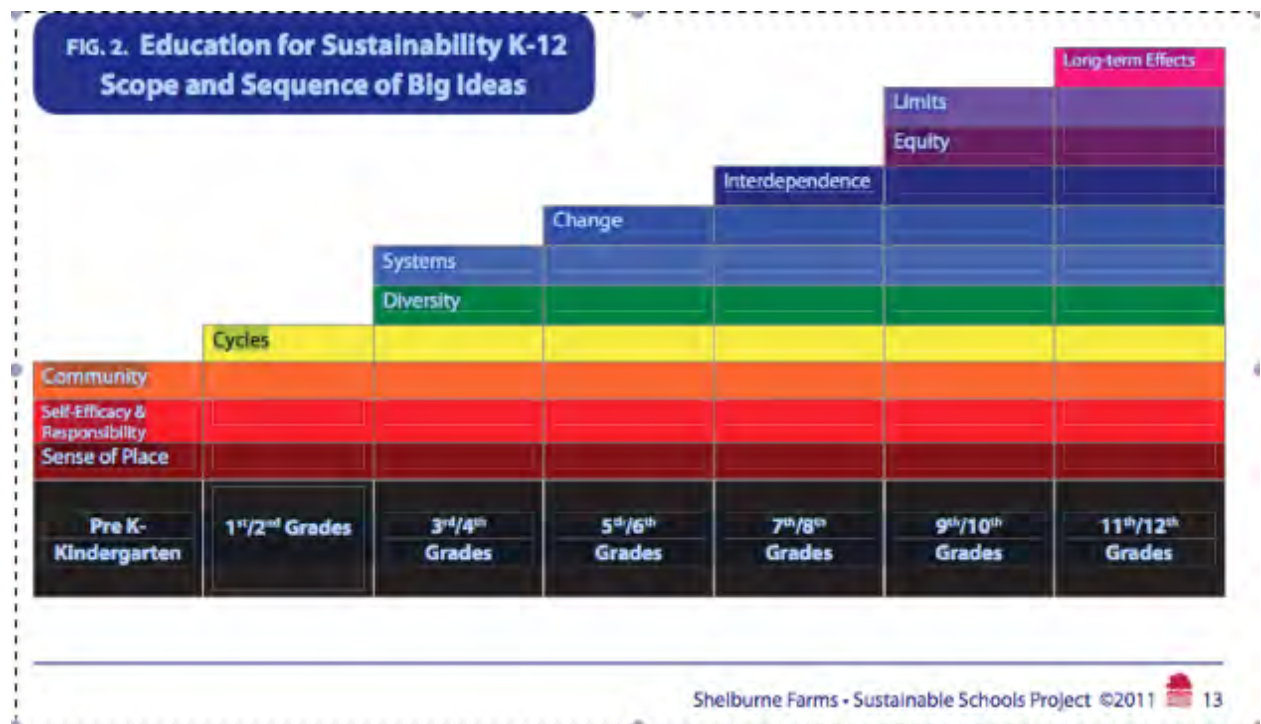


Figure 6: Education for Sustainability K-12 Scope and sequence based on ecological concepts.

9.3.5 Canada

The Council of Ministers of Education of Canada (CMEC) supports the United Nations Bonn Declaration. In developing a Pan-Canadian Education for Sustainable Development Framework for Collaboration and Action, CMEC (2010) notes that Education for Sustainable Development (ESD), is sometimes referred to as Environmental Education in Canada. They emphasize that ESD entails a reorienting of education to guide and motivate people to become responsible citizens of the planet, addressing the interrelationships among the environment, the economy, and society. ESD supports the acquisition of knowledge to understand our complex world and the development of interdisciplinary, critical-thinking, and action skills to address challenges with sustainable solutions. ESD is experiential, authentic, and action-oriented education, using real-world sources rather than relying exclusively on textbooks. ESD identifies what citizens should know, be able to do, and value when they graduate from the formal school system about key sustainability issues.

The Framework for Environmental Learning and Sustainability in Canada (Government of Canada, 2007) was designed to promote, expand, support and facilitate environmental learning and sustainability in Canada. The vision of this framework is for Canadians of all generations and from all sectors of society to be given opportunities to engage in environmental learning and sustainability within and beyond the classroom walls. The government suggests with increased awareness, knowledge, skills, attitudes, values, and motivation, Canadians can become more ecologically literate and act competently to build a sustainable future for humans and ecosystems. It is believed that environmental learning and sustainability must be



inextricably linked to values and ethical ways of thinking and learners should be allowed to draw their own conclusions about issues.

The framework recognizes environmental learning should be participative and transformative. Environmental learning and sustainability should promote 'big picture' thinking with local and personal applications. It should help find new ways of understanding how we can achieve ecological sustainability while meeting our social and economic needs, ensuring that human economic and social systems are kept in balance with the Earth's natural systems.

The Canadian Framework also suggests environmental learning and sustainability should be intergenerational, interdisciplinary, call on many modes of knowing, and takes place at all levels in formal education. It recognizes that recovering, restoring, honouring and using the traditional knowledge and wisdom of aboriginal peoples will provide a sound basis for environmental learning and sustainability. CMEC also notes that environmental education should also develop a sense of place and value local knowledge while acknowledging the global nature of environmental and sustainability issues (Gov't of Canada, 2007).

Significantly, the Canadian Framework emphasizes that learning must inspire a sense of wonder and awe with respect to nature.

9.3.6 Learning for Sustainable Future (LSF)

LSF is a non-profit Canadian organization that was created to integrate sustainability education into Canada's education system. The Canadian Sustainability Curriculum Review Initiative is a project of LSF supporting the United Nations Decade of Education for Sustainable Development (2005-2014), focusing on key themes that should be incorporated in formal education. The following themes have been developed: Biodiversity, Ecology, Climate Change, Water, Energy and Community, Political Systems & Responsible Citizenship (LSF, 2012). Each document identifies learning benchmarks for grade level groupings.

9.3.7 The Western and Northern Canadian Protocol

The Western and Northern Canadian Protocol (WNCP), (2011) has developed guiding principles for WNCP curriculum framework projects. It outlines five guiding principles for rethinking curricular frameworks for the 21st Century. The framework highlights the need for:

- Depth and coherence in learning;
- Diversity as a fundamental feature;
- Disciplines are a cultural inheritance;
- Competencies unite learning; and
- Learning and living well together in an interconnected world leads to sustainability.

All WNCP curriculum frameworks must address the three pillars of sustainable development (economic, social and environmental) to enable learners to participate in and contribute to society in ways that build identity, social responsibility, citizenship, independence and an ethical mind. The principles of sustainability require us to examine critically our knowledge, skills, priorities, habits, beliefs, values, attitudes and practices. This involves:



- Understanding knowledge, including indigenous knowledge, as a lived practice in the world that is linked to community well-being, individual well-being and ethical issues on the use and application of knowledge in the world, and therefore, is a critical factor for sustainable development.
- Explicitly linking a living knowledge of the world to the functioning and wellbeing of a democratic, diverse, multicultural and First Nations, Métis and Inuit society.
- Creating collaborative opportunities that bring together communities in shared activity—including elders, parents/caregivers, the broader community as well as links to knowledge practices in the local and global communities.
- Respecting other people in the local community and in other places of the world. Cultivating a sense of local, national and global citizenship, coupled with a concern for environmental stewardship.

As environmental education is recognized as an essential feature of education in the interconnected reality of the 21st Century, many other provinces are redesigning their K-12 education, in line with CMEC and WNCPC guidelines.

9.3.8 Alberta

Alberta's Ministry of Education (2011) has developed *The Framework for Student Learning: Competencies for Engaged Thinkers and Ethical Citizens with an Entrepreneurial Spirit* in response to dialogues engaging diverse stakeholders about the kind of education students need to meet the opportunities and challenges in the 21st Century. The framework incorporates competencies related to:

- Social, cultural, global and environmental responsibility;
- Communication;
- Digital and technological fluency;
- Life-long learning, personal management and wellbeing;
- Collaboration and leadership;
- Critical thinking, problem solving and decision making; and
- Creativity and innovation

When one considers the mandate, scope and focus of environmental education outlined above by the research, UNESCO and CMEC, each of the competencies in this educational framework are clearly addressed and incorporated in the competencies inherent in environmental education.

Following an extensive literature review ACEE (2010) identified guiding principles for a new curriculum for Alberta education, as an input to one of the Provincial Symposia hosted by Alberta Education. Once again, these are corroborated by this literature review as synonymous with environmental education and supportive of Alberta's Framework for Student Learning. The principles are summarized as:

- Provides knowledge, skills and values clarification to learn by doing and engage in real-world, personally relevant, project based learning;
- Empowers engagement with democracy and citizenship;
- Promotes health, happiness, quality of life, and a sense of meaning, purpose and interconnectedness with one's physical and social environment;



- Encourages systems thinking, understand complexity and multiple perspectives;
- Supports multidisciplinary and interdisciplinary teaching;
- Is flexible, responsive and adaptable to changes;
- Emphasizes depth not breadth, allowing relevant, meaningful learning; and
- Provides learning in local communities and environments

In light of the new developments in Alberta Education it is particularly important to recognize the contribution of past and present initiatives. The present science and social studies curricula incorporate strong environmental perspectives. The Science, Grade 1-6 curriculum incorporates environmental literacy topics into every grade level. The Grades 7-10 curriculum guidelines emphasize the interrelationships of science and technology and society and the need to critically address societal, economic, ethical and environmental issues. The Social Studies curriculum uses an issue-focused approach. Of the six organizational strands, the strand 'The Land: People and Places' emphasizes social-ecological issues. Throughout, social-economic-environmental issues are incorporated to develop social, cultural, global and environmental responsibility.

Of particular note is Alberta Education's Junior High Environmental and Outdoor Education course that has been offered since 1990 (Alberta Education, 1990). This curriculum incorporates competencies in the outdoors, environmental literacy and in social, cultural, global and environmental responsibility. Its detailed competency indicators lead students from awareness to empowerment and a commitment to action.

9.3.8.1 Alberta Teachers

The Alberta Council for Environmental Education collaborated with the Alberta Teachers Association in its 2010 'Creating a Legacy' Curriculum Symposium' (ACEE, 2010). A team of 15 professional facilitators captured the vision of over 250 educators for the future education system that would deliver on environmental education and citizenship. Alberta teachers characterized the ideal competencies of environmentally literate students, outlined what teachers need to learn, and described their ideal education system:

- This system offers students authentic inquiry-based learning experiences.
- Students learn by doing, engaging in collaborative real-world project-based learning that is guided by their interests and relevant to their life.
- Teachers have abundant time, opportunities, and resources to create these learning experiences.
- Teachers teach the curriculum using environmental and global topics as an integrating context for learning, and 'walk the talk,' teaching through modeling appropriate behaviours.
- The system is characterized by a rich web of connections between the learner, their teachers, and the community.

This ideal system is similar in many ways to that described through 'Inspiring Action on Education' (Alberta Education, 2010).

9.3.9 British Columbia

The British Columbia Ministry of Education has developed *Environmental Learning and Experience: An Interdisciplinary Guide for Teachers (ELE)*, (Government of British Columbia,



2007). The ELE guide offers a conceptual interdisciplinary framework for introducing environmental learning into all subjects and grades. The principles for organizing and conceptualizing environmental education is based on the mnemonic - C.A.R.E. representing complexity and the integration of social-ecological systems, aesthetics, responsibility, and ethics. It emphasizes the importance of learning about, in and for the environment and for students to make informed and responsible decisions for themselves.

The BC Ministry of Education has also developed a curricular framework for a course in sustainability. The framework highlights 7 modules: an introduction to sustainability; environmental ethics and social development; ecology and nature; environmental challenges and sustainable solutions; sustainable design and technology; balancing ecology and economics; and sustainable actions.

9.3.10 Manitoba

Manitoba Education and Training (2000) has developed Education for a Sustainable Future: A Resource for Curriculum Developers, Teachers and Administrators.

This is an interdisciplinary approach, and provides direction for the integration of sustainability knowledge, skills, values, and life practices within the curriculum, the classroom, and the community. They note the process of sustainable decision-making involves a critical examination of priorities, habits, beliefs, and values. Their vision is, “Students will become informed and responsible decision-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” (Manitoba, 2000, p. 4).

Manitoba’s interdisciplinary framework focuses on the four broad categories of: Sustainability Knowledge, Skills, Values, and Life Practices. This will enable them to:

- Commit to a lifestyle consistent with the principles of sustainability.
- Take personal responsibility for a sustainable future and work towards an equitable quality of life for all.
- Think critically about global issues and take action locally.
- Advocate for a strong economy and for government policies that support a strong economy.
- Understand the consequences of unequal distributions of power; inequalities in the sharing and distribution of global resources; and the impacts of rampant consumption, consumerism, and built-in obsolescence — and live in such a way as to lessen the impact of these consequences (Manitoba, 2000, p. 11).

In facilitating curricular connections the Manitoba framework suggests using thematic topics as organizers to integrate sustainability through an interdisciplinary approach

9.3.11 Nunavut

In Nunavut the fundamental belief that the connectedness which individuals feel

for each other and to their environment has influenced their educational framework. They see this as the definition of sustainability, ultimately determining personal character and value to



the community. Within this framework ‘the igloo’ is identified as the metaphor for learning. Similar to the building of an igloo, education is seen as a spiraling, developmental progression aimed at producing resilient, lifelong learners. The proposed program of studies for Nunavut schools consists of four curricular strands embedded within six cross-curricular competencies. The four strands, replacing the subjects of the traditional school curriculum, are:

- Nunavut for Nunavusiutit- an integrated core of history, geography and environmental science;
- Wellness- an integrated core of social, emotional, physical and spiritual health;
- Communication- an integrated core of language and literacy;
- Describing and improving the world- an integrated core of math, science, technology and critical thinking.

The framing cross-curricular competencies for these strands are to:

- 1) Develop a collaborative relationship and work together for the common good;
Show environmental stewardship;
Be empowered and build capacity through knowledge and skills acquisition;
Be resourceful and seek solutions through creativity, adaptability and flexibility;
Co-operate, develop shared understanding to arrive at decisions through consensus;
Contribute to the common good through serving and leadership.

As a foundational principle, ESD is built into every aspect of the curriculum – content, teaching/ learning strategies and evaluation.

9.3.12 Ontario

The Bondar Report, *Shaping our Schools, Shaping our Future – Environmental Education in Ontario Schools*, (2007), identified the need for a comprehensive environmental education policy for Ontario schools. This report detailed the key elements in regard to leadership and accountability, curriculum and teaching and resources. The Ontario government adopted every recommendation in this report and has created *Environmental Education – Scope and Sequence of Expectations* for grades 1 to 12. They also published *Standards for Environmental Education in the Curriculum* (Ontario Ministry of Education, 2008).

The Standards for Environmental Education are statements that, taken together, describe the nature and scope of environmental education, as it will be reflected throughout the revised Ontario curriculum. They are grouped around four themes – *community, knowledge, perspectives, and action* – and are designed to prepare students to support environmental sustainability by bridging the gap between their awareness of issues and their ability to take action. On the basis of these standards, environmental education in Ontario schools will provide opportunities for learners to become environmentally literate; to apply their acquired knowledge, perspectives, skills, and practices in real-world situations; and to become environmentally responsible citizens who are aware of the global implications of local action. The standards are based on current research and a sound theoretical foundation and have been reviewed by elementary and secondary school educators and school board staff (Ontario Ministry of Education, 2008). The various strands provide students with opportunities as follows:



Community:

- Engage in authentic learning situations and interactions in their local environments (natural, built, cultural);
- Explore and appreciate the outdoors to develop their understanding;
- Develop and communicate a sense of connection with local and global environments;
- Demonstrate environmental stewardship by thinking globally and acting locally.

Knowledge:

- Study a variety of human and natural systems at local, regional and global levels;
- Develop a general understanding of the kinds of interactions that occur within and between human and natural systems;
- Understand the concept of sustainability and the behaviours, practices and approaches that promote sustainability in various areas of human activity.

Perspectives

- Consider different points of view or perspectives on the environment and the role of human beings in relation to it;
- Examine and explain the assumptions and motivations underlying their own and others' (e.g. other individuals, NGOs', governments', countries') actions and reactions with respect to environmental issues and concerns;
- Develop and articulate their own perspective on human-nature interactions and environmental issues.

Actions

- Develop skills in problem solving, inquiry and research, decision making, and action planning;
- Contribute to the protection, conservation, and remediation of the environment;
- Develop, communicate, and implement plans to support sustainability.

9.3.13 Saskatchewan

The Saskatchewan Ministry of Education has developed cross-curricular competencies supporting environmental education (Saskatchewan Ministry of Education, 2010). The report categorizes the learning into four cross-curricular competencies: Thinking, Identity and Interdependence, Literacies and Social Responsibility.

9.4 Schools of Thought in Environmental Education in Relation to Learner outcomes

As environmental education evolved there have been a number of schools of thought that have developed, as our understanding of our environmental impacts and ways we think about the environment have developed. Sauvé (2005) identifies a number of currents in environmental education including naturalist, conservation, issue or problem solving, holistic and ethnographic. There also tends to be different emphases within these currents.



The naturalist current is centered on human relationships with nature. This incorporates learning in and about the environment, stressing inquiry learning and the intrinsic value of nature. Within this naturalist current Van Matre (1990) argued for deep emotional attachments to the natural world and puts this lack of focus down to there being no clear definition of environmental education. He argued that as environmental education developed it became anything and everything related to an environment. He goes back to the common definition, 'Environmental Education is education in, about and for the environment' feeling it opened up the field to such diverse applications that almost any educational experience could qualify. Even the word 'environment' was interpreted widely.

In response to this confusion, Van Matre (1990) developed Earth Education. He clearly identified its goals as helping people learn a) how ecological systems of the earth function; b) how we are personally tied into those systems in our lives; and c) how we can make changes (individually and collectively) in order to lessen our impact upon those systems. Using immersing experiences to focus on natural systems Earth Education involves students in first of all understanding the ecological systems and our relationship with them and then developing a deep and abiding emotional attachment to the earth and its life. Throughout, the emphasis is on lifestyles before issues.

Within the naturalist current, Orr (1994) feels we need to develop interdisciplinary, systems thinking by immersing students, Kindergarten through to PhD, in the natural environment. This he feels would: allow first hand learning through all our senses; cultivate mindfulness by slowing the pace of learning to allow a deeper kind of knowledge to occur; encourage interdisciplinary perspectives, careful observation and the study of place; and teach students that there are some things that cannot be known or said about a mountain, or a forest, or a river – things too subtle or too powerful to be caught in the net of science, language, and intellect.

Higgins (1996) believes outdoor education has a valuable contribution to make in developing an environmentally sustainable society by incorporating an environmental dimension to outdoor education. He feels this will help students develop an understanding of the consequences of individual actions on the environment through direct experience and the involvement of the affective, emotional and physical dimensions as well as the cognitive.

Although Van Matre offers a clearly defined ecological perspective, authors such as Robinson (1998) take exception to Van Matre's premise that there should be one clear model that all should aspire to. Warner (1993) also critiques the single model approach as the romantic metaphors about the natural world that pervade much of the programming in Earth education are irrelevant for many people in non-European cultures and inner cities. Van Matre's approach also falls short of the recommendations of Webster (2004), Tilbury & Wortman (2004), Fein (2000), Huckle & Sterling (1996) and Smyth (1995) among others who argue environmental education or education for sustainability needs to have a wider focus, have more emphasis on social perspectives, and be central to all learning rather than as a separate program or package.



The conservation current, one that tends to focus on the 3-Rs of reduce, reuse, recycle as an early response to environmental issues. It tends to see the environment as a limited pool of resources and focuses on environmental management.

The problem-solving current or issue-based approach current in environmental education developed further, focuses on learning about environmental issues and developing the skills and attitudes to deal with them. Beyond first hand immersing experiences with the natural world, Orr (1994) feels both students and teachers need to work together in an effort to solve real problems in an attempt to integrate learning with service. This broadens the educational institute so that it incorporates the communities of which it is an integral part. By involving people in a common effort to accomplish something that needs to be done, "...students and faculty alike discover that they are competent to change the things that otherwise appear to be unchangeable." (Orr, 1994, p. 98).

As Fein (1993) noticed, much environmental education tends to centre on processes and skills for inquiry into environmental issues and environmental problem solving. Issue-based environmental approaches became very popular through the Eco-schools programs in Europe. The Foundation for Environmental Education in Europe (FEE) developed the Eco-schools Program in response to the Rio Earth Summit's Agenda 21 document, which promoted local action to solve global environmental problems. FEE Eco-schools offer opportunities for schools to link with their communities and work together to solve and prevent environmental problems at the local level (Henderson and Tilbury, 2004).

