A Systems Thinking Approach to Green Schools

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Abstract

The school facility is positioned to provide contextual cues for informal and formal learning in environmental education (EE). Evidence suggests that incorporating the school facility with EE also provides a context in which students can engage with environmental issues like waste management and energy conservation. Using the school building as a learning tool has been well documented and is supported as an instructional approach in Ontario's public schools. The purpose of this study is to explore the interacting attributes of Ontario EcoSchools to identify themes supporting the integration of the school facility with EE. This qualitative study examines how this occurs within the context of whole school sustainability. This is achieved through a secondary data analysis of the results from 2017/2018 EcoSchool Platinum applications to determine how these schools are integrating the school facility with EE. Platinum certification allows high achieving schools to deepen their existing green school program. A school's building and operations are important components in achieving school board policies for EE and sustainability while also supporting national and provincial climate change mitigation and sustainability objectives. The findings in this investigation highlight the themes, *Formal/Curriculum Learning, Non-formal Learning, Building Attributes, Cross-Cutting and Partnerships* within the school facility that is a sub-system functioning as a place where students are learning about environmental issues through direct and indirect engagement with their surroundings. Integrating the school facility with EE reflected non-linear approaches to EE where students were reflexive as they engaged in sustainable practice while co-creating their sense of place with the school facility.

Forward

Through this Major Research Paper, I wanted to investigate alternate methods in implementing environmental education (EE) within everyday learning, more specifically how the built environment can be used as a tool for EE and sustainable practice. My experience within the public-school system highlights the need to develop different access points that facilitates student engagement with environmental learning. Ontario schools are diverse and how EE is presented within classroom should reflect that diversity. During my fourth term I attended the Green Building Festival 2018, and I left feeling inspired because of the potential of sustainable buildings in society and how they can be used as more than just a place to learn in. School buildings are recognized as the "third teacher" and have the potential to expand learning in environmental sustainability if they are thoughtfully integrated with an EE program. This became the catalyst for my study. In collaboration with Ontario EcoSchools, I was provided with data from Platinum applications to investigate the relationship between school facilities and comprehensive EE programs.

My graduate work fulfills the three areas of my plan of study. My first component is Education Models. The analysis of data describes how 23 schools established whole school sustainability through completion of the EcoSchools program with the school facility functioning as an active part of the school system. The themes and their corresponding codes that came from the analysis illustrate how these schools have structured themselves as green schools. This is reflected in the strategies and initiatives schools took within the 6 program sections, Teamwork and Leadership, Energy Conservation, Waste Minimization, School Ground Greening, Curriculum and Environmental Stewardship.

The second component, Sustainable Practice and Ecological Citizenship is reflected in how the schools created a culture of sustainability. This is especially portrayed through the events, challenges and campaigns each school implemented throughout the school year. This demonstrates how students and staff organized themselves to implement strategies and hold each other accountable to obtain their established

goals. A common thread supporting consistent sustainable practice is the establishment of clearly defined values reflecting environmental ethics and demonstrated through the behaviour of staff and students. The school facility becomes a symbol of sustainability and a reminder of students' efforts in EE.

Limitations to EE and Sustainable Practice is the final component of my plan of study and is developed through the analysis of EcoSchools as systems. I took a systems thinking approach to describe the relationships between the attributes of the school facility and the identified codes. A systems approach to analysis highlights the factors that influence the outcomes of the strategies implemented to develop EE programs. System thinking is an apt skill to learn and practice in EE and is recognized as an important method for solving ecological problems (Ministry of Education, 2009). Explicit lessons in systems thinking where students are aware of their learning goals in developing this skill was not determined. However, there were examples of students recognizing the environmental impact of their actions with the school facility through formal and non-formal learning. Some students tracked changes in their water and energy use and identified and discussed the impact of their behavioural changes within their class, school and wider societal context. Understanding the relationship between the elements of a green school explains where strengths and limitations are in the system. In the case of this study, the school facility is a sub-system within the larger school system.

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Terms and Definitions

Critical pedagogy of place – is a response to education reform policies and practices that do not examine relationships between education and the politics of economic development. Place becomes a critical construct because it analyzes the impact of political and economics of place to: identify and change ways of thinking that injure and exploit people and places (decolonization); create material spaces and places that teach us how to live in total harmony with environments (re-inhabitation) (Gruenwald, 2003).

Education for the environment - regards environmental improvement as an actual goal of education; develops a sense of responsibility and active pupil participation in the resolution of environmental problems; acknowledges the political elements that underpin any study of the environmental situation (Tilbury, 1995).

Education for Sustainability (EfS) - education directed at transforming existing cultural-discursive, material-economic and social-political orders and arrangements that hold non-sustainable ways of living in place (Kemmis & Mutton, 2012).

Environmental Education (EE) - environmental education is education about the environment, for the environment, and in the environment (Ontario Ministry of Education, 2009).

Holism – environmental education is about learning to see the whole picture surrounding a separate problem; it is concerned with how people interact with their total environment and with addressing environmental problems holistically through the curriculum (Meadows, 1990; Tilbury, 1995).

Indigenous sustainability science - emphasizes humans as components of complex systems that together make up, with other organisms an ecological web (Vaughan-Lee, 2013).

Place-based education – The process of using the local community and environment as a starting point to teach concepts in subjects across the curriculum. Emphasizing hands-on, real-world learning experiences, this approach to education helps students develop stronger ties to the community, enhances students' appreciation for the natural world, and creates a heightened commitment to serve as active, contributing citizens (Sobel, 2004).

Progressive pedagogy – learning shifts from texts and teachers to learning through experience, emphasis is on the context of learners and how they interact with their environments to construct meaning from social experience, the curriculum is organised around issues of personal and social significance (Webber & Miller, 2016). Shifts from static aims and materials toward engaging with a changing world and students critically reflect their experiences (Dewey, 1938).

School facility – the physical elements of the school environment; including school building, technology, grounds and garden.

Sustainability – commitment to the preservation and enhancement of and respect for the environment while advocating a coexistence with nature and the responsible use of the resources (Beckford, Jacobs, Williams & Nahdeee, 2010).

Sustainable development – the need for reconciliation between economic development and environmental conservation; the need to place any understanding of environmental concerns within a socio economic and political context; the need to combine environment and development concerns; development that meets the needs of the present without compromising the ability of future generations to meet their needs (WCED, 1987).

Systems – an interconnected set of elements that are coherently organized in a way that achieves something and must consist of: elements, interconnections and a function or purpose (Meadows, 2008).

Systems thinking - is a way of addressing complex problems and designs, which can be applied in any discipline or practice; is a framework for seeing interrelationships rather than things, for seeing patterns rather than static snapshots; a way of 'learning your way towards effective action' by looking at connected wholes rather than separate parts (Godfrey, 2010).

Transformational/Transformative learning - is the process of deep, constructive, and meaningful learning that often leads to profound changes in thoughts, feelings, perspectives, beliefs, and behaviors because it is a radical shift of consciousness. It results in a fundamental change in worldview because of reflective and conscious learning experiences (Simsek A, 2012).

Whole school sustainability – the incorporation of sustainability into all aspects of a school organization including; school governance, pedagogical approaches, curriculum, resource management, school operations, and grounds (Henderson and Tilbury, 2004).

"People make places and places make people. The kind of teaching and shaping that places accomplish, of course, depends on what kinds of attention we give to then and on how we respond to them."
(Gruenewald, 2003)

Introduction

Schools are valued places that provide contexts for learning from an internal and external landscape. These landscapes interact with individuals to form and organize their social experience. Places are invested with meaning and shape our consciousness, social identities, attitudes and behaviors (Hutchison, 2004). Increasing global concern and action for environmental sustainability make schools logical places to learn about environmental literacy, sustainable practice and ecological citizenship. Green schools are a response to widespread pressures for more comprehensive approaches to environmental sustainability that recognize the social, economic, biophysical and ecological relationships in solving problems associated with environmental degradation. Green schools offer unique places to engage with environmental education (EE) through the built and natural environment.

There are many components contributing to how green schools in Ontario function and each school has distinct qualities that inform how they develop and implement EE and sustainable practice. Even though there are differences in how green schools operate, there are common attributes that interact and affect their function. The school facility, curriculum and pedagogy are attributes of an education system that can be thoughtfully used to support learning for environmental sustainability. This study will examine the relationship between these attributes in Ontario EcoSchools to examine how they are engaging in EE and sustainable practice.

An emerging area of study in EE is beginning to identify the potential of explicitly using sustainable school buildings as learning tools to engage with environmental issues and sustainable practice. L B. Cole's article "The Teaching Green School Building" (2014) and her subsequent study "Framing the Teaching Green Building" (2017) demonstrate the role sustainable facility design can play in providing opportunities to implement EE while also supporting students in sustainable practice. One of the outcomes of Cole's study

is the importance of aligning the "channel and origin of sustainable messaging" on the impact of an EE program. School facilities do not have to be identified as green buildings to be integrated into EE as this study will show. Older established buildings can still be integrated with EE to provide rich learning opportunities with students. A key factor with this integration is alignment between curriculum and green building education (Cole, 2014).

Alignment between governance, school culture, role models and green facilities provided strong channels of sustainability messaging (Cole, 2017). This alignment results in students exhibiting increased levels of pro-environmental action and in-depth understanding about the attributes of their green school. Cole's study also illustrates the notion that having ideal components does not guarantee they will work together to support EE. Alignment between green school attributes is further emphasized in Bar's study "Green Schools that Teach: Identifying Attributes of Whole School Sustainability" (2011). Barr found that using the built environment as a learning tool for EE occurs when school culture and curriculum are interconnected with shared values and beliefs being at the core of whole-school sustainability.

Ontario's *Green Schools Resource Guide* (Ministry of Education, 2010) describes the ideal principles of sustainable green schools as, protecting the environment, lowering operational costs, improving the health and quality of the learning environment and integrating learning opportunities with the built environment. These principles reflect complex interaction between important components of green schools that do not always work together in an integrated and consistent way. Integrating the school facility with curriculum supports several influential progressive approaches to EE including experiential learning, place-based education and interdisciplinary learning. The design and function of physical space has pedagogical value by providing cues for inquiry and learning while informing occupants about how they relate with the built and natural environment (Strong-Wilson & Ellis, 2007). Identifying how the built environment and EE function as part of a green school's system will demonstrate whether an integrated approach to EE is occurring.

Ontario's policy framework for EE, *Acting Today, Shaping Tomorrow* (ATST) (Ministry of Education, 2009) supports an integrated approach to EE where curriculum and program development is a

shared responsibility between stakeholders. This includes professional development, ongoing progress reporting and community involvement. There is evidence supporting an integrated approach in school board policy and stakeholder objectives. The Toronto District School Board's (TDSB) *The Environment Policy* (2010) "commits the Board to an ongoing alignment between teaching and learning and the operation of schools to develop whole school ecologically literate communities" (p.1). An intended outcome of the *Environment* (2015) policy for Hamilton Wentworth District School Board (HWDSB) is an EE program that "models and teaches environmental education through an integrated approach that promotes collaboration in the development of resources and activities" (p.1). National organizations like Learning for a Sustainable Future (LSF) adopts a systems view of learning for EE that "thinks about the whole school learning experience in terms of parts, processes and their interactions" (Kozac and Elliot, 2014).

Green Schools, Sustainable Schools and Eco-Schools

There is not just one definition for green schools, rather there are attributes that make them distinct from traditional schools. Critics of traditional education view its subject matter to "consists of bodies of information and skills that have been worked out in the past" (Dewey, 1938, p. 17), thus restricting opportunities for students to be active participants in their learning. Further criticism is that learning is "too neatly packaged, complete and objective, and portrayed as clear and distinct items that are easily transferable" and not a reflection of current reality (Joldersma, 1999, p. 132). Information and skills in a traditional classroom are given to students from teachers, and students are rarely given a chance to develop their own knowledge (Freire, 1970). One of the main objectives in *Acting Today, Shaping Tomorrow* (Ministry of Education, 2009), is to "provide students with the skills, perspectives, and practices they will need to meet the social and environmental challenges of the future" (2007, p. 7). This involves supporting students in finding agency to create and implement solutions to environmental issues that are of interest to them. One of the core attributes of green schools is an integrated focus to implement EE and sustainable practice. The methods through which this focus manifests varies depending on different factors. Green schools are influenced by but not limited to geographical location, funding as well as government and school

board policy. Canada's Green Building Council (CaGBC) defines green schools as healthy, high-performance learning environments for students and provides 13 characteristics that further defines them. Energy and natural resource conservation, habitat protection, waste management efforts that benefits the local community and improving environmental literacy in students are some of the characteristics that define green schools (CaGBC, 2018).

The Center for Green Schools describes three pillars through which green schools can achieve success; reduce environmental impacts and costs, improve occupants' health and performance, and increase sustainability literacy (2019). The approaches to EE and sustainability in schools are generally centered around three interconnected areas, the school building and grounds, school culture and curriculum which are mutually reinforcing (Chernos, 2008). Creating a culture of sustainability in green schools requires parallel efforts in policy, community and curriculum which reflect the social, economic, political and psychological relationships within the school system (Cole, 2014).

Facility design including maintenance and operation are essential components of green schools. Public schools are ideal locations to enact sustainable practice like energy conservation by implementing a variety of behavioural and operational strategies (Schelly et al., 2012). A properly managed facility can reduce energy consumption and provide cost savings through energy efficient installations and accommodating behaviour. Ontario's Electricity Act (O. Reg. 507/18) requires school boards to implement and report to the public their energy conservation and demand management plans. This was formerly achieved through the now repealed Green Energy Act as of January 1, 2019. York Catholic District School Board (YCDSB) has saved a total of $34.2 million in energy costs since 2000 and diverted more than 850 tonnes of GHG emissions annually (Natural Resources Canada, 2018). Energy efficiency and conservation is vital for the function of green schools and is a major subject of focus within green school facilities, "Canadian schools spend about $500 million annually on energy" (NRCan, 2017). In addition to providing economic value, green school facilities also provide multiple pathways to environmental and sustainability education.

Best practices for environmental and sustainability education reflect an integrated and interdisciplinary approach to learning with an intention of fostering stewardship and conscious equitable relationships with place (Ministry of Education, 2017; Warner & Elser, 2015; Higgs & McMillan, 2006; Gruenewald, D. A, 2003; Tilbury, 1995). An effective way this is achieved is through progressive and critical pedagogy where knowledge is integrated with practical application to transform unjust social and environmental conditions (Speck & Hoppe, 2004; Dewey, 1986; Giroux, 1985). These types of learning situations are practical and provide opportunities for reflective problem solving (Rocheleau, 2004). Green schools that promote a progressive education program emphasize the context of the learner as they learn through experience (Dewey, 1986). Experiential learning is a hallmark of progressive education (Webber & Miller, 2016) and is a significant component of learning in green schools. EE at Green School in Bali, Indonesia is project-based that are connected to the built and natural environment (Macroy, 2013).

Integrating academic learning with environmentally sustainable practice through hands-on, place-based application is how many green schools implement their curriculum. Inquiry, problem, and land-based learning are progressive approaches to environmental and sustainability education that support students in solving environmental issues while allowing them to be reflexive about their own ideas and behaviour (Tucker & Izadpanahi, 2017; Craig & Allen, 2015; Gislason, 2009; Gallagher et al., 2000). Progressive and critical pedagogy are rooted in place and provide an avenue for students to actively engage in learning through the built environment. The intended outcome of these approaches to environmental learning facilitate the construction of knowledge while building agency to change oppressive social conditions that undermine the well-being of people and the environment.

Organizational culture within green schools reflect a pattern of shared values, beliefs and behaviour that align with environmental sustainability (Schelly et al., 2012). The different aspects of the school system work together to reinforce values and influence behaviour. Instead of repairing two aging elementary schools, Rainbow District School Board (RDSB Sudbury, ON) amalgamated them to form Valley View P S which was designed to save cost and coincide with the school board's *Go Green* policy (Chernos, 2008). *Go*

Green portrays the values of RDSB and is implemented to foster a culture of conservation, integrate green technology and encourage eco-friendly practices (2019). Students transferring to Valley View P S were involved during the construction phase of their new school through "assemblies with the architect, engineers and other key project personnel" (Chermos, 2008, p. 24). Educators, leaders and other stakeholders are essential in the process of communicating environmentally responsible behaviour, "one requirement of successful efforts to create organizational change for sustainability is the articulation of a clear vision based on values that are linked to behaviours and strategies" (Schelly et at., 2012, p. 145).

Active student engagement in formal and informal learning experiences also contribute to school culture. Formal learning is connected to curriculum expectations, is structured and reflects what students are required to achieve by the end of the school year. Informal learning can occur outside of structured lessons and is not directly related to assessment and evaluation (Callanan et at., 2011). The school facility can provide informal educational support for formal EE programs and facilitate sustainable practice (Cole, 2014). Student engagement in school can be linked with, facility maintenance, building design, school organization and learning. This provides different opportunities for students to learn from their experience with place and work collaboratively in applying practical skills to complete projects related to environmental sustainability.

Ontario School Buildings

Structural changes that embody sustainable practice like energy efficient upgrades and retrofits support the ability for buildings to play a critical role in climate change mitigation while also symbolizing industry and public support for environmental sustainability. In Ontario, the Greenhouse Gas Reduction Fund (GGRF) was a funding mechanism that supported school building renewal through retrofits in energy efficient building components (Ministry of Education, 2017). This assisted school boards with integrating LED lighting systems, new windows, and solar energy (Ministry of Education, 2017; 2018). Government funding for renewable energy and energy efficiency largely depend on political agendas. Ontario's recent change in political leadership saw the elimination of cap and trade, the carbon pricing scheme designed to reduce greenhouse gas (GHG) emissions while providing revenue for the GGRF (Bowe, 2018). This has

impacted future retrofit plans in Ontario school boards as well as opportunities for integrating industry standards in building performance. All levels of government have significant influence in school board progress towards the establishment of sustainable buildings. The Federal government has recently allocated new funding for energy efficient retrofits for Ontario's elementary and secondary schools through its Climate Action Incentive Fund (Government of Canada, 2019; Fix Our Schools, 2019).

Third party certification programs like Leadership in Energy and Environmental Design (LEED) and Building Owners and Managers Association (BOMA) provide environmental assessments for new and existing buildings while establishing best practices for high performance standards. These programs are voluntary but have the potential to engage building occupants like students in active learning from sustainable green buildings. Third party certification may not always be accessible to schools transitioning towards sustainable facilities. The costs and requirements associated with the certification process are often out of budget for schools as they receive all their funding from the Ministry of Education. The Ministry of Education does not provide school boards with multi-year funding allocations "while a Board may have a five-year energy management strategy, the Board's ability to implement their energy demand management strategy is dependent on the funding that's received for each of the five years covered by their plan" (Halton District School Board, 2019, p. 2).

Improving energy performance as well as overall building upgrades provide a variety of benefits in addition to reducing operation costs. Other benefits include, improved health and safety for occupants like better ventilation and the potential for creating a culture of conservation through changed occupant behaviour and well managed facilities. These are important factors because sustainably designed school buildings may not translate into desired cost savings if they are not appropriately operated. Developing a culture of sustainability requires alignment between building design, operations and maintenance and occupant behaviour.

Sustainability

Sustainability is a term used in ongoing global action towards solving complex issues related to environmental degradation, natural resource depletion and climate change. Sustainability is integrated within a variety of contexts and takes on different meanings depending on ideological perspective. This creates contention in how sustainability is conceptualized and practiced. The World Commission on Environment and Development presented the widely used definition for sustainability as "meeting our own needs without compromising the ability of future generations to meet their own needs" (1987, p.43). The Commission recognized sustainability as part of a process of social transformation that includes "a production system that respects the obligations to preserve the ecological basis for development as well as an international system that fosters sustainable patterns of trade and finance" (WCED, 1987, p. 65).