Eco-schools as well as others in the issue-based current typically added environmental education onto the existing curriculum in an 'infusion' approach that attempts to supplement the curriculum by sprinkling environmental messages and activities throughout (Henderson and Tilbury, 2004). The theory behind it is interdisciplinary, trying to tie subjects together to give a holistic picture. Smyth (1995) supported this, arguing that environmental education should not be a separate educational package as it came to be structured and recognized, but rather it should seek to reform education.

Although issue-based approaches received a lot of attention in environmental education, systemic, holistic, eco-centric approaches became critical of this current. As early as 1987, Gough, (1987) has criticized the early "in, about and for" model. He states:

Apart from being somewhat patronizing and anthropocentric (who are we to say what is 'good for' the environment, and which environment is 'the environment', anyway?), this slogan maintains the sorts of distinctions that tend to work against a deeply ecological world view – distinctions between subject and object, education and environment, learner and teacher (Gough, 1987, p. 50).

Gough (1987) suggests attention be shifted away from *objects* of environmental education towards the interactions or inter-relationships that exist among people and environments. "As a foundation for educational inquiry, an ecological paradigm should give us cause for optimism that we may someday learn to live, and live to learn, *with* environments." (ibid, p. 50).



Webster (2004) also criticizes the issue-based approach as being an example of programs that lack the essential basis of ecological understandings and the development of systemic thinking, as a necessary pre-requisite to developing sustainable attitudes and behaviours. He feels we have taught people the names of some of the parts of the earth but have failed to convey how it functions as a whole. As a result students have not made simple connections between their lifestyle decisions and how they are contributing members of the systems they influence and are influenced by. This highlights the systemic, eco-centric current as well as another strong current in environmental education, one that is focused on the importance of values and ethical competency (Sauvé, 2005).

Sauvé (2005) also recognizes an ethnographic current in environmental education. In emphasizing the cultural dimension of environmental relationships, this current recognizes the importance of taking into account the culture of reference for cultures or populations. Accordingly, pedagogy should be adapted to different cultural realities and pedagogy should be drawn from these diverse cultures that have another relationship to the environment.

The development of these currents in environmental education have all added important perspectives and broadened our understanding of important dimensions of environmental education to create social, cultural, global and environmentally responsible citizens. This framework highly values the naturalist, holistic and ethnocentric currents. These currents recognize how humans are part of the environment, needing to deal with socio-ecological issues by learning to live with environments through systems thinking.

9.5 Environmental Competencies

As many schools of thought have developed in environmental education over the years it is helpful to see them in light of the types of competencies and learning outcomes they promote. This may be helpful, as over the years there has been a significant amount of argument in the literature regarding schools of thought and the type of competencies environmental education should incorporate. Numerous environmental education frameworks that have influenced the development of environmental education in North America through the 1980s and 1990s have identified environmental learning outcomes in terms of cognitive, affective, intrinsic, behavioural, instrumental, and social competencies (NAAEE, 2010).

9.5.1 Instrumental Competencies

An instrumental view of education sees it essentially as a means to an end. With an instrumental objective environmental education then becomes an agent or vehicle for a specific outcome such as educating *for* the environment or developing sustainable lifestyles. Instrumental competencies focus on pre-determined learner outcomes. Sterling (2010) suggests much of the early work in environmental education had, and often still has, an instrumental focus. The emphasis is on increased awareness and understanding, and attitudinal and valuative change leading to action towards environmental protection. Volk (1993) exemplifies this type of competency, identifying Investigation & evaluation, and Action skills as well as Environmental sensitivity, Ecological foundations, and Issues & values as elements of environmental education.



Monroe, Andrews, and Biedenweg, (2007), developed their Framework for Environmental Education Strategies by reviewing a variety of recent environmental education frameworks from WWF projects and Scott and Gough (2003). From this they propose a framework for environmental education based on the four categories of: Convey information; Build understanding; Improve skills; and Enable Sustainable Actions. These issue-based, problem-solving approaches to environmental education tend to focus primarily on instrumental competencies.

9.5.2 Intrinsic Competencies

In contrast to instrumental competencies, intrinsic competencies are related to process rather than product. They focus on the internal transformation of the learner so they cannot have pre-defined outcomes. Numerous researchers question the prescriptive, at times dogmatic tendencies of the instrumental approach of education for the environment, objecting on educational grounds (Sterling, 2010; Jickling 2001; Selby, 2008). These authors emphasize the importance of intrinsic competencies, highlighting the need for critical thinking and reflection on values, ethics and assumptions. This emphasis on intrinsic competencies lines up with Albertan's concern that environmental education should teach people how to think, not what to think (Appendix 3). An instrumental approach might focus on "we must learn to recycle", whereas an intrinsic approach would ask, "should we recycle?"

Fontes (2004) traces the development of action competencies in environmental education, recognizing the importance of affective as well as cognitive competencies. These are further identified as factual, interpretive and commitment competencies (relating to values, ethics and motivation). He emphasizes that these need to be practiced in complex, authentic social situations. Mogensen and Schnack (2010) support competency indicators in Education for Sustainable Development and argue for open-ended rather than prescriptive competencies recognizing the need to motivate active citizens in a complex uncertain world.

Foster (2001) argues it is essential education move beyond instrumental environmental education competencies to developing a learning mindset and a learning society. Scott and Vare, (2008, 3) suggest the intrinsic view 'involves the development of learners' abilities to make sound choices in the face of uncertainty and complexity of the future'.

Bonnett (2002) concurs, insisting we need to move beyond instrumental and action competencies in environmental education and education for sustainable development to develop sustainability as a frame of mind. This necessitates engaging students in exploring the dominant motives that are in play in society, inherent in our fundamental ways of thinking about us and the world; and the need to strengthen our intimate connection with the power and gift of nature. In this view environmental and sustainability issues provide an important context for learning, but whether or not the learner engages in environmental protection or sustainable behaviour, although important, is secondary to the judgment that needs to be made by the critically reflective learner (Sterling, 2010).

Gunderson and Holling (2002) argue that dynamic and evolving systems and relationships between people and nature require an emphasis on resilience defined as persistence,



adaptiveness, variability and unpredictability. As social-ecological systems are constantly changing, the literature supports students developing the competencies to both understand resilience and become resilient in being able to adapt and change as social-ecological systems emerge (Sterling, 2010; Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci & Rumble, 2012).

This is also supported by Krasny and Roth (2010), who see the need to integrate environmental education at multiple scales, so that it deals with building capacity at the level of the individual, and adaptive capacity at the level of the social–ecological system. With this emphasis on needing to adapt and change as social-ecological systems emerge, Foster (as quoted in Sterling, 2010) emphasizes the importance of open-ended learning equipping students with knowledge, sensitivity, emotional range and moral imagination to act together as a genuine learning community. These competencies, relating specifically to being a resilient learner, correspond to the intrinsic learning competencies identified in the Competency Categories and Descriptors outlined in the next section.

As Plummer (2010) notes, recognizing linkages between the social and ecological systems has supported integrative approaches and principles for understanding the complex social-ecological systems we are dealing with in transitioning to a sustainable society. He argues that incorporating the concepts of resilience into environmental education enhances problem-solving capabilities.

These intrinsic competencies are incorporated in what Sauvé (2005) recognized as the systemic, holistic and ethnographic currents in environmental education. Due to the systemic, social nature of these currents, they also incorporate social learning competencies.

9.5.3 Social Learning Competencies

Social learning competencies are focused on learning in context and in collaboration with others. These competencies relate to being able to engage positively with, collaborate and learn from and with diverse ages, cultures and a cross-section of community members. The benefits social learning in environmental education were highlighted by Manion and Lynch (2010), as noted earlier in Section 2. Social learning competencies are developed through service, issue-based learning referred to by Orr (1994) and place-based, intergenerational learning experiences that use the environment as an integrating context (Manion and Lynch, 2010). Social learning supersedes and goes beyond the traditional educational focus on individualism, recognizing communities are essential learning frameworks, and the whole, what is experienced collectively, is greater than the sum of individual experiences and actions.

This empowering social context is essential in relation to the past emphasis on individual responsibility and negative environmental messaging today's K-12 generation has grown up with. O'Neill and Nicholson-Cole (2009) found the 'doom and gloom' messaging related to the environment has resulted in a sense of hopelessness and stress. They found that fear messaging has the potential to attract people's attention but it is an ineffective tool for motivating genuine effective engagement. The authors note that when people cannot control an external fear they try to control the inner fear through issue denial or apathy, both of which become barriers to meaningful engagement. Further barriers to acting individually include uncertainty and



skepticism, externalizing responsibility and blame, stating other issues are more pressing, and fatalism. Nonthreatening imagery and icons that link to individuals' everyday emotions and concerns tend to be the most engaging. They also note literature that suggests people become desensitized to fear and fear may damage trust in the communicator. These findings emphasize the importance of environmental education having a positive, empowering focus in order to engage students and encourage social, cultural, global and environmental responsibility.

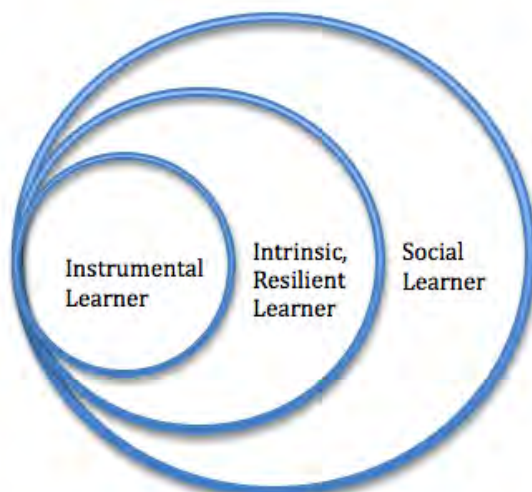
9.6 An Integration of Competencies and Schools of Thought

Although there is significant debate between instrumental and intrinsic educational traditions, as shown above, environmental education is recognized as a combination of these different currents and competencies. In recognizing the urgency of collaborative problem solving, given the sustainability issues that face us, Sterling (2010) recognizes the intrinsic stance may be necessary, but not sufficient. He therefore suggests environmental education has a mandate to incorporate both instrumental and intrinsic competencies, which are individually focused, with social learning that is community based. He argues that social learning is essential as it emphasizes and enables collaboration and participative learning, self-organization and emergence, and engagement with real-world issues in local contexts, thereby enabling innovation and changes in worldviews.

Other researchers also advocate an amalgamation of these 3 types of competencies. Tilbury & Wortman (2004), in their publication to support the UN Decade in Education for Sustainable Development (2005-2014), exemplify case studies from around the world to highlight the importance of futures thinking, critical thinking and reflection, participation in decision-making, partnerships and systemic thinking. Based on research across North America, in developing guidelines for environmental education, the North American Association of Environmental Educators (NAAEE, 2010) incorporates these three types of competencies in their four strands in environmental education: questioning, analysis and interpretive skills; knowledge of environmental processes and systems; skills for understanding and addressing environmental issues; and personal and civic responsibility.

Sterling (2010) emphasizes an ecological transformative learning theory, identifying these types of learning with Bateson's (1972) levels of learning. In considering these types of learning competencies as learning responses to the environmental/sustainability crisis, he suggests instrumental competencies fall into the category of a first-order or basic learning response; intrinsic competencies consistent with a second-order learning response and social competencies as a third-level response subsuming the other levels. Sterling sees the value of each level of learning relative to the development of the student as an individual, instrumental, and intrinsic, resilient learner to becoming a social learner, identifying themselves as part of their social-ecological community and developing society. These three levels, of learning for environmental education, as identified by Sterling, are conceptualized in Figure 6.





Levels of Learning in Environmental Education

Figure 6: A conceptualization of Sterling's (2010) argument that Environmental Education has a mandate to foster all 3 Levels of Learning

As Section 8.5 shows, the literature reviewed supports that enabling positive, effective engagement at instrumental, intrinsic and social levels is essential given the socio-ecological stresses our society is faced with.

9.7 Key Organizing Ideas and Descriptors of Environmental Literacy

The literature in the previous sections relating to initiatives to incorporate environmental education in formal K-12 education internationally, nationally, and provincially; environmental literacy; and schools of thought in environmental education, identified numerous ways of categorizing and describing necessary competencies and learning outcomes. The following five categories were identified consistently (Appendix B), even though in various references, some of the categories were subsumed within a broader classification system. Six categories have been identified here to give detail and clarity to the findings in the literature. The following six key organizing ideas were identified consistently (Appendix 5), even though in various references, some of the key organizing ideas were subsumed within a broader classification system. Six have been identified here to give detail and clarity to the findings in the literature. The six broad key organizing ideas are:

- Understanding ecological principles (ecological foundations), processes and systems
- Environmental sensitivity (empathy and connections); Build identity
- Understanding systems & issues; ethical mind; be aware of, develop and discuss attitudes and values
- Investigation and evaluation knowledge and skills
- Action competency
- Social Responsibility; Citizenship



The descriptors of these key organizing ideas, that provide further detail, are incorporated in the table below.

The Literature Review also showcased different levels of learning as instrumental; intrinsic and resilient; and social. The related environmental education learning levels and competencies are cross-referenced in Table 1 to clarify the level of learning that relates to each key idea and descriptor. The numbers in yellow correspond to the following levels of learning:

- 1) Instrumental levels
- Intrinsic and Resilient learner levels
- Social learner levels

The colour coding shows where categories and descriptors relate to the relevant colour-coded cross-curricular competency groupings in Alberta Education's *Framework for Student Learning* (Appendix 1). The colours correspond to the following constructs:

- ✓ Social, Cultural, Global & Environmental Responsibility
- ✓ Communication
- ✓ Digital & Technological Fluency
- ✓ Lifelong Learning, Personal Management & Wellbeing
- ✓ Collaboration & Leadership
- ✓ Critical Thinking, Problem Solving & Decision Making
- ✓ Creativity & Innovation

These key organizing ideas and descriptors, incorporated in environmental education, lead to a competent, environmentally literate student and to developing “social, cultural, global and environmental responsible” citizens.

Key Organizing Ideas & Descriptors	Learner Levels	Cross-curricular competency groupings
Understanding ecological principles; processes; and systems:		✓✓✓
<ul style="list-style-type: none"> • Interdependence, cycling, community, diversity, feedback loops, adaptation, emergence, change, resilience, complexity. 	(1)	
Environmental sensitivity (empathy and connections); Build Identity		✓✓✓✓
<ul style="list-style-type: none"> • Positive relationship with nature; living in harmony with Nature and others (local to global); wellbeing; Intergenerational, inter-cultural respect 	(2)	



<ul style="list-style-type: none"> Aesthetic appreciation 	(2)	
Understanding systems & issues: ethical mind; be aware of, develop and discuss attitudes & values:		✓✓✓✓
<ul style="list-style-type: none"> How society, economy and the environment interact 	(1) (3)	
<ul style="list-style-type: none"> Systems thinking 	(2) (3)	
<ul style="list-style-type: none"> Values & implications 	(2)	
<ul style="list-style-type: none"> Ethics 	(2)	
Investigation and evaluation knowledge and skills:		✓✓✓✓✓
<ul style="list-style-type: none"> Literacy & numeracy 	(1)	
<ul style="list-style-type: none"> Critical thinking 	(2)	
<ul style="list-style-type: none"> Futures thinking 	(2)	
<ul style="list-style-type: none"> World viewing 	(3)	
<ul style="list-style-type: none"> Problem Solving 	(2) (3)	
<ul style="list-style-type: none"> Lateral thinking 	(2)	
<ul style="list-style-type: none"> Systems thinking: understand and work with complexity 	(3)	
<ul style="list-style-type: none"> Questioning, analysis & interpretation 	(2)	
Action competency:		✓✓✓✓✓



• Inner drive, motivation	(2)	
• Creative, innovative learners	(2)	
• Know their actions make a difference	(2)	
• Active citizens (local, regional, national, global)	(2) (3)	
• Intergenerational, inter-cultural communication skills	(2) (3)	
• Life-long learners: cope positively with change; flexible, responsive, adaptable to local needs and changing circumstances	(2)	
Social Responsibility; Citizenship:		✓✓✓✓✓✓
• Responsibility for local and global environments	(2) (3)	
• Active citizens (local, regional, national, global)	(2) (3)	

Table 1: Categories and descriptors incorporated in environmental education that leads to developing social, cultural, global, environmental responsibility.

As these key organizing ideas and descriptors were distilled from the relevant literature cited (Appendix 5), they provide foundational categories for developing a Framework for Environmental Education and the development of Learning Outcome Levels. This is original work by ACEE and Dr. Ireland that describes and defines the key organizing ideas of environmental education.

This summary, indicating the breadth and depth of environmental education shows its ability to address the needs of 21st Century learning in developing social, cultural, global and environmental responsibility. It supports a systemic, holistic educational approach that encourages systems thinking, adaptation, resilience and emergence. The work of Alberta Education, summarized in their Framework for Student Learning (Alberta Education, 2011), supports this educational approach.



10.0 Literature Review on Assessment

10.1 Executive Summary

This literature review confirms that it is possible to measure environmental literacy competencies, and clearly demonstrates how to assess environmental literacy following the principles of 21st Century standards and assessment. It provides a depth of information on valid assessment tasks and reliable assessment tools for evaluating learning outcomes. Assessment methods range from tests and questionnaires to interviews, peer assessments, journal entries, focus groups and observing skills exemplified in carrying out action projects. Authentic assessment rubrics are shown to be a valuable, effective tool to provide assessment criteria in relation to learning outcomes.

This work will assist Alberta Education in their work of developing assessment of indicators for the various competencies in the Framework for Student Learning (Appendix 1) and applies specifically to developing social, cultural, global and environmental responsibility.

This literature review encompasses both formative and summative assessment, providing details for educators in terms of assessment categories, methods, criteria, weighting and levels of performance. Throughout this review the literature identifies how we can assess real-world skills and abilities for a complex, interrelated society that is constantly adapting and changing.

In the highly interconnected, rapidly evolving reality of our developing society, assessments need to measure high level attitudes, skills and knowledge, be largely performance-based, and incorporate adaptability and the ability to cope with novel unpredictable situations. In this way, assessment should ask students to apply content knowledge to critical thinking, problem solving, and analytical tasks (Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci & Rumble, 2012).

The North American Association for Environmental Education (NAAEE), in particular, has developed an assessment framework based on an extensive literature review of assessment frameworks and validated instruments in the various domains of environmental literacy (Hollweg, Taylor, Bybee, Marcinkowski, McBeth and Zoido, 2011). They also emphasize the importance of considering context. The NAAEE framework is proposed as an optional component in the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA) 2015. It has incorporated expertise in research, assessment, and evaluation in the fields of social studies education, science education, environmental education, and related science and social science fields.

NAAEE also suggests learning outcomes related to performance standards, appropriate for assessment at grades 4, 8 and 12. Finally, this review includes NAAEE's extensive list of guiding questions in helping educators develop a contextually relevant, comprehensive environmental literacy assessment framework given particular assessment needs.



10.2 Scope and Criteria

The literature review will look at environmental education in relation to the definition generated by multi-stakeholder meetings throughout Alberta in recent years (ACEE, 2007):

Through consecutive summits on environmental education, Albertan stakeholders have consistently insisted that environmental education show varying perspectives on issues, showing learners how to think, not what to think; and that environmental education should take place in a way that allows the learner to understand the interconnections between environment, society, and economy, learning the social, economic, and political implications of decision making in connection with the environment and the use of natural resources.

Appendix 1 also illustrates the connection between environmental education and education for sustainable development. As well, it outlines the evolution of sustainable development from the 1980s to the present.

The literature review uses this broad definition of environmental education, which connects very well with the Framework for Student Learning competency wheel (Appendix 2). The work ensures that the “Social, Cultural, Global and Environmental Responsibility” competency is well covered in the literature review and the connection to other competencies is also clearly delineated. The competency is very broad and the research overlaps many areas. The Literature Review will not draw any boundaries between areas but due to time and budget constraints and the expertise of ACEE, the work will have more of a focus on environmental responsibility.

The Framework for Student Learning (Alberta Education, 2011) provided a description for “Social, Cultural, Global and Environmental Responsibility” as follows:

Alberta students are responsible and contribute positively to the quality and sustainability of their environment, communities and society. They appreciate social, cultural, economic and environmental interconnectedness and diversity, demonstrate stewardship, and respect the rights and beliefs of others within local and global communities. Their potential to contribute to their communities, including as volunteers, is enhanced through their personal understanding of place and their ability to value fairness, equity and the principles of a democratic society. As active participants in their local and global community, they act responsibly and ethically in building and sustaining communities. In developing their identity, learners see themselves as individuals and as active agents of a broader world.

This literature review summarizes what the research is stating and does not make any recommendations or suggestions regarding the direction of environmental education assessment in Alberta. The literature review will be guided by and focus on the following questions:

- 1) What assessment is recommended to evaluate the environmental and sustainability literacy of learners?
 - a) Principles of assessment



- b) Tasks/components being assessed
 - c) Assessment methods
 - d) Assessment criteria
 - e) Weight given to & within categories
- 2) What does the literature say about what to assess in environmental literacy at different grade level groupings or learning level outcomes?

Literature Review Criteria

The methodology for the literature review was a meta-analysis, focused on the following areas of review:

- Policy and frameworks for formal environmental education in K-12;
- International jurisdictions leading in K-12 environmental and sustainability education;
- Canadian jurisdictions leading in K-12 environmental and sustainability education;
- Publications in peer-reviewed journals that address research in relation to the scope of the literature review.

These were prioritized by most recent and significant literature identified by the Alberta Education member of the Project Team, PISA, the North American Association of Environmental Educators, Alberta Assessment Consortia, and ACEE.

10.3 Principles of 21st Century Standards and Assessment

Today more than ever, society needs high-quality environmental education programs that succeed in moving values and changing behaviours in the direction of sustainability and environmental conservation. Effective, relevant evaluation offers a very powerful way to improve these education programs, and enables them to succeed in accomplishing more of their objectives and goals. (Thomson, Hoffman & Staniforth, 2000, p. 3)

Assessment is an integral part of using learner outcomes to guide the learning process, and is in fact critical to learner success. For learners, it provides the means of determining if they have understood and can apply the material learned (Battersby, 1999; Huba and Freed, 2000). For educators it lets them know if their teaching has been effective.

In Chapter 2, *Principles for Twenty-first Century Standards and Assessments*, Binkley et al (2012, p24) note that,

While it should be clear that large-scale state, national, regional, or international assessments should be conceived as only part of any system to support student learning, assessments at each level represent a significant opportunity to signal the important learning goals that should be the target of the broader system as well as to provide valuable, actionable data for policy and practice. Moreover, carefully crafted, they can model next generation assessments that, through design and use, can support learning.



Binkley et al (2012, p. 24-26) suggest that twenty-first century standards and assessments should:

- *Be aligned with the development of significant, twenty-first century goals.* Standards and assessments must fully specify the rich range of twenty-first century knowledge and skills students are expected to understand and apply. In addition, the standards and assessment should ideally represent how that knowledge and set of skills is expected to develop from novice to expert performance
- *Incorporate adaptability and unpredictability.* One hallmark of twenty-first century demands is the need to adapt to evolving circumstances and to make decisions and take action in situations where prior actions may stimulate unpredictable reactions that in turn influence subsequent strategies and options. Dealing with such uncertainty is essential, but represents a new challenge for curriculum and assessment
- *Be largely performance-based.* The crux of twenty-first century skills is the need to integrate, synthesize, and creatively apply content knowledge in novel situations. Consequently, twenty-first century assessments must systematically ask students to apply content knowledge to critical thinking, problem solving, and analytical tasks throughout their education, so that we can help them hone this ability and come to understand that successful learning is as much about the process as it is about facts and figures.
- *Add value for teaching and learning.* The process of responding to assessments can enhance student learning if assessment tasks are crafted to incorporate principles of learning and cognition. For example, assessment tasks can incorporate transfer and authentic applications and can provide opportunities for students to organize and deepen their understanding through explanation and use of multiple representations.
- *Make students' thinking visible.* The assessments should provide a window into student's understandings and the conceptual strategies a student uses to solve a problem. Further, by making students' thinking visible, assessments must provide a model for quality practice.
- *Be fair.* Fair assessments enable all students to show what they know and provide accommodations for students who would otherwise have difficulty accessing and responding to test items for reasons other than the target of the assessment.
- *Be technically sound.* Assessment data must provide accurate and reliable information for the decision-making purposes for which they are intended to be used. In the absence of reasonable measurement precision, inferences from results, and decisions based on them may well be faulty. The requirement for precision relative to intended purposes means both that intended uses and users must be clearly specified and evidence of technical quality must be established for each intended purpose. Establishing evidence of quality for innovation approaches to assessing twenty-first century skills may well require new psychometric approaches.
- *Valid for purpose.* The extent an assessment is intended to serve as an indicator of schools' success in helping students acquire twenty-first century skills, skill and test results must be both instructionally sensitive and generalizable. That is, instructionally sensitive tests are influenced by the quality of instruction. Students who receive high-quality instruction should out-perform those who do not. The alternative is that students' basic ability or general intelligence, which are not under a school's control, are the reason for performance. A generalizable result transfers to other real-life applications.



- *Generate information that can be acted upon and provides productive and usable feedback for all intended users.* Teachers need to be able to understand what the assessment reveals about students' thinking. School administrators, policy makers and teachers need to be able to use this assessment information to determine how to create better opportunities for student learning.
- *Provide productive and usable feedback for all intended users.* It seems axiomatic that if stakeholders such as teachers, administrators, students, parents, and the public are expected to use the results of an assessment, they must have access to reports that are accurate, understandable, and usable.
- *Build capacity for educators and students.* Feedback from assessments can help students, teachers, administrators, and other providers to understand the nature of student performance and the learning issues that may be impeding progress. Teachers and students should be able to learn from the process.
- *Be part of a comprehensive and well-aligned system of assessments designed to support the improvement of learning at all levels of the educational hierarchy.*

10.4 Types of Assessment

Based on the literature reviewed, a number of different types of assessment relevant to environmental education were identified. Generally, the assessment process is not only a form of evaluation but is also an additional opportunity for learners to practice the application of the skills and knowledge to real-life situations and to receive helpful feedback during the process (Battersby, 1999). Thus, it is helpful to consider the assessment process as having two distinct but inter-related purposes: formative and summative. Formative assessment can be described as ongoing feedback for the purpose of improving learning and performance. Summative assessment involves a culminating assessment of learner performance against a set of predetermined standards usually described in specific grading levels. Some assignments will emphasize one type over the other but it is important to note that both are critical to ensuring that the assessment process is an integral part of the overall learning process (Hamilton, 2008). As the Alberta Education's new Framework for Student Learning and the particular construct, Social, Cultural, Global and Environmental Responsibility emphasizes student learner outcomes both formative and summative assessment is relevant.

Both formative and summative assessments rely on the provision of clear and meaningful feedback to provide learners with guidance on how to potentially improve their performance or how to apply the information gained from the assessment to future learning and assessment situations. This means that learners need an understanding of how their work associated with a specific outcome compares to a *standard*. In order to achieve this understanding, learners require a clear appreciation of the *criteria* that are being used to evaluate the student evidence related to the attainment of the specific learning outcome and the assessment tasks that enable learners to provide this evidence (Hamilton, 2008).

10.5 Assessment Categories or Tasks

The real things, the ways in which environmental education can change someone's life, are much more subtle and difficult to measure. You can ask questions about meaning, about influence, about impacts, and look at things that aren't visible necessarily over a



short time, but become apparent over the long term. This is what we have to consider as we look at effectiveness of environmental education (Dr. Rick Kool, Environmental Educator, 2000, as referenced in Thomson et al, 2000).

Hamilton (2008) notes that assessment tasks are complex and significant tasks learners complete to demonstrate mastery of the learning outcome; they also describe how the attainment of the learning outcome will be assessed within the course.

The environmental education literature research that preceded this document identified five categories in environmental education, identified in Table 1 below. These relate to assessment literature that discusses assessing knowledge, skills, attitudes, values, behaviour, and action. NAAEE (2010) in their *Framework for Assessing Environmental Literacy* categorize knowledge, attitudes & values, skills and behaviour & action as knowledge, dispositions, competencies and behaviour. It is important to note that Alberta Education's use of the term 'competency' is broader than NAAEE as it includes attitudes, skills and knowledge as outlined in their *Framework for Student Learning*. As seen in the chart below the NAAEE category of 'Competencies' is more commonly referred to in the educational and environmental literature as skills (typically related, in environmental education, to investigation and evaluation).

Table 1. A synthesis of categories for assessment

Bloom's Assessment Categories	NAAEE Categories	EE Literature Review Categories
Knowledge	Knowledge	Understanding ecological principles (ecological foundations), processes and systems; being environmentally literate
Attitudes & Values	Dispositions	Understanding systems & issues: ethical mind; be aware of, develop and discuss.
Skills	Competencies	Investigation and evaluation knowledge and skills.
Behaviour & Action	Behaviour	Action competency. Social Responsibility; Citizenship.

10.5.1 International: PISA

The Organisation for Economic Co-operation and Development (OECD) launched the OECD Programme for International Student Assessment (PISA) in 1997. PISA represents a commitment by governments to monitor the outcomes of education systems through measuring student achievement on a regular basis and within an internationally agreed common framework. It aims to provide a new basis for policy dialogue and for collaboration in defining and implementing educational goals, in innovative ways that reflect judgments about the skills that



are relevant to adult life. PISA is a collaborative effort undertaken by its participants – the OECD member countries as well as over 30 non-member partner economies – to measure how well students, at age 15, are prepared to meet the challenges they may encounter in future life. The work of PISA is particularly relevant to this document as it has been created to support Alberta students in meeting the challenge to become ethical, engaged, entrepreneurial citizens through the Alberta Framework For Student learning and the competency construct, Social, Cultural, Global and Environmental Responsibility.

The PISA assessment takes a broad approach to measuring knowledge, skills and attitudes that reflect current changes in curricula, moving beyond the school-based approach towards the use of knowledge in everyday tasks and challenges. It is based on a dynamic model of lifelong learning in which new knowledge and skills necessary for successful adaptation to a changing world are continuously acquired throughout life. While it does assess students' knowledge, PISA also examines their ability to reflect, and to apply their knowledge and experience to real-life issues.

PISA is designed to collect information through three-yearly assessments and presents data on domain-specific knowledge and skills in reading, mathematics and science. The data can be presented for students, schools and countries.

PISA focuses on young people's ability to use their knowledge and skills to meet real-life challenges. This orientation reflects a change in the goals and objectives of curricula themselves, which are increasingly concerned with what students can do with what they learn at school and not merely with whether they have mastered specific curricular content. PISA is not limited to assessing students' curricular and cross-curricular competencies, but also asks them to report on their own motivation to learn, their beliefs about themselves and their learning strategies. In assessing students' abilities to use their knowledge and skills to meet real-life challenges it appears to be particularly relevant with regards to assessing environmental literacy, and addressing the goals of Alberta Education's Framework for Student Learning: being competent in social, cultural, global and environmental responsibility and in developing engaged thinkers and ethical citizens with entrepreneurial spirit.

10.5.2 NAAEE

Based on an extensive literature review of assessment frameworks and validated instruments in the various domains of environmental literacy, NAAEE has created a detailed framework for an assessment of environmental literacy (Hollweg, Taylor, Bybee, Marcinkowski, McBeth and Zoido, 2011). This framework is also proposed as an optional component in the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA) 2015. It has incorporated expertise in research, assessment, and evaluation in the fields of social studies education, science education, environmental education, and related science and social science fields.

The NAAEE assessment framework is based on a definition of an environmentally literate person as someone who, both individually and together with others, makes informed decisions concerning the environment; is willing to act on these decisions to improve the well being of



other individuals, societies, and the global environment; and participates in civic life. Those who are environmentally literate possess, to varying degrees:

- The knowledge and understanding of a wide range of environmental concepts, problems, and issues;
- A set of cognitive and affective dispositions;
- A set of cognitive skills and abilities; and
- The appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts.

This definition treats the primary elements of environmental literacy - the cognitive (knowledge and skills), affective, and behavioral components - as both interactive and developmental in nature. They recognize individuals develop along a continuum of literacy over time - they are not either environmentally literate or illiterate.

The NAAEE Assessment Framework uses 'domains and components' to categorize assessment for environmental literacy. These domains relate to the various interrelated categories and descriptors identified in the environmental education literature review, as noted above in Table 1. These domains and their components are summarized in Table 2 below:

Domains	Knowledge	Cognitive & Affective Dispositions	Environmental Competencies	Environmentally Responsible Behavior
Components	Physical & Natural World Socio-Political Systems Environmental Issues Alternative Solutions Action Strategies	Sensitivity Attitudes/Concern Personal Responsibility Locus of Control/Efficacy Motivation/Intent	Identify Issues Ask Questions Analyze Issues Investigate Issues Evaluate/Judge Issues Defend Positions Create/Evaluate Plans	Eco-management Consumer/Economic Persuasion Political Legal

Knowledge

Environmental literacy entails knowledge of: physical and ecological systems; social, cultural and political systems; environmental issues; multiple solutions to environmental issues; and citizen participation and action strategies.

Cognitive and Affective Dispositions

Hollweg et al (2011) recognize dispositions are important determinants of behaviors related to the environment, both positive and negative. They feel the learner's dispositions towards the environment are thought to influence their willingness to recognize and choose among value perspectives, as well as their motivation to participate in public deliberations about



environmental issues. Dispositions include: sensitivity; attitudes, concern, and worldview; personal responsibility; self-efficacy/locus of control; and motivation and intentions.

Environmental Competencies

The NAAEE Assessment Framework sees *competencies* as the core and primary importance of assessment being influenced by as well as influencing an individual's *knowledge* and *dispositions*. *Knowledge, dispositions* and *competencies* are in turn expressed as *behaviours*.

The NAAEE Assessment Framework defines competencies as follows:

Competencies are defined as clusters of skills and abilities that may be called upon and expressed in real-world and assessment settings for a specific purpose. In general, a person is considered to be competent when he or she can do something repeatedly and at a certain level of quality or precision. For example, the identification of environmental issues requires the ability to receive sensory input and interpret that input on the basis of prior knowledge and experience. This competency also may require the identification and use of appropriate media sources; the ability to discriminate between features of environmental problems and issues in those sources; the ability to judge the validity of information and recognize value perspectives apparent in those sources; and the ability to determine the status and relevance of that issue (Hollweg et al, 2011, p. 7).

Environmentally responsible behavior

The NAAEE Framework recognizes competencies, knowledge, and dispositions enable and are expressed as behaviors, and environmentally responsible behavior is the ultimate expression of environmental literacy. They emphasize that treating behavior as a component of large-scale environmental literacy assessments, however, is controversial, in part because it is more difficult to assess than the other components and relies heavily on self-reports.

This Framework does, however, mention three approaches from the literature of conceptualizing environmentally responsible behavior, recognizing there may be measurement problems associated with each. Hungerford and Peyton's (1980) conceptualization includes five categories of citizen action: eco-management, persuasion, consumer/economic action, political action, and legal action. Stern (2000) has developed a second conceptualization of environmental behaviour. He identifies four categories: environmental activism, non-activist behaviors in the public sphere, private sphere environmentalism, and other environmentally significant behavior.

A third conceptualization, 'action competence', relates to systems thinking and social learning identified in the accompanying literature review for environmental education. Action competence focuses on critical, integrative thinking as it relates to contextual decisions made as part of citizen participation; the development of personal competence and agency; and collective competence and capacity. This action competence approach, as described by Jensen & Schnack (1997), Scott & Gough (2003), and Wals (2007), has not yet been used in large-scale assessments (Hollweg et al, 2011). "Systemic and integrative thinking, collaborative



deliberation, and decision making described in this approach will be called to the fore as individuals strive to create healthy built environments and vibrant and resilient social systems, and further the sustainability of Earth's systems" (Hollweg et al, 2011, p. 15)

Context

Hollweg et al (2011) recognize environmental issues do not operate in a vacuum, but in a variety of physical, personal, social, and political contexts. In different contexts, people may have different disagreements about and solutions for similar issues. As such varying contexts need to be identified in relation to the domains being assessed. They further clarify, decisions regarding the specific competencies and related components to include in any one environmental literacy assessment depend on factors such as the particular population and purpose of the assessment. Appendix 6 is a compilation of guiding questions for developing an environmental literacy assessment framework developed by Hollweg et al (2011).

Below is the NAAEE Framework for Assessment:

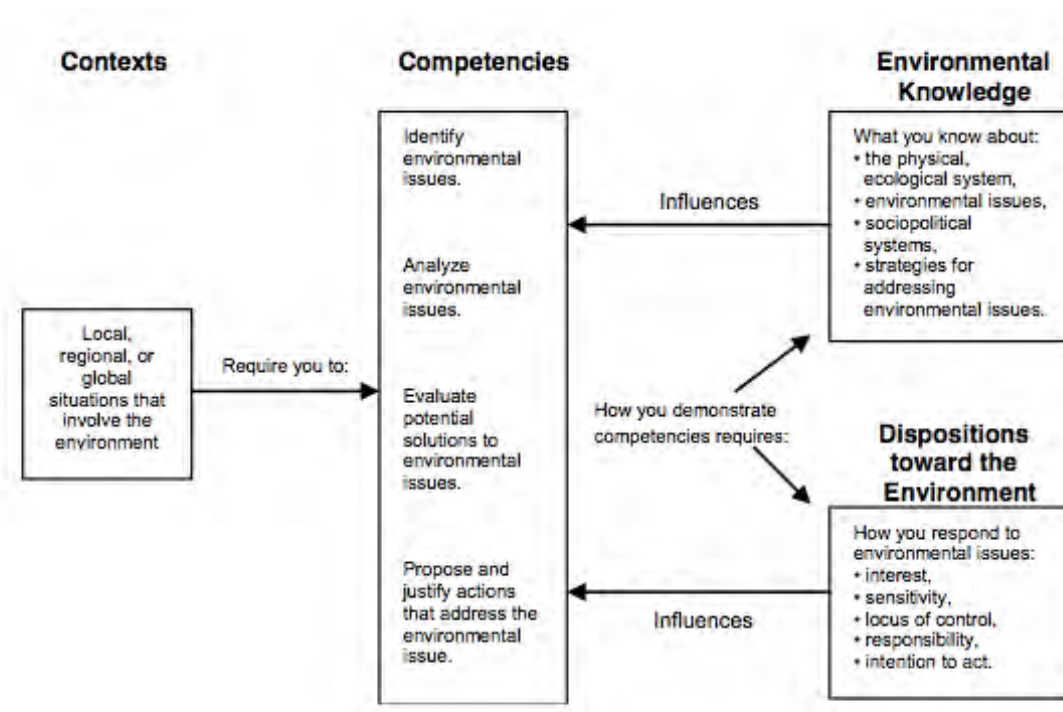


Figure 1: NAAEE Framework for Assessment

10.5.3 Environmental Education Council of Ohio

The Environmental Education Council of Ohio (EECO) (2000) also organizes learning into knowledge, skills, attitudes and values, and behaviour. Knowledge emphasizes conceptual understanding of subject matter. Skills include a full range of processes and abilities, higher-level thinking, and communication skills that encourage lifelong learning. Attitudes and values involve analysis and clarification of individual and group attitudes and values, rather than the acceptance of a particular set of attitudes and values. Behavior refers to individual and



collective actions that contribute to healthy and sustainable living in a global community, linking today's actions with future consequences. It includes an emphasis on the strategies that lead to responsible behavior and global stewardship (p. 9). EECO follows the 4 strands outlined by NAAEE (2010). Appendix 8 shows the details of how these are incorporated into a framework for learning and assessment.

10.6 Evaluation Methods

How we evaluate, what tools we use will vary according to whether we are assessing knowledge, attitudes and values, skills, behaviour or action – and what performance standard or level of learning we are assessing. Traditional assessment has placed an emphasis on efficient tasks and tests that are perceived as demonstrating the student's educational abilities. Authentic assessment has become increasingly popular as a perception has grown that there is a need for more holistic approaches to evaluating students (University of Alberta and University of Lethbridge, 2004). Their literature synopsis on authentic assessment further states:

Authentic assessment moves beyond learning by rote and memorization of traditional methods and allows students to construct responses. Authentic assessment captures aspects of students' knowledge, deep understanding, problem-solving skills, social skills, and attitudes that are used in a real-world, or simulation of a real-world situation. Authentic assessments set meaningful and engaging tasks, in a rich context, where the learner applies knowledge and skills, and performs the task in a new situation. Authentic tasks help students rehearse for the complex ambiguities of adult and professional life (University of Alberta and University of Lethbridge, 2004, p. 1).

As such, authentic assessment can be applied to knowledge but also attitudes and values, skills, competencies, behaviours and action. In addition to authentic assessment the following assessment methods can be used in each of the following categories.

10.6.1 Attitudes / Values

In measuring attitudes and values, assessing attitude or value shifts can also be important in assessing environmental literacy and social, cultural, global and environmental responsibility. As Thomson, Hoffman & Staniforth (2006, p. 30) note, "The advantage of measuring value shifts is that in some cases this might be all that changes: there are many good reasons why thought does not always translate into action". The following table summarizes some of the measurement instruments and associated outcome indicators for measuring a values shift.