One of the contentions in sustainability is that it provides a means to reproduce the conditions that create environmental problems by acting as a "methodology for maintaining economic growth" (Huckle, 2014, p. 33). Orr (2002) points out the notion that financial measures like GDP do not adequately account for wealth and wellbeing. Emphasis on economic measures for wealth does not accurately model the natural capital used to produce and consume a product or service (Orr, 2002). For example, how does society measure healthy forests or account for costs of soil erosion in a market economy that emphasizes profit in the production of things? The Trans Mountain Expansion Project is an example of the interplay between government agenda, corporate interest, legal rights of Indigenous People and public activism for environmental protection. Within a market driven framework, "sustainability is the desired condition wherein access to a resource is stable, secure and as inexpensive as possible" (Kealiikanakaleohaililani & Giardina, 2016, p.59). The global perspective is that EE will support societies in becoming places where pro-environmental values can be developed to promote sustained behavioural change, and K-12 schools are optimal places to achieve these objectives (International Conference on Environmental Education, 1977). The challenges in finding balance between economic growth and sustainable ecosystems is largely influenced by worldview and environmental ethics.

Indigenous peoples are in unique positions to inform environmental sustainability because they established cultures that were highly adaptive to place (Hall, 2008). They created a cultural practice where their needs were met without compromising the integrity of the environment to continue providing for future needs (Cajete, 2000). Indigenous cultures provide a different conceptual framework to view human relationship with natural resources and offer opportunities to integrate Western and Indigenous ideologies for sustainability. Combining Western and Indigenous science is increasingly being used within biodiversity conservation, resource management and sustainability policy (Ens et al 2016; Popp et al 2019; Ban et al 2017; Beckford et al 2010). Indigenous sustainability science is an approach that emphasizes place, relationship and sacred exchanges among humans and the resources required for survival (Kealiikanakaleohaililani et al 2016). Sustainability is an attempt to reconcile the economic, social and political dimensions that cause and reinforce environmental degradation. As a result, sustainability is integrated throughout industry and institutions including the school system as an attempt to respond to the structural inequalities in the Western capitalist relationship with the environment. Ideology towards sustainability shapes the development of green schools and influences how environmental and sustainability education are implemented.

Research Problem

Ontario's definition for EE "education about the environment, for the environment and in the environment" (Ministry of Education, 2009, p.4) reflects the inherent complexities of EE which comprises a multitude of interrelated components. I recognize that it allows for the inclusion of diversity in content and in approaches to EE while also facilitating wider application within Ontario's schools. In addition, what is also broad is the duration of time between the initiation of this definition in policy and what we are currently dealing with in EE. In ten years, are the objectives in *Acting Today, Shaping Tomorrow* (Ministry of Education, 2009) being met? Is EE in Ontario school boards effectively implemented? How do they know? Leesa Fawcett (2009) describes this definition as "ubiquitous" and "divisive" which I think presents the contentions that lie within EE. So not only is EE complicated, it is also contentious. In attempting to include everything, EE in Ontario has generally become outdated, aimless and segregated from everyday learning. This is not to say that there isn't great work being done in schools. The Ontario EcoSchools program is an example as well as work from passionate educators. A reoccurring question I have is how does EE become entrenched, accessible and meaningful to students and communities?

As I stated earlier, EE is complex and there is not just one meaning. I think it's important to recognize that EE should occur in a variety of forms to allow for different entry points. Even though EE occurs in a variety of ways, there are some important concepts that support what EE should be for. EE is for sustainability. The United Nations Brundtland Commission (1987) presents a widely used definition for sustainability as "meeting our own needs without compromising the ability of future generations to meet their own needs". The concept of balance and reciprocity comes out of this, not only in the natural and built environment but also in our social, political and economic relationships. In *What is Education Good For?* (Orr, 1994) one of the problems presented in modern education is the fragmentation of the world into pieces seen through distinct disciplines and subjects often taught in isolation. Individuals leave school without an integrated sense of how society and the environment are interconnected, and this includes the ways in which

we are (dis)connected with place. Orr (2013) believes we are disengaged from place; we spend more time going from place to place rather than developing our sense of belonging and rootedness.

In *Rewilding the Future* (2014), Bekoff explains that the loss of ecosystems and animals is not due to lack of knowledge but a result of not being able to come to terms with biodiversity and of understanding our place in ecology. I think this idea of disengagement with place has also impacted how we relate with one another. If our education system develops fragmented ideas about the world, it also shapes how we make decisions about how we interact within the world. One of the main objectives for EE in *The World Becomes What We Teach* (Weil, 2016) is for learning to be solutionary with the goal of supporting students in solving real world problems. This is also a goal in *Acting Today, Shaping Tomorrow* (ATST) where EE would enable students "to find new solutions in building a healthy society" (Ministry of Education, 2009, p.10). Students need to be provided with opportunities and tools in solving environmental issues, this also means that teachers need to be prepared to educate students to be solutionaries. Educating students to be solutionaries requires them to think critically, creatively and in systems (Weil, 2016).

Public schools have remained largely unchanged since their inception in the mid-1800 while society has undergone dramatic changes. In general, within my experience supply teaching in Toronto's public schools, I feel like I'm transported back into the 80s and 90s when I was in school. In Part 1 *Why Schools Must Change* (2016), Weil describes this as problematic because we can't solve current environmental issues within an outdated education system. How do we fix a problem with the same tools that created the problem? This also coincides with Freire's perspective that the traditional banking model perpetuates the existing status quo because students are not given the opportunity to be active participants in their learning and transform their realities.

There is evidence indicating the benefits of integrating school facilities with EE such as supporting students in solving environmental issues while critically engaging with place. Common approaches to EE such as place-based education and experiential learning tend to emphasize the natural environment. Identifying how the built environment can be used as a learning tool in EE expands on the notion of place

while supporting opportunities for sustainable practice. Students in Ontario's public schools are expected to receive at least five hours of instructional time per day, O. Reg. 298, s. 3(1), and the majority of this occurs within the school building.

The school facility is positioned to provide contextual cues for informal and formal learning in EE. Further evidence suggests that incorporating the school facility with EE also provides a context in which students can engage with environmental issues like waste management and energy conservation. Using the school building as a learning tool has been well documented (Strong-Wilson, 2007; Li, 2005; Taylor, 1993; Hillier, 1987), and is supported as an instructional approach in Ontario's kindergarten program (Ontario Ministry of Education, 2016). Explicitly integrating the school facility with EE as part of a whole school approach to sustainability in Ontario's public schools requires further study. This qualitative study examines how EcoSchools in Ontario are integrating their school facility with EE within the context of whole school sustainability.

Purpose of the Study

The purpose of this study is to explore the interacting attributes of Ontario EcoSchools to identify themes supporting the integration of the school facility with EE. This will also identify how EE policy is being established within school boards in the Greater Toronto Area (GTA). One of the objectives in ATST is to enable students "to find new solutions in building a healthy society" (Ministry of Education, 2009, p.10). This requires students to be provided with opportunities and tools to solve environmental issues. Using the school building as a teaching tool for EE has the potential to support diverse approaches to EE. This can assist with building student capacity in actively solving environmental issues while encouraging sustainable practice.

Study Objectives

The objective of this study is to conduct a secondary data analysis of the results from 2017/2018 EcoSchool Platinum applications to understand and describe how these schools are integrating the school facility with EE. The study obtained data directly from the Ontario EcoSchools organization which require participating schools to

submit responses in an online application. Platinum certification allows high achieving schools to deepen their existing green school program (Ontario EcoSchools, 2018). Application results reflect achievement in the six program sections:

1. teamwork and leadership;
2. energy conservation;
3. waste minimization;
4. school ground greening;
5. curriculum; and
6. environmental stewardship.

Data is collected throughout the school year and illustrate how each school engages in whole school sustainability through environmental learning and action. A school's building and operations are important components in achieving school board policies for EE and sustainability while also supporting national and provincial climate change mitigation and sustainability objectives. Identifying the themes describing how the school facility can be used as a learning tool to enhance EE can provide strategies for integrating environmental literacy and sustainability into curriculum and daily practice.

Research Question

The research question that frames this investigation of green schools is:

How are K-8 EcoSchools in Ontario integrating the school facility with environmental education?

Literature Review

Environmental Education in Ontario

EE in Ontario is influenced by Canada's international commitments to environmental sustainability and reflects national and international action toward climate change and mitigation. These actions include the Pan-Canadian Framework for Clean Growth and Climate Change (2016), Canada's pledge to the Paris Agreement (2015), and Ontario's Climate Change Action Plan (2016). These initiatives and responsibilities are enacted within the education system through the provincial curriculum and school board sustainability policies. The United Nations (UN) plays a key role in facilitating research and partnerships for EE and is a major influence in how member states shape their policies and programs. The Tbilisi Conference in 1977 was the United Nation's Education, Scientific and Cultural Organisation's (UNESCO) first inter-government conference on EE (UNESCO, 1978). The recommendations generated from the conference highlight the need to facilitate an integrated and interdisciplinary approach to solving environmental issues. The third recommendation mentions the built environment as part of the "basic aim of EE which is to succeed in making individuals and the community understand the complex nature of the natural and built environment while also acquiring practical skills to participate in solving environmental problems" (UNESCO, 1978, p.25).

The fundamental concepts from this conference were expanded in the subsequent *Brundtland Report* (1987) from the UN's World Commission on Environment and Development (WCED). This report recognizes the integrated quality of the global environment by emphasizing the economic and social impacts on the environment while highlighting disparities in economic development. Sustainable development is presented as the means to achieve environmental protection, economic growth and social equity to "meet the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p.16). The outcomes of the Tbilisi Declaration and Brundtland Report provided guidelines for larger applications of EE in member states and led to the 2005 - 2014 UN Decade for Education for

Sustainable Development (ESD) which is referenced in ATST (p.3) as a catalyst for the development of EE in Ontario.

In 2007, the Working Group on Environmental Education's report *Shaping Our Schools, Shaping Our Future* (the Bondar Report) provided the Curriculum Council with recommendations for what is required to facilitate responsible environmental practices through EE in schools. A province wide cohesive approach would denote the importance of EE by integrating it into learning outcomes for students. The first recommendation in the Bondar Report is the need to develop a comprehensive EE policy in Ontario schools (p. 11). The intention of the policy is to also guide ongoing investments for continued development and provide concrete accountability measures (p. 7). The report identifies the core elements of a provincial EE policy as, leadership and accountability, teaching and resources, and curriculum. These elements are described as necessary to the implementation of EE and shape the policy framework in ATST. Other important recommendations are the development of assessment strategies to monitor student achievement and feedback strategies to assess achievement in schools.

ATST supports all 32 recommendations from the Bondar Report (Fawcett 2009) and is Ontario's policy framework for EE. ATST provides an integrated approach to EE where environmental, sustainability and conservation ideologies are intended to be woven through K-12 curriculum expectations and best practices. ATST defines EE as "promoting an appreciation and understanding of, and concern for, the environment, and to foster informed, engaged, and responsible environmental citizenship" (Ministry of Education, 2007, p. 6). This broad definition of EE reflects the wide application of the policy framework into Ontario's diverse school communities. The framework is intended to be flexible, allowing school boards and schools to create their own EE policy based on their needs, capabilities and community dynamics. The overall principles and concepts of ATST are intended to be the core components of school board EE policy. This definition for EE is used in subsequent Ministry of Education curriculum documents, *Environmental Education: Scope and Sequence of Expectations* (2017) and is also the definition used throughout school board policy and programs.

ATST is a guide and does not require school boards to measure and report how students are developing skills in EE. School boards are required to create an EE policy, but how those policies are implemented and established are left for schools to decide, "specific goals and processes must be defined locally to meet the differing environmental, social, and economic conditions that exist in Ontario communities" (Ministry of Education, 2009, p. 4). Diversity within schools and their communities inform EE program development and influence how the attributes of green schools function. This creates variation in how EE is integrated within everyday learning and challenges the objectives of ATST. Ontario schools are not required to assess and evaluate their environmental and sustainability programming like other subjects even though there are curriculum documents supporting the integration of EE into the curriculum.

Progressive Pedagogy

Using the school facility as a pedagogical tool supports progressive pedagogies like place-based education (PBE), "sense of place as it relates to the biophysical dimension does not occur only in the outdoors; rather, the built environment also provides a powerful physical context" (Ardoin, 2006, p.114). Education reformist John Dewey emphasized student centered learning and supporting them in becoming socially responsible citizens (Williams, 2017). By integrating learning with real world experiences, students can construct meaningful connections among cultural, political and social issues (Graham, 2007). PBE is grounded in critical pedagogy and social constructivism. A central aspect of constructivism is that the learner constructs their reality and knowledge through their experience (Hemphill, 2001). Other related progressive pedagogical theories like critical place-based education (Gruenwald, 2003), and land-based education (Calderon, 2014) encourage social and environmental justice while supporting innovation because students are actively creating their own learning while problematizing the existing social structure that is explicitly linked with current environmental issues. Cole (2014) suggests that green buildings can contribute to EE where pedagogy and curriculum are aligned with the built environment.

The Teaching Green Building Model for Learning identifies a range of possibilities for how building design can support or encourage EE like shifting between passive to active student engagement (Cole, 2014). Considering the learning space as a medium and tool for facilitating pro-environmental behaviours. Izadpanahi, Elkadi, & Tucker, 2017 found in their study that sustainable school design is the best predictor of children's environmental attitudes towards the green learning spaces in their school environment when compared to the other independent variables (teachers' and parents' environmental attitudes). This study also indicated that sustainability within school design can "improve students' attitudes about environmental issues by increasing awareness of the impact of the built environment on the natural environment" (p. 913). It is worth noting that there are other interconnected factors that influence the outcome of EE and sustainable programs in schools, "the pedagogical success of sustainably designed schools is at the intersection of factors like school governance, school culture, curricula, and individual role models" (Cole, 2017).

Traditional pedagogical approaches to EE have focused on education *about* and *in* the environment. Hungerford & Volk (1990) describe traditional thinking towards EE as inadequate and reflecting a simplistic linear approach to EE. This approach assumes a direct correlation between knowledge about the environment being linked to attitude and attitude to behaviour. Ramsey and Rickson (1976) propose in their study that "not all knowledge offered to the public within the environmental context leads to favourable attitudes towards programs of pollution abatement" (p.11). In *Pedagogy of the Oppressed* (1970) Freire would characterize this linear approach to EE as the banking concept of education where traditional learning situations are "a dichotomy between human beings and the world: a person is merely *in* the world, not *with* the world or with others; the individual is a spectator, not re-creator" (p.75). Within this top-down approach learners do not critically engage with the context in which they learn which prevents them from acting to change their social conditions. Hines, Hungerford and Tomera (1987) assert in their meta-analysis on environmental behaviour that a false assumption is often made about skills evolving naturally from knowledge. Their study proposed a "Model of Responsible Environmental Behaviour" (p.7) which presents a

complex interaction of factors required for responsible environmental behaviour including an individual's desire to act, appropriate application of skills and knowledge of issues.

Approaches to EE i*n* the environment are generally focused on the natural environment and not the built environment. Louv's book *Last Child in the Woods* discusses the notion of nature deficit disorder and advocates for thoughtful reconnection between children and natural spaces. Louv describes nature deficit disorder as resulting from shifts in North American cultural practices that include urban sprawl, indistinctions between humans, animals and machines within a system heavily reliant on technology. This shift has disconnected humans from the natural world and has shaped a dysfunctional relationship with the environment that includes an increasing list of environmental issues like climate change and loss of biodiversity. In the late 1980s, outdoor education was an increasingly prominent method of implementing EE in Ontario public schools (Eagles et al., 1992), and influenced how EE programs were defined. A goal of education in Ontario during this time was to help students develop "respect for the environment and wise use of resources" (Ministry of Education, 1982; Eagles et al, 1992).

In *Place and Pedagogy* (2013), Orr describes the importance of integrating place into education where the study of place is a combination of intellect and experience. For Orr (2013) the understanding of place in general has become "abstracted" and disengaged from its intrinsic ties to the economic, ecological, social, political and spiritual aspects of society. Using place as a learning tool involves direct observation, investigation, experimentation and knowledge application and requires students to be actively engaging with the natural and built environment. This contrasts traditional school settings where learning is segregated into subjects; to teach one subject or discipline in isolation from others prevents opportunities to identify relationships and make connections (Orr, 1991). The Reggio Emilia approach views schools as systems with interconnected relationships that should be reciprocal, activated and supported (Gandini, n.d.). One of the guiding principles in the Reggio Emilia setting, is that the learning environment becomes the third teacher (Robson, & Mastrangelo, 2017). In this approach to learning, students are actively engaged in constructing their environment while supporting the notion of bi-directionality where learners impact their environment

and in turn are impacted by the environment (Bronfenbrenner, 1979). Ontario also refers to the learning environment in the kindergarten program as the "third teacher", "it can either enhance learning, optimize students' potential to respond creatively and meaningfully, or detract from it" (Ministry of Education, 2016, p.29).

Background of Green Buildings in Canada

Green buildings are an important component in efforts toward environmental sustainability and climate change mitigation. Development in green building construction is supported by governmental and institutional policy and regulation. This has led to standards and practices that support the development and construction of green buildings. Legislation and regulation for green buildings in Ontario is influenced by Canada's international commitments to sustainable development and reflects national and international action toward climate change and sustainability. Sustainable building practices are inconsistent across Canada, Boehm (2010) attributes this to inadequate cooperation between federal, provincial, municipal governments and businesses in creating cohesive standards that address reductions in energy consumption and emissions. Canada's Federal Government has several sustainable development frameworks, programs and initiatives in support of green building development. Clean energy, modern and resilient infrastructure, low-carbon government as well as safe and healthy communities incorporate mechanisms that are used to promote green building development and initiatives. These initiatives include the establishment of national regulations and funding for sustainable development and environmental protection.

The 2017 Federal Budget included $182 million over the next eleven years in developing new building codes, retrofitting existing buildings and building new net zero energy consumption buildings across Canada through the Federal Sustainable Development Strategy (FSDS). The Federal Canadian Municipalities' (FCM) Green Municipal Fund (GMF) provides support to municipalities in achieving their sustainability goals. This includes funding for innovative approaches to environmental issues and by building networks for sustainability initiatives (FCM, 2018). The types of projects the GMF supports include funding for feasibility studies, as well as pilot and capital projects (FCM, 2018). Many of these projects directly or

indirectly relate to sustainable building development; the GMF has contributed funding toward construction of Leadership in Energy and Environmental Design (LEED) certified buildings, as well as feasibility studies for district heating which impacts how buildings become sustainable. Policy and regulation for sustainability in the built environment is influenced by many variables including international and intergovernmental organization and cooperation, public and private sector relationships and partnerships as well as funding and accountability measures.

Buildings as Teaching Tools

The architecture and layout of a school building has implications on learning and has been noted to have a "hidden curriculum that teaches as effectively as any course taught in them" (Orr, 1993, p. 226). In *Architecture and Pedagogy* (1993), Orr describes that the ways in which academic facilities have been traditionally built has shown missed opportunities in design, construction and operation. Integrated design involves collaboration between key stakeholders in organized sessions called charettes to develop a vision for the school and how that can be embodied within the architecture (Canada Green Building Council, 2019). Stakeholders are involved throughout the entire process which allows for the inclusion of diverse perspectives from students, teachers, engineers, and other major stakeholders. A collaborative design process supports development of ideal design criteria by identifying choices that best meet the needs of all stakeholders (Ontario Association of Architects, 2019; New Building Institute, n.d). Integrating design, construction and operation with learning opportunities in green schools provides "an opportunity to learn something about the relationship between ecology and economics" (Orr, 1993). This highlights the connections between ecology and economics which are integral components of sustainability while also demonstrating their relationship within the larger social system. The school building can facilitate authentic learning experiences that applies knowledge in real life situations within communities.