Measurement instrument	Pre and Post Test?	Outcome Indicator
Questionnaires (Likert scale or multiple choice)	✓	Quantitative shift in individuals or group for questions pertaining to values
Interview		Student responses reveal a higher appreciation of natural values
Focus Group		Unprompted, at least 15% of students will comment that



		their values are more supportive of the environment
Review of Peers		Students comment on changes in the values of their peers (this is weak)
Journals	✓	Students make written reference to changes they feel have occurred in their own beliefs, attitudes, or values
Student art work	✓	Students' drawings of their schoolyard give more emphasis (using colour and perspective) to natural objects
Feedback form (ex. an unsolicited email or letter to your organization)		Unsolicited, students comment on how the program influenced or changed how they feel about some aspect of nature

Table 3: Measuring A Shift In Values (Thomson et al, 2006, p. 30-31)

Two notes regarding this table:

Pre/Post. In many cases, an objective measurement of a change in values requires a baseline, pre-program measurement as well as a post-program measurement. If this is necessary, a check mark is placed in the table.

Outcome Indicators: These are quantitative or qualitative statements that result to desired results we get after using the relevant measurement instrument.

10.6.2 Skills or Competencies

Authentic or performance-based assessment aims to evaluate students' abilities in 'real-world' contexts as students learn how to apply their skills or competencies to authentic tasks and projects (Mueller, 2006) it is particularly suited to assess skills or competencies. It is an approach to the monitoring of students' progress in relationship to identified learner outcomes (University of Wisconsin-Stout, 2007). Authentic assessment focuses on students' analytical skills; ability to integrate what they learn; creativity; ability to work collaboratively; and written and oral expression skills. It emphasizes process and performance and can incorporate assessment activities such as performance assessment, short investigations, open-response questions, portfolios peer or self-assessments, journaling, webbing, mapping and interviewing (Pearson Educational Group, 2007; University of Wisconsin-Stout, 2007).

10.6.3 Behaviour

Although authentic assessment is very effective in evaluating behaviour, particular behavioural learner outcomes may not exhibit themselves immediately.

“A new difficulty presents itself when measuring behavioural outcomes: time. Whereas changes in values tend to occur during or shortly after a program, it may take longer for behaviours to manifest themselves. This not only calls for a long-term approach to evaluation that spans a number of years, but also opens the door to the possibility that some influence other than the program caused the behaviour” (Thomson et al, p. 36).



Many similar tools for assessing attitudes and values can be used to assess behaviour. Thomson et al (2006) suggest the following instruments and outcome indicators for measuring behaviour change:

Measurement instrument	Pre/Post?	Outcome Indicator
Questionnaires	✓	Respondents list behaviours that they began after the program
Interviews		Open-ended questions prompt interviewees to remark on changes to their behaviour
Observations	✓	Observer tests for the presence or absence of a number of behavioural criteria (e.g. classroom recycling program)
Focus Group		Over a quarter of students agree that their behaviour has changed in a specific way
Student art work		?
Feedback form		?

Table 4: Measuring Behaviour Change (Thomson et al, 2006, p. 37)

Two notes regarding this table:

Pre/Post. In many cases, an objective measurement of a change in values requires a baseline, pre-program measurement as well as a post-program measurement. If this is necessary, a check mark is placed in the table.

Outcome Indicators: These are quantitative or qualitative statements that result to desired results we get after using the relevant measurement instrument.

10.6.4 Action

Table 5 provides a discussion of the five kinds of environmental action and their evaluation (Thomson et al, 2006, p. 38).

Type of environmental action	Ease of evaluating benefits to the environment
Persuasion: educating or lobbying other members of the public	Benefits may never be demonstrable, and/or may not exist. The possibility exists that this persuasion may not in fact change anyone's behaviour.
Consumerism: either changing one's own consumer habits or encouraging others to do so	Several measurement instruments can be used to identify changes in consumerism, and resources documenting the relationship between consumer habits and environmental



	impact are readily available*
Political Action: action that is aimed at influencing a decision-maker	Decision-makers may never respond to pressure – or a pro-environmental decision they make may be due to other factors. Interviews of decision-makers can be helpful to determine this.
Ecomanagement: action to restore, remediate, or improve a natural area	This is easily measured. Funders who emphasize easy accountability, such as EcoAction, place high emphasis on activities of this sort. See below.
Legal Action: action taken through legal avenues	Action of this sort can be easily documented, through such things as judicial decisions.

Table 5: Measuring Action

In *Ideas for Measuring Success of Taking Action*, the Council for Environmental Education/Project WILD (1995, p. 19) suggests that taking time to evaluate an action project helps students understand what they've accomplished and allows recognition of how their project facilitated their personal growth.

Their suggestions for assessing student knowledge, values, and behaviours within an action project include:

- Keep a video or photo log of project highlights.
- Collect memorabilia (articles about the project, photos, planning schedules, and so on) to create an action project scrapbook that students can sign and write comments in.
- Have students write essays and /or keep a journal about any changes in their thinking or behaviours as a result of the project.
- Have students evaluate other members of their group, as well as themselves.
- Give students pointers on positive constructive feedback and focus the session on specific points, such as contribution to the project, effort, conflict resolution approach, etc.
- Have community members involved in the project assess student performances.

The move towards authentic assessment, according to Wiggins (1990, p. 220) is designed to:

- 1) Make students successful learners with acquired knowledge.
- 2) Provide students with a full range of skills (e.g., research, writing, revising, oral skills, debating, and other critical thinking skills).
- 3) Demonstrate whether the student can generate full and valid answers in relation to the task or challenge at hand.
- 4) Provide reliability by offering suitable and standardized criteria for scoring such tasks and challenges.
- 5) Give students the chance to 'rehearse' critical thinking in achieving success in their future adult and professional lives.
- 6) Allow for assessment that meets the needs of the learners by giving authenticity and usefulness to results while allowing students greater potential for improving their learning and teachers more flexibility in instruction.



In addition to the assessment tools identified by Thomson et al (2010) authentic assessment can include role play and drama, concept maps, student portfolios, utilizing multiple sources of information, and group work in which team members design and build models. It moves beyond the practices of traditional tools and tasks and allows for a greater expression of students' abilities and achievements (University of Alberta and University of Lethbridge, 2004).

10.7 Assessment Criteria

The University of Alberta and the University of Lethbridge (2004) emphasize authentic assessment is criterion-referenced, as opposed to norm-referenced. Tanner (2001) notes that criterion-referenced assessments are designed to compare students' performance against learning task standards. By contrast, norm-referenced tests are designed to compare a student's performance against that of other students. He emphasizes that criterion-based standards are necessary to maintain authenticity.

According to University of Wisconsin-Stout (2007) authentic assessment achieves validity and reliability by emphasizing and standardizing the appropriate criteria for scoring competencies effectively through assessment rubrics. The advantages of using rubrics in assessment are that they:

- allow assessment to be more objective and consistent;
- focus the teacher to clarify his/her criteria in specific terms;
- clearly show the student how their work will be evaluated and what is expected;
- promote student awareness about the criteria to use in assessing peer performance;
- provide useful feedback regarding the effectiveness of the instruction; and
- provide benchmarks against which to measure and document progress.

Rubrics can be created in a variety of forms and levels of complexity, however, they all contain common features which:

- focus on measuring a stated objective (performance, behavior, or quality);
- use a range to rate performance; and
- contain specific performance characteristics arranged in levels indicating the degree to which a standard has been met.

Rubrics can be used as a formative type of assessment when it becomes an ongoing part of the whole teaching and learning process. Students can be involved in the assessment process through both peer and self-assessment. As students become familiar with rubrics, they can assist in the rubric design process. This involvement empowers the students and as a result, their learning becomes more focused and self-directed. Authentic assessment, therefore, blurs the lines between teaching, learning, and assessment (University of Wisconsin-Stout, 2007).

According to Hamilton (2008) using a rubric serves the following purposes:

- Clearly describe different levels of performance in relation to the assessment criteria.
- Clarify expectations for discrete performance levels.
- Provide 'scoring rules'.
- Often are used for assessing and grading authentic tasks.



- Can be used both formatively and summatively.
- Provide an effective means of providing feedback as well as 'stretch goals' for learners.

Cronin-Jones (2005) found that a scoring rubric was an effective quantitative tool for analyzing student drawings in assessing students' perceptions and understandings of ecological concepts.

10.7.1 Weight given to & within categories

Tables a-f in Appendix 6 provide a useful tool for identifying the domains and components to be assessed and the weighting given to each. Hellweg et al (2011) emphasize these will vary given the target audience and specific circumstances.

In the *Proposed Framework for Assessing Environmental Literacy – PISA 2015*, NAAEE suggests the following distribution of score points across the categories: contexts, knowledge, competencies, and dispositions (Hollweg et al, 2011, p. 25).

Distribution and weighting for Contexts

Biodiversity	Population Growth	Resources: Terrestrial & Marine	Environmental Quality and Health	Hazards/Disasters	Total
15%-20%	20%-25%	20%-25%	20%-25%	5%-10%	100%

Distribution and weighting for Environmental Knowledge

Physical and Ecological Systems	Environmental Issues	Socio-political Systems	Strategies for Addressing Issues	Total
10%-20%	30%-40%	30%-40%	10%-20%	100%

Distribution and weighting for Environmental Competencies

Identify Issues	Analyse Issues	Evaluate issues	Propose and justify actions to address an issue	Total
10%	20%	30%	40%	100%

Distribution and weighting for Dispositions towards the environment

Interest	Sensitivity	Locus of Control	Responsibility	Intention	Total
10%-20%	10%-20%	20%	20%-30%	20%-30%	100%

There is no indication of weightings between categories. Nor have they incorporated all domains or components as they deemed the Behaviour domain and other components inappropriate for the PISA assessment.



10.8 Proficiency Levels

According to Hamilton (2008) proficiency levels, often referred to as performance standards, consider A) How the assessment criteria are applied to gauge the level of learning accomplished (i.e. level of mastery) or B) The desired level of performance.

Learner outcomes and their assessment can address a wide range of levels of learning. The level of learning is important for both the learner outcomes and the assessment. In the 1950's, Bloom and his colleagues (Bloom, 1984) grouped learning into three major categories: cognitive, affective and psychomotor. Cognitive learning is centered on knowledge and cognitive processes, and generally is comprised of facts, terminology and analysis of elements. Affective learning centers on values and value systems; for example, an openness to or awareness of selected ideas, valuing of ideas, and integrating values into a total world philosophy. The Psychomotor domain of learning involves eye-hand coordination and any other physical component of performance. Bloom's hierarchy of cognitive learning outlines six levels: recall (knowledge), comprehend, apply, analyze, synthesize, evaluate (Boydell, 2004). The following tables identify verbs that can be used for assessment, which are associated with various levels of Bloom's taxonomy of learning in the cognitive, affective and psychomotor domains (Boydell, 2004).



Verbs Associated With the Various Levels of Bloom's Taxonomy

COGNITIVE DOMAIN (KNOWLEDGE)					Complex
Simple					<u>Evaluation</u>
<u>Knowledge</u>	<u>Comprehension</u>	<u>Application</u>	<u>Analysis</u>	<u>Synthesis</u>	
Cite Count Define Draw List Name Record Relate Repeat Underline	Compute Describe Discuss Explain Express Identify Locate Report Restate Review Tell Translate	Apply Calculate Demonstrate Dramatize Employ Examine Illustrate Interpret Operate Practice Schedule Sketch Solve Use	Analyze Appraise Calculate Categorize Compare Contrast Debate Diagram Differentiate Examine Inventory Question Test	Arrange Assemble Collect Compose Create Design Formulate Integrate Manage Organize Plan Prescribe Propose	Appraise Assess Choose Compare Criticize Estimate Evaluate Judge Measure Rank Revise Score Select
					<i>The hierarchical steps in the cognitive domain</i>

AFFECTIVE DOMAIN (ATTITUDES)					Complex
Simple					<u>Characterization</u>
<u>Receiving</u>	<u>Responding</u>	<u>Valuing</u>	<u>Organization</u>		
Accept Attend Develop Receive Recognize Reply	Behave Complete Comply Cooperate Discuss Examine Obey Observe Respond	Accept Balance Believe Defend Devote Influence Prefer Pursue Seek Value	Codify Discriminate Display Favour Judge Order Organize Relate Systematize Weigh		Internalize Verify (Formal instruction does not address)
					<i>The hierarchical steps in the affective domain</i>

PSYCHOMOTOR DOMAIN (SKILLS)					Complex
Simple					<u>Origination</u>
<u>Perception</u>	<u>Set</u>	<u>Guided Response</u>	<u>Mechanism</u>	<u>Overt Response</u>	
Distinguish Hear See Smell Taste Touch	Adjust Approach Locate Place Position	Copy Determine Discover Duplicate Imitate Inject	Adjust Build Illustrate Indicate Manipulate Mix Set up	Calibrate Coordinate Demonstrate Maintain Operate	Construct Create Design Produce
					<i>The hierarchical steps in the psychomotor domain</i>

Roth developed a framework that may help assess levels of environmental literacy, as part of a standard-setting process undertaken by NAAEE and the American Society for Testing and



Materials (ASTM). It included three levels of environmental literacy: nominal, functional, and operational (Roth, 1992; Disinger & Roth, 1992). This framework also defined four broad components of environmental literacy similar to the categories identified in the Tbilisi framework: knowledge, affect (attitudes), skill, and behavior (participation) (Roth, 1992, pp. 17-26).

Appendix 9 outlines the knowledge, skills, affect (attitudes & values) and behavioural learner outcomes for each level of literacy. The operational level does not incorporate knowledge outcomes as presumably he sees this having been covered sufficiently in the nominal and functional levels.

Volk (1993) identifies Environmental Sensitivity, Ecological foundations, Issues & values, Investigation & evaluation, and Action Skills as elements of environmental education. She proposes where they should have major and minor influence in a K-12 curriculum. The following Table shows the different emphasis at grade level groupings for each aspect of environmental literacy.

Grade Level Ranges	Major Emphasis	Minor Emphasis
K-3	Environmental sensitivity Ecological foundations	Issues and values Investigation and evaluation Action skills
3-6	Ecological foundations Issues and values	Environmental sensitivity
6-9	Ecological foundations Issues and values Investigation and evaluation Action skills	Environmental sensitivity
9-12	Issues and values Investigation and evaluation Action skills	Environmental sensitivity Ecological foundations

Table 6: Emphasis of environmental education elements at grade level groupings (Volk, 1993).



11.0 References

Alberta Council for Environmental Education ACEE (2010). 'What we heard' at the ATA 'Creating a Legacy' Curriculum

Symposium. Retrieved from: <http://abcee.org/what-we-heard-2010-symposium/>

Alberta Council for Environmental Education (ACEE) (2011). *Environmental Education:*

Creating the Engaged and Innovative Alberta Citizens of Tomorrow. Retrieved June

14, 2012 from: [www.abcee.org/cms/.../2011/.../The-Case-for-Environmental-](http://www.abcee.org/cms/.../2011/.../The-Case-for-Environmental-Education.docx)

[Education.docx](http://www.abcee.org/cms/.../2011/.../The-Case-for-Environmental-Education.docx)

Alberta Education (1990). Environmental and Outdoor Education. Retrieved

from: <http://education.alberta.ca/media/768718/eoed.pdf>

Alberta Education (2010). *Inspiring Action on Education: A Discussion Paper*.

Retrieved from: <http://ideas.education.alberta.ca/engage/related-initiatives/inspiring-action>

Alberta Education (2011). *Framework for Student Learning: Competencies for Engaged Thinkers and Ethical Citizens With an Entrepreneurial Spirit*. Retrieved

from: <http://education.alberta.ca/department/ipr/curriculum.aspx>

Australian Government, Department of Environment, Water, heritage and the

Arts (2010). Sustainability Curriculum framework: A Guide for

Curriculum Developers and Policy Makers.

Barraza, L., Duque-Aristiza'Bal, A. & Rebolledo, G. (2003). Environmental

Education: From policy to practice, *Environmental Education Research*,

9:3, 347-357 <http://dx.doi.org/10.1080/13504620303462>

Bateson, G. 1972. Steps to an ecology of mind. San Francisco: Chandler.

Battersby, M. (1999) *So, what's a learning outcome anyway?* Centre for Curriculum, Transfer and Technology. Accessed March 1, 2007 at:

<http://merlin.capcollege.bc.ca/mbatters/whatsalearningoutcome.htm>.

Berto, R. (2005). Exposure to restorative environments helps restore

attentional capacity. *Journal of Environmental Psychology*, 25(3), 249-259.

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble,



- M. (2012). Ch 2 Defining Twenty-First Century Skills in P. Griffin, B. McGaw, E. Care, (Eds) *Assessment and Teaching of 21st Century Skills*. New York, NY: Springer Science + Business Media B.V. (p17 – 66).
- Bloom, B.S. (1984). *Taxonomy of educational objectives*. Boston, MA: Allyn and Bacon.
- Bonnett, M. (2002) 'Education for Sustainability as a Frame of Mind' in *Environmental Education Research*, 8(1), pp. 9-20.
- Bowers, C. (1993) *Education, Cultural Myths, and the Ecological Crisis: Toward Deep Changes*. Albany: State University of New York Press.
- Bowers, C.A. (2002). Toward a Cultural and Ecological Understanding of Curriculum, in W.E. Doll and N. Gough (eds) *Curriculum Visions*. New York: Peter Lang.
- Boydell, T. (2004). *Learning Outcomes Essentials*. Centre for Teaching and Learning, Royal Roads University.
- Breiting, S. & Wickenberg, P. (2010). The progressive development of environmental education in Sweden and Denmark, *Environmental Education Research*, 16:1, 9-37
<http://dx.doi.org/10.1080/13504620903533221>
- British Columbia Ministry of Education (2007). *Environmental Learning and Experience: An Interdisciplinary Guide for Teachers*. Government of British Columbia (ELE). Retrieved from: http://www.bced.gov.bc.ca/environment_ed/
- British Columbia Ministry of Education (2010). *Sustainability Course Content: A Curricular Framework*. www.cudenver.edu/cye
- Chawla and Escalante (2007). *Student Gains From Place-Based Education*. Children, Youth and Environments Center for Research and Design, University of Colorado.
- Council of Ministers of Education of Canada (CMEC) (2010). *Developing a Pan- Canadian ESD Framework for Collaboration and Action*. Education



- for Sustainable Development Working Group (ESDWG). Retrieved from:
<http://www.cmec.ca/Publications/Lists/Publications/Attachments/222/ESD-collaboration-action.pdf>
- Council of Ministers of Education of Canada (CMEC) (2010). Report to UNECE and UNESCO on Indicators of Education for Sustainable Development Report for Canada 2007–2010. Retrieved from:
http://www.unesco.ca/en/activity/education/documents/FINALCanadaESDReportOct2007ApprovedEN_000.pdf
- Council for Environmental Education / Project WILD (1995). *Taking Action. An Educator's Guide to Involving Students in Environmental Action Projects*. Bethesda, MD: Project WILD / World Wildlife Fund.
- Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches*. CA: Sage Publications, Inc.
- Cronin-Jones, L. (2005). Using Drawings to Assess Student Perceptions of Schoolyard Habitats: A Case Study of Reform-Based Research in the United States. *Canadian Journal of Environmental Education*, 10, 225-240
- Dale, A. (2002). *At the edge: Sustainable development in the 21st century*. University of British Columbia Press.
- Dawe, N. K. and Ryan, K. L. (2003). The faulty three-legged-stool model of sustainable development in *Conservation Biology*, 17 (5) pp. 1458-1460.
- Environment Canada (2007). Framework for Environmental Learning and Sustainability in Canada. Retrieved from:
<http://www.ec.gc.ca/education/default.asp?lang=En&n=44E5E9BB-1&offset=5&toc=show#2.1>
- Environmental Education Council of Ohio (2000). *Best Practices for Environmental Education: Guidelines for Success*. A project of Ohio EE 2000: A Strategic Plan for Environmental Education in Ohio.
- Fein, J. (1993) *Education for the Environment* (Geelong: Deakin University Press).



- Fein, J. (2000) 'Education for the Environment: a critique – an analysis' in *Environmental Education Research*, 6(2) pp. 179-192.
- Fontes, P. (2004) 'Action Competence as an Integrating Objective for Environmental Education' in *Canadian Journal of Environmental Education*, 9, pp. 148-162.
- Foster, J. (2001) 'Education as Sustainability' in *Environmental Education Research*, 7(2), pp. 154-165.
- Gough, N. (1987) 'Learning with Environments: Towards an ecological paradigm for education', in: I. Robottom (Ed.) *Environmental Education: Practice and Possibility* (Victoria, Australia: Deakin University Press).
- Gough, S. (2002) 'Increasing the Value of the Environment: a 'real options' metaphor for learning' in *Environmental Education Research* 8(1) pp62-72.
- Gunderson, L. H. and Holling, C. S. (Eds.). (2002). *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington: Island Press.
- Hamilton, D. (2008). Outcomes-Based Learning and Assessment at Royal Roads University: A Resource Guide. Retrieved May 27, 2012 from www.royalroads.ca.
- Hartig, T., van den Berg, A. E., Hagerhall, C. M., Tomalak, M., Bauer, N., Hansmann, R., . . . van Herzele, A. (2010). Health benefits of nature experience: Psychological, social and cultural processes. *Forests, Trees and Human Health.*, 127-168.
- Dawe, N. K. and Ryan, K. L. (2003). The faulty three-legged-stool model of sustainable development *Conservation Biology*, Volume 17, No. 5, October 2003, 1458-1460.
- Henderson, K. & Tilbury, D. (2004) *Whole-School Approaches to Sustainability: An International Review of Sustainable School Programs* Report prepared by the Australian Research Institute in Education for Sustainability (ARIES) for The Department of the Environment and Heritage, Australian Government (Sydney: MacQuarie University).



- Higgins, P. (1996). 'Outdoor Education for Sustainability: Making Connections', *Far Out – Practical and Informative Adventure Education*, 1(4), pp. 4-11.
- Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a framework for assessing environmental literacy*. Washington, DC: North American Association for Environmental Education. Available at <http://www.naaee.net>.
- Huckle, J. & Sterling, S. (1996) *Education for Sustainability* (London: Earthscan).
- Jickling, B. (2001) 'Environmental Thought, the Language of Sustainability, and Digital Watches' in *Environmental Education Research*, 7(2), pp. 167-180.
- Jickling, B. (2010). 'Reflecting on the Fifth World Environmental Congress Montreal, 2009' in *Journal of Education for Sustainable Development*, 4(1), pp. 25-36.
- Krasny, M.E. & Roth, W.M. (2010). Environmental education for social-ecological system resilience: a perspective from activity theory, *Environmental Education Research*, 16:5-6, 545-558
<http://dx.doi.org/10.1080/13504622.2010.505431>
- Landers P., Naylor M., Drewes A. (2002) *Environmental Literacy Scope and Sequence: providing a systems approach to environmental education in Minnesota* Minnesota Office of Environmental Assistance, St Paul, Minnesota
- Learning for a Sustainable Future (LSF) (2011). *Connecting the Dots: Key Learning Strategies for Environmental Education, Citizenship and Sustainability*. Retrieved May 29, 2012 from: <http://lsf-1st.ca/en/projects/teacher-resources/professional-development/pd-tools/dots>
- Learning for Sustainability (LSF) (2012). The Canadian Sustainability



- Curriculum Review Initiative. Retrieved April 25, 2012 from <http://www.lsf-lst.ca/en/projects/key-themes-in-sustainability-education/canadian-sustainability-curriculum-review-initiative>.
- Li, Q., Morimoto, K., Nakadai, A., Inagaki, H., Katsumata, M., Shimizu, T., Miyazaki, Y.(2007). Forest bathing enhances human natural killer activity and expression of anti-cancer proteins. *International Journal of Immunopathology and Pharmacology*, 20(2 Suppl 2), 3.
- Lieberman, G. and Hoody, L. (1998). *Closing the Achievement Gap – Using the Environment as an Integrating Context for Learning*.
- Lundholm, C. and Plummer, R. (2010). Resilience and learning: a conspectus for environmental education, *Environmental Education Research*, 16:5-6, 475-491. <http://dx.doi.org/10.1080/13504622.2010.505421>
- Malone, K. & Tranter, P, (2005). “Hanging Out in the Schoolground”: A Reflective Look at Researching Children’s Environmental Learning. *Canadian Journal of Environmental Education*, 10, 212-224.
- Manion, G., Adey, C. & Lynch, J. (2010) *Intergenerational Place-based Education: where schools, communities, and nature meet*. Stirling: University of Stirling for Scottish Centre for Intergenerational Practice.
- Manitoba Education and Training (2000). Education for a Sustainable Future: A Resource for Curriculum Developers, Teachers and Administrators. Retrieved from: <http://www.edu.gov.mb.ca/k12/docs/support/future/sustainededucation.pdf>
- Manitoba Education, Citizenship and Youth, 2006. Rethinking Classroom assessment with Purpose in Mind: Assessment for Learning, Assessment as Learning, Assessment of Learning. Retrieved January 14, 2013 from: http://www.edu.gov.mb.ca/k12/assess/wncp/rethinking_assess_mb.pdf
- Monroe, Martha C. , Andrews, Elaine and Biedenweg, Kelly (2007) 'A Framework for Environmental Education Strategies', *Applied Environmental Education & Communication*, 6: 3, 205 — 216



To link to this Article: DOI: 10.1080/15330150801944416

Mogensen, F. & Schnack, K. (2010). The action competence approach and the 'new' discourses of education for sustainable development, competence and quality criteria, *Environmental Education Research*, 16:1, 59-74

<http://dx.doi.org/10.1080/13504620903504032>

Mueller, J. (2006). *The authentic assessment toolbox*. Retrieved April 19, 2007 from <http://jonathan.mueller.faculty.noctrl.edu/toolbox/whatisit.htm>.

North American Association for Environmental Education (NAAEE) (2008)

Developing a State Environmental Literacy Plan (2008). Retrieved from:

<http://eelinked.naaee.net/n/elp/posts/NAAEEs-Guide-to-Developing-a-State-Environmental-Literacy-Plan>

North American Association for Environmental Education (NAAEE) (2010). *Excellence in*

Environmental Education: Guidelines for Learning (K-12). Retrieved June 17, 2012 from:

<http://eelinked.naaee.net/n/guidelines/posts/Excellence-in-Environmental-Education-Guidelines-for-Learning-K-12>

New South Wales Department of Education and Training (2009). Earth

Citizenship: A Conceptual Framework for Learning for Sustainability.

State of New South Wales, Australia.

New South Wales Council on Environmental Education (2006). *Learning for Sustainability:*

NSW Environmental Education Plan 2007-10. Retrieved October 4, 2012 from:

<http://www.environment.nsw.gov.au/cee/lfs.htm>

OECD, 2009. PISA 2009 Assessment Framework – Key Competencies in Reading,

Mathematics and Science.

O'Neill, S. and Nicholson-Cole, S. (2009) "Fear Won't Do It": Promoting

Positive Engagement With Climate Change Through Visual and Iconic

Representations in *Science Communication* 2009 30: 355 originally

published online 7 January 2009 DOI: 10.1177/1075547008329201

Ontario Ministry of Education, (2010). *Growing Success: Assessment, Evaluation and*



- Reporting in Ontario Schools. Retrieved January 24, 2013 from <http://www.edu.gov.on.ca>.
- Ontario Ministry of Education, (2008). Standards for Environmental Education in the Curriculum. Retrieved October 4, 2012 from: <http://www.edu.gov.on.ca/eng/teachers/enviroed/standards.html>
- Ontario Ministry of Education, (2007). Shaping our Schools, Shaping our Future – Environmental Education in Ontario Schools. Retrieved from: <http://www.edu.gov.on.ca/eng/teachers/enviroed/shapingSchools.html>
- Orr, D. (1994). *Earth in Mind: On Education, Environment, and the Human Prospect* (Washington, D.C.: Island Press).
- Orr, D. (2004). The Learning Curve Retrieved October 4, 2012 from <http://www.ecoliteracy.org/essays/ecological-design-intelligence>
- Pearson Educational Development Group (2007). *Authentic assessment overview*. Retrieved April 19, 2007 from <http://www.teachervision.fen.com/teaching-methods/educational-testing/4911.html>.
- Plummer, R. (2010). Social–ecological resilience and environmental education: synopsis, application, implications, Environmental Education Research, 16:5-6, 493-509 <http://dx.doi.org/10.1080/13504622.2010.505423>
- Roth, C. (1992). *Environmental Literacy: Its Roots, Evolution and Directions in the 1990's*. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.
- Saskatchewan Ministry of Education (2010). Cross-curricular Competencies. Retrieved from: <http://www.education.gov.sk.ca/adx.aspx/adxGetMedia.aspx?DocID=522,523,127,107,81,1,Documents&MediaID=15291&Filename=Cross-curricular+Competencies+-+Sept+27+2010.pdf>
- Sauvé, L. (2005) 'Currents in Environmental Education: Mapping a Complex and Evolving Pedagogical Field' in *Canadian Journal of Environmental Education*, 10, pp. 11-37.



- Scott, W., & P. Vare. 2008. Education for sustainable development – Two sides and an edge. DEA Thinkpiece.
http://www.tidec.org/GL%20toolkit/Secondary%20handbook/2c.61%20dea_thinkpiece_vare_scott.pdf.
- Selby, D. (2008). The firm and shaky ground of education for sustainable development. In Green frontiers – Environmental educators dancing away from mechanism, (Ed.) J. Gray- Donald and D. Selby, 59–75. Rotterdam: Sense Publishers.
- Shelburne Farms (2011). The Guide to Education for Sustainability. Shelburne Farms Sustainable Schools Project, Vermont. Retrieved from: <http://www.sustainableschoolsproject.org/tools-resources/efs-guide>
- Simpson, L. (2002). Indigenous Environmental Education for Cultural Survival, *Canadian Journal of Environmental Education* 7(1), 13-25.
- Smyth, J. (1995) 'Environment and Education: a view of a changing scene', in *Environmental Education Research*, 1(1), pp. 3-120.
- Stables, A. & Bishop, K. (2001). Weak and Strong Conceptions of Environmental Literacy: Implications for environmental education in *Environmental Education Research*, 7:1 pp. 89-97.
- Stapp, W. B. (1982). On Instructional Programme Approach to Environmental Education. In V. N. Wanchoo (Ed.), *World Views on Science Education* (pp. 333-370). New Dehli, India: Oxford & IBH Publishing Co.
- Sterling, S. (2001) *Sustainable Education: Re-visioning Learning and Change*. Totnes, Devon: Green Books Ltd.
- Sterling, S., Maiteny, P., Irving, D., & Salter, J. (2005) *LinkingThinking: New Perspectives on Thinking and Learning for Sustainability*. Perthshire, Scotland: WWF-Scotland.
- Sterling, S. (2010). Learning for resilience, or the resilient learner? Towards a necessary reconciliation in a paradigm of sustainable education, in



Environmental Education Research, 16:5-6, 511-528

<http://dx.doi.org/10.1080/13504622.2010.505427>

Tanner, D. E. (2001). Authentic assessment: A solution, or part of the problem? *High*

School Journal, 85, 24-29. Retrieved May 19, 2004 from EBSCO database.

Thayer, J. F., & Sternberg, E. (2006a). Beyond heart rate variability. *Annals of*

the New York Academy of Sciences, 1088(1), 361-372.

The Alberta Teachers Association (2009). Real Learning First: The Teaching Profession's

View of Student Assessment, Evaluation and Accountability for the 21st Century.

Retrieved January 24, 2013 from: www.teachers.ab.ca.

The Galileo Educational Network (2012). Retrieved June 12, 2012 from:

<http://www.galileo.org/tips/inquiry.html#Sci2>

Thomson, G., Hoffman, J., & Staniforth, S. (2006). *Measuring the Success of*

Environmental Education Programs. Canadian Parks and Wilderness Society;

Sierra Club of Canada, BC Chapter. Retrieved from:

content/uploads/2010/10/Measuring_the_Success_Sept_7_2010-1.pdf

Tilbury, D. & Wortman, D. (2004) *Engaging People in Sustainability* (Gland,

Switzerland: IUCN).

UNCED (1992) 'Promoting Education, Public Awareness and Training', *Agenda*

21, Chapter 36 (Paris: UNESCO).

UNESCO (2009). The Bonn Declaration . Retrieved from:

http://www.google.com/url?q=http://www.esd-world-conference-2009.org/fileadmin/download/ESD2009_BonnDeclaration080409.pdf&sa=U&ei=tmdjT5WLLM32sQLch5icCw&ved=0CAQQFjAA&client=internal-uds-cse&usg=AFQjCNHpb0I0Y7Ji5emGS75WmloGKecaOg

UNESCO (1975) *The Belgrade Charter: a framework for environmental*

education (Belgrade: UNESCO).

UNESCO (1977) *Declaration of the First Intergovernmental Conference on*

Environmental Education (Tbilisi: UNESCO).



- University of Alberta and University of Lethbridge (2004). *Literature Synopsis: Authentic assessment*. Retrieved June 12, 2012 from:
http://education.alberta.ca/media/6412562/literature_synopsis_authentic_assessment_2004.pdf
- University of Connecticut. *Choosing the right assessment tools*, Retrieved May 24, 2012 from
http://www.assessment.uconn.edu/docs/Choosing_the_Right_Assessment_Tool.pdf
- University of Wisconsin-Stout (2007). *Authentic assessment: Online assessment resources for teachers*. Retrieved May 24, 2012 from
<http://www.uwstout.edu/soe/profdev/assess.shtml>.
- University of Wollongong (2007). *A comparison of assessment methods*. Retrieved May 24, 2012.
<http://www.uow.edu.au/about/teaching/goodpractice/assessment/A1comparison.html>.
- Van Matre, S. (1990) *Earth Education: a new beginning* (Greenville, West Virginia: The Institute for Earth Education).
- Volk, T. (1993) 'Integration and Curriculum Design', *Environmental Education Teacher Resource Handbook*, Wilke R.J. (ed.) Corwin Press, New York.
- Waters Foundation (2010). *Habits of a Systems Thinker*. Retrieved June 8, 2012 from:
<http://www.watersfoundation.org/index.cfm?fuseaction=content.display&id=135>
- Webster, K. (2004) *Rethink, Refuse, Reduce... Educating for sustainability in a changing world* (Preston Montford, Shrewsbury: FSC Publications).
- Western and Northern Canadian Protocol (WNCP) (2011). *Guiding principles for WNCP Curriculum Framework Projects*. Retrieved from:
http://www.education.gov.sk.ca/adx/adxGetMedia.aspx?DocID=73,1429,107,81,1,Documents&MediaID=15800&Filename=Guiding_Principles_FEB2011.pdf
- Wheeler, G. and Thumlert, C. (2007). *Environmental Education Report*.
Olympia, WA: OSPI.
- Wiggins, G. (1990). *The case for authentic assessment*. ED328611. Retrieved June 11, 2012
from: assessment.uconn.edu/.../Grant_Wiggins_Case_for_Authentic_Assessment.pdf



12.0 Appendices

Appendix 1: Terms of Reference

Ensuring Education Transformation Supports Environmental Education

Final Terms of Reference for Alberta Education

Submitted by the Alberta Council for Environmental Education

February 1, 2012

Purpose: The Alberta Council for Environmental Education proposes to hire a Research Associate, convene a multi-stakeholder advisory group, and work with Alberta Education staff to develop an Environmental Education Framework that ensures that Alberta Education's Curriculum Development Framework is based on current research in environmental education. This work will help deliver on Premier Redford's goal, as she articulated in her response to an ACEE survey sent to all of the PC Alberta Leadership candidates:

"(Environmental education) teaches kids about foresight and consequences, inspiring them to think creatively about their effect on the Earth. I want to see Alberta on a road to a greener future, keeping our province beautiful as the economy grows. Environmental education is critical in achieving this goal."
Alison Redford, September, 2011

This will also support the expectation of Albertans from a poll conducted by Ipsos Reid in 2009 of over 800 households, in which Albertans indicated their strong support for all dimensions of environmental education. Most notably, 75% of Albertans agreed that schools in Alberta should give top priority to provide students with opportunities to engage in environmental action projects.¹

The work will also refer to and support the Education for Sustainable Development work of the Council of Ministers of Education, Canada (CMEC).

Outcome: In collaboration with a multi-stakeholder advisory group, the environmental education community and Alberta Education staff, ACEE will create an Environmental Education Framework that will support Alberta Education in developing its Curriculum Development Framework. The Environmental Education Framework will be developed in a manner that is parallel to and complementary to Alberta Education's work.

¹ Ipsos Reid Public Affairs, *Provincial Polling on Environmental Education and Market-Based Instruments Final Report* (March 2009) Pg. 33



ACEE understands and will accommodate Alberta Education's philosophy of 'prototyping,' permitting a flexible and adaptable relationship and evolution of this work over the duration of this project, and commits to the close relationship and communication that will be required to 'march in lockstep' with Alberta Education in its important work.

The Environmental Education Framework will cover the following areas to support environmental education:

Phase I

- Competencies indicators for various levels

Phase II

- Effective practices for teaching and learning including assessment practices
- For Phase I, ACEE's role will be to work alongside Alberta Education to develop competencies indicators that directly support the work of Alberta Education. Phase II will begin initial work on identifying effective practices for teaching and learning including assessment.

The Environmental Education Framework will be provided to Alberta Education as a tool for Alberta Education to use as it continues its work in this area. It is also important to recognize that the Terms of Reference does not preclude either ACEE or Alberta Education to conduct other research or sharing of information to stakeholders regarding environmental education and its role in formal education.

Process:

Phase I – December 2011 to June 2012

1. ACEE will convene a multi-stakeholder advisory group to act in an advisory capacity for this work. An informal advisory group has already been working with ACEE and this will be formalized into a multi-stakeholder advisory group (see Appendix A for the potential list of participants).
2. ACEE has already compiled a body of research work for input into Alberta Education's Action on Curriculum process. ACEE will provide a condensed summary of this research for Alberta Education. ACEE will draw on this body of work (Appendix B) as well as other research to develop environmental education competency descriptors and indicators for a variety of levels supporting the competencies outlined in Alberta Education's *Framework for Student Learning*.
3. ACEE will hire a Research Associate in February 2012 to compile and review the research to develop environmental education competencies indicators and provide recommendations for a model for competencies indicators. ACEE has already secured \$15,000 toward this work.
4. The Research Associate will work closely with Alberta Education to ensure a complete linking to the Alberta governments' definition and key understandings related to all this work, and to ensure that recommendations from Alberta Education's work will enhance and strengthen the work of ACEE on environmental education competencies indicators.



5. ACEE, Alberta Education staff and the multi-stakeholder group will provide guidance for the research component.
6. The Research Associate will develop a draft Phase I Environmental Education Framework for review by the multi-stakeholder advisory group, ACEE and Alberta Education staff.
7. ACEE and Alberta Education will share the Phase I EE Framework draft with the environmental education community through two engagement sessions (Calgary and Edmonton) and through its online community.
8. The draft Phase I Environmental Education Framework will be revised based on the input from the Environmental Education community.
9. Phase I of the Environmental Education Framework will be completed and submitted to Alberta Education and the broader education community.
10. ACEE with the support of the Research Associate and the multi-stakeholder advisory group will continue to provide input on environmental education guiding principles and standards as required in the process of transforming education.

Phase II – July to October 2012

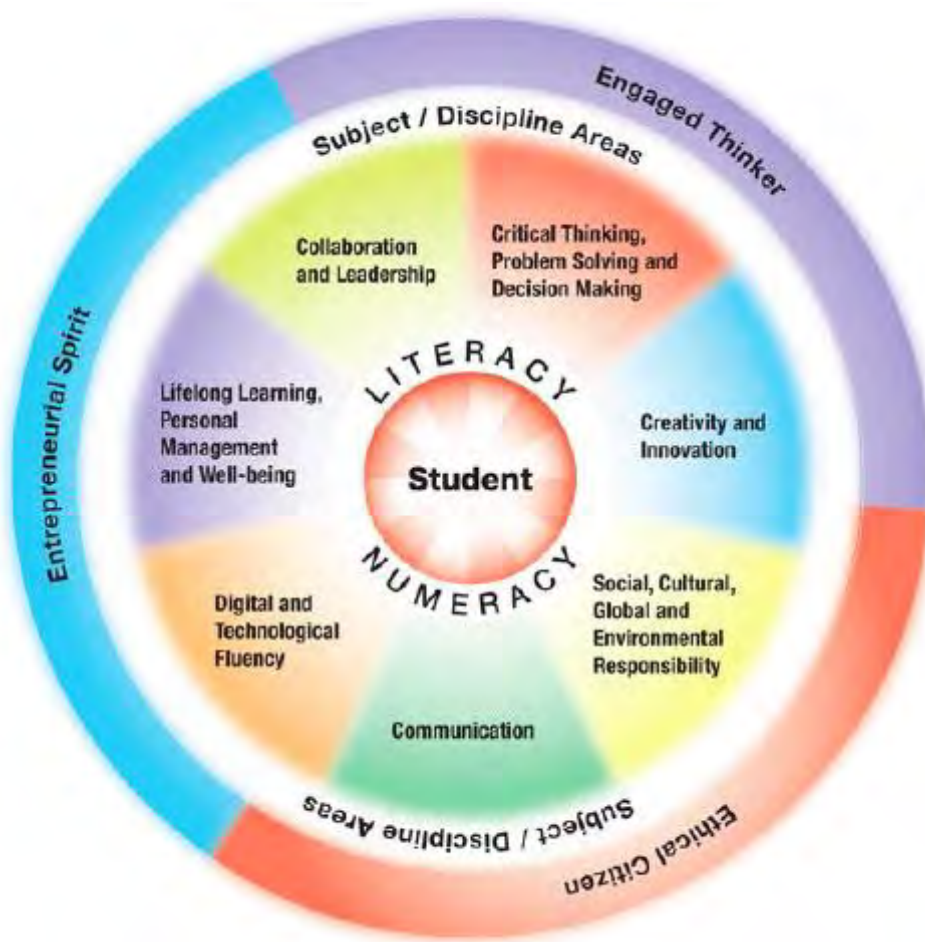
1. The Research Associate with guidance from ACEE, the multi-stakeholder advisory group and Alberta Education will compile research/case studies on effective practices and assessment practices for teaching and learning for environmental education.
2. The Research Associate will develop Phase II of the Environmental Education Framework to include effective practices and assessment practices based on the competencies indicators.
3. The multi-stakeholder advisory group, ACEE and Alberta Education staff will review the Phase II EE Framework draft.
4. ACEE and Alberta Education will share the Phase II EE Framework draft with the education community through an online feedback format.
5. A final Environmental Education Framework document will be finalized and submitted to Alberta Education for reference and potential use in the development of its Curriculum Framework Document and the broader education community.
6. Alberta Education and ACEE will determine if there is any further role for ACEE to play in supporting the work of Alberta Education.