A school building is a visible component in defining place in a community and provides symbolic representation of what schools and school boards value. A sustainable school building embodies sustainable values and can be used to communicate those values to staff, students and the broader community. Orr (1997)

believes learning must support students in, reducing the amount of materials, water and land used per capita; growing their own food sustainably; preserving biodiversity; and equitably distribute wealth across generations. These types learning experiences encourages creative inquiry, where students ask questions, engage with content, and look for answers through experiences and experimentation (Montuori, 2012). Using the built environment as a place to facilitate environmental inquiry supports transformative learning where students use their knowledge and skill to critique and transform existing inequalities which results in fundamental changes in worldview (Gravett, 2004). Students can critically engage with issues related to ecological sustainability through ongoing inquiry, and the active process of creating and reflecting on meaning, knowledge, self, and engagement with the world (Montuori, 2012). Transformational learning causes changes in the learner's perspective where "learning is the process of making a new or revised interpretation of the meaning of an experience (Mezirow, 1990). The school building becomes a place for students to learn about their relationship with the environmental through direct engagement with their surroundings while aligning behaviour and sustainable values.

Buildings have instructional value and influence the learning process (Orr, 1997). Green school buildings "should be seen as an opportunity to enhance educational outcomes by creating better learning environments" (Tucker & Izadpanahi, 2017, p. 210). The impact of architecture and layout are core elements in the Reggio Emilia, Waldorf and Montessori schools. These progressive pedagogies identify the built and natural environment as fundamental to education and integrates them throughout everyday learning. The Reggio Emilia approach presents the environment as a third teacher and recognizes "architectural language and atmosphere of the environment as having and established identity" (Nikolova, 2012, p. 71). This established identity emphasizes the importance of place in teaching and learning especially within environmental and sustainability education. A building can be considered a teaching tool when its "physical features can be engaged, manipulated and impacted by students and faculty" (Cole, 2014). Integrating the school building and its sustainable features with curriculum and learning is a component for LEED school certification, "the curriculum should not just describe the features but explore the relationship between

ecology, natural ecology and the building (USGBC, 2009). The school facility offers a "curriculum in applied ecology" (p. 227) where learning is multifaceted and the building is a means through which to engage building materials, energy and resource use, water and waste management, plants, layout, light and landscapes with interdisciplinary learning (Orr, 1993).

Spatial configuration, transformability and flexibility are important elements of a green school because they help to determine how students access the sustainable features of the building and creates learning environments that can be changed to meet the needs of students. The layout of a school building allows the physical environment to support and facilitate the sociocultural aspects of a school (Cole, 2014).

Whole-School Sustainability

Henderson and Tilbury's research "Whole-school approaches to sustainability: An international review of whole-school sustainability programs" (2004) describes education for sustainability (EFS) as an extension of EE that shifts away from education about the environment and raising awareness towards critically reflecting in sustainable practice. EFS emphasizes the connection between students' lived experience with environmental quality and human rights within the political context (Henderson et al., 2004). Tilbury (1995) describes EE for sustainability (EEFS) as a process that engages students in identifying and investigating issues, while collaboratively finding solutions that they can implement and evaluate the impact of their actions in solving the issue. EEFS and EFS both build from EE, and emphasize a "holistic outlook on problems, requiring a deeper integration between the environment and social development" (Tilbury, 1995). The Ministry of Education (2007) views effective EE as incorporating problem solving, hands-on learning, action projects, scientific inquiry, higher order thinking, and cooperative learning. Environmental sustainability in Ontario schools is also supported by curriculum documents like *Scope and Sequences of Expectations* (2017) which recognizes the integrative quality of EE and responds by providing an interdisciplinary approach for examining complex environmental issues.

Included in the desired outcomes for EE in Ontario is for students to develop skills in systems thinking (Ministry of Education, 2017). Systems structures are based on multiple diverse relationships,

connecting parts of an entity with a driven purpose (Bernier, 2018). A systems perspective looks for the interconnections between the parts to "identify the root causes of problems and see new opportunities" (Meadows, D. H, 2009, p.2.). The patterns and processes of the elements within school systems contribute to how green schools achieve environmental sustainability. Protecting the environment, lowering operating costs, improving the health and quality of the learning environment, and integrating learning opportunities with the built environment are principles found in green schools and are supported by the Ministry of Education (2010). Wright (2002) describes themes that can be used to develop sustainable schools; energy and water efficient buildings; interdisciplinary curriculum; and developing partnerships with community stakeholders. Identifying limitations and emerging qualities in a green school system presents opportunities to help refine EE programs.

Ontario EcoSchools

Overview

Ontario EcoSchools is a voluntary program that supports schools across Ontario in developing whole school approaches to sustainability and environmental literacy. EcoSchools exhibit consistent school-wide comprehensive practice (EcoSchools, 2018), and portray the conditions where the built environment and pedagogy are integrated to support EE, sustainability and related policy objectives. There are four levels of certification, Bronze, Silver, Gold and Platinum and schools must meet specific criteria before certification can be awarded. This requires ongoing documentation throughout the school year in six sections: teamwork and leadership, energy conservation, waste minimization, school ground greening, curriculum and environmental stewardship.

An integral component of the EcoSchools program is the implementation of an EcoTeam that must reflect adults in the school community (Appendix 1, Section 1.2) as well as all parts of the school community (Appendix 1, Section 1.2). To obtain all the points for these two questions, the EcoTeam must represent three or more representatives from different grade levels and from the following adult groups; teachers/ECEs/EAs; Parents/guardians; Community members; Principal/administrators; Custodial staff; Office support staff; Other. The EcoTeam acts in a leadership role by participating in professional development, planning, promoting, and communicating all aspects of the EE and sustainability program to the school community.

Ontario EcoSchools Application

The 6 program sections in the EcoSchools application reflect criteria questions that include initial and follow-up EcoReviews, open and closed-ended questions as well as portfolio submissions. EcoReviews provide benchmark comparisons resulting from specific actions taken in sections 2 and 3 to conserve energy and minimize waste. There are 15 questions in both sections including Platinum questions that require an assessment of what the school has achieved. This includes actions to monitor energy consumption through but not limited to metering data, online energy portals or utilities bills. Other actions include methods to

reduce food waste through composting, waste-free lunch programs or boomerang lunches where everything in the lunch goes back home at the end of the day. Open-ended questions allow schools to provide written detailed responses. Closed-ended questions are check-box responses or drop-down menu selections. Portfolio submissions require uploaded supporting documentation including pictures, student work samples and written responses of achievements detailing the extent to which schools are performing the necessary tasks and meeting program expectations. Platinum questions and criteria are completed only if schools were on track to achieve Gold certification. Each section has an overall guiding question with subsequent questions that are specific and given a set number of points to be earned.

Section 1 focuses on Teamwork and Leadership (Appendix 1) and the guiding question within this section is, *how does your whole school build capacity and communicate feedback to create an environmentally responsible school?* The questions in this section included a portfolio submission (1.1) which required a completed yearly planner that Ontario EcoSchools provides, or schools can submit their own equivalent plan. The planner reflects EcoTeam meeting records and upcoming actions such as campaigns, events and goals. Included in this section are descriptions of environmental learning obtained from workshops, conferences, presentations or webinars.

Section 2 is Energy Conservation (Appendix 2) and the guiding question is, *how does your school make decisions and follow daily routines and operational practices that significantly reduce the use of energy and its impact on the environment?* This section consists of EcoReview questions (2.1-2.9), portfolio submissions (2.10, 2.12) and a closed-ended question (2.11). The Follow-up EcoReview must be completed three months after the Initial EcoReview has been submitted. The portfolio submission requires a classroom lighting assessment, or energy consumption assessment, appliance audit or equivalent. This section is separated into three sub-sections, lights and equipment; efficient school systems and practices; student monitoring and communication.

Section 3 reflects criteria for Waste Minimization (Appendix 3) and the guiding question within this section is, *how does your school make decisions and follow daily routines and operational practices that*

significantly reduce its impact on the environment through waste reduction? This section is structured like section two and consists of EcoReview questions (3.1-3.9), portfolio submissions (3.10 & 3.12) a check box response (3.11) and written responses (3.11 & 3.12). Follow-up EcoReviews must be submitted three months after the Initial EcoReview has been submitted. This section is separated into four sub-sections, reduce, reuse, recycle and student monitoring and communication.

Section 4 is School Ground Greening (Appendix 4) with the guiding question, *how does your school engage students and staff in projects that care for the natural environment, encourage teaching and learning in the outdoors, and increase biodiversity on the school grounds?* This section has two portfolio submissions (4.1b, 4.4). These submissions indicate evidence of active student engagement in school ground greening projects and its impact on the broader community. Question 4.1a includes an open-ended question that asks schools to describe their school ground greening project(s) and how it improves biodiversity and/or ecological sustainability. Questions 4.2, 4.3 and 4.5 reflect closed-ended questions that indicate the process, involvement and use of the project that are determined through check boxes.

Section 5 focuses on Curriculum connections (Appendix 5). The guiding question is, *how do students learn in, about, and for the environment as a regular part of teaching and learning?* The guiding question reflects the Ministry of Education's definition for EE "environmental education is education about, in and for the environment" (2009). All the questions in this section are portfolio submissions and schools can complete a maximum of seven submissions. These questions include grade level, subject, environmental focus as well as an open-ended question that describes "what the students learned about the environment" (Appendix 1). The submissions must, demonstrate environmental learning, be completed during the current school year and answer portfolio requirements. These elements must be completed to be evaluated.

Section 6 is Environmental Stewardship (Appendix 6) and the guiding question is, *how does your school foster environmental stewardship through whole-school and community engagement?* This section is structured like section 5 where the entire section requires portfolio submissions. In this section schools can submit a maximum of 4 submissions. The questions demonstrate the actions taken on a specific

environmental issue. Open-ended questions describe what students learned about the environment through their participation in the school-wide initiative as well as a description detailing the environmental action students were engaged in through the initiative. Each submission must demonstrate environmental learning, environmental action and initiatives that go beyond what is required from the EcoSchools program.

Ontario EcoSchools Assessment and Evaluation

Evaluation of program criteria in each of the 6 sections is done through a self-evaluation rubric and an EcoSchools assessment of applications with adjustment of scores based on an internal assessment matrix. An EcoSchools staff member finalizes the applications to ensure they are assessed in a standardized manner. Schools can achieve points for each question based on the rubric scale ranging from 0 where there is no evidence to level 4 where there is comprehensive evidence of practice and participation (Table 1). Each level corresponds with a percentage of the available points for that question. Level 0 receives 0% of points, level 1 receives 25% of points, level 2 receives 50% and level 4 receives 100%. For example, question 1.1 is worth 2 points, if level 3 (75% of points) is selected, 1.5 points will be allocated. Schools must obtain a minimum of 50 points to be considered for certification. To achieve Gold certification, "a school must achieve a minimum of 75% of the possible points in each of the six sections" (EcoSchools, 2018, p.6). To be certified Platinum, a school must acquire at least an additional twenty points after gold certification is achieved. To acquire the extra points needed to become platinum, a separate set of criteria must be completed for each section in addition to the criteria for the standard application (Table 2).

Table 1 Assessment and Scoring Rubric (Ontario EcoSchools, 2018)

Level 0	**Level 1**	**Level 2**	**Level 3**	**Level 4**
0% of points	25% of points	50% of points	75% of points	100% of points
No evidence	Emerging	Implementing	Implemented	Comprehensive
Not attempted or addressed	**Awareness**, but no active participation or **limited** practice/results	**Inconsistent**/ **some** practice, participation, or results	**Consistent**/ **considerable** practice, participation, or results	**Frequent and consistent/school-wide comprehensive** practice participation, or results

Table 2 Four Levels of Ontario EcoSchools Certification (2018)

Level	Bronze	Silver	Gold	Platinum
Total points	50-65	66-74	75-100	20-25* *Additional 20-25 points in the Platinum section on top of Gold status

Table 3 illustrates the total number of points each program section is worth and the minimum amount of points needed for Gold certification. The table also presents the minimum number of points required in each section to achieve Platinum certification.

Table 3 Points Required for Gold and Platinum Certification (Ontario EcoSchools, 2018)

Program Section	**Gold Certification** Minimum number of points required for Gold Certification in each section	**Platinum Certification** A minimum of 20/25 Platinum points must be claimed, after Gold Certification is achieved
1. Teamwork and Leadership	12/16	4
2. Energy Conservation	15/20	5
3. Waste Minimization	15/20	5
4. School Ground Greening	10.5/14	3
5. Curriculum	10.5/14	4
6. Environmental Stewardship	12/16	4
Total points for certification	75/100	20 out of 25 available points

Research Design and Methodology

Overview of Methodology

This study examines the role of the school facility in EE and sustainable practice within Platinum certified Ontario EcoSchools by conducting a secondary data analysis of application submissions. The data was initially collected through online applications and encompasses standard applications that include two EcoReviews for energy conservation and waste minimization, written and check-box responses as well as portfolio submissions. Portfolio submissions include questions, student samples, site plans, photographs, energy and waste audits. Certification applications were completed by teachers from each school's EcoTeam through their online application tracker. Schools must submit their documents at specified due dates throughout the year. The applications demonstrate the school's achievement within the six sections of the program throughout the school year. This study does not analyze student work samples or images from portfolio submissions. This analysis reflects information from written check-box responses from raw data sets obtained from Ontario EcoSchools.

Sampling Frame

During the 2017/2018 school year, 1,900 schools within 58 school boards across Ontario were certified as an EcoSchool (EcoSchools, 2018). The sample for this study was provided directly from Ontario EcoSchools and included 49 Platinum certifications for school boards across the GTA. The data set included elementary, secondary, Catholic, public, and French Immersion schools. The GTA is a collection of four regional municipalities, Durham, Halton, Peel, City of Toronto and York that are made up of individual municipalities (Figure 1). There is no access to samples for the Toronto District School Board (TDSB) from the Ontario EcoSchools organization. The TDSB and Ontario EcoSchools have separate methods of collecting data. A different inquiry would need to be made directly to the TDSB's EcoSchools program to obtain data sets. To keep data collection consistent and manageable, the City of Toronto was not used as a component of the GTA in this study. This situates the schools in the sample within suburban locations.

Figure 1 Greater Toronto Area Regional and Local Municipalities

Regional municipalities in the GTA as well as the individual municipalities within them have developed and implemented plans supporting environmental sustainability which reflect key areas commonly found within sustainability discourse. Municipalities within the GTA provide a context that could support the schools in the sample with integrating the school facility with EE. Municipal plans for sustainability are influenced by provincial policy drivers like *The Provincial Policy Statement* (2014) which "sets the policy foundation for regulating the development and use of land" (p. 1). *The Provincial Policy Statement* includes "promoting green infrastructure to complement infrastructure" (p. 15), "…facilitate, encourage and promote reduction, reuse and recycling objectives" (p. 19) and "promote renewable energy systems and alternative energy systems" (p. 19). Other policy drivers include the *Planning and Conservation Land Statute Law*

Amendment Act, (S.O. 2006, c. 23 – Bill 51) which includes "the promotion of development that is designed to be sustainable, to support public transit and to be oriented to pedestrians" (Section 2). These regions have structured frameworks that support environmental sustainability and provide the context in which school boards can support their EE programs.

Even though the *Brundtland Report's* 1987 definition for sustainability is widely used, defining sustainability is not concrete and it has been previously noted that there are contentions in how sustainability is defined. Sustainability is conceptualized differently depending on context, and because of this, "we cannot assume the meaning of sustainability in the plans of local governments in Canada" (Tozer, 2018, p. 178). This means that sustainable practice is not consistently defined or implemented across municipalities and communities. Tozer's study identifies how concepts within sustainability and climate change exhibit themselves within 15 Canadian local governments through an analysis of municipality sustainability plans. Her study identified the pillars within the sustainability plans to be social, cultural, environmental, economic and cross-cutting practices. The practices found within these pillars of sustainability include energy, waste, buildings, greenhouse gases, public infrastructure among others. These practices reflect general methods found within regional planning for environmental sustainability throughout the GTA and are reflected in the sections of the EcoSchool program application.

Regional and individual municipal sustainability planning influence how school boards enact their environmental sustainability policies while also acting as a resource for EE. Durham Region provides waste management education programs to schools across all grades (Durham, 2017). York Region offers EE programs for schools in water conservation, waste education, gardening and outdoor education. The Student Water Conservation Program "provides grade 4 students with the opportunity to learn about water conservation through a variety of interactive, curriculum-linked activities" (York Region, 2019). Peel Region offers EE programs for schools, homes and businesses that are designed to promote the region's sustainable policy objectives. This includes an EE section for educators that offers workshops, site tours, events and curriculum connected resources (Region of Peel, 2019). Regional initiatives for EE and sustainable practice

are linked with stakeholders and organizations with shared interests. Conservation Halton works with its Region to provide Community Education and Involvement programs like the Halton Children's Water Festival for grade 2 to 5 students (Conservation Halton, 2019). Regional municipalities within the GTA provide programs and services that support school board environment and sustainability policy.

Individual municipalities also have supporting frameworks in place to offer resources for EE in schools. The Town of Oakville's electronic Eco-Letter shares a calendar of programs and events for educators that "contains curriculum resources, in-class activities and free presentations about environmental stewardship" (2019). The programs and resources offered by municipalities reflect general aspects of environmental and sustainability education like energy and water conservation, stewardship and waste management. Identifying how these programs are used by school boards and schools would provide insight on the impact and effectiveness of the frameworks in place that support environmental sustainability within municipalities. However, that is out of the scope for this study, but could serve as a topic for further research.

The initial sample included secondary and Catholic schools which were eliminated to allow the sample to be manageable. Catholic schools were removed because there are elements that influence their philosophy for teaching and learning. In addition to religious implications, Catholic schools across the GTA also implement Catholic graduate expectations and Catholic social teaching. These elements influence the school's approach to EE and prompts teachers to incorporate aspects like Stewardship of Creation (Durham Catholic District School Board, 2018) and responsible citizenship (York Catholic District School Board, 2018) into pedagogy. Ontario Catholic schools are publicly funded and are required to implement an EE policy, so within these schools EE is framed through Catholic philosophy. Secondary schools have a different curriculum where students receive credits for courses taken.

The final sample includes 23 K-8 public schools that exhibit comprehensive EE programs achieved through Ontario EcoSchools. These schools including French Immersion represent Durham, Halton, Peel and York Region district school boards. The level of EE programming is measured by EcoSchool certification submissions and reflect the most recent data. For the purpose of this study, only Platinum certified public

elementary schools for 2017/2018 were selected because they specifically demonstrate established and extensive EE programs, “Platinum certification allows high-achieving schools to deepen their existing program” (EcoSchools, 2018). These schools exhibit consistent school-wide comprehensive practice (EcoSchools, 2018), and portray the conditions where the built environment could be integrated with EE to support certification, and environmental sustainability objectives.