Appendix 2: Framework for Student Learning

The *Framework for Student Learning: Competencies for Engaged Thinkers and Ethical Citizens with an Entrepreneurial Spirit* is a foundational element for the review and replacement of the student learning outcomes in the current Ministerial Order (MO) on the *Goals and Standards Applicable to the Provision of Basic Education* (Alberta Education, 2011). The Framework and the new MO, along with revised standards, guidelines and processes, will provide direction for the development of future curriculum (programs of study, assessment, and learning and teaching resources) for Alberta's K-12 curriculum.

The Framework for Student Learning, exemplified in the diagram below, outlines the relationships among literacy, numeracy, competencies and subject/discipline areas essential for students to become engaged thinkers and ethical citizens with an entrepreneurial spirit.



Appendix 3: A Framework to Advance Environmental Education in Alberta (ACEE, 2007)

What exactly is Environmental Education?

Albertan environmental education stakeholders have rallied around a classic definition of environmental education as a learning process that:

- Increases peoples' knowledge and awareness about the environment and associated challenges;
- Develops the necessary skills and expertise to address these challenges, including critical thinking skills
- Fosters attitudes, motivation, and commitment to make informed decisions and take responsible action

Through consecutive Summits on environmental education, Albertan stakeholders have consistently insisted that environmental education show varying perspectives on issues, showing learners how to think, not what to think; and that environmental education should take place in a way that allows the learner to understand the interconnections between environment, society, and economy, learning the social, economic, and political implications of decision making in connection with the environment and the use of natural resources.

Environmental education can be interpreted and put into practice in a variety of ways, according to differing perspectives, philosophies, and paradigms. Even the term 'environmental education' has in some cases changed, in response to critiques of environmental education, the desire for new terms with 'less baggage,' and the need for specific emphases. For example, Ecological education and ecological literacy are terms used by some within the community; place-based education emphasizes the importance of connection to place; outdoor education commonly includes a major environmental component; and wilderness and conservation education also have their own special emphases. Corporate terminology has in part created the term education for sustainable development. **This document uses environmental education as an umbrella term to refer to ALL the 'educations' described above.**

About environmental education and other 'educations' in Alberta.

How does environmental education relate to peace, social justice, or development education? Environmental education shares many similar values and broader sustainability goals with these important elements of 'global education,' but generally has a greater focus on environmental concepts and environmental stewardship outcomes. Canada's commitment to the U.N Decade of Education for Sustainable Development (2005-2015) means that environmental and all these other 'educations' are considered to contribute to Sustainable Development. Groups such as the Alberta Council for Environmental Education will work hard to communicate, collaborate, and identify common ground (and possibly common projects) with the broader global education community.

About environmental education and environmental literacy... Someone who has gone through a robust environmental education process can be termed an 'environmentally literate' person:



someone who has all the relevant abilities and competencies (understanding, values, attitudes, skills, and behaviours).

Appendix 4: Multi-stakeholder Advisory Committee Members and Governance

Antonella Bell	PhD Candidate, U of A	
Barb Simic	Advisor, Community Investment and Volunteerism, ConocoPhillips	
Bill Bagshaw	Environment & Outdoor Education Specialist, Edmonton Public Schools	
Dr. Bonnie Shapiro	Faculty of Education, University of Calgary	
Cal Kulman	Executive Director, River Watch	
Cathy Gill	Alberta Education Specialist, Parks Canada	
Dr. Gail Jardine	Faculty of Education, University of Calgary	
James Bartram	Education Director, The Palisades Stewardship Education Centre, Parks Canada and GYPSD	
Jason Taylor	Nature Talks LLC and Development Team for NAAEE Framework for Assessing Environmental Literacy proposal for Programme for International Student Assessment (PISA)	
Jeff Gaulin	Director, Communications & Government Relations, Tervita	
Dr. Jerine Pegg	Faculty of Education (elem), U of A	
Joanne Barwise	Education Program Coordinator, Alberta Environment, Cross-ministry representative	
Kathryn Wagner	Program Manager, Inside Education	
Kerrie Morton	Manager, Education Programs, Wild BC	
Kimberly Gray	Masters Student, Royal Roads University	
Laura Perry	Community Member	
Lisa Vandendool	Grade 1 Teacher, Lac La Biche & Masters Student, Royal Road University	
Lois Wozney	Community Involvement Advisor, EnCana	
Lorie Ashworth	Regional Manager, TD Canada Trust	
Michael Podlosky	Coordinator, Professional Development, ATA	
Dr. Rick Mrazek	Professor and Associate Dean, Faculty of Education, University of Lethbridge	
Sherry Bennett	Executive Director, Alberta Assessment Consortium	
ALBERTA EDUCATION		
Keith Million	Renate Taylor Majeau	Wendy Malanthen



Guidelines to govern the work of Multi-stakeholder Advisory Committee and a Project Team for the creation of an Environmental Education Framework in Collaboration with Alberta Education

FINAL – March 23, 2012

Overview

This document provides an overview of the work ACEE is doing with Alberta Education and the roles, responsibilities, operational and procedural guidelines for the groups that will be guiding this process. The complete work is outlined in the “Ensuring Education Transformation Supports Environmental Education” Terms of Reference (Feb 1, 2012). The outcome from the Terms of Reference is listed below.

Outcome

In collaboration with a multi-stakeholder advisory group, the environmental education community, and Alberta Education staff, ACEE will create an Environmental Education (EE) Framework to support Alberta Education in developing its Curriculum Development Framework. The Environmental Education Framework will be developed in a manner that is parallel to and complementary to Alberta Education’s work.

The term environmental education is being used with the understanding that it will include a number of other areas tied to sustainability and includes the social, cultural and global aspects as outlined in Alberta Education’s Framework for Student Learning. ACEE will deliver a draft literature review in March 2012 that contains a more detailed definition of environmental education.

Groups Guiding the Work

There are three groups that will guide and influence this work:

1. Project Team – Gareth Thomson and Kathy Worobec of ACEE will be joined by Renate Taylor Majeau of Alberta Education and Dr. Liza Ireland, who has been contracted by ACEE to deliver on the work as outlined in the Terms of Reference
2. Multi-stakeholder Advisory Committee (member list attached) – co-chairs are Gareth Thomson and Kathy Worobec
3. Environmental education community in Alberta

Project Team

Roles and Responsibilities

- The Project Team is charged with the creation of an Environmental Education Framework, in collaboration with other committees and stakeholder groups, as per the Feb 1 Terms of Reference for this work



- The Project Team will convene robust consultations with a Multi-Stakeholder Advisory Committee, the Environmental education community, Alberta Education, and other key stakeholders as it sees fit
- ACEE Executive Director - Gareth Thomson – will ensure that the work supports and aligns with ACEE’s vision and mission
- Project Lead (ACEE Board or Staff member) Kathy Worobec – will ensure tasks are completed in a timely and effective manner, will set the Project Team meeting agendas, ensure meeting outcomes are summarized and provide connections to other ACEE work
- Research Associate - Liza Ireland – will conduct the work on contract, as guided by the Project Team
- Alberta Education - Renate Taylor Majeau – will ensure that the work supports and connects with Alberta Education’s work, and will be the main point of contact for questions or contact with other Alberta Education staff

Operational and Procedural Guidelines

- The Project Team will strive to achieve consensus in all of its work using a consensus model with three decision making choices – consensus (all are in agreement), consensus reached with an identified area of concern but can live with the decision, consensus blocked – not in agreement and need to do more work to reach consensus
- As ACEE holds the agreement with Alberta Education for the work, if consensus cannot be reached, ACEE will have the authority to make a final determination
- The Project Team may be provided with draft documents for its work from Alberta Education that must remain confidential until approved by Alberta Education
- The Project Team will meet regularly (bi-weekly) to provide guidance for the project

Multi-stakeholder Advisory Committee

Roles and Responsibilities

- Co-chairs – ACEE Executive Director (Gareth Thomson) and Project Lead (Kathy Worobec) – will set agendas for the multi-stakeholder advisory committee meetings with input from committee members and the Project Team, will chair and facilitate meetings and ensure meeting summaries are provided to the Advisory Committee
- Research Associate – Liza Ireland – will participate in Advisory Committee meetings to respond to questions, provide clarity and share results of phases of the work
- Alberta Education – Renate Taylor Majeau – will be the Alberta Education representative to provide information regarding the work of Alberta Education as needed
- Committee Members
 - will review documents created by the Project Team in leading to the development of an EE Framework
 - will attend meetings and provide non-binding advice and guidance on the development of the EE Framework
 - will be included in acknowledgements for their role in helping develop the EE Framework, including on the ACEE website

Committee Members Review and Meetings

- Review documents created in the following stages (tentative timeline):
 - Literature Review – March



- Environmental Education Framework outline and testing – March/April
- Environmental Education Framework Draft – May/June
- Environmental Education Framework Final – June
- Literature Review on effective teaching and assessment tools – Sep
- Environmental Education Framework Ph II Draft – October
- Environmental Education Framework Ph II Final – October
- Face-to-face meetings – two half-day meetings – March and Sep
- Virtual meetings – monthly 2 hour meeting – Apr, May, Jun, Aug, Oct

Expenditures

- ACEE has a limited budget for this work and asks committee members to request support from ACEE only if their organization cannot support their time and/or expenses

Operational Procedures and Guidelines

- Each member of the committee has something to offer and all voices will be heard equally
- The Advisory Committee membership list is for the use by the committee members only
- The Advisory Committee will strive to achieve consensus in all of its work using a consensus model with three decision making choices – consensus (all are in agreement), consensus reached with an identified area of concern but can live with the decision, consensus blocked – not in agreement and need to do more work to reach consensus
- If consensus cannot be reached, ACEE will have the authority to make a final determination. If Advisory Committee members cannot support the final decision, they may ask that their names be removed from the committee
- The Advisory Committee may be provided with draft documents for its work from Alberta Education that must remain confidential until approved by Alberta Education

Alberta Environmental Education Community

Roles and Responsibilities

- Engagement will be open to any interested party interested or offering environmental education
- Review documents that are shared online through ACEE's web site or through two engagement sessions (Edmonton & Calgary)

Operational Procedures and Guidelines

- Each member that provides input or attends the sessions has something to offer and voices will be heard equally
- Comments from the environmental education community will be compiled and will guide the revisions to the Environmental Education Framework



Appendix 5: Literature Support for Environmental Education Categories and Descriptors.

This spreadsheet shows what categories and descriptors are identified and supported by the literature cited.

Reference	Environmental Education Categories and Descriptors					
	Ecological principles	Environmental Identity	Systems, Issues & Ethics	Investigation & Evaluation	Motivation & Action	Responsibility & Citizenship
ABCEE (2010)	✓	✓	✓	✓	✓	✓
AB Ed. EOE (1990)	✓	✓	✓	✓	✓	✓
Australia (2010)	✓	✓	✓	✓	✓	✓
Barraza et al (2003)	✓	✓	✓	✓	✓	✓
BC (2007)	✓	✓	✓	✓	✓	✓
BC (2010)	✓	✓	✓	✓	✓	✓
Bonnett (2002)		✓	✓		✓	✓
Breiting (2010)	✓	✓	✓	✓	✓	✓
CMEC (2010)	✓	✓	✓	✓	✓	✓
Environment Canada (2007)	✓	✓	✓	✓	✓	✓
Fontes (2004)		✓	✓	✓	✓	✓
Foster (2001)	✓	✓	✓	✓	✓	
Gunderson (2002)	✓	✓	✓	✓	✓	✓
Manion (2010)	✓	✓	✓	✓	✓	✓
Manitoba (2000)	✓	✓	✓	✓	✓	✓
Monroe et al (2007)	✓	✓	✓	✓	✓	✓
Mogensen (2010)		✓	✓	✓	✓	✓
NAAEE (2010)	✓	✓	✓	✓	✓	✓
NSW (2009)	✓	✓	✓	✓	✓	✓
Plummer (2010)	✓		✓	✓		✓
Sask. (2010)		✓	✓	✓	✓	✓
Simpson (2002)	✓	✓	✓	✓	✓	✓
Sterling (2010)	✓	✓	✓	✓	✓	✓
Tilbury (2004)	✓	✓	✓	✓	✓	✓
Volk (1993)	✓	✓	✓	✓	✓	✓
WNCP (2011)	✓	✓	✓	✓	✓	✓



Appendix 6: Guiding Questions for Developing an Environmental Literacy Assessment Framework (Hollweg et al, 2011)

The following sets of questions are intended to serve as a general guide to those who are involved in planning and conducting large-scale environmental literacy assessments (e.g., on a national or international scale). These questions have been organized into sets and placed under headings that reflect the relative sequence in which they are likely to arise and require attention by a planning team. However, those who are involved in such a venture will need to review these sets of questions carefully to determine which must be addressed, which are less relevant or irrelevant to that particular assessment, the sequence and relative timetable in which they need to be addressed, and which may need to be revisited and addressed further as the design of a particular assessment unfolds.

A. Framing and organizing the assessment

1. What is the geographic scale and scope of this assessment (e.g., one country, several countries, a large number of countries)?
 - What are the major commonalities and differences within, between, or among participating countries with respect to: (a) natural environments; (b) existing environmental problems and issues; (c) national policies, programs, and practices that pertain to environmental protection and remediation/restoration; (d) national policies and cultural practices that pertain to citizen participation, environmental action, and community service; and (e) national education policies and programs that pertain to attention to (a-d) in formal and non-formal education?
 - What implications do these commonalities and differences hold for the selection and description/definition of environmental literacy components to be assessed?
 - What implications do these commonalities and differences hold for the selection of thematic areas in which environmental literacy components are to be assessed?
2. Is this framework to be used for an assessment directly related, indirectly related, or unrelated to national curriculum guidelines assessment (e.g., policies, frameworks) in the participating country or countries?
 - Will there be any formal or informal review of national curriculum guidelines to inform the selection and/or definition of environmental literacy components to be assessed?
 - *What are the major commonalities and differences between the Ministry/Department of Education's National Curriculum Framework(s) and this environmental literacy framework?
 - What implications do these commonalities and differences hold for the selection and description/definition of environmental literacy components to be assessed?
 - Which agencies, organizations, institutions, and firms will assume responsibility for the major functional roles in this assessment, to include: organizing, funding, designing, developing, administering, analyzing data, preparing reports, and using findings?
 - What implications, if any, do these responsibilities hold for the scope and substance of this environmental literacy assessment?

B. Shaping the scope and substance of the assessment

4. What are the target audience(s) of this assessment (e.g., one or more age cohorts, such as elementary, middle, and secondary students)?



- What are the developmental and experiential characteristics of each target audience?
 - What implications do these characteristics hold for the selection of environmental literacy components to be assessed?
 - What implications do these characteristics hold for the selection of thematic areas in which environmental literacy components are to be assessed?
5. Which prior empirical studies have been conducted and reported for each target audience that pertain to these environmental literacy components in this geographic area (i.e., reviews of research, descriptive studies or curricular and instructional practices, assessments, and evaluation studies)?
- In these studies, which environmental literacy components have and have not been studied?
 - What are the major findings from these studies about these environmental literacy components?
 - What implications do these studies and findings hold for the selection, description/definition, and measurement of the environmental literacy components to be assessed?
 - What implications do these characteristics hold for the selection of thematic areas in which environmental literacy components are to be assessed?
6. On the basis of responses to previous questions, which components of environmental literacy will be assessed in each of the following sub-domains: environmental knowledge; dispositions toward the environment; environmental competencies; and environmentally responsible behavior?
7. On the basis of responses to previous questions, in which thematic areas should greater vs. lesser attention be given to the assessment of these components of environmental literacy?

C. Determining the degree of emphasis/distribution of score points

8. Using the charts presented below or a revised version of them, how much emphasis should be placed on the assessment of selected components in each of the following: (a) thematic areas; (b) environmental knowledge; (c) dispositions toward the environment; (d) competencies; and (e) environmentally responsible behavior? In other words, what is the approximate distribution of score points for each?

Table a: Degree of emphasis and distribution of score points for thematic areas

	Biodiversity	Human Population	Natural Resources	Env. Quality/Health	Natural Hazards/Extreme Weather	Land Use/Economic Zones	Total
Emphasis	%	%	%	%	%	%	100%
Score Pts.	%	%	%	%	%	%	100%



Table b: Degree of emphasis and distribution of score points for environmental knowledge

	Physical & Ecological Systems	Socio-Political Systems	Env. Issues	Multiple Solutions to Env. Issues	Citizen Participation/ Action Total Strategies	Total
Emphasis	%	%	%	%	%	100%
Score Pts.	%	%	%	%	%	100%

Table c: Degree of emphasis and distribution of score points for dispositions toward the

	Env. Sensitivity	Env. Attitudes & Concern	Assumption of Personal Responsibility	Locus of Control (Efficacy)	Motivation, & Intention to Act	Total
Emphasis	%	%	%	%	%	100%
Score Pts.	%	%	%	%	%	100%

environment



Table d: Degree of emphasis and distribution of score points for competencies

	ID Issues	Ask Relevant Questions About Issues	Analyze Issues	Investigate Issues	Evaluate & Make Judgments About Issues	Use of Evidence/ Experience to Defend Positions on Issues	Create & Evaluate Plans to Resolve Issues	Total
Emphasis	%	%	%	%	%	%	%	100%
ScorePts.	%	%	%	%	%	%	%	100%

Table e: Degree of emphasis and distribution of score points for environmentally responsible behavior

	Ecomanagement (Physical)	Consumer & Economic	Persuasion	Political	Legal	Total
Emphasis	%	%	%	%	%	100%
Score Pts.	%	%	%	%	%	100%

Table f: Overall degree of emphasis and distribution of score points for environmental literacy

	B. Environmental Knowledge	C. Dispositions	D. Competencies	E. Behavior	Total
Emphasis					
Score Pts.					

D. Determining item formats and scoring procedures

9. About how much time will be available to administer this assessment?

- What implications does administration time hold for the relative amount of time available to assess each of the selected components given the emphases/distributions reflected in responses to Question 8.b - 8.f?
- What implications does administration time hold for the relative amount of time available to assess these components in the selected thematic areas given the emphases/distribution reflected in response to Question 8a?



10. Which types of selected- and constructed-response items should be used to assess the selected components and in the selected thematic areas identified in response to Question 6?

- To which types of selected- and constructed-response items have subjects in the target population(s) been exposed?
- Which types of selected- and constructed-response items have been used in prior studies of each of the selected components?
- Are there any “valid and reliable measures” of these selected components that use these types of selected- and constructed-response items?

Sub-Domain	Knowledge	Dispositions	Competencies	Behaviors
Components	Physical & Natural World Socio-Political Systems Environmental Issues Alternative Solutions Action Strategies	Sensitivity Attitudes/Concern Personal Responsibility Locus of Control/Efficacy Motivation/Intent	Identify Issues Ask Questions Analyze Issues Investigate Issues Evaluate/Judge Issues Defend Positions Create/Evaluate Plans	Eco-management Consumer/Economic Persuasion Political Legal

11. Approximately how many of these items will be used to assess each of the selected components of environmental literacy?

12. Which component(s) will be assessed in separate scales and sections, and which component(s) will be combined in each section? (Draft the directions and items for gathering responses in each section of the assessment instrument.)

13. If this assessment will be administered to subjects in different countries and/or to different cultural groups, how will items be reviewed to ensure their appropriateness?

14. If this assessment is to be administered in different languages, how will items be translated and how will items translations be reviewed to ensure consistency across these languages?

15. To what extent is the level of readability of the developed items consistent with the age(s), grade level(s), developmental abilities, of the target population identified in response to Question 4?

16. How will the selected- and constructed-response items used to assess each selected component be scored? (Develop the answer and scoring key and/or scoring protocols for this assessment)

- What implications do the emphases/distributions reflected in charted responses to Question 9 hold for the scoring of the items to be used to assess each of the selected components of environmental literacy?



E. Determining methods to conduct the assessment

17. How will those who are to participate in the assessment be selected to do so?

- What is the critical or optimal sample size for this assessment, and how will that be determined?
- What will be the sampling unit for this assessment (e.g., individual students, selected classes within a school, all students/classes in a particular grade level, selected schools)?
- Which sampling methods will be used to select these participants (e.g., purposeful, simple random, stratified random, multi stage probability-proportional)?

18. How will the assessment be administered (e.g., as a paper-and-pencil instrument, in an electronic or on-line format)?

- If this assessment is to be administered in pencil-and-paper form, who will do so? How will they be oriented/prepared to do this? What additional steps will be taken to ensure a high degree of consistency of assessment administration across sites?
- If this assessment is to be administered using an on-line format, are there a sufficient number of computer stations to support simultaneous assessments? To what extent are subjects in each site familiar with on-line tests and assessments? Once a decision is made to do so, who will oversee the formatting of the on-line assessment? Can the electronic assessment be formatted to allow students to return to previous questions within that section of the assessment?

F. Scoring responses

19. What decision rules and procedures, if any, will be used to remove incomplete and invalid responses?

20. What steps, if any, will be taken to fill in any remaining 'blanks' in a subject word (e.g., which form of imputation will be used)?

21. Which items, if any, will require reverse scoring (i.e., due to the reversal of item wording and meaning, such as the use of "not" as a check on the reliability of responses)?

22. What steps, if any, must be taken to convert responses from alphabetic to numeric form?

23. What procedures will be used to generate raw scores for each section and/or selected component?

24. How, if at all, will raw scores be transformed for further analysis and/or reporting purposes (e.g., into a percentile rank, a weighted score, a standard score, and/or a performance level)?

G. Planning for the collection and analysis of additional, context-relevant data

25. What kinds of additional data, if any, will be collected from students?

- Will any demographic data be collected (e.g., age, grade, gender, etc.)?
- Will any experiential data be collected (e.g., for students: curricular and extra-curricular experiences such as environmental courses, projects, and clubs; non-formal experiences



such as camps and on-site programs; and informal/free time experiences with family, peers, and on their own)?

26. What kinds of additional data, if any, will be collected from schools?

- Will any information or data about the schools be collected (e.g., grade levels served, total number of students, student: teacher ratio)?
- Will any information about the curricular and instructional features of the environmental program to which students are exposed be collected (e.g., curricular materials used, sites and additional resources used for instruction, teaching methods)?
- Will any information or data about teachers who work with these students be collected (e.g., number of years teaching, years teaching at particular grade levels and in certain subject areas, professional development and personal experiences in the environmental area, professional and personal perceptions)?

27. What kinds of additional data, if any, will be collected from parents of students?

- Will any additional demographic data be collected (e.g., parental educational levels, socio-economic status, occupation)?
- Will any additional data on parents' environmental views be collected (e.g., their environmental perceptions, opinions, attitudes, behaviors)?
- Will any additional information or data be collected from parents that can be used as a validity check on self-reported student data (e.g., on the relative frequency of student participation in different kinds of outdoor experiences as a check on student self-reports when outdoor experience items are included in a sensitivity scale; on the relative frequency of student engagement in different kinds of environmentally responsible behavior as a check on students responses in a behavior scale)?

28. In addition to presenting the results of any additional data collection in descriptive form, will any attempt be made to analyze the relationship of these data to students' scores (i.e., qualitatively and/or quantitatively)?

H. Reporting the assessment

29. What will be the form or format for the primary technical report of this assessment?

- Is there a standard or required format for this report?

30. In what ways, if any, will this technical report be converted to one or more simple reporting formats?

- Will an Executive Summary or Briefing Paper be prepared for major assessment stakeholders, either as part of or in addition to this technical report?
- Will the technical report serve as the basis for any abbreviated, less technical report(s) or white paper(s) designed for specific audiences (e.g., teachers, non-formal educators, and faculty in related university programs)?
- Will the technical report serve as the basis for any article(s) in peer-reviewed journals?
- Will the technical report serve as the basis for conference presentations (e.g., in .ppt) and/or conference proceedings?
- Will the technical report serve as the basis for any article(s) in popular journals?



Appendix 7: Pro's and Con's of Evaluation Instruments

(Thomson et al, 2006)

The following table is a summary of the advantages and disadvantages of the evaluation instruments mentioned above.

Instrument	<i>Advantages</i>	<i>Disadvantages</i>
<p>1. Questionnaires and Surveys</p> <p>Types include:</p> <ol style="list-style-type: none"> 1. Self-administered. 2. Interview administered by telephone. 	<ul style="list-style-type: none"> ✓ Inexpensive. ✓ Easy to analyze. ✓ Easy to ensure anonymity. ✓ Can be quickly administered to many people. ✓ Can provide a lot of data ✓ Easy to model after existing samples. 	<ul style="list-style-type: none"> ✗ Wording of questions might bias responses. ✗ No control for misunderstood questions, missing data, or untruthful responses. ✗ Not suitable for examining complex issues. ✗ Can be impersonal ✗ By telephone: respondents may lack privacy.
<p>2. Interviews</p> <p>Types include:</p> <ol style="list-style-type: none"> 1. Informal, conversational interview 2. Standardized, open-ended interview 3. Closed, fixed-response interview 	<ul style="list-style-type: none"> ✓ Can allow researcher to get a full range and depth of information. ✓ Develops relationship with client. ✓ Can be flexible with client. ✓ Can allow you to clarify responses. ✓ Interviewer controls situation, can probe irrelevant or evasive answers. ✓ With good rapport, may obtain useful open-ended comments. ✓ Usually yields richest data, details, and new insights. ✓ Best if in-depth information is wanted. 	<ul style="list-style-type: none"> ✗ As a rule not suitable for younger children, older people, and non-English speaking persons. ✗ Not suitable for sensitive topics. ✗ Respondents may lack privacy. ✗ Can be expensive. ✗ May present logistics problems (time, place, privacy, access, safety). ✗ Often requires lengthy data collection period unless project employs large interviewer staff. ✗ Can take much time. ✗ Can be hard to analyze and compare. ✗ Interviewer can bias client's response.
<p>3. Focus groups</p>	<ul style="list-style-type: none"> ✓ Useful to gather ideas, different viewpoints, new insights, improving question design. ✓ Researcher can quickly and reliably 	<ul style="list-style-type: none"> ✗ Not suited for generalizations about population being studied. ✗ It can often be difficult to



	<p>obtain common impressions and key information about programs from group.</p> <ul style="list-style-type: none"> ✓ Can be efficient way to get much range and depth of information in short time. ✓ Information obtained can be used to generate survey questions. 	<p>analyze responses.</p> <ul style="list-style-type: none"> ✗ A good facilitator is required to ensure safety and closure. ✗ It can be difficult to schedule people together.
<p>4. Tests</p> <p>Types include</p> <p>Norm-referenced</p> <p>Criterion-reference</p> <p>Performance assessment tests</p>	<ul style="list-style-type: none"> ✓ Test can provide the "hard" data that administrators and funding agencies often prefer. ✓ Generally they are relatively easy to administer. ✓ Good instruments may be available to model. 	<ul style="list-style-type: none"> ✗ Available instruments may be unsuitable. ✗ Developing and validating new, project-specific tests may be expensive and time consuming. ✗ Objections may be raised because of test unfairness or bias.
<p>5. Observations</p> <p>Types include</p> <ol style="list-style-type: none"> 1. Observations 2. Participant Observations 	<ul style="list-style-type: none"> ✓ If done well, can be best for obtaining data about behaviour of individuals and groups. ✓ You can view operations of a program as they are actually occurring. ✓ Observations can be adapted to events as they occur. 	<ul style="list-style-type: none"> ✗ Can be expensive and time-consuming to conduct. ✗ Needs well-qualified staff to conduct. ✗ Observation may affect behaviour of program participants. ✗ Can be difficult to interpret and categorize seen behaviours. ✗ Can be complex to categorize observations.
<p>6. Documentation and Record Review</p>	<ul style="list-style-type: none"> ✓ Can be objective. ✓ Can be quick (depending on amount of data involved). ✓ Get comprehensive and historical information. ✓ Doesn't interrupt program or client's routine in program. ✓ Information already exists. ✓ Few biases about information. 	<ul style="list-style-type: none"> ✗ Can also take much time, depending on data involved. ✗ Data may be difficult to organize. ✗ Can be difficult to interpret data. ✗ Data may be incomplete or restricted. ✗ Need to be quite clear about what looking for. ✗ Not flexible means to get data.



7. Case Studies	<ul style="list-style-type: none"> ✓ Fully depicts client's experience in program input, process and results. ✓ Can be a powerful means to portray program to outsiders. 	<ul style="list-style-type: none"> ✗ Usually quite time consuming to collect, organize and describe ✗ Represents depth of information, rather than breath.
------------------------	--	--

The above table is a compilation of information take from the following documents and sources: Carter McNamara's *Basic Guide to Program Evaluation*; HER/NSF's *User-Friendly Handbook for Project Evaluation*; and SAMHSA – CSAP – NCAP.



Appendix 8: The Environmental Education Council of Ohio Guidelines for Success (EECO, 2000)

Strand 1: Questioning and Analysis Skills.

Environmental literacy depends on learners' ability to ask questions, speculate, and hypothesize about the world around them; seek information; and develop answers to their questions.

Learners must be familiar with inquiry, master fundamental skills for gathering and organizing information, and interpret and synthesize information to develop and communicate explanations. Specific skills in this strand are:

- Questioning.
- Designing investigations.
- Collecting information.
- Evaluating accuracy and reliability.
- Organizing information.
- Working with models and simulations.
- Developing explanations.

Strand 2: Knowledge of Environmental Processes and Systems.

An important component of environmental literacy is understanding the processes and systems that comprise the environment, including human systems and influences. That understanding is based on knowledge synthesized from across traditional disciplines. The guidelines in this section are grouped in four sub-categories:

2.1 The Earth as a Physical System

- Processes that shape the Earth.
- Changes in matter.
- Energy.

2.2 The Living Environment

- Organisms, populations, and communities.
- Heredity and evolution.
- Systems and connections.
- Flow of matter and energy.

2.3 Humans and Their Societies

- Individuals and groups.
- Culture.
- Political and economic systems.
- Global connections.
- Change and conflict.

2.4 Environment and Society

- Human/environment interactions.
- Places.
- Resources.



- Technology.
- Environmental issues.

Strand 3: Skills for Understanding and Addressing Environmental Issues.

Skills and knowledge are refined and applied in the context of environmental issues. These environmental issues are real-life dramas where differing viewpoints about environmental problems and their potential solutions are played out. Environmental literacy includes the abilities to define, learn about, evaluate, and act on environmental issues. In this section, the guide- lines are grouped in two sub-categories:

3.1 Skills for Analyzing and Investigating Environmental Issues

- Identifying and investigating issues.
- Sorting out the consequences of issues.
- Identifying and evaluating alternative solutions and courses of action.
- Working with flexibility, creativity, and openness.

3.2 Decision-Making and Citizenship Skills

- Forming and evaluating personal views.
- Evaluating the need for citizen action.
- Planning and taking action.
- Evaluating the results of actions.

Strand 4: Personal and Civic Responsibility.

Environmentally literate citizens are willing and able to act on their own conclusions about what should be done to ensure environmental quality. As learners develop and apply concept-based learning and skills for inquiry, analysis, and action, they also understand that what they do individually and in groups can make a difference. Specific skills in this strand are:

- Understanding societal values and principles.
- Recognizing citizens' rights and responsibilities.
- Recognizing efficacy.
- Accepting personal responsibility.

EECO uses Roth's three levels of environmental literacy (nominal, functional and operational) as guidelines for adult and general public audiences.



Appendix 9: Roth's Levels of Environmental Competency

Nominal Environmental Literacy:

Knowledge Strand: Nominally environmentally literate individuals are familiar with:

- The nature of the basic components of elemental systems (e.g., living and non-living things, requirements for life)
- Types and examples of interactions between humans and nature
- Basic components of societal systems

Affective Strand: Have affective sensitivities about:

- Appreciation of both nature and society
- Elementary sensitivity and empathy for both nature and society
- Elemental perceptions of points of conflict between nature and society

Skill Strand: Have skills of: **Identifying** and defining problems.

- Recognizing issues surrounding identified problems or proposed solutions (e.g. latent and visible conflicts)

Behavior Strand: Demonstrate:

- Familial, school and organization activities and habits aimed at maintenance of environmental quality
- Responding and coping behaviors

Functional Environmental Literacy

Knowledge Strand: The functional environmentally literate citizen, in addition to the knowledge of the nominally literate, has knowledge of and understanding of a number of ecological, economic, geographic, religious, educational and political processes and understanding of the effects/impacts of humans on natural systems, including (abbreviated listing):

- Population dynamics
- Interactions
- Interdependence
- Thinking in terms of time frames or scales

Skill Strand: The functionally environmentally literate demonstrate basic skills in analyzing problems and issues and conducting investigations of problems and issues using primary and secondary resource/ strategies such as (abbreviated listing):

- Identifying environmental issues
- Seeking historical background of issues
- Investigating environmental issues
- Evaluating sources of information
- Analyzing environmental issues from various perspectives
- Applying ecological concepts to predicting probable ecological consequences



- Identifying alternative solutions and value perspectives
- Evaluating alternative solutions
- Conducting basic risk analysis
- Identifying and clarifying his/her value positions
- Examining issues from local, national, regional, and international points of view
- Thinking in terms of systems
- Demonstrating ability to forecast, to think ahead, plan

Affect Strand: The functionally environmentally literate demonstrate such basic affects, attitudes and values as:

- Identification with, and feelings of concern for, both society and the environment
- Willingness to recognize and choose among differing value perspectives associated with problems and issues
- Internal locus of control
- Treating public and private property with equal respect
- Sense of stewardship

Behavior Strand: The functionally environmentally literate moves to action through selected lifestyle activities/behaviors and community/organizational behaviors demonstrated by:

- Taking action positions and actions based on best available knowledge
- Taking individual and/or group action through: persuasion, consumerism, political action, legal action, ecomanagement

Operational Environmental Literacy

Skill Strand: Skills involved with evaluating problems and issues on the basis of available evidence (facts) and personal values and skills used in planning, implementing, and evaluating solutions, including using the process skills of scientific inquiry:

- Using ability to forecast, to think ahead, plan
- Using ability to separate number, quantity, quality, and value
- Imagining
- Connecting
- Valuing and value analysis
- Using primary and secondary sources of information
- Using ability to separate fact from opinion
- Determining the roles played by differing human beliefs and values in environmental issues

Affect Strand:

Affects, attitudes and values, that indicate a valuation of both nature and society, a sense of investment in and responsibility for the resolution of problems and issues along with a respect for both nature and society and a willingness to participate in, and show a sense of efficacy toward the resolution of problems and issues including (abbreviated listing):

- Awareness of and sensitivity to the total environment and its allied programs



- Motivation to actively participate in environmental improvement and protection
- Taking into account historical perspectives while focusing on current and potential environmental situations
- Strong internal locus of control
- Personal responsibility: recognition of impacts of personal behavior; acceptance of personal responsibility for the impacts; willingness to help correct or avoid negative impacts

Behavior Strand: Actions that demonstrate leadership in working toward the resolution of problems and issues including:

- Evaluating actions with respect to their impact on quality of life and environment
- Providing verbal commitments
- Working to maintain biological and social diversity
- Continually examining and reexamining the values of the culture
- Making decisions based on beneficence, justice, stewardship, prudence, cooperation, and compassion



Appendix 10: American Association for the Advancement of Science K-12 Benchmarks for Scientific Literacy – Systems Understanding

Grade Level	AAAS Benchmarks
K-2	<ul style="list-style-type: none"> • Most things are made of parts. • Something may not work if some of its parts are missing. • When parts are put together, they can do things that they couldn't do by themselves.
3-5	<ul style="list-style-type: none"> • In something that consists of many parts, the parts usually influence one another. • Something may not work as well (or at all) if a part is missing, broken, worn out, mismatched or misconnected.
6-8	<ul style="list-style-type: none"> • A system can include processes as well as things. • Thinking about things as systems means looking for how every part relates to others. The output from one part of a system (which can include material, energy or information) can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole. • Any system is usually connected to other systems, both internally and externally. Thus a system may be thought of as containing subsystems and as being a subsystem of a larger system.
9-12	<ul style="list-style-type: none"> • A system usually has some properties that are different from its parts but appear because of the interaction of those parts. • Understanding how things work and designing solutions to problems of almost any kind can be facilitated by systems analysis. In defining a system it is important to specify its boundaries and subsystems, indicate its relation to other systems, and identify what its input and outputs are expected to be. • The successful operation of a designed system usually involves feedback. The feedback of output from some parts of a system to input for other parts can be used to encourage what is going on in a system, discourage it, or reduce its discrepancy from some desired value.²² The stability of a system can be greater when it includes appropriate feedback mechanisms. • Even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.

Appendix 11: NAAEE Environmental Literacy Learner outcomes for fourth, eighth and twelfth grades (NAAEE, 2010)

OVERVIEW

FOURTH GRADE



Learners should be able to meet the guidelines included in this section by the end of fourth grade. The kindergarten through fourth grade years are a time of tremendous cognitive development. By third and fourth grades, learners have developed some basic skills that help them construct knowledge. Instructors in earlier grade levels should use these fourth grade guidelines as a target, extrapolating from this end goal appropriate activities and lessons for younger learners.

In these early years of formal education, learners tend to be concrete thinkers with a natural curiosity about the world around them. Environmental education can build on these characteristics by focusing on observation and exploration of the environment - beginning close to home.

EIGHTH GRADE

Learners should be able to meet the guidelines included in this section by the end of eighth grade.

In the fifth through eighth grades, learners begin to develop skills in abstract thinking and continue to develop creative thinking skills - and along with these, the ability to understand the interplay of environmental and human social systems in greater depth. Environmental education can foster this development by focusing on investigation of local environmental systems, problems, and issues. As learners become actively engaged in deciding for themselves what is right and wrong, educators can use environmental problems to help learners explore their own responsibilities and ethics.

TWELFTH GRADE

Learners should be able to meet the guidelines included in this section by the time they graduate from high school.

By the end of twelfth grade, learners are well on their way to environmental literacy. They should possess the basic skills and dispositions they need to understand and act on environmental problems and issues as responsible citizens - and to continue the learning process throughout their lives. In the ninth through twelfth grades, environmental education can promote active and responsible citizenship by challenging learners to hone and apply problem-solving, analysis, persuasive communication, and other higher-level skills - often in real-world contexts.

STRAND 1: Questioning, Analysis, and Interpretation Skills

FOURTH GRADE

A) Questioning:

Learners are able to develop questions that help them learn about the environment and do simple investigations.

B) Designing investigations: Learners are able to design simple investigations.



C) Collecting information:

Learners are able to locate and collect information about the environment and environmental topics.

D) Evaluating accuracy and reliability:

Learners understand the need to use reliable information to answer their questions. They are familiar with some basic factors to consider in judging the merits of information.

E) Organizing information:

Learners are able to describe data and organize information to search for relationships and patterns concerning the environment and environmental topics.

F) Working with models and simulations:

Learners understand that relationships, patterns, and processes can be represented by models.

G) Drawing conclusions and developing explanations:

Learners can develop simple explanations that address their questions about the environment.

EIGHTH GRADE

A) Questioning:

Learners are able to develop, focus, and explain questions that help them learn about the environment and do environmental investigations.

B) Designing investigations:

Learners are able to design environmental investigations to answer particular questions—often their own questions.

C) Collecting information:

Learners are able to locate and collect reliable information about the environment or environmental topics using a variety of methods and sources.

D) Evaluating accuracy and reliability:

Learners are able to judge the weaknesses and strengths of the information they are using.

E) Organizing information:

Learners are able to classify and order data, and to organize and display information in ways that help analysis and interpretation.

F) Working with models and simulations:

Learners understand many of the uses and limitations of models.



G) Drawing conclusions and developing explanations:

Learners are able to synthesize their observations and findings into coherent explanations.

TWELFTH GRADE

A) Questioning:

Learners are able to develop, modify, clarify, and explain questions that guide environmental investigations of various types. They understand factors that influence the questions they pose.

B) Designing investigations:

Learners know how to design investigations to answer particular questions about the environment. They are able to develop approaches for investigating unfamiliar types of problems and phenomena.

C) Collecting information:

Learners are able to locate and collect reliable information for environmental investigations of many types. They know how to use sophisticated technology to collect information, including computer programs that access, gather, store, and display data.