Ethical Considerations

Initial contact was made with the executive director of Ontario EcoSchools and subsequent contacts were made with the systems and impact manager. Prior to obtaining the data, I was asked to submit my research proposal to provide an overview of my study objectives in addition to a non-disclosure and confidentiality agreement. Once the required documents were approved, the process of obtaining the raw data set began. The data was cleaned by EcoSchools to remove all names from written responses. Student work samples and photographs were not provided. Individual participants in the EcoSchools program were not identifiable in any aspect of the data set. The names of participating schools and their respective school boards were part of the data set. However, I chose not to include the names of schools in this study. Instead school cases are given typologies that include the school board abbreviation and a corresponding number indicating their position within the data set. Information indicating the names of participating school are found on the Ontario EcoSchools website as well as school board and individual school websites. Working with secondary data from EcoSchool prevented any possible interaction with schools participating in the program.

Reliability, Validity and Credibility

Reliability

Ontario EcoSchools provides a standard application accessible to all public schools across Ontario. Standardized applications ensure consistency in how responses are provided and allows for comparison between data sets. Schools must follow the application guidelines and submit completed applications,

reviews and portfolio requirements by a specified deadline to be considered for certification. All participating schools have access to resources to support implementation of the program through the Ontario EcoSchools website. There is also consistency between the Platinum certified schools in this sample as they were all certified as Platinum or Gold during the previous certification year after completing the same standard application as the one this study is based on (Appendix 7).

Validity

Initial evaluation of applications was based a school self-assessment and EcoSchool assessment through an internal benchmark matrix. Reponses to application criteria (open and closed ended questions) were written by school representatives (teachers). This is the raw data used for this study. Different sources were used to help validate the application responses, this included school newsletters detailing initiatives and progress in the EcoSchools program, school board media articles about the involvement of their participating schools, and third-party certification reports and case studies (Enerlife, Sustainable Schools). Application responses reflect 23 schools exhibiting established comprehensive approaches to EE and sustainability. These schools are situated in 4 regions across the GTA.

Credibility

Consistency in data analysis was established by applying the definition provided for school facility to distinguish cases. Codes were grounded within the language of application responses. The codes were recurrent throughout all cases. Once the codes were established, they were defined within the thematic framework to avoid inconsistencies in the analysis.

Participant Profile

School Boards

All school boards in Ontario are required to have an EE policy in some form as indicated in ATST (Ministry of Education, 2009). The ways in which these policies translate into EE programs within individual schools varies due to the dynamic nature of schools. This is recognized within the policy framework, “there

is no universal model for the implementation of environmental education…specific goals and processes must be defined locally to meet the differing environmental, social, and economic conditions that exist in Ontario Communities" (Ministry of Education, 2009, p.4). Even though there are differences in how schools enact their EE policy, school boards in the GTA demonstrate commonalities within the content of their policies.

The objectives within school board EE policies for this sample cluster around key concepts and related practices within environmental sustainability. Operations and infrastructure, educational programs, community, and stewardship are common concepts found within school board policy for EE. These concepts are also interrelated and influenced by broader environment, economic and societal contexts (DDSB, 2019, HDSB, 2012; PDSB, 2009; YRDSB, 2018). School board EE policies define the organization's role in their commitment to environmental sustainability by establishing values, setting priorities and providing the structure to implement policy objectives.

Shared responsibility and an integrated approach to EE and sustainable practice are key concepts that were found within the school board policies. *Environmental Responsibility* (YRDSB, 2018) defines the roles of trustees, superintendents, principals, teachers, staff and students and leadership by stating the responsibilities for each of the groups. A shared responsibility also extends to partnerships with community members, organizations and vendors (PDSB, 2018). The Ministry of Education provides educators with the resource guide, *Environmental Education, Scope and Sequence of Expectations* (2017) which links curriculum expectations across all subjects and grades with EE. An important aspect of an integrative approach to EE is the relationship between operational practices and everyday learning (HDSB, 2012). The relationship between facility operations and EE is usually expressed through energy conservation and waste management practices.

Schools

For the purpose of confidentiality, the names of schools in the sample were not used. Instead, the schools are recognized by the name of their regional district as an abbreviation with a corresponding number linking individual cases (schools) to the data set. All schools achieved at least Gold certification during the

2016/2017 certification year (Appendix 7). It was a previous requirement for schools wanting to pursue Platinum applications to first obtain a Gold certification to allow them to establish the foundation necessary to pursue Platinum certification (EcoSchools, 2018). The distribution of schools is found across 4 regions and in 12 municipalities (Table 4 and Figure 2).

There are 23 schools in the sample (N = 23). Of these responses, YRDSB represents almost half of the sample, n = 11 (48%), HDSB, n = 6 (26%), PDSB, n = 4 (17%) and HDSB, n = 2 (9%).

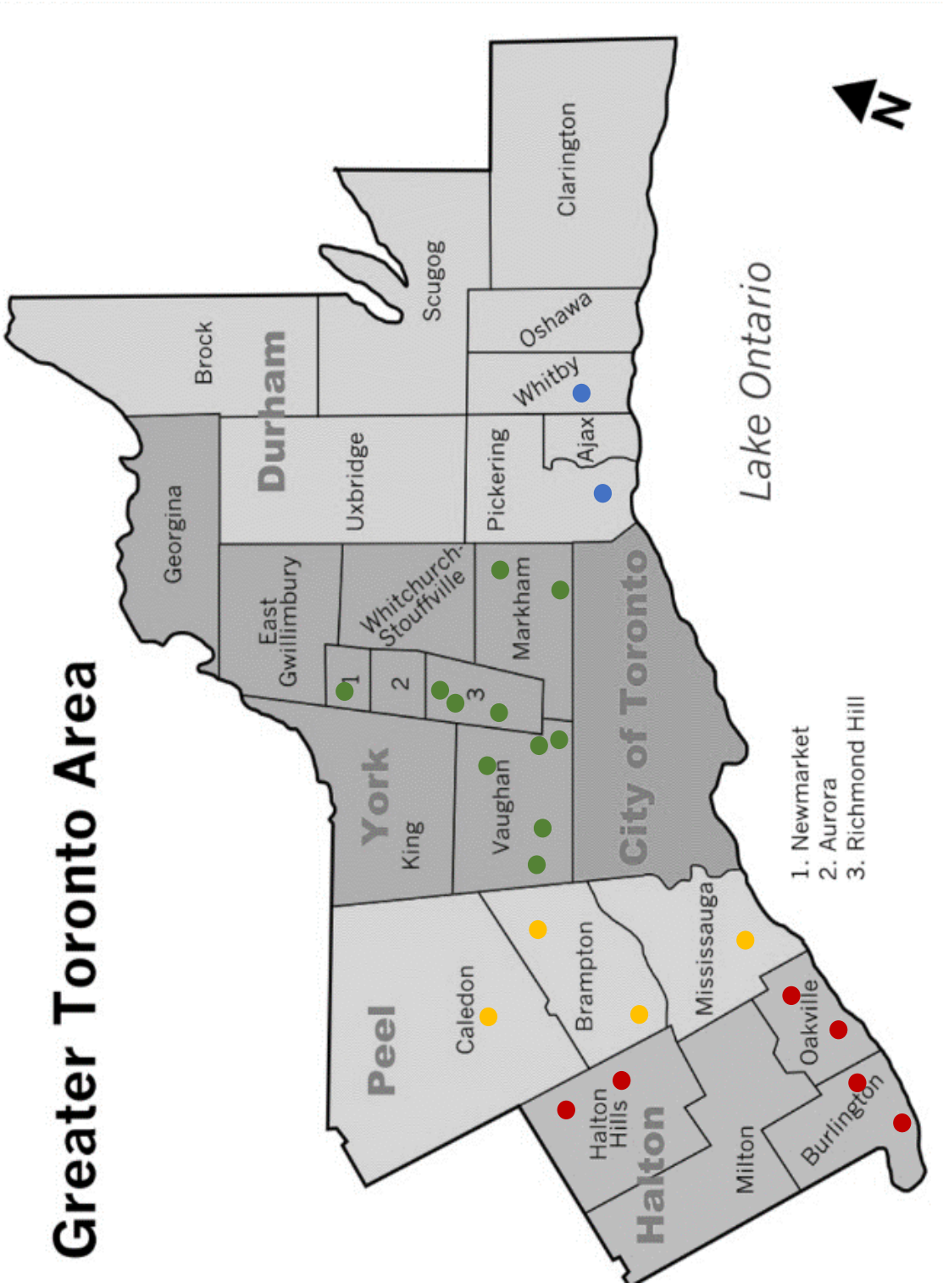
Table 4 Summary of Participating Platinum Certified EcoSchools

***School**	**Grade Level**	**School Board**	**Municipality**	**Region**
DD.2	K-8	Durham District	Whitby	Durham
DD.3	K-8	Durham District	Pickering	
HD.5	K-5	Halton District	Halton Hills	Halton
HD.6	K-8	Halton District	Burlington	
HD.7	K-8	Halton District	Oakville	
HD.8	K-8	Halton District	Oakville	
HD.9	K-8	Halton District	Halton Hills	
HD.10	K-6	Halton District	Burlington	
PD.11	K-5	Peel District	Brampton	Peel
PD.13	K-5	Peel District	Mississauga	
PD.15	K-8	Peel District	Caledon	
PD.17	K-8	Peel District	Brampton	
YR.34	1-8 **(FI)	York Region	Richmond Hill	York
YR.35	K-8	York Region	Markham	
YR.36	1-8, 2-8 (FI)	York Region	Vaughan	
YR.37	K-8	York Region	Markham	
YR.38	K-8	York Region	Vaughan	
YR.39	1-8 (FI)	York Region	Vaughan	
YR.42	K-8	York Region	Richmond Hill	
YR.43	K-8	York Region	Vaughan	
YR.44	K-8	York Region	Richmond Hill	
YR.45	1-8 (FI)	York Region	Newmarket	
YR.48	K-8	York Region	Vaughan	

*Individual schools are represented by school board abbreviation and number code.

**French Immersion (FI)

Figure 2 Participating Schools by Geographical Location



Approach to Data Analysis

The data was initially collected through the Ontario EcoSchools online application to determine certification level. This study conducted a secondary analysis of data from Ontario EcoSchools application responses for Platinum certifications. The responses reflect actions taken by elementary schools within the GTA to meet the application criteria. Ontario EcoSchools provided an Excel file for standard applications that included all submitted responses, points acquired for each question, total points claimed for each section, final scores as well as certification levels from previous years. Points were allocated through the self-assessment rubric and through an Ontario EcoSchool assessment. Applications are assessed by EcoSchools staff to ensure they meet program benchmarks. This study reflects data from standard application responses, the additional Platinum criteria section responses were not available for use because they contained student samples and pictures.

Data analysis began with familiarization to obtain an overview of the coverage of the material. I read the entire data set to begin to understand the overall meaning of application responses, specific attention was given to open-ended responses. The open-ended responses were reviewed and filtered using the definition of a school facility, *the physical elements of the school environment; including school building, technology, grounds and gardens* as a guiding construct. This process began with a printout of open-ended responses and highlighting of key ideas within each section relating to how the school facility functions as part of the schools' EE program. For example, if the content of the response dealt with transportation (Bike to School, no idling during student drop off and pick up), they would be removed from analysis. The same filtering approach was used for closed ended questions.

Reoccurring concepts began to emerge from key ideas, and this was acknowledged with words and phrases used by respondents to help describe concepts. Table 5 outlines the initial stages of analysis. The open-ended responses in Table 5 were a component of a set of questions 4.1a (Appendix 4). For this question (4.1a_1), respondents selected which school ground greening project they would be working on for the year

from a check box list (trees for shade, food garden, habitat for pollinators/butterflies, native species garden, no-mow zone, drought-tolerant garden, nature study area or other). In addition to this, written descriptions of the project were given (4.1a_2) as well as identifying how the project encourages biodiversity and ecological sustainability (4.1a_3) and the number of trees planted (4.1a_4). A similar table was completed for each of the 6 sections in the application.

Table 5 Open Coding, Initial Stage of Analysis: School Ground Greening

Section 4: School Ground Greening		
4.1a Is your school actively involved in one or more school ground greening projects that improve biodiversity and/or ecological sustainability? 4.1a_2. Please describe the project.		
Concept	**Direct Responses**	**Case #**
Outdoor Learning Spaces	Used regularly Learning outside & well-being	YR.36
Gardens	Indoor tower garden for food	DD.3
	Each class is growing seeds Planting seedlings Vegetable garden	HD.5
	We start seeds in many different classrooms	HD.7
	Native flowers at the front of the school Encourage butterflies and bees.	HD.8
	4 gardens; all plants added in last 3 years Native species.	PD.11
	Raised planters at front entrance Add pollinators	PD.17
Proposal/Grants/Fundraising	Applied for a pollinator gardens grant	DD.2
	Fundraising campaigns to plant a native species garden,	
	Raised funds to plant shade trees Native species/butterfly garden.	PD.13
	Grant to receive trees	YR.34
	Evergreen, Regional Municipality of York & YRDSB grant to plant 5 trees	
Trees/Shrubs/Groves	Service Berry Tree in middle of the garden Native species.	HD.6
	Study (measuring diameter to determine impact of climate change on urban trees).	PD.11
	Planting 2 staghorn sumacs and 3 cedar bushes Attract various species and birds.	PD.15
	Shade	YR.36
Irrigation	OAK team Irrigated Planter Method to start seeds.	HD.7
Learning Approaches	Kindergartens inquiry project about saving bees	HD.9
	Proposal writing	YR.44
Structures	Installed garden structure	HD.6
	Birdhouses on school grounds Pinecone bird feeders hang from trees	PD.15

Partnerships	Teamed with Town of Whitby for a school-wide cleanup	DD.2
	Sheridan Nurseries donation	HD.5
	Oakville Green we have purchased pollinators	HD.8
	Evergreen in partnership with Regional Municipality of York	YR.34
	Markham Legacy community garden donation	YR.36
	Local farms seed donation	YR.43
Maintenance	Gardening Club & EcoTeam maintained vegetable garden.	HD.9
	During and outside school hours	YR.38
	JR Eco students	YR.39
	Vinegar and soap mixture to kill weeds	YR.42
	Remove garbage from around trees	YR.48
Signage in Gardens	Ensure students respect area	YR.34

This process continued with an inductive analysis to begin identifying patterns from the topics and concepts emerging from the data. This began forming the initial thematic framework. I initially used the application section headings Teamwork and Leadership, Energy Conservation, Waste Minimization, School Ground Greening, Curriculum and Environmental Stewardship as potential themes in the initial framework (Appendix 8). The codes within the initial framework reflect the concepts formed in Table 5. Codes and categories were developed by summarizing each schools' response within open-ended questions using words from their response to describe the text as well as answers from closed ended questions. This allowed the data to be sorted and organized according to similar ideas through indexing. For the process of indexing (Appendix 8), the data was labeled according to the thematic framework by writing the thematic code reference beside data texts (Ritchie et al., 2003).

Further analysis began illustrating the data linking together to generate themes that better addressed the relationship between the school facility and EE. The resulting themes that emerged from the initial framework are, formal learning, non-formal learning, facility attributes, cross-cutting and partnerships. These 5 underlying themes were used to continue linking and grouping concepts in the data to identify the final codes (Table 6 and Appendix 9). Using in-vivo codes allowed for emerging ideas to be grounded in the data, in-vivo concepts enable "the researcher to capture the essence of talk and interaction" within participant responses. The "Teaching Green Building Model for Learning" (Cole, 2014) was used as a key analytical

concept to help develop final themes. This model "links EE with architecture within a Teaching Green Building" (Cole, 2014), and assisted in understanding how to name the refined themes, formal and non-formal learning.

Table 6 Final Themes and Codes

Theme	Code	Description
Formal Learning/Curriculum	Science and Technology	Curriculum expectations relate explicitly to aspect of EE.
	Social Studies	Curriculum expectations relate explicitly to aspect of EE.
	Literacy	Curriculum expectations can be connected to aspects of EE
Non-Formal Learning	Monitor & Feedback	Observations to generate a record of actions taken and used to adjust actions towards desired behaviour
	Extracurricular Activities	Student groups working together to accomplish goals outside of structured class time
Facility Attributes	Garbage, Recycling and Organics	Designated bins for sorting waste and compost
	Indoor/Outdoor linkages	Connections made between natural spaces on school grounds and within the school facility including types of access to school grounds
	Energy	Occupant relation with energy as related to types and function within systems (types of energy, electricity, uses)
Cross Cutting	Signage, Bulletin Boards & Posters	Methods used to inform and communicate that are updated and changed. Assisting in explanation and meaning making through labeling about the function of the item labeled.
	Campaigns, Events & Challenges	Whole school activities implemented to achieve a goal in support of a specific occasion(s). Can be competitive in nature
	Incentive & Reward	Methods used to encourage active support and participation
	Gardens & Outdoor Learning Spaces	Designated area for formal & non-formal learning Planting and maintaining gardens on school grounds
Partnerships	Municipality	Regional or local
	Third Party Organization	Community groups, organizations & businesses

Data Analysis and Findings

The following analysis describes each theme and its accompanying codes with details from participant responses to support. Each school was given a corresponding number given from its location in the Excel sheet instead of using their actual name. The participant responses are identified by their school district abbreviation, corresponding number and the corresponding question.

Formal Learning/Curriculum

Formal learning "can be defined as structured learning environments with a specified curriculum" (Richter et al., 2011). Formal learning in Ontario delivers a set of curriculum expectations for each subject with learning outcomes measured through assessment and evaluation. Learning in public schools generally occurs in time slots (or periods) allocated for different subjects. EE in Ontario is meant to be integrated within all subject areas, however, there aren't specific learning expectations required for EE in every subject. The *Scope and Sequence of Expectations* (Ministry of Education, 2017) guides educators with this integration and acknowledges that EE is explicitly linked with certain subjects, whereas in other subjects, EE can relate to curriculum expectations.

Science and Technology

There are fundamental concepts that provide the framework for scientific and technological knowledge (Ministry of Education, 2007). Strands in the curriculum express the main ideas that students are expected to understand after completing subjects. In addition, strands are consistent threads that run throughout each grade within subjects in the elementary curriculum (grades 1-8). Each strand has a grade specific theme that characterizes the overall and specific expectations within the strand for example, in the grade 3 strand Understanding Earth and Space Systems, the specific theme is Soils in the Environment, within the same strand in grade 5, the theme is Water Systems.

Environmental and sustainability learning are specific components of the fundamental concepts in the Science and Technology curriculum and found within all 4 strands (Understanding Life Systems,

Understanding Structures and Mechanisms, Understanding Matter and Energy, and Understanding Earth and Space Systems).

The analysis of application responses found that there are reoccurring strands in the science and technology curriculum where aspects of the school facility are primary components in how learning expectations are delivered in EE.

> *Grade 3. Learning about soils. Big idea: The composition, characteristics, & condition of soil determine its capacity to sustain life. In the 1st lesson, we examined soils samples from our school yard & discussed what we could see/find. In the 2nd lesson we talked about how worms add nutrients to the soil. For the rest of the year, all Grade 3 classes took care of a vermicomposter and observed the changes to the soil.* (PD.13-5.3_7).

> *Homemade toys- project ties into the Simple Machines unit in the Science curriculum. Students (grade 2) had to collect recycled material to create a new toy. Students discussed the importance of the 3R's.* (DD.2-5.4_7).

Transformative learning "involves individuals gaining awareness of their habits of mind by critiquing their assumptions and beliefs to assess alternate views resulting in a changed perspective" (Gravett, 2004, p. 259). It is a pedagogical approach that can be used to deliver lessons and activities that incorporate aspects of the school facility like energy and water systems with EE. The distinguishing elements of transformative learning are "critical reflection, or critical self-reflection on assumptions and critical discourse, where the learner validates best judgements" (Kitchenham, p.105 2008).