D) Evaluating accuracy and reliability:

Learners can apply basic logic and reasoning skills to evaluate completeness and reliability in a variety of information sources.

E) Organizing information:

Learners are able to organize and display information in ways appropriate to different types of environmental investigations and purposes.

F) Working with models and simulations:

Learners are able to create, use, and evaluate models to understand environmental phenomena.

G) Drawing conclusions and developing explanations:

Learners are able to use evidence and logic in developing proposed explanations that address their initial questions and hypotheses.

STRAND 2: Knowledge of Environmental Processes and Systems

STRAND 2.1: The Earth as a Physical System

FOURTH GRADE

A) Processes that shape the Earth:

Learners are able to identify changes and differences in the physical environment.

B) Changes in matter:

Learners are able to identify basic characteristics of and changes in matter.



C) Energy:

While they may have little understanding of formal concepts associated with energy, learners are familiar with the basic behavior of some different forms of energy.

EIGHTH GRADE

A) Processes that shape the Earth:

Learners have a basic understanding of most of the physical processes that shape the Earth. They are able to explore the origin of differences in physical patterns.

B) Changes in matter:

Learners understand the properties of the substances that make up objects or materials found in the environment.

C) Energy:

Learners begin to grasp formal concepts related to energy by focusing on energy transfer and transformations. They are able to make connections among phenomena such as light, heat, magnetism, electricity, and the motion of objects.

TWELFTH GRADE

A) Processes that shape the Earth:

Learners understand the major physical processes that shape the Earth. They can relate these processes, especially those that are large-scale and long-term, to characteristics of the Earth.

B) Changes in matter:

Learners apply their understanding of chemical reactions to round out their explanations of environmental characteristics and everyday phenomena.

C) Energy:

Learners apply their knowledge of energy and matter to understand phenomena in the world around them.

STRAND 2.2: The Living Environment

FOURTH GRADE

A) Organisms, populations, and communities:

Learners understand basic similarities and differences among a wide variety of living organisms. They understand the concept of habitat.

B) Heredity and evolution:

Learners understand that plants and animals have different characteristics and that many of the characteristics are inherited.



C) Systems and connections:

Learners understand basic ways in which organisms are related to their environments and to other organisms.

D) Flow of matter and energy:

Learners know that living things need some source of energy to live and grow.

EIGHTH GRADE

A) Organisms, populations, and communities:

Learners understand that biotic communities are made up of plants and animals that are adapted to live in particular environments.

B) Heredity and evolution:

Learners have a basic understanding of the importance of genetic heritage.

C) Systems and connections:

Learners understand major kinds of interactions among organisms or populations of organisms.

D) Flow of matter and energy:

Learners understand how energy and matter flow among the abiotic and biotic components of the environment.

TWELFTH GRADE

A) Organisms, populations, and communities:

Learners understand basic population dynamics and the importance of diversity in living systems.

B) Heredity and evolution:

Learners understand the basic ideas and genetic mechanisms behind biological evolution.

C) Systems and connections:

Learners understand the living environment to be comprised of interrelated, dynamic systems.

D) Flow of matter and energy:

Learners are able to account for environmental characteristics based on their knowledge of how matter and energy interact in living systems.

STRAND 2.3: Humans and Their Societies

FOURTH GRADE



A) Individuals and groups:

Learners understand that people act as individuals and as group members and that groups can influence individual actions.

B) Culture:

Learners understand that experiences and places may be interpreted differently by people with different cultural backgrounds, at different times, or with other frames of reference.

C) Political and economic systems:

Learners understand that government and economic systems exist because people living together in groups need ways to do things such as provide for needs and wants, maintain order, and manage conflict.

D) Global connections: Learners understand how people are connected at many levels, including the global level -

by actions and common responsibilities that concern the environment.

E) Change and conflict:

Learners recognize that change is a normal part of individual and societal life. They understand that conflict is rooted in different points of view.

EIGHTH GRADE

A) Individuals and groups:

Learners understand that how individuals perceive the environment is influenced in part by individual traits and group membership or affiliation.

B) Culture:

As they become familiar with a wider range of cultures and subcultures, learners gain a new understanding of cultural perspectives on the environment and how the environment may, in turn, influence culture.

C) Political and economic systems:

Learners become more familiar with political and economic systems and how these systems take the environment into consideration.

D) Global connections: Learners become familiar with the ways in which the world's environmental, social, economic, cultural, and political systems are linked.

E) Change and conflict:

Learners understand that human social systems change over time and that conflicts sometimes arise over differing and changing viewpoints about the environment.

TWELFTH GRADE



A) Individuals and groups:

Learners understand the influence of individual and group actions on the environment, and how groups can work to promote and balance interests.

B) Culture:

Learners understand cultural perspectives and dynamics and apply their understanding in context.

C) Political and economic systems:

Learners understand how different political and economic systems account for, manage, and affect natural resources and environmental quality.

D) Global connections:

Learners are able to analyze global, social, cultural, political, economic, and environmental linkages.

E) Change and conflict:

Learners understand the functioning of public processes for promoting and managing change and conflict, and can analyze their effects on the environment.

STRAND 2.4: Environment and Society

FOURTH GRADE

A) Human/environment interactions:

Learners understand that people depend on, change, and are affected by the environment.

B) Places:

Learners understand that places differ in their physical and human characteristics.

C) Resources:

Learners understand the basic concepts of resource and resource distribution.

D) Technology:

Learners understand that technology is an integral part of human existence and culture.

E) Environmental issues:

Learners are familiar with some local environmental issues and understand that people in other places experience environmental issues as well.

EIGHTH GRADE

A) Human/environment interactions: Learners understand that human-caused changes have consequences for the immediate environment as well as for other places and future times.



B) Places:

Learners begin to explore the meaning of places both close to home and around the world.

C) Resources:

Learners understand that uneven distribution of resources influences their use and perceived value.

D) Technology:

Learners understand the human ability to shape and control the environment as a function of the capacities for creating knowledge and developing new technologies.

E) Environmental issues:

Learners are familiar with a range of environmental issues at scales that range from local to national to global. They understand that people in other places around the world experience environmental issues similar to the ones they are concerned about locally.

TWELFTH GRADE

A) Human/environment interactions:

Learners understand that humans are able to alter the physical environment to meet their needs and that there are limits to the ability of the environment to absorb impacts or meet human needs.

B) Places: Learners understand “place” as humans endowing a particular part of the Earth with meaning through their interactions with that environment.

C) Resources:

Learners understand that the importance and use of resources change over time and vary under different economic and technological systems.

D) Technology:

Learners are able to examine the social and environmental impacts of various technologies and technological systems.

E) Environmental issues:

Learners are familiar with a range of environmental issues at scales that range from local to national to global. They understand that these scales and issues are often linked.

STRAND 3: Skills for Understanding and Addressing Environmental Issues

STRAND 3.1: Skills for Analyzing and Investigating Environmental Issues

FOURTH GRADE



A) Identifying and investigating issues:

Learners are able to identify and investigate issues in their local environments and communities.

B) Sorting out the consequences of issues:

As learners come to understand that environmental and social phenomena are linked, they are able to explore the consequences of issues.

C) Identifying and evaluating alternative solutions and courses of action:

Learners understand there are many approaches to resolving issues.

D) Working with flexibility, creativity, and openness:

Learners understand the importance of sharing ideas and hearing other points of view.

EIGHTH GRADE

A) Identifying and investigating issues:

Learners are able to use primary and secondary sources of information, and apply growing research and analytical skills, to investigate environmental issues, beginning in their own community.

B) Sorting out the consequences of issues:

Learners are able to apply their knowledge of ecological and human processes and systems to identify the consequences of specific environmental issues.

C) Identifying and evaluating alternative solutions and courses of action:

Learners are able to identify and develop action strategies for addressing particular issues.

D) Working with flexibility, creativity, and openness:

Learners are able to consider the assumptions and interpretations that influence the conclusions they and others draw about environmental issues.

TWELFTH GRADE

A) Identifying and investigating issues:

Learners apply their research and analytical skills to investigate environmental issues ranging from local issues to those that are regional or global in scope.

B) Sorting out the consequences of issues:

Learners are able to evaluate the consequences of specific environmental changes, conditions, and issues for human and ecological systems.

C) Identifying and evaluating alternative solutions and courses of action:

Learners are able to identify and propose action strategies that are likely to be effective in particular situations and for particular purposes.



D) Working with flexibility, creativity, and openness:

While environmental issues investigations can bring to the surface deeply held views, learners are able to engage each other in peer review conducted in the spirit of open inquiry.

STRAND 3.2: Decision-Making and Citizenship Skills

FOURTH GRADE

A) Forming and evaluating personal view:

Learners are able to examine and express their own views on environmental issues.

B) Evaluating the need for citizen action:

Learners are able to think critically about whether they believe action is needed in particular situations and whether they believe they should be involved.

C) Planning and taking action: By participating in issues of their choosing, mostly close to home - they learn the basics of individual and collective action.

D) Evaluating the results of actions:

Learners understand that civic actions have consequences.

EIGHTH GRADE

A) Forming and evaluating personal views:

Learners are able to identify, justify, and clarify their views on environmental issues and alternative ways to address them.

B) Evaluating the need for citizen action:

Learners are able to evaluate whether they believe action is needed in particular situations, and decide whether they should be involved.

C) Planning and taking action:

As learners begin to see themselves as citizens taking active roles in their communities, they are able to plan for and engage in citizen action at levels appropriate to their maturity and preparation.

D) Evaluating the results of actions:

Learners are able to analyze the effects of their own actions and actions taken by other individuals and groups.

TWELFTH GRADE

A) Forming and evaluating personal views:

Learners are able to communicate, evaluate, and justify their own views on environmental issues and alternative ways to address them.



B) Evaluating the need for citizen action:

Learners are able to decide whether action is needed in particular situations and whether they should be involved.

C) Planning and taking action:

Learners know how to plan for action based on their research and analysis of an environmental issue. If appropriate, they take actions that are within the scope of their rights and consistent with their abilities and responsibilities as citizens.

D) Evaluating the results of actions:

Learners are able to evaluate the effects of their own actions and actions taken by other individuals and groups, including possible intended and unintended consequences of actions.

STRAND 4: Personal and Civic Responsibility

FOURTH GRADE

A) Understanding societal values and principles:

Learners can identify fundamental principles of U.S. society and explain their importance in the context of environmental issues.

B) Recognizing citizens' rights and responsibilities:

Learners understand the basic rights and responsibilities of citizenship.

C) Recognizing efficacy: Learners possess a realistic self-confidence in their effectiveness as citizens.

D) Accepting personal responsibility:

Learners understand that they have responsibility for the effects of their actions.

EIGHTH GRADE

A) Understanding societal values and principles:

Learners understand that societal values can be both a unifying and a divisive force.

B) Recognizing citizens' rights and responsibilities:

Learners understand the rights and responsibilities of citizenship and their importance in promoting the resolution of environmental issues.

C) Recognizing efficacy: Learners possess a realistic self-confidence in their effectiveness as citizens.

D) Accepting personal responsibility:

Learners understand that their actions can have broad consequences and that they are responsible for those consequences.



TWELFTH GRADE

A) Understanding societal values and principles:

Learners know how to analyze the influence of shared and conflicting societal values.

B) Recognizing citizens' rights and responsibilities:

Learners understand the importance of exercising the rights and responsibilities of citizenship.

C) Recognizing efficacy: Learners possess a realistic self-confidence in their effectiveness as citizens.

D) Accepting personal responsibility:

Learners understand that their actions can have broad consequences and accept responsibility for recognizing those effects and changing their actions when necessary.



Appendix 12: Manitoba Life Practices Learner outcomes

Sustainability Life Practices

Activating — Early Years

Human Health and Well-Being

1E Demonstrate healthy behaviours

- eat and drink wisely (e.g., eating fewer processed foods)
- participate in daily physical activity
- get proper rest
- practise good personal hygiene

2E Demonstrate safe behaviours

- participate in safety awareness programs (fire, water, bike, traffic, etc.)
- avoid behaviour that may cause injury

3E Demonstrate care and concern for others at home and at school

- do volunteer work
- make charitable donations, assist with fundraising
- contribute to food hampers for the needy
- show respect for other people, regardless of gender or culture
- care for and treat animals humanely
- engage in peaceful conflict resolution
- appreciate the diversity that makes each human unique

The Environment

4E Demonstrate behaviours that contribute to the well-being of their local environment

- participate in a recycling program in their classroom
- make environmental changes to the classroom or home that enhances physical and mental health, e.g., grow potted plants to improve air quality, install wildlife houses and feeders
- dispose of trash in an appropriate manner
- stay on paths and don't pick wildflowers in natural areas
- take part in a variety of activities in the local environment, e.g., visit a local nature centre
- reduce personal use of water and energy, e.g., don't leave water running when brushing teeth, turn off lights when leaving a room
- appreciate how humans and other living things depend on the environment to meet their needs
- show respect for living things

The Economy

5E Make wise choices about consumption:



- reduce, reuse, and recycle products used in the classroom, school, home, and their school
- reduce the amount of garbage produced
- use litterless lunch kits
- avoid wasting food, i.e., take only that which can be eaten, and eat what is taken
- make and use a compost in the classroom
- use natural and recycled materials for projects
- differentiate between needs and wants; don't make unnecessary purchases
- use and treat resources (clothing and school supplies such as notebooks, binders, paper, crayons, glue) wisely and judiciously, so as not to be wasteful; e.g., use both sides of paper before recycling, reuse binders year to year, etc.

5E Use energy-efficient practices

- turn off lights when not in use
- turn off tap water while brushing teeth
- take shorter showers
- bike or walk instead of asking for rides
- dress warmly instead of turning up the heat

6E Understand basic economic principles

- become involved in family budget discussions and decisions
- save money in a piggy bank or savings account for future activities
- engage in trade and barter of goods and services
- help sustain the family household, e.g., do regular chores
- share personal resources equitably and cooperatively with others

Taking Action

7E Take action on sustainability issues

- communicate the principles of recycling with their families and friends, and pen pals

Acquiring — Middle Years

Human Health and Well-Being

1M Demonstrate healthy behaviours

- make informed and healthy food choices by purchasing and eating healthy food and making appropriately sized lunches
- demonstrate awareness of the advantages of physical activity both personally and for society, e.g., participate in daily physical activity to improve health and reduce health care costs
- reduce sedentary time, e.g., watching TV, playing video games, etc.

2M Demonstrate safe behaviours

- demonstrate safety precautions related to weather and the seasons, e.g., stay off of thin ice, cover face and head if outdoors during extreme windchill
- practise fire safety and prevention
- carry out activities in a safe and responsible manner
- encourage others to act in a safe manner
- wear appropriate safety gear, e.g., bicycle helmet, safety goggles



3M Demonstrate care and concern for others, locally, nationally, and globally

- interact empathetically with people of other cultures and with the disabled
- contribute to, or volunteer for a worthwhile cause, e.g., a local shelter or soup kitchen
- as a class or school, undertake a project to aid others locally, nationally, or globally, e.g., sponsor a foster child in a developing country

The Environment**4M Demonstrate behaviours that contribute to the well-being of the environment, at home, school, and in the community**

- establish a recycling program in their school
- establish sustainability guidelines for student-council decisions and activities
- work in teams and participate in community sustainability projects, e.g., clean up a local riverbank
- do not keep exotic pets, which threatens or endangers their existence
- participate in the repairing of environmental damage to the school yard and surrounding community
- find and use alternatives to herbicides and pesticides in school and family gardens, e.g., pull weeds by hand, use non-chemical slug traps, etc.
- engage in activities that reduce or prevent water, air, soil, and noise pollution
- practise proper disposal of hazardous waste, e.g., batteries, motor oil, printer cartridges, bleach containers, etc.
- explore a stream, river, pond, lake, estuary, or bay through observation and study
- get involved in life practices that protect watershed or drainage basins

The Economy**5M Make wise choices about consumption:**

- use a word processor instead of paper
- where possible, read online instead of printing hard copies
- recycle, i.e., refuse, reduce, replace, reuse in order to reduce consumption and recycling
- purchase in bulk or concentrated forms
- use clotheslines instead of dryers
- repair products to extend useful life instead of replacing them
- repair worn or torn clothing items instead of purchasing new items
- avoid purchasing products made with excessive packaging
- avoid buying products made from endangered plants and animals

5M Use energy-efficient practices

- investigate alternative energy sources
- conduct an energy audit of the school and suggest improvements

6M Understand basic economic principles

- help set priorities and contribute to decision making regarding the family budget
- create and follow a personal budget
- begin to investigate career options
- shop and make purchases according to sustainability principles
- volunteer to help in home, school, and/or community programs, e.g., community clubs,



recreation programs, church, babysitting, etc.

Taking Action

7M Take action on sustainability issues

- analyze local and national sustainability issues
- use the sustainability decision making model to explore sustainability issues

Applying and Promoting — Senior Years

Human Health and Well-Being

1S Demonstrate healthy behaviours

- choose a healthy diet that makes wise use of resources, e.g., reduce meat consumption and increase grain consumption; purchase in bulk; eat less junk food; increase consumption of fruits and vegetables, organically grown foods, and foods with a high fibre content
- make decisions that promote active living, personal safety, and responsible sexual behaviour
- participate in outdoor recreation, e.g., canoeing, cycling, hiking
- participate in programs that prevent substance abuse, e.g., anti-tobacco and anti-drug use programs

2S Demonstrate safe behaviours

- take safety training courses, e.g., first aid, CPR, boating, snowmobiling, handling farm equipment
- use hiking/cycling/snowmobiling paths and show respect for and follow rules related to recreational paths or routes
- drive cautiously in wildlife areas
- drive within speed limits in a properly tuned vehicle

3S Demonstrate care and concern for others, locally, nationally, and globally

- engender and promote intercultural understanding
- be a sustainability role model/mentor to younger children
- take a child on a nature hike
- participate in school, local, and national government and decision making processes, e.g., present a petition to the town council asking for the establishment of a teen drop-in centre

The Environment

4S Demonstrate behaviours that contribute to the well-being of the environment, locally, nationally, and globally

- establish a recycling program in their community
- take ecology courses offered in school, or request courses be developed if they are not available
- respect and follow the laws governing hunting, fishing, and trapping
- repair environmental damage to the community and surrounding areas
- design and implement projects that enhance or protect a natural habitat, e.g., prairie



- restoration project
- participate in community projects to enhance the environment, e.g., shelterbelt planting, shoreline restoration
- sow indigenous plants at school and at home
- educate others about the importance of a healthy natural environment
- work with faculty and administration to implement sustainability policies and practices within the school
- participate in school, local, and national government decision-making processes, e.g., take part in local decisions to approve or not approve agricultural or industrial expansion

The Economy

5S Make wise choices about consumption:

- organize and establish a recycling program/project at home, school, and in the community
- avoid excessive consumerism
- be a responsible consumer by purchasing durable goods of good quality
- avoid purchasing disposable or unneeded items, e.g., fad items, non-reusable items, and items purposely designed to become obsolete
- demonstrate awareness of the origin of purchased goods and production practices related to the goods they purchase

5S Use energy-efficient practices

- evaluate energy efficiency means at home (heat, hot water, and appliances)
- make suggestions for improvement, and work with family members to create a more sustainable household
- choose energy efficient vehicles
- choose a sustainable method of transportation, e.g., walk, bicycle, car pool, and use public transportation
- purchase foods and goods grown and produced locally to eliminate energy used for long-distance transport

6S Understand basic economic principles

- take responsibility for the management of personal finances
- earn money to support personal needs
- make a career and/or post-secondary education plan
- advocate for the equitable distribution of resources, locally, nationally, and globally
- find substitutes for scarce resources
- encourage and/or open and operate an environmentally sustainable business, e.g., environmentally friendly lawn service, snow-shovelling, etc.
- volunteer at a local food bank, soup kitchen, homeless shelter, or for community projects such as Habitat for Humanity, community clean-up
- appreciate the benefits of industrial development in contributing to our present standard of living

Taking Action

7S Take action on sustainability issues

- investigate sustainability issues



- participate in sustainability discussions with peers and decision makers
- debate local, national, or global issues by researching and adopting a particular perspective
- participate in Earth Day celebrations, school-planting, "Green School" programs, marathon clubs, "Yellow Fish" painting on storm drains
- as a class, identify and discuss a significant sustainability problem/issue
- participate in sustainability discussions with their peers
- prepare and present a persuasive argument that supports sustainability
- send letters and email to people of influence in the surrounding community
- reflect on personal beliefs and actions related to sustainability
- join a local community group to solve an environmental problem
- communicate their views on sustainability issues to local and federal politicians
- lobby within their local community for hiking/cycle paths
- reduce noise pollution related to volume, e.g., dances, portable stereo volume, industrial noise
- analyze local, national, and global issues from a sustainability perspective, including attention to human health and well-being, the environment, the economy, and quality of life