> *Students (grade. 8) tracked their estimated total water use in a 24-hour period (connection to math). They classified their water use as "optional" and "essential". Students compared their daily water use to an average Canadian. Next, they developed a plan to reduce the amount of water they consumed. They put their plan in action and tracked their water for 24 hours again. Students compared their previous amount to their new amount and reflected on their changes.* (YR.43-5.2_7).

Other lessons reflected applied learning about a sustainability concept in a variety of ways through active engagement with the school facility.

> *Students (grade 1) read about and discussed proper recycling, composting, green carts, and garbage minimization. The culminating task was to cut out pictures of various items and put these items in the correct containers. Then students went outside and cleaned up the school grounds and put items in the correct receptacles. Students learned to be more aware of waste and how it should be eliminated or the proper course of action to dispose of various items in garbage, green carts or recycle bins. (HD.10-5.1_7).*

Social Studies

Social Studies is another subject that has explicit EE connections within curriculum expectations. Inquiry, citizenship education framework and disciplinary thinking are strategies that are promoted in the curriculum to support its implementation.

Not all lessons facilitated direct engagement with the school facility. Some lessons supported students in making broader connections between built environments and their attributes with concepts in sustainability.

> *Grade 8 Students were learning about different types of renewable energy (e.g., solar and wind energy). Then, students researched how different cities (e.g., Stockholm) around the world implemented renewable energy in its infrastructure. The students explored the positive effects of these renewable sources on energy consumption. Their findings were presented in a photo essay on Google Slides. Their final task was to develop and present their own sustainable cities to their class.* (YR.39-5.5_7).

> *Students (grade 8) watched a movie on sustainable housing developments around the world and researched how to create green cities. They explored urban planning strategies and designed their own sustainable city using only reclaimed and reused materials. They presented their cities and explained how the features of their city (layout, public transit, energy sources, types of housing, water resources, etc.) are sustainable and reduce carbon emissions therefore do not contribute to climate change* (PD.17-5.2_7).

Literacy

Unlike the Social Studies and Science and Technology Curriculum, specific concepts in EE are not explicitly found within the strands (oral communication, reading, writing and media literacy) and expectations in the Language Curriculum. Rather, EE can be integrated throughout the curriculum. The *Scope and Sequence of Expectations* provides examples of prompts educators can use to bridge subjects that are not directly connected with EE like Language and The Arts.

Some EE lessons may not necessarily support active interaction with the school facility through sustainable practice, but still reinforce concepts in environmental sustainability.

> *Inspired by conversations and learning about energy conservation from Earth Hour, this grade one class wrote stories about Energy Superheroes, that they then shared with other students to encourage them to save energy too. Their superhero used their powers to conserve energy and showed that other students can be energy superheroes as well.* (PD.11-5.7_7).

Non-Formal Learning

Non-formal learning occurs alongside the formal systems of education, they are intentional, organized activities in schools and are voluntary as opposed to mandatory participation (Perulli, 2009; Dudzinska et al, 2008). This contrasts with formal learning where learning occurs within a structured environment with a specific curriculum, learning objectives and assessment, "typically, non-formal participation is viewed either as a support for or complement to formal education" (Thompson, 2012, p. 58,). Non-formal learning situations in schools include teams, clubs or associations. Students in the sample participate in a variety of ongoing activities that support formal learning in EE. These activities occur in groups as part of whole school environmental sustainability initiatives.

Monitor and Feedback

Monitoring is the means through which students collect data which becomes feedback about their waste management and energy conservation process. This creates ongoing opportunities for students to engage with the school facility through monitoring their actions in sorting waste and conserving electricity.

Students monitor their collection and separation of waste by using recycling (blue), organics (green) and garbage (black) bins on a daily or weekly basis. This includes managing contamination of waste which impacts diversion rates through audits. Waste audits are components of the application, "Have students participated in a school-wide waste audit which includes a breakdown of contents of both garbage and recycling and communicated the results to the whole school? What is your school's waste diversion rate?" (EcoSchools, 2018, p. 20).

The students from HD.6 monitor their waste and recycling bins while checking for contamination.

Students monitor classroom bins daily to stop contamination and share results with classes. (3.3).

Everyday students from the Eco team walk around the school to audit the use of waste bins to ensure they are used appropriately. The classes who are not using them appropriately are given a reminder note on their board and an email to the teacher. (YR.38-3.12).

Monitoring is completed by designated groups, usually EcoTeams or individual classrooms monitor their actions and report their findings to the EcoTeam.

> *On a weekly basis during Recycling time, our Eco champs check for contamination within our recycling bins.* (PD.15-3.11).

> *Students track the garbage/recycling with sheets in each class. Student leaders from each class share eco messages and discuss the results.* (YR.36-3.11).

Feedback of students' actions in conserving energy and minimizing waste is presented to individual classes and the entire school on announcements, displays, as notes, and through electronic communications. Providing feedback allows students to see their progress and make behavioural adjustments to support the goals of the activity.

> *Eco-Ambassadors are assigned to every classroom and they regularly visit and monitor the classrooms and give feedback in the form of report cards.* (YR.45-2.11).

> *The "Energy Police" patrol the school once per week to see if any lights or equipment are left on during recess or at the end of the day.* (PD.13-2.11).

> *Eco team members share results via P.A. announcements daily, posters, in collaboration with our care-taking team in the form of graphs to show results posted on our Eco bulletin board*. (YR.38.2.11).

Extracurricular Activities

School based extracurricular activities provide an additional context in which students can access EE. These contexts are usually highly structured with direction from an adult and require regular participation from students (Darling et al., 2995). Extracurricular activities can support school connectedness and climate (Martinez et al., 2016) while also having the potential to influence the embodiment of environmental sustainability within school culture. An essential component of the EcoSchools program is the creation of an EcoTeam and is a criterion in Section 1, Teamwork and Leadership. EcoTeams are encouraged to be diverse to reflect all parts of the adult community and student body (EcoSchools, 2018).

Teams and clubs within the sample act as facilitators for how the student body engages with the school facility in sustainable practice. This occurs through developing and communicating initiatives.

> *Our Eco-team has made posters for Lights Out Lunches, and team members regularly make announcements reminding staff and students to conserve energy.* (YR.37-2.11).

> *We regularly shared with the whole school by making announcements about Lights-Out Wednesdays and Fridays.* (YR.43-2.11).

EcoTeams or similar groups act as leaders in their school-wide environmental initiatives, this includes educating the student body about what they've learned through workshops, monitoring the behaviours of their peers and providing feedback on actions taken.

> *Students (EcoTeam) created a power point to share the process of calculating the diversion rate and also how waste was collected, sorted and weighed to collect the data. Audit report was shared with each division and the next steps/goals were discussed/shared.* (HD.6-3.12).

> *The Eco Reps shared what they learned with the rest of the Eco Club. The students were passionate about greening our school, which lead us to plan a campaign to raise money to buy flowers for our garden, to clean up our yard on a regular basis, and spreading awareness to the wider school community*. (DD.2-1.8b_6).

There is also collaboration between EcoTeams and other school clubs with coinciding objectives.

> *This year our Gardening Club and EcoTeam maintained the vegetable garden. This Spring we are focusing on pollinators.* (HD.9-4.1a_3).

> *A group of grade 7 students from eco created the idea to sell plants for Mother's Day and then eco club helped to create the posters and promote the event (YR.34-6.4_3)… Students in each classroom saved their milk cartons to use them as pots. Students created posters and we announced the number of cartons we saved. Art club helped decorate. (YR.34-6.4_5).*

Facility Attributes

Facility attributes are the aspects and characteristics of a facility that meet the needs of the occupants, such as physical conditions, safety and security and accessibility, and indoor air (Gopikrishnan, 2017). The interaction between a building's occupants and its attributes influences the building's performance, its physical integrity and how occupants function in that space. The facility attributes within the sample are directly linked with operations and management. The students in the sample were actively involved with the operations and management of their school building through managing waste, conserving energy and maintenance of school grounds.

Garbage, Recycling and Organics

Waste management is an essential component in the function of school buildings and is affected by school board and municipal policy objectives for waste management. This includes partnership between regional municipalities and school boards in the collection of recycling, waste and organic materials. A core element of waste minimization in the sample is the use of recycling, organic and garbage bins (blue, green and black bins). The location of bins affects how students access and implement their waste minimization strategies. This includes their ability to monitor contamination of recycled materials, identifying appropriate waste sorting and relaying results to their classmates.

> *Green bins and blue bins in every class, Students monitor classroom bins daily to stop contamination and share results with classes.* (HD.6-3.3).

> *All blue, black garbage all 13 locations were collected at the end of the same day. The next day each recycling/garbage bag was weighed and audited by the Green Eagles.* (HD.5-3.12).

> *Every classroom has a green cart, and these are collected twice a week throughout the year*. (HD.8-3.3).

> Some schools place multiple bins in high use areas like cafeterias and lunchrooms.

> *We also have compost bins in all lunchrooms and multiple compost and recycling bins in the cafeteria.* (YR.33-3.11).

Indoor/Outdoor Linkages

Extending the learning environment beyond classrooms into outdoor spaces allows students to engage in diverse settings that "can inspire thinking, learning and innovation that can be incorporated back into the classroom environment" (Ontario Public Service, 2016). The connection between indoor and outdoor learning spaces in the sample centers primarily around gardening and connections between formal learning in curriculum expectations.

> Seeds are planted and cared for indoors and then transitioned to be planted outside on school grounds.

> *We start seeds in many different classrooms who eventually will plant, water and help care for the food garden.* (HD.7-4.1a_3).

> *Each class is growing seeds and planting their seedlings in our vegetable garden* (HD.5-4.1a_3).

Planting seeds offered an opportunity for students to learn from one another.

> *Peer leadership and experiential learning; junior students showed primary students how to plant seeds.* (PD.15-4.5_2).

Curriculum expectations that facilitate the connection between indoor and outdoor learning spaces were primarily found in science and technology.

> *Outdoor classroom is used regularly by K-5 classes to take learning outdoors. Use "grove" to relax in nature, run, study habitats (gr 2 and 4), examine bugs (K,1), plants (3) and measure tree growth (5) to determine effect of climate change on trees.* (PD.11-4.5_2).

> *All the grade 3 classes spend time observing, planting, watering and caring for the plants as part of their science lessons on plants and soil. They also harvest and eat the fruits & vegetables.* (YR.45-4.5).

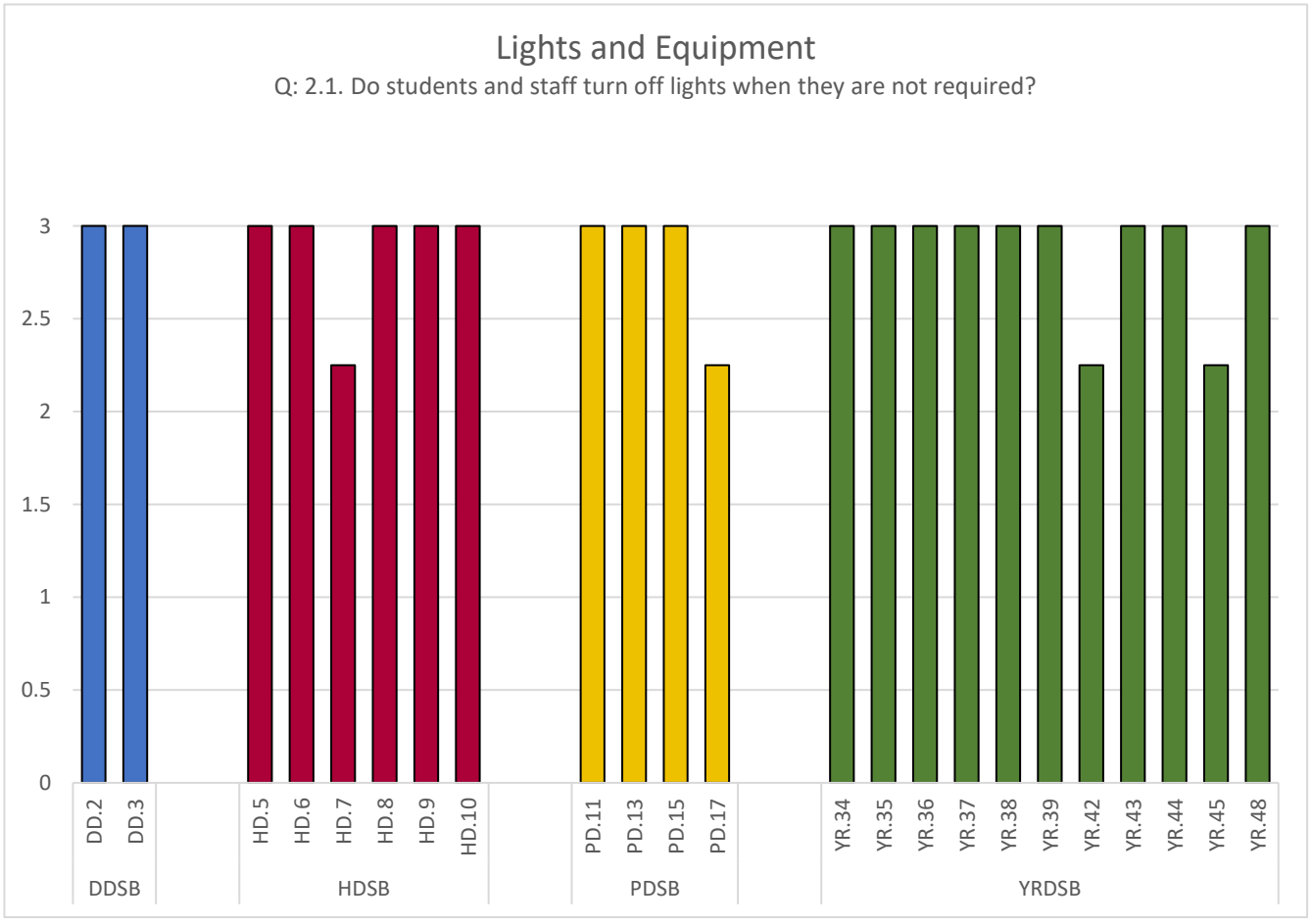
Energy

Energy conservation is a dominant area of focus within sustainable practice for buildings. This is apparent in school boards across Ontario who are required to report their energy conservation and demand management plans (O. Reg. 397/11, s. 3). This includes an annual summary of each school board's "energy consumption and greenhouse gas emissions and a description of previous, current and proposed measures for conserving energy" (O. Reg. 397/11, s. 4). In addition to this regulation, conserving energy and integrating energy efficient and renewable energy upgrades allows schools to save on building operational costs.

Energy management falls into three categories, building design (retrofit and construction), operations and maintenance and occupant behaviour (Enerlife, 2019). PDSB's Energy Conservation and Demand Management Plan (2019) describes the primary energy end use within their schools as lighting, ventilation fans, pumps (heating), chillers and plug loads (p.8). School Construction Projects in HDSB detail the new school constructions, major additions and renovations happening throughout the board. HD.9 is listed as undergoing installations for automatic door openers, switching lights to LED and replacements of building system controls (HDSB, 2019). Lighting is an easily accessible aspect of the school facility for students to manage ("low hanging fruit") and is the main facility attribute that presents itself in the sample.

The sub-sections in Section 2, Energy Conservation, *Lights and Equipment* and *Efficient School Systems and Practices* requires respondents to assess how they interact with the energy system in their school. The questions in these two sub-sections are also components of EcoReview submissions that must be submitted twice during the school year. The responses for the questions in these sub-sections reflect points allocated from self-assessment and Ontario EcoSchools program benchmark assessments. Figure 3 illustrates the total points claimed for question 2.1 which is worth 3 points. All schools implemented consistent practice (Level 3) or comprehensive practice (Level 4) for this question.

Figure 3 Total Points Claimed for Turning off Lights When Not in Use



This is evidenced by descriptions of each school's written response of the strategies they are using to monitor energy conservation practices in question 2.11, *Do students use communication strategies to*

effectively share energy conservation goals, successes and areas of improvement related to lights-off and monitor off campaigns?

> *Students make regular checks and use green and red stickers to monitor the energy conservation in classroom.* (HD.6).
>
> *Eco-Ambassadors are assigned to every classroom and they regularly visit and monitor the classrooms and give feedback in the form of report cards. We also have a mini-tree awarded each month to the classroom that is doing the best work. (YR.45).*

YRDSB was ranked #5 in Ontario's top energy performing school boards (McIntyre & Jarvis, 2016) and cites the triangle of conservation as the biggest factor that influenced their energy performance. They are currently ranked second in the 2019 Top Energy Performing Schools (Enerlife, 2019). Their approach to conservation was "interdependent, encompassing efficient facility design, optimal building operations, and the mindful behaviours and actions of facility occupants" (Sustainable Schools YRDSB, 2015, p.3). Students and staff at YRDSB can access energy consumption data through EcoWatch which is an internal school board website that monitors real-time energy use and conservation efforts. (Sustainable Schools, 2015).

> *We spread word about YRDSB's EcoWatch, which shows the energy use of our school over a day.* (YR.40-2.11).

Cross-Cutting

Cross-cutting themes represent codes that intersect with the other themes. The codes in this theme are either directly or indirectly interrelated with the other themes. It is worth noting that the nature of school systems present overlap between the components making up the system. However, the codes in this theme are emphasized due to their relationship within the other themes.

Signage

The signs described in the sample are intended to inform staff and students about the physical features of the facility. These signs act as guides for how students and staff are to engage with the features to support EE and sustainable practice. Signs are used to provide knowledge about how to maintain the environmental performance of the building, "a common approach to teaching occupants about the green building is to layer

signage over the finished product" (Cole, 2014). Sign use in green schools can support active and passive participation from students. In the sample, signs are used to reinforce stewardship behaviours that support objectives in energy conservation, waste management and garden maintenance.

Signs act as reminders for students to properly sort waste.

Correct bin usage posters (HD.6-3.11).

We post posters on top of our recycling bins, to remind students and staff. (YR.33-3.12).

Signs to ensure students respect area (YR.34-4.1a_3).

Signs were used to inform the school community about the content of gardens.

Students researched the plants that will be going into the garden- they learned how to care for them and their uses. Info will be used to complete our signage to educate whole school and neighbourhood community. (YR.34-4.3).

Signs were used to prompt desired behaviours.

Stickers on all computers and light switches as reminders to turn off equipment and lights. (YR.42-2.11).

Correct bin usage posters -waste management bulletin board. (HD.6-3.12).

Bulletin Boards and Posters

The displays, bulletin boards and posters in the sample were designed to inform staff and students about the ongoing environmental and sustainable practice initiatives occurring in the school. They were designed to promote, educate and strengthen environmental stewardship.

Bulletin boards were managed by EcoTeams or similar groups to promote ongoing and upcoming environmental sustainability initiatives.

Enforced Boomerang Lunch. Eco Club has promoted this on bulletin (DD.2-3.3).

Our Eco-team has made posters for Lights Out Lunches, and team members regularly make announcements reminding staff and students to conserve energy. (YR.37-2.11).

We also have a bulletin board that is updated monthly with information and events. (YR.38-3.11).

Posters were also created by specific classes as part of formal curriculum learning.

Students chose an environmental issue and researched the following questions: 1. What is happening? What levels of government are helping? What can students do? Students presented their research in a poster format which displayed their researched facts and pictures. (YR.37-5.5_7).

Grade 2. Language - Create posters (as part of a media literacy unit) to educate other students about "How we can help the Earth". (PD.11-5.6_7).

Students used a system of centicubes in cups to track water usage. After a week results were evaluated, and conclusions displayed in poster form of how to conserve water. (YR.34-5.1_7).

Bulletin boards and posters educate students about the purpose of environmental sustainability campaigns and the strategies they can employ to participate in the initiative.

Students engage in weekly reminders through announcements, updates on the Eco bulletin board, posters, 'Lights out Lunches". They present specific facts about the effects on the environment and outline ways that we can reduce our energy consumption. (YR.44-2.11).

Eco members made announcements about bringing a waste-free lunch to school. They made posters on what a waste-free lunch and a wasteful lunch looks like. The waste audit and divergent rate results were displayed on the bulletin board. (YR.37-3.11).

The content of bulletin boards and posters allow staff and students to see the outcomes of their sustainable practice. This acts as feedback about their actions in school wide challenges and competitions.

Eco team members share results via P.A. announcements daily, posters, in collaboration with our care-taking team in the form of graphs to show results posted on our Eco bulletin board (YR.38-2.11).

Eco-Schools bulletin board to share Energy usage charts (e.g., energy reduction during Earth Hour) (YR.39-2.11).

We use a bulletin board to track and show classes the results of their energy conservation efforts. (YR.37-2.11).

Bulletin boards and posters also educate the student body about the importance of environmental sustainability and the impact of sustainable practice in the natural environment, community and broader society.

We send out eblasts about saving energy to all of the parents at the school. (HD.7-2.11).

Events, Campaigns and Challenges

Events, campaigns and challenges are found primarily within 3 sections in the application, Energy Conservation and Waste Minimization and Environmental Stewardship. Campaigns, events and challenges facilitate interaction with the attributes of the school facility by encouraging students to be conscious about their interactions with these attributes. The intention is to promote changes in student and staff behaviour that coincide with environmental and sustainability values.

Ontario EcoSchools provides an entire section for school resources that includes campaign kits, calendar of events, lesson plans that are separated by grade and subject (Ontario EcoSchools, 2019). Schools boards also promote campaigns and events along with resources to support school involvement (PDSB, 2019; YRDSB, 2018). Local and regional municipalities promote environmental sustainability through campaigns that are available for schools to participate in as well as specialized school programs (Durham Region, 2017; Halton Hills, 2017; Region of Peel, 2019).

> *Eco Team always leads this campaign. Halton Hills promotes this event as well. They provide the school with biodegradable gloves and garbage bags*. (HD.9-6.4_3).

> *Earth Hour Energy Conservation Fair. Our school partnered with Vaughan City Hall to make an eco-banner (climate change).* (YR.36-6.2_5) *... At City Hall, students learned from over 10 centres/stations all focused on energy conservation. There were over 30 students with families present. The grade 7/8s made an eco-banner about global warming. The banner shows, i.e. alternative sources of renewable energy, alternative transportation.* (YR.36-6.2_6).

Challenges are expressed as activities that have elements that are outside of regular daily practice which elicits challenge for participants as they shift from their normal behaviour towards behaviour aligning with environmental sustainability.

> *Every week (starting November), our school encourages students to participate in Meatless Monday and Trash less Tuesday.* (HD.8-3.3).

> *Litter-less Lunch Campaign. Students learned to reduce their waste by bringing their lunches in reusable containers. They became aware of how much garbage they generate by bringing wasteful lunches.* (PD.13-6.1_6) *…Students needed to persuade their parents and others to pack their lunches in reusable containers. They recorded their classmates progress*. (PD.13-6.1_7).

> The duration of events varied between one day, weekly or monthly initiatives.

Students made posters about the event and placed them around the school. Students made announcements to inform the school. The Eco Fair was included in the Eco Week schedule at school. (YR.36-6.4_5).

We did month long trivia about Peel water on the announcements about tap water and water conservation. Posters lined the hallways to remind students to bring in bottles for Great Gulp. We ended with a whole school Great Gulp assembly. (PD.17-6.4_5).

Events and campaigns were single or multi themed.

Students learned about different environmental issues, i.e. waste and recycling, e-waste disposal and recycling, upcycling and milk bag mats, solar panels and sustainability practices, water conservation and environmental services, reduce paper consumption, bringing reusable containers and water bottles. (YR.36-6.4_6).

In order to qualify as a submission for environmental stewardship in the application, the activity must "engage the whole school community in active participation" (Ontario EcoSchools, 2018). Administration involvement provides students with a different perspective on how their stewardship behaviours impact the function of school.

Good on One Side (GOOS) Campaign. Through this campaign, students were engaged in reducing the amount of paper being wasted or recycled. Our principal also shared with us how much of our school budget we spend on paper and it was astonishing. It would be a great goal for next year to cut down on the paper budget and make teachers have more strict copying limits. Goals for next year! (DD.3-6.1_5).

Some events presented in the sample were connected to national and international events.

They turned off lights in class for the rest of the day for Earth Hour. (HD.7-6.4_7).

Incentive and Reward

Incentives and rewards are connected to campaigns and challenges. They are methods used to encourage student participation while reinforcing sustainable practice. Incentives and rewards engage students in EE by creating 'buy-in'. This also facilitates non-formal learning in EE which can complement formal learning in EE.

Student were given tangible rewards, or they were rewarded through recognition announcements to the whole school.

We documented who made the biggest improvement and gave away a popcorn party at the assembly to the winning classes from each grade level. (PD.17-2.11).

Green Eagle class quiz questions, posters, earth week challenges, Green Eagles banner award. (HD.5-3.11).

The "Energy Police" patrol the school once per week to see if any lights or equipment are left on during recess or at the end of the day. Class that do well get recognized on the PA. (PD.13-2.11).

Outdoor Learning Spaces and Gardens

Outdoor learning spaces in this sample assist in shaping and defining the school grounds. Gardens are primary components within these learning spaces and were used to support formal and non-formal learning.

Explicit connections were made between curriculum expectations and different elements of school gardens (ex. plants and soil). The connection between indoor and outdoor learning was often seen through classroom vermicomposting and butterfly classrooms kits. Curriculum expectations explicitly related to EE are found within these subjects, science and technology, geography and social studies (Ministry of Education, 2017), however, the outdoor spaces in this sample facilitated EE in other subjects.

Grade 1 and grade 1/2 classes are augmenting the butterfly garden with plants donated from Sheridan nurseries, researching what painted lady butterflies need and will be hatching painted lady butterflies to release. (HD.5-4.1a_3).

Our existing outdoor space/seating area is used for reading, sketching, and drama games (HD.8-4.5).

Learning about soils. Ontario curriculum big idea: The composition, characteristics, & condition of soil determine its capacity to sustain life. In the 1st lesson, we examined soils samples from our school yard & discussed what we could see/find. In the 2nd lesson we talked about how worms add nutrients to the soil. For the rest of the year, all Grade 3 classes took care of a vermicomposter and observed the changes to the soil. (PD.13-5.3_7).

Outdoor learning spaces were used in ways that extended beyond structured curriculum learning. School needed to identify in their application response (p.13) the various ways in which their school grounds extended learning opportunities (EcoSchools, 2018).

Trees have been planned and placed strategically to create shade and added shaded areas for outdoor play for Students. Space is regularly used by staff for community circles, art and nature yoga at times. (HD.6-4.4).

Classes use the rock circle to meet, yoga is done on the grass, connection to nature right next to our school improves health and well-being (HD.7-4.5_2).

Our EcoTeam is involved in mapping the location of trees and measuring their diameters and growth. This data is sent to ACRE as part of their citizen science program which studies impact of climate change on growth of native tree and shrub species. (PD.11-4.3).

Gardening includes planning and preparation of the designated space, the act of planting and maintaining the garden space. Planting seedlings was either accomplished by EcoTeam members or by individual classes. Maintenance was often a role taken by EcoTeams, however, general school ground clean ups were primarily accomplished through whole school campaigns.

Each class is growing seeds and planting their seedlings in our vegetable garden (HD.5-4.1a_3).

Our OAK team learns how to use the Sub Irrigated Planter Method to start seeds and does workshops with other classes. We start seeds in many different classrooms who eventually will plant, water and help care for the food garden (HD.7-4.1a_3)… OAK club maintains the space on a regular basis (HD.7-4.5_2).

The location of gardens is also worth mentioning because in addition to providing learning opportunities, they were also symbolic representations of the school's efforts in EE for students and the community. The gardens reflect biodiversity, with emphasis on plants that attract pollinators, native species and drought resistant plants.

School gardens (front and back of the school have plants that have been selected for pollinators, low water and native). Ex. Asters. (DD.3-1a_3).

Green Team is working on the raised planters at the front entrance of our school. Usually we plant annuals to add colour to the front but instead we are going to put in native perennials that can grow in the shade. In the raised planter, we are going to add some pollinators like coneflowers. (PD.17-4.1a_3).

This new garden will take time to grow, but already provides a welcoming feeling at our front entrance. Our sign "Pollinators" creates conversations too. (HD.8-4.5).

Partnerships

Partnerships played an important role in supporting EE in the EcoSchools sampled by creating access to programs and resources that would otherwise not be available to schools. The main intention of developing partnerships was to enhance the existing EE program by providing new opportunities for students to engage directly or indirectly with their school facility.

Municipality

Local and regional municipalities provide structured environmental sustainability programs that were offered as workshops, presentations or field trips.

> *Peel waste reduction workshops supported students with investigating the secret life cycle of everyday products, students discovered the importance of the 3Rs and how to tackle issues like food waste, over-packaging, resource use in their own lives and how to dispose of materials properly according to Peel recycling, green bin and garbage regulations.* (PD.17-1.8a_6).

> *The Grade 2 teachers and students went to the Peel Water Festival in Brampton, organized by Peel Region. There was a variety of activities to raise awareness of water conservation and preserving a clean environment*. (PD.13-18a_5).

> *As part of the Region of Peel's Waste Reduction Campaign, we participated in 2 whole school waste audits. These were communicated through posters around school, bulletin board, and whole school assembly with detailed slide show. Diversion rate 75.2%. (PD.11-3.12).*

Third Party

Third party partnerships provided an opportunity for students to make connections between sustainable practice in their homes, school and broader community.

> *The lesson was based around the Crayola Color Cycle program. Students learned about solar panels and the energy that they produce to power most of the Crayola plant, students made the connection to other places they have seen those panels (e.g., buildings, and homes). Students looked into the process of making clean fuel and what clean fuel is. Students then started a school wide campaign by creating posters, and announcements that would be used to promote the collection of dried markers.* (HD.7-5.3_7).

> *Students learned about Passive Houses from a community partner who made a video tour of his Oakville home. Students learned about what makes an energy efficient building. They needed to plan, build and share a model of their Passive House which included a minimum of 8 efficient features.* (HD.7-5.6_7).

Summary

The analysis of these responses demonstrates that Platinum certified EcoSchools are integrating their school facility in diverse and interconnected ways. Even though there are distinguished codes, there is significant overlap between how they function as part of an interconnected system. The school facility is a tool for EE in a variety of ways and not restricted to use in formal learning. Ongoing active engagement with elements of the school facility usually occurred through multiple channels most notably through campaigns, challenges

and events. The responses illustrate that the framework of the EcoSchools program in addition to school board and regional programs for environmental sustainability are essential in assisting schools in developing EE programs where the school facility is an integral tool for facilitating sustainable practice. More importantly, establishing a school culture with values that align with environmental sustainability creates the foundation on which schools can begin to access alternate entry points for sustainable practice.

Discussion

Society organizes, manages and governs complex systems in isolated parts, Orr (2014) believes this is a prime factor in the failure of generating transformative solutions for ecological sustainability. This fragmented perspective impedes our ability in recognizing connections, patterns and behaviours that are inherent between elements in systems. We see evidence of this type of fragmentation in how traditional education systems structure themselves. Traditional learning is generally presented to students through distinct subjects that are sectioned into blocked periods. Learning in this way is an abstraction of place, it is not a true reflection of a society made up of interconnected relationships between the built and natural environment. The way learning occurs is as important as content, just like the relationships between elements in a system are just as important as the individual elements. Learning about how environmental issues exist within systems can facilitate thinking across disciplines to find multifaceted solutions to ecological problems that are linked within our relationship with place. Systems thinking can frame how we understand and manage complex relationships between social and ecological experiences (Orr, 2014). Systems thinking is a means through which to understand how EcoSchools are integrating their built environment with EE.

Response to the Research Question.

Q. **How are K-8 EcoSchools in Ontario integrating the school facility with environmental education?**

Ontario EcoSchools are complex systems with interrelated sub-systems that can support and/or conflict with its overall purpose in embedding "ecological literacy into curriculum and daily practice while creating networks between stakeholders" (EcoSchools, 2018, p. 2). The school facility is a sub-system that functions as a place where students are learning about environmental issues through direct and indirect engagement with their surroundings. The findings in this investigation highlight the themes, *Formal/Curriculum Learning, Non-formal Learning, Building Attributes, Cross-Cutting and Partnerships* and how they overlap to demonstrate the ways in which Platinum EcoSchools are integrating their school facility with EE. Identifying how the elements within the themes (codes) function as part of the school

facility subsystem demonstrates the underlying principles in establishing whole school sustainability and EE programs.

Systems exhibit distinct properties that contribute to its function, they are groupings of stocks and changing flows of inputs and outputs. Stock and flow diagrams will help illustrate how the EcoSchools in this study integrated their school facility with EE. Stocks are the foundation of any system, “they are an accumulation of material or information that can be measured at any given time” (Meadows, 2008, p. 17) and are affected by the inputs and outputs of a system. Flow indicates the movement of material in and out of a stock. This means that stocks can accumulate, maintain its balance or deplete depending on the nature of inflow and outflow which can change.

Feedback loops are other structural properties within systems that are integral to their function, “feedback loops are formed when changes in a stock affect the flows into or out of that same stock” (Meadows, 2008, p. 25). There are two main feedback loops within systems, balancing and reinforcing. The findings from this analysis emphasize the prevalence of both feedback loops. Reinforcing feedback loops “are found wherever a system element has the ability to reinforce or reproduce itself, they can lead to exponential growth or runaway collapses over time” (Meadows, p. 34, 2008). Balancing feedback loops supports the system in maintaining its goal and can be “sources of stability and sources of resistance to change” (Meadows, p. 30, 2008).

EcoSchools and schools in general are open systems. Open systems regularly exchange feedback with its external environment (Reuter, 2013). For example, public schools in Ontario are required to administer standardized testing every year for grade 3 and 6 students from the Education Quality and Accountability Office (EQAO). These tests provide feedback to the Ministry of Education and school boards to assist in making improvements in math and literacy programs for elementary schools.

Figure 4 Stock and Flow Diagram: Building Attributes, Garbage, Recycling & Organics

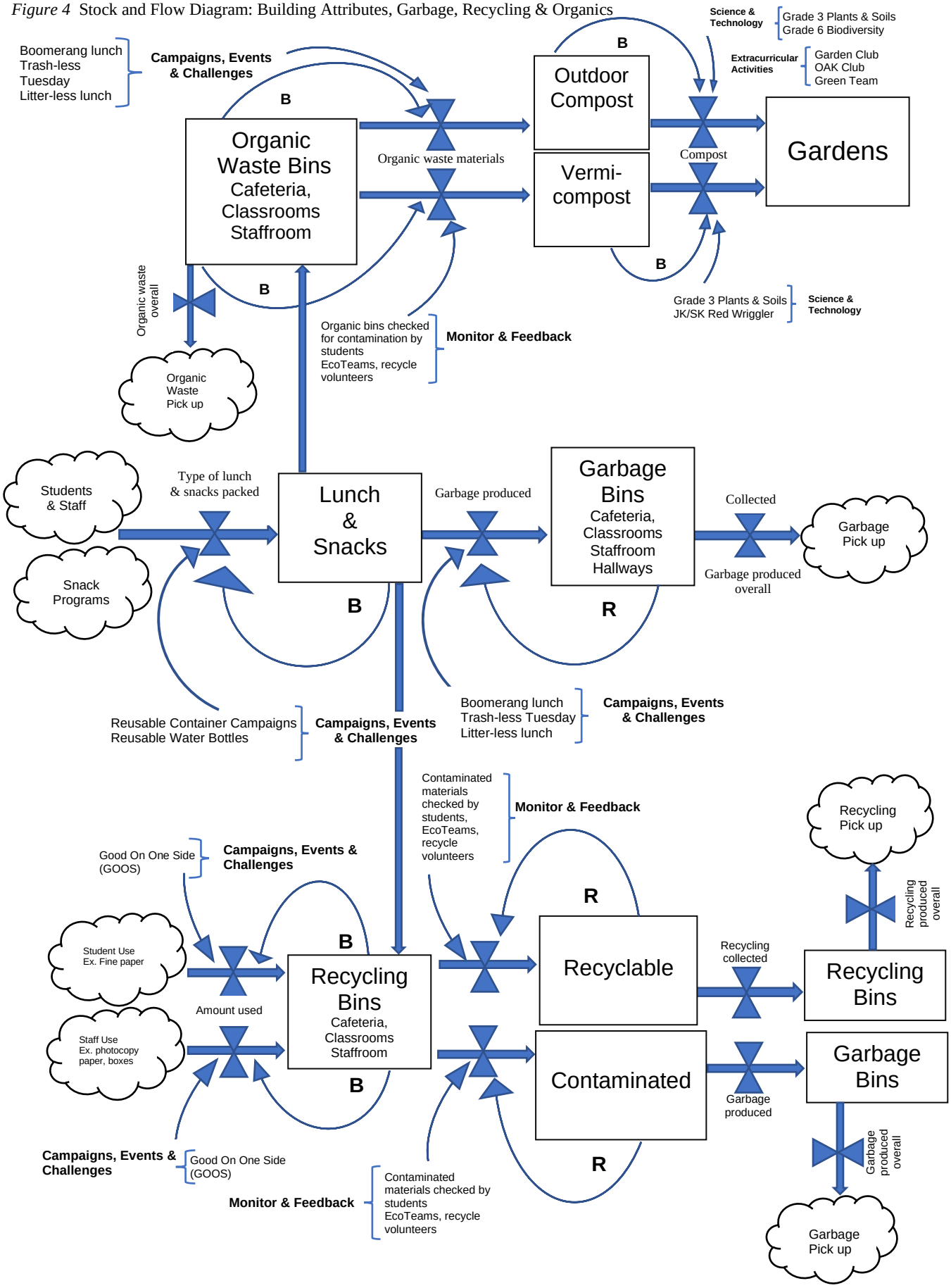


Figure 4 illustrates how garbage, recycling and organic waste function as part of an EcoSchool's building facility. The purpose of this system which is an aspect of the school facility sub-system is waste minimization. Stocks are shown as the boxes and represent the codes within building attributes. The stock "lunch and snacks" is not an identified code but is a primary source of waste input and is an instigator for sustainable practice. Figure 4 demonstrates how this component of the school facility is integrated with EE through the behaviours of occupants. These behaviours are presented within the themes *Formal Learning/Curriculum*, *Non-Formal Learning and Cross-Cutting*. The prevalence of codes from all the themes highlight the overlap between the different elements of an EcoSchool system and emphasizes how systems thinking works to identify the quality of relationships. The external environmental factors are represented by clouds and show the origin (source) and destination (sink) of flow. For example, the source *students and staff* and *snack programs* provide the flow for *lunch and snacks* from an external source, usually lunch is brought to school from home or in the case of a snack programs from a third party.

The amount of flow in and out of stocks is impacted by reinforcing (R) and balancing (B) feedback loops. The catalysts for these feedback loops are the result of occupant behaviour. For example, the reduction of overall garbage produced is achieved through campaigns, events and challenges. Staff and students participate in reducing their lunch and snack waste which then reduces the amount of garbage produced which then reduces the overall garbage to be picked up. The actions taken by students and staff reinforce the reduction of waste input and output. The balancing feedback loop in Figure 4 stabilizes the amount of compost produced through its use in gardens. This is facilitated through formal and non-formal learning. For example, grade 3 students participating in plants and soil lessons study the role of worms in vermicomposting which is used as compost for plants in their school garden(s). Most compost bins are managed by students participating in extracurricular clubs like Green Teams by monitoring organic bins and providing feedback to their peers about contaminated bins and proper sorting. Green Teams also work with other student groups to facilitate the use of the compost in gardens.

There are other examples of stocks and flow from this investigation that can be incorporated within Figure 4. For example, signage, bulletin boards and posters can be portrayed as a stock that provide an output of information to influence the amount of waste produced by presenting feedback to students and staff about waste audits, proper sorting techniques, and results from challenges and campaigns. Another reinforcing feedback loop can be added to indicate how challenges and incentives reduce the flow of contaminated material to the overall waste produced. Figure 4 is an example of how EcoSchools are integrating one aspect of the school facility with EE. The building attribute highlighted in Figure 4 is part of a larger school facility sub-system that works to support EE and sustainable practice as a result of deliberate interaction between students and the built environment to develop their sense of place. The fact that Figure 4 can be expanded to include many more stocks, flows and feedback loops emphasizes the complexities within schools.

The school facility is used to develop meaningful learning experiences in EE, "meaningful EE occurs when learning is situated in real world events" (Brody, 2005, p. 608). The campaigns, challenges and events developed to support completion of EcoSchool applications facilitated opportunities for students to engage in managing their waste production, designing and maintaining their school grounds and conserving their use of energy. This reflects applied learning where students were practicing what they know and were provided feedback to adjust their behaviour. This occurred within the context of the school facility that was an active participant with students. The school facility responded to the actions taken by students such as, reductions in energy costs and waste production, the appearance of growing plants and by facilitating partnerships like parents and community members maintaining school gardens during the summer break. Feedback through public address (PA) system announcements, whole school assemblies, posters, displays and bulletin boards provided ongoing information to students about their participation in campaigns and challenges. This supported their understanding about the consequences of their actions in each section of the EcoSchools application.

Integrating the school facility with EE reflects a non-linear approach to EE. Students in this study were reflexive as they engaged in sustainable practice while co-creating their sense of place with the school

facility. Participating in campaigns, events and challenges allowed students to monitor and collect data about their actions for sustainable practice. They used data to inform themselves, adjust and reinforce behaviour to aligned with their goals in EE and sustainability.

Leveraging What We Know

Investigating how EcoSchools are integrating the school facility with EE from a systems perspective allows for new opportunities to be identified through the interconnections between the elements of the system. The relationships between the themes and codes found in this study presents emerging concepts that support an integrative approach to EE where the school facility is thoughtfully used as a tool to support the values of green schools. This investigation also provides insight into how students are engaging as elements within the school facility sub-system in comprehensive EE programs. The relationships between these system elements is where we can see how established EcoSchools are integrating their school facility with EE. The nature of these relationships can identify leverage points that can be considered in the development of EE programs in schools.

"Leverage points are places in the system where a small change could lead to a large shift in behaviour" (Meadows, 2008, p. 145). Every school is different and may not have the capacity to implement the EcoSchools program, so implementing small changes that have the potential to create a large impact could provide alternate access points for EE. It is important to recognize that values and goals set the direction of EcoSchools and systems in general. Aligned values and practices established within the organizational structure play a fundamental role in supporting EE. Alignment is supported by auxiliary parts of the school system that act as feedback loops like the relationship between student behaviour and the attributes of the school facility.

The Power of Feedback

Balancing Feedback Loop

"The strength of a balancing loop is its ability to keep its appointed stock at or near its goal" (Meadows, 2008, p. 153).

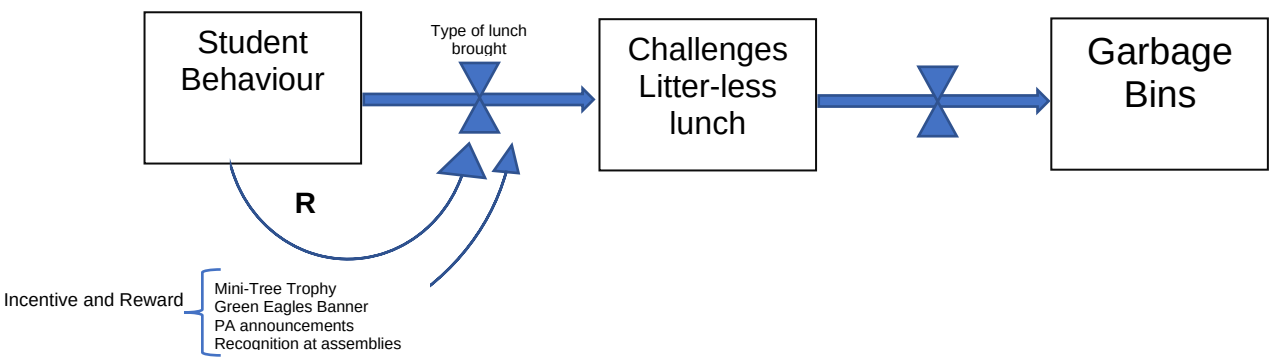
Platinum EcoSchools in this study were using non-formal learning situations to generate balancing feedback loops. Monitor and feedback and extracurricular activities were used to manage behaviour in energy conservation and waste minimization. Eco-Ambassadors and Green Teams as well as classroom volunteers used checklists to monitor lights, computers, and waste bins to identify how their classmates were participating in campaigns and challenges like "Lights Out Lunches" (YR.36-2.11) ,"Litter-less Lunches" (PD.13-3.3) and "Earth Hour" (DD.3-2.11). The checklists were used to measure progress in achieving campaign and event objectives, and to provide a framework for challenges. Monitor, feedback and extracurricular activities coupled with events, challenges and campaigns stabilize the school's efforts in waste management and energy conservation.

Reinforcing Feedback Loop

"A reinforcing feedback loop is self-reinforcing. The more it works, the more it gains power to work some more, driving the system in one direction" (Meadows, 2008, p. 155).

Incentive and reward acted as catalysts for continued student participation in campaigns and challenges which encouraged changes in student behaviour. Incentive and rewards were tangible "popcorn party" (PD.17-2.11) or through recognition, "announcements are made to announce best kept classes" (HD.9-3.11). Figure 5 is a simple stock and flow diagram illustrating this reinforcing feedback loop.

Figure 5 Stock and Flow Diagram. Reinforcing Feedback Loop – Incentive and Reward



Information Flow Feedback Loop

"Missing information flows is one of the most common causes of system malfunction. Adding or restoring information can be a powerful intervention…There is a systematic tendency on the part of human beings to avoid accountability for their decisions" (Meadows, 2008, p.157).

Signage, bulletin boards and posters were emphasized throughout the data set and were used to convey information in a variety of ways. Posters were used to communicate strategies to conserve energy and minimize waste as well as to communicate results from waste and energy audits (YR.44-2.11). Posters were used to encourage participation in (HD.9-2.11) and share results from challenges and campaigns (YR.37-2.11). They were also used as method for students to share their learning from formal lessons with one another (PD.11-5.6_7). Signs were used to inform about correct waste bin use and the types of plants in gardens. The location of posters and signs was also described as being in highly visible places. In some cases, stickers were placed beside light switches and computer monitors as reminders to turn them off (YR.42-2.11). EcoTeams were described as having their own designated bulletin board which provided a centralized place to deliver information about upcoming events and general information about the objectives of the team (DD.2-6.3_5).

Schools relayed information about their activities in the EcoSchools program through school newsletters. YR.45's January 2018 newsletter has a section for *Eco-Team News* that describes the function of the EcoTeam as well as the initiatives they are implementing. This section includes an outline for the milk bag mat initiative that details why they are collecting the bags. School newsletters are available to parents and to the community, it extends information beyond the school to include a broader audience. Energy Star is a third-party organization used in one case (HD.7-3.12) to provide energy use data graphs. YRDSB's EcoWatch, provided daily energy use in schools allowing schools to monitor the impact of their energy conservation actions in real time (YR.40-2.11). One of the drawbacks of this study was the inability to see the content of signs and posters used to promote student initiatives in the EcoSchool program to see what kinds of messaging was used. This would provide insight into the impact of the posters and signs to influence behaviour.

Study Limitations

Working with secondary data has inherent limitations, most notably working with information that has been framed by the initial researcher and their methodology. The inability to ask participants follow-up questions due to consent and confidentiality also limited the scope of this study. The questions in the Ontario EcoSchools certification application are comprehensive and participants are given the school year to answer questions and build their online portfolio. Follow-up questions from interviews or focus groups with staff and students in addition to completed applications would expand the quality of the responses. Working with schools and students require informed consent and assent documents for research involving minors as well as completion of research ethics protocol for educational settings and human participants.

The written responses in the applications varied in detail and in length. Some answers were vague and, in some cases, did not explicitly define the nature of the pronoun or noun discussed. For example, in some responses the quality of the word "students" was not adequately defined, so there was difficulty in identifying who the students were. This made it challenging to know if the students being referred to were from specific groups like EcoTeams, or students in general. Another issue with not being able to ask follow-up questions was the prevention of obtaining more detail about the process of completing application criteria. Asking survey or interview questions that align better with the research question may have provided in-depth responses that primarily centered around the relationship between the school facility and EE.

Assessing architectural design of the interior and exterior of school buildings may have provided additional insight about other building attributes that may be used as part of the school's EE program. Relying on secondary data to define these attributes were from the perspective of participants. Their responses reflect their activities in completing the requirements of the application. Information about the interior layout of schools could provide additional details in how students are accessing messages from the physical features of the facility.

Recommendations for Future Studies

An in-dept analysis that includes the perspectives of major stakeholders especially the perspectives of staff and students would highlight details in the strategies used to integrate the school facility with EE. This analysis can be extended to include all four levels of EcoSchool certification to provide comparison between established and emerging green schools. Further studies would do well to include the architectural design of interior and exterior components of the school building to potentially expand the attributes that can be integrated with EE. This study was limited to what applications indicated as building attributes.

ATST cites systems thinking as a skill students "will need to become discerning, active citizens" (Ministry of Education, 2009, p.13). Systems approach to solving complex environmental issues provides opportunities for interdisciplinary learning that facilitates student learning in identifying the root causes of problems. Analyzing established green schools from a systems perspective begins to identify the mechanisms in place for schools to deliver comprehensive EE programs. This is important because there are challenges in how to effectively integrate EE into everyday learning.

Conclusion

"If we cannot imagine any other possibilities now, it is a failure of our imaginations, not of our natures. And that is a much more readily solvable problem" (Weston, 2012, p.17).

In *Mobilizing the Green Imagination* (2012), Weston challenges readers to imagine beyond current conceptions of ecological sustainability. This includes the solutions that often attempt to solve ecological problems in isolation from the complex systems they are inherently connected with. This is the same challenge with attempting to educate students to be future problem solvers of ecological problems when the education system they're situated in isolates learning into subject specific parts. This challenges us to rethink our approach to EE to imagine hopeful alternatives where we begin recognizing our role in solving these issues. To become inhabitants of place where knowledge becomes practical through thinking and doing rather than as passive residents of place. Students need to believe that there are solutions to environmental issues and imagine themselves solving problems. This inquiry into EE in Ontario's EcoSchools reveals the important function the built environment has in supporting students in actively managing and reducing energy consumption and waste production. Active participation extends throughout the major themes found in this analysis. The systems approach to the ways in which Platinum certified schools are integrating their facility attributes with EE through occupant behaviour indicates the critical role of feedback loops in assisting schools with completing application criteria. The information, balancing and reinforcing feedback loops presented can be leverage points to help schools with implementing EE. The opportunities found in this study work to support students and educators in deliberately engaging with their environment through the integration of the school facility with EE. This increases student capacity in shaping and creating their sense of place.

Hungerford and Volk (1990) present the notion that knowledge about environmental issues does not equate to changed learner behaviour "typically issues awareness does not lead to behaviour in the environmental dimension" (p.17). They argue that students must be provided with opportunities to develop a

"sense of ownership and empowerment" to become active participants in solving environmental issues (p.17). Integrating the school facility with EE provided students with multiple channels in becoming empowered to contribute action towards whole school sustainability in the EcoSchools program. This was achieved through changes in their behaviour by taking ownership of their actions and holding each other accountable in sustainable practice.

Self-reflection is a way to personalize our relationships with one another and with our built and natural environment. When self-reflection is implemented in a meaningful way students and educators can begin challenging what they know about EE and the decisions they make as participants in interconnected systems. Transformative learning "involves a massive change in consciousness that could bring about a new order of social justice and ecological balance" (O'Sullivan, 2008, p. 30). Critical (self)reflection is a defining component of this type of learning. There was scarce mention of student reflection in the case responses and where it was mentioned it was attached to formal/curriculum learning. Integrating reflection in systems thinking could help bridge the external environment with the internal self. Critical reflection about the purpose of the built environment in EE can extend learning opportunities and perhaps begin shifting cultural practice towards a society deeply rooted in place.

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Appendix

Appendix 1 Ontario EcoSchools Application Section 1: Teamwork and Leadership

1. TEAMWORK AND LEADERSHIP

Guiding Question: **How does your whole school build capacity and communicate feedback to create an environmentally responsible school?**

1.1	Does the **EcoTeam meet regularly** and have defined goals? **Portfolio requirement:** A completed copy of the *EcoSchools Yearly Planner*, one set of meeting minutes demonstrating EcoTeam planning (actions, campaigns, goals) OR an equivalent planning document.	**2**
1.2	Does your **EcoTeam reflect all parts of the adult school community?** (Level 4 = three or more groups): ☐ Teachers/ECEs/EAs ☐ Community members ☐ Principal/administrators ☐ Parents/guardians ☐ Custodial staff ☐ Office support staff ☐ Other: _____	**2**
1.3	Does your **EcoTeam reflect all parts of the student community?** (Level 4 = 3 or more groups represented): Please select the number of grades represented in your EcoTeam.	**2**
1.4	Does your **principal and/or other administrators make Ontario EcoSchools a part of the school culture?** (Level 4 = 3+ administrative supports). Please check all that apply: ☐ Includes Ontario EcoSchools goals in the school improvement/success plan ☐ Hosts "green" events, meetings, parent-teacher nights ☐ Provides funding for initiatives/release time ☐ Includes EcoSchools updates at staff meetings ☐ Provides environmental awards/recognition ☐ Other: _____	**2**
1.5	Does your EcoSchools program provide **opportunities for student leadership?** (Level 4 = 3+ student leadership opportunities). Please check all that apply: ☐ Deliver announcements ☐ Deliver presentations (class or assembly) ☐ Plan and lead campaigns/initiatives ☐ Mentorship between students and schools ☐ Develop partnerships with other clubs, schools, or community groups ☐ Other: _____	**2**
1.6	To what extent is your **environmental program visible throughout the school?** (e.g., signs for proper recycling; lights-off and monitors-off stickers; campaign posters; eco-themed displays; use of bulletin boards or LCD monitors; environmental awards and plaques in prominent areas.)	**1**
1.7	Does the **EcoTeam communicate successes and areas for improvement with the whole school** community on a regular basis?	**1**
1.8a **1.8b**	Did staff, EcoTeam, and/or students develop environmental knowledge or skills through participation in workshops, conferences, presentations, or webinars? **To qualify, the following criteria must be met:** ☑ Clear connection to environmental learning ☑ Occurs during the school year, within this time frame: July 1, 2018 to June 30, 2019. ☑ One entry per session—if two people attend the same session, only one can be claimed. **Workshops/presentations:** Whole school, divisional, class, or EcoTeam attendance at presentation/workshop with outside presenters **Webinars:** Attendance at a webinar (live or recorded)	**2** **2**

WORKSHOP

1. Name of participants
Sylvie Green and Bob Tree

2. Type of event
Workshop (with outside presenter)

3. Date of event and length (hours):
October 18, 2017 - 4 hours

4. Event Title:
Ontario EcoSchools Intro Workshop

5. Description of event and presenter:
Intro to Ontario EcoSchools workshop presented by Ontario EcoSchools. Provided information, resources, and student engagement strategies.

6. What impact on environment-related teaching/decisions/activities resulted from this event?
Green Leaf PS is focusing on Waste Min.: Students conduct a whole school waste audit and present findings at school assembly; track contamination in recycling bins and award "golden garbage cans".

2. ENERGY CONSERVATION

Guiding Question: **How does your school make decisions and follow daily routines and operational practices that significantly reduce the use of energy and its impact on the environment?**

EcoReview Deadlines:

- **The last Friday of January**: Input results from the Initial EcoReview (questions 2.1-2.9) into the application.
- **The last Friday of April**: Input results from the Follow-up EcoReview.

Please note: The Follow-up EcoReview should be completed three months after the Initial EcoReview.

LIGHTS AND EQUIPMENT		
2.1	Do students and staff **turn off lights** when they are not required? (e.g., when classrooms are not in use, in stairwells and corridors with extensive natural lighting, or according to the season.)	3
2.2	Do students and staff **turn off electronics** (monitors, LCD projectors, smartboards) when not in use?	3
2.3	Are printers, scanners, and photocopiers **on standby when not in use and turned off at the end of the day**?	1
2.4	Has your school's **equipment been consolidated** to ensure that energy is not wasted by using more equipment than is necessary? (e.g., reducing the number of computer printers through networking.)	1
EFFICIENT SCHOOL SYSTEMS AND PRACTICES		
2.5	Do students and staff ensure that **blinds and curtains (if present) are closed** when appropriate to minimize heat loss?	1
2.6	Do students and staff consistently monitor that the **space around vents on walls, ceilings, or windowsills is kept clear** to ensure effective cold air return?	1
2.7	Do students and staff ensure that **doors to the outside of the building are not left open** unnecessarily to reduce energy/heat loss?	1
2.8	Does your school **monitor energy consumption** through one or more of the following: ☐ Energy dashboards ☐ Online energy Portal ☐ Other (please describe) ☐ Utilities bills ☐ Metering data ☐ Attempted to access data (please describe)	1
2.9	Are **regular inspections of mechanical equipment and water faucets** conducted and problems addressed promptly? (e.g.. fix broken valves, check roof vent seals, dampers, louvres, filters for school and portable motors, window/door seals.)	2
STUDENT MONITORING AND COMMUNICATION		
2.10	Do students regularly **monitor energy conservation practices** throughout the school? Where did you see the most success (e.g. lights, electronics, blinds & curtains, vents)? **Portfolio requirement:** Energy Conservation Walkabout Worksheet or equivalent monitoring sheet (Level 4 = a completed monitoring sheet with a minimum of three tracking dates across ten classrooms.)	2
2.11	Do students use communication strategies to effectively share energy conservation goals, successes and areas of improvement related to lights-off and monitors-off campaigns? Please check all that apply: ☐ Posters/bulletin board ☐ School newsletter ☐ Awards (i.e.,Energy hog) ☐ Announcements ☐ Assembly/classroom ☐ Lights-off/monitors-off stickers ☐ Social media (Twitter posts, etc.) presentations/booths ☐ Other (please specify): _____	2
2.12	To what extent do students **actively explore energy use and energy conservation behaviour** within the school? **Portfolio requirement** (provide **one** of the following): A copy of a completed *Classroom Lighting Assessment, School Energy Consumption Assessment, School Appliance Audit* or equivalent worksheet.	2

3. WASTE MINIMIZATION

Guiding Question: **How does your school make decisions and follow daily routines and operational practices that significantly reduce its impact on the environment through waste reduction?**

EcoReview Deadlines:

- **The last Friday of January:** Input results from the Initial EcoReview (questions 3.1-3.9) into the application.
- **The last Friday of April:** Input results from the Follow-up EcoReview.

Please note: The Follow-up EcoReview should be completed three months after the Initial EcoReview.

REDUCE		
3.1	How is **paper consumption being monitored** (e.g. budget tracking, automated sheet tracking, quotas, other)?	**1**
3.2	Does your school regularly **use electronic methods (email, website) to communicate with parents/ guardians** or, if printed communication is necessary, use a sibling list?	**1**
3.3	Do students and staff work towards **reducing food-related waste through regular practices** (e.g., cafeteria/lunchroom composting, waste-free lunch programs, boomerang lunches)? (Level 4 = consistent, weekly, or daily programs over a minimum of three months.)	**3**
REUSE		
3.4	Has your school put in place **systems to reuse paper** with Good On One Side (GOOS)/Reuse it boxes placed in key locations throughout the school (e.g., classroom, office, library, photocopy room)?	**1**
3.5	How many **waste-free events/meetings** did staff and students host this year (e.g. none, some, most, all)?	**1**
3.6	Does your school make use of **systems (board-wide or school-wide) for reusing office equipment, surplus goods, electronics, craft supplies**, etc.?	**1**
RECYCLE		
3.7	Has a **school-wide paper recycling** system been effectively implemented (i.e., bins strategically placed throughout the school containing minimal contamination from non-recyclable items)?	**2**
3.8	Has a **school-wide container recycling** system been effectively implemented (i.e., bins strategically placed throughout the school containing minimal contamination from non-recyclable items)?	**2**
3.9	Does your school **recycle photocopier toner bottles and printer cartridges**?	**1**
STUDENT MONITORING AND COMMUNICATION		
3.10	Do students **regularly check for contamination in the garbage and recycling bins** using the *Waste Minimization Walkabout Worksheet* or equivalent monitoring system? **Portfolio requirement:** *Waste Minimization Walkabout Worksheet* or equivalent monitoring sheet (Level 4 = a completed monitoring sheet with a minimum of three tracking dates across ten classrooms).	**2**
3.11	Do students use communication strategies to effectively share **waste minimization goals, successes and areas of improvement** related to recycling, waste sorting, reducing lunch time waste, or GOOS bin campaigns? Please check all that apply: ☐ Posters/bulletin board ☐ Assembly/classroom presentations/booths ☐ Clear waste-sorting signs by waste bins ☐ Announcements ☐ Sharing Waste Audit results ☐ Social media (Twitter posts, etc.) ☐ Awards (i.e.,recycling award) ☐ Other (please specify): _____ ☐ School newsletter	**2**
3.12	Have students participated in a **school-wide waste audit** which includes a breakdown of contents of both garbage and recycling and communicated the results to the whole school? What is your school's waste diversion rate? **Portfolio requirement:** Student-led Ontario EcoSchools School Waste Audit or comparable audit analyzing a representative sample of both garbage and recycling.	**3**

4. SCHOOL GROUND GREENING

Guiding Question: **How does your school engage students and staff in projects that care for the natural environment, encourage teaching and learning in the outdoors, and increase biodiversity on the school grounds?**

4.1a Is your school actively involved in one or more school ground greening projects that improve biodiversity and/or ecological sustainability?

1. Please select the school ground greening project(s) that you are working on this year. Please check all relevant boxes:
   - ☐ Trees for shade
   - ☐ Food garden
   - ☐ Habitat for pollinators/butterflies
   - ☐ Native species garden
   - ☐ No-mow zone
   - ☐ Drought-tolerant garden
   - ☐ Nature study area
   - ☐ Other _____

2. Please describe the project:

3. How does your project(s) improve biodiversity and/or encourage ecological sustainability?
   - ☐ provides habitat to local animals (insects, birds, mammals etc.)
   - ☐ includes native plant species
   - ☐ includes drought-resistant perennials
   - ☐ includes food-producing plants
   - ☐ Other _____

4. How many trees have you planted this year (tree planting projects only)?

2

4.1b How have **students been actively engaged in your school ground greening project(s)** during the current school year? Please check the phase(s) of the project in which students are engaged:

☐ Planning ☐ Planting ☐ Regular care

Portfolio requirement (provide one of the following to demonstrate student engagement):

- **Planning:** Student-drawn site plan, evidence of student-driven fundraising
- **Planting:** Photos of students planting, mulching, watering
- **Regular care:** Maintenance plan specifying student activities, photos of students caring for the project

4

4.2 Were members of the **wider school community involved** in the planning, planting, or regular care of your school ground greening project(s) during the current school year and summer months? (Level 4= 1 or more groups). Please specify who by checking all relevant boxes:

☐ Conservation authority ☐ Funder/foundation ☐ Families/community volunteers
☐ Landscaper ☐ Organization/business ☐ Municipality/local government
☐ Parent council ☐ School board ☐ Other: _____

1

4.3 To what extent did your EcoTeam follow a **research and/or planning process** to ensure that your project(s) improves biodiversity and/or encourages ecological sustainability?

- **Improves biodiversity** (e.g., provides habitat, includes diverse plant species) and/or
- **Encourages ecological sustainability** (e.g., includes native plant species, drought-resistant perennials, food-producing plants)

Please check all that apply:

☐ EcoTeam/student inquiry/research project(s) ☐ Partnering with a local expert/organization/municipality
☐ Classroom lessons/unit ☐ Other: _____

2

4.4 To what extent do your school ground greening project(s) have an **impact on the broader community**? (e.g., provides useful shade for students; provides habitat for diverse animals; grows food; provides a venue for events; reduces stormwater runoff.)

Portfolio requirement (provide one of the following):

- To demonstrate 'useful shade' provide a detailed copy of a site plan (can be student-drawn) or shade survey
- Copy of poster, newsletter, or communication that demonstrates community engagement and outreach
- Photos that clearly demonstrate project impact

2

4.5 How do students and teachers **regularly use the school ground greening project(s)** mentioned in 4.1a to enrich student learning?

Please check all that apply.

☐ Curriculum-linked lessons ☐ Whole-school activities ☐ Sports and clubs ☐ Learning in the outdoors
☐ Health and wellbeing

3

5. CURRICULUM

Guiding Question: **How do students learn IN, ABOUT, and FOR the environment as a regular part of teaching and learning?**

To qualify, curriculum submissions must meet all of the following criteria:

- ☑ **Environmental learning:** Demonstrate learning IN, ABOUT, and FOR the environment. Please include one submission per lesson (points are awarded per lesson, regardless of the number of times it is taught).
- ☑ **Completed during the current school year:** September to June.
- ☑ **Portfolio requirement:**
  - Include one copy of one student's completed work per submission.
  - Portfolio documentation is ***not*** required for off-site field trips.
  - Lesson plans/planning notes are only accepted for submissions occurring AFTER the certification deadline (last Friday of April).

5.1	**Example of online Curriculum template**	2
5.2	1. ☐ Lesson was an off-site field trip 2. Location of field trip: N/A	2
5.3	3. Grade: Gr. 10 4. Subject: Secondary – Can. & World Studies	2
5.4	5. Number of hours of instruction? 3 6. How many students participated in the lesson/unit? 23	2
5.5	7. What was the environmental focus of the lesson/unit? Climate Change	2
5.6	8. Please describe what the students learned about the environment: Using Environment Canada data, students investigated the potential impacts of climate change over time for assigned regions of Canada. They created maps and wrote an MP suggesting actions. Students learned about the potential impacts of climate change on both human & natural systems in different regions of Canada, potential mitigating initiatives, and how to advocate for change. Assessment: annotated maps and copies of letter that suggested actions.	2
5.7	9. Where did you find your lesson/unit? Self-created	2
	Maximum of 7 submissions x 2 points each	

6. ENVIRONMENTAL STEWARDSHIP

Guiding Question: **How does your school foster environmental stewardship through whole-school and community engagement?**

To qualify, environmental stewardship activities must meet all of the following criteria:

- ☑ **Environmental learning:** Demonstrate clear connection to learning about an environmental issue (e.g., conserving resources, mitigating the impacts of climate change).
- ☑ **Environmental action:** Engage the whole school community in active participation focused on a specific environmental issue (e.g., campaigns/presentations/assemblies with action initiatives).
- ☑ **Above and beyond:** Include school-wide initiatives that go beyond other sections of the Ontario EcoSchools program (i.e., cannot be initiatives that have already been allocated points – for example, lights-off/ electronics-off, general recycling or contamination, waste-free lunches, and GOOS paper programs).

Portfolio requirement: One supporting document that verifies that a **specific environmental issue** has been the focus of student learning and action for each submission (e.g., announcement, newsletter, picture, or poster sharing information about an environmental issue).

6.1 **Example of online Environmental Stewardship template** — 4

ENVIRONMENTAL STEWARDSHIP SUBMISSION #1

1. Environmental focus

6.2 Waste — 4

2. Campaign type

Bottled Water (e.g., reducing plastic waste, reusable water bottles)

3. Were students involved in planning the campaign?

6.3 Yes — 4

4. Who participated in the campaign?

The whole school participated

5. How many students participated in the campaign?

6.4 250 — 4

6. How did students communicate the campaign and its impacts to the whole school community?

Please check all that apply:

☑ Posters ☐ Social media ☑ Presentation/Assembly
☑ Announcements ☐ Newsletter ☐ Other _____

7. Describe what students LEARNED about the environment through participation in this campaign:

Students learned about the environmental costs of bottled water, the health effects of drinking from plastic, and about the great taste of tap water.

8. Describe the environmental ACTION students were engaged in through this campaign:

The whole school participated in the Bottled-Water Free day, which was launched at an assembly. Students surveyed water bottle waste, set-up an informational taste booth in the foyer where students took a blind taste test comparing bottled water to tap water. All students were instructed to bring-in a reusable water bottle and during lunch the whole school took a synchronized sip from their reusable bottle.

Maximum of 4 submissions x 4 points each

Appendix 7 Ontario EcoSchools Certification Levels 2015/2016 – 2017/2018

School Board	Number of schools	*Schools	Certification Level		
			2018	2017	2016
Durham District (DD)	2	DD.2	Platinum	Gold	Gold
		DD.3	Platinum	Platinum	Platinum
Halton District (HD)	6	HD.5	Platinum	Gold	Gold
		HD.6	Platinum	Platinum	Gold
		HD.7	Platinum	Gold	Gold
		HD.8	Platinum	Gold	Gold
		HD.9	Platinum	Platinum	Platinum
		HD.10	Platinum	Platinum	Platinum
Peel District (PD)	4	PD.11	Platinum	Platinum	Gold
		PD.13	Platinum	Platinum	Platinum
		PD.15	Platinum	Gold	Gold
		PD.17	Platinum	Gold	Gold
York Region (YR)	11	YR.34	Platinum	Gold	Gold
		YR.35	Platinum	Platinum	Gold
		YR.36	Platinum	Gold	Gold
		YR.37	Platinum	Platinum	Platinum
		YR.38	Platinum	Platinum	Gold
		YR.39	Platinum	Platinum	Platinum
		YR.42	Platinum	Gold	Gold
		YR.43	Platinum	Platinum	Platinum
		YR.44	Platinum	Platinum	Gold
		YR.45	Platinum	Gold	Gold
		YR.48	Platinum	Platinum	Platinum

*Individual schools are represented by school board abbreviation and number code.

Appendix 8 Initial Thematic Framework

Section 3: Waste Minimization
Short Questions

3.3: Do students and staff work towards reducing food-related waste through regular practices (e.g., cafeteria/lunchroom composting, waste-free lunch programs, boomerang lunches)? (Level 4 = consistent, weekly, or daily programs over a minimum of three months.)

3.11: Do students use communication strategies to effectively share waste minimization goals, successes and areas of improvement related to recycling, waste sorting, reducing lunch time waste, or GOOS bin campaigns? Please check all that apply:

♦Posters/bulletin board ♦Announcements ♦Social media (Twitter posts, etc.) ♦School newsletter ♦Assembly/classroom presentations/booths ♦Awards (i.e.,recycling award) ♦Clear waste-sorting signs by waste bins ♦Sharing Waste Audit results ♦Other (please specify): ____

3.12: Have students participated in a school-wide waste audit which includes a breakdown of contents of both garbage and recycling and communicated the results to the whole school? What is your school's waste diversion rate? Portfolio requirement: Student-led Ontario EcoSchools School Waste Audit or comparable audit analyzing a representative sample of both garbage and recycling.

Categories	Case	Waste Minimization
Displays	DD.2 3.3	Enforced Boomerang Lunch. Eco Club has promoted this on bulletin board and announcements, and as activities during the Eco Olympics. We have also done a month-long school-wide campaign to track how well each class was reducing their waste.
	DD.3 3.11	Students are great at coming up with positive feedback for individual classes and tracking it on a school map in order to deliver it to classes. Announcements are made to remind students of things that we saw throughout a number of classes.
	HD.5 3.11	announcements on the PA, Green Eagle class quiz questions, posters, earth week challenges, Green Eagles banner award, posters of various events
	HD.6	3.3 Green bins and blue bins in every class, Students monitor classroom bins daily to stop contamination and share results with classes. Audit was arranged and students helped with audit also shared a slide show and the audit report showing better result
		3.11 -Students monitor the green, blue and blacks bins daily and record results -notes are left to specific classes -announcements are made to announce best kept classes -correct bin usage posters -waste management bulletin board/recycling relay
		3.12 Students created a power point to share the process of calculating the diversion rate and also how waste was collected, sorted and weighed to collect the data. Audit report was shared with each division and the next steps/goals were discussed/shared.
	HD.7 3.12	Students used the graphs provided through EnergyStar which we were connected to through a community partner. We displayed graphs on the announcements, described the results and set goals.
	PD.11 3.11	-bulletin boards, posters around school, monthly student presentations to each class reflecting on the monthly waste audit for that class which includes what was done well and "next steps" and includes a written copy for class; monthly awards
	PD.15 3.11	On a weekly basis during Recycling time, our Eco champs check for contamination within our recycling bins. Students receive a class checkmark for having a clean recycling bag with all recyclable items. This poster remains at the front of the school.
	YR.33 3.12	Overtime, the results improve. We post posters on top of our recycling bins, to remind students and staff. We have think about it Thursdays, where we give facts about the recycling we throw out every day. Our school's diversion rate is 33%.
	YR.38	3.11 We make daily announcements, encourage the use of the Remind app for communication to reduce paper, have interactive goal charts, and update our school blog daily. We also have a bulletin board that is updated monthly with information and events.
		3.12 Everyday students from the Eco team walk around the school to audit the use of waste bins to ensure they are used appropriately. The classes who are not using them appropriately are given a reminder note on their board and an email to the teacher.
	YR.35 3.11	We have signs around the school promoting litterless lunches, recycling and composting. We have a google document for each class that updates when we have done an eco check. This gives them immediate feedback on waste management.
	YR.37 3.11	Eco members made announcements about bringing a waste-free lunch to school. They made posters on what a waste-free lunch and a wasteful lunch looks like. The waste audit and divergent rate results were displayed on the bulletin board.

	YR.39 3.11	- Jr. Eco-team shares waste-minimization tips with school via morning video-announcements - Eco-Schools bulletin board is used to communication waste audit results - Student-made posters encourage students & staff to bring Boomerang Lunches
School Grounds & Gardens		
Announcements	HD.6 3.12	-Students monitor the green, blue and black bins daily and record results -notes are left to specific classes -announcements are made to announce best kept classes -correct bin usage posters -waste management bulletin board/recycling relay
	HD.5 3.11	announcements on the PA, Green Eagle class quiz questions, posters, earth week challenges, Green Eagles banner award, posters of various events
	HD.7 3.11	Some things we have done are made a waste sorting quiz, announcements for our school, and we are going to have another earth hour assembly where we could talk about this.
	HD.9	3.11 -Students monitor the green, blue and blacks bins daily and record results -notes are left to specific classes -announcements are made to announce best kept classes -correct bin usage posters -waste management bulletin board/recycling relay
		3.12 After our weekly Eco meeting, we communicated our results with the school in our monthly school assembly.
	YR.41 3.11	Students have made monthly announcements and we held an information session that focussed on our data collected to this point with a strong element of Leave No Trace philosophy so we could try and embed an ethic or ethos into our message.
	YR.36 3.11	Students track the garbage/recycling with sheets in each class. Student leaders from each class share eco messages and discuss the results. Students share the results of the waste audit and tips to improve in the Earth Day assembly for whole school.
	YR.38 3.11	We make daily announcements, encourage the use of the Remind app for communication to reduce paper, have interactive goal charts, and update our school blog daily. We also have a bulletin board that is updated monthly with information and events.
	HD.10 3.11	Our results were communicated by announcements on PA, newsletter announcements, and assembly presentations. In each class children were assigned to monitor the waste daily, and older students reviewed the results with younger students.
3 R's		
Reduce	DD.3 3.3	At Maple Ridge, we encourage boomerang lunches and look for waste in the garbage cans when we do walkabouts. We give feedback to classes about what we found and what they need to improve on in the future.
	HD.5 3.12	All blue, black garbage all 13 locations were collected at the end of the same day. The next day each recycling/garbage bag was weighed and audited by the Green Eagles. Results-PA announcements, assembly announcements, displays 73.4 diversion Apr
	HD.6 3.3	Green bins and blue bins in every class, Students monitor classroom bins daily to stop contamination and share results with classes. Audit was arranged and students helped with audit also shared a slide show and the audit report showing better result
	HD.8 3.3	Every classroom has a green cart and these are collected twice a week throughout the year. Every class has recycling volunteers that bring the green carts to the custodian to empty, We also held a "Waste Free Lunch" week initiative.
	PD.12 3.3	Breakfast program has waste-free days. Several departments take waste home to compost, many rooms have vermicompost bins for organics. Science has a rolling composter on their terrace. Occasionally, students collect compost from the cafeteria.
	PD.17	-the Grade 1 pod started their own compost program, and reduced size of garbage bin in their classroom -Boomerang lunch week -consistent monitoring by GT for litterless lunches, prizes for classes and students with perfect waste-free lunches
	YR.36 3.3	We use green composting bins in every class and important areas. Student leaders promote reusable containers and water bottles for school. All students participate in waste-free lunch challenge. Whole school participates in litterless lunch program.
Reuse		
Recycle	YR.36 3.11	Students track the garbage/recycling with sheets in each class. Student leaders from each class share eco messages and discuss the results. Students share the results of the waste audit and tips to improve in the Earth Day assembly for whole school.
Compost	YR.38 3.3	Level 4: Our school strongly supports and successfully executes boomerang lunch initiatives. We also have 3 compost bins throughout the school, and an additional bin in a classroom with worms creating fertilizer.

	YR.33 3.3	Every week (starting November), our school encourages students to participate in Meatless Monday and Trash less Tuesday. We also have compost bins in all lunchrooms and multiple compost and recycling bins in the cafeteria.
Incentive, Challenges & Rewards	HD.10 3.3	We review weekly on Tuesdays the waste-free lunch program. We give rewards for students that are totally waste free. We also reward classes for for composting, recycling and not having compost or recycle items in garbage.
	PD.13 3.3	The student Eco Team presented the Litterless lunch program at an assembly. Each class has a Litterless lunch monitor who counts pieces of garbage in classmates' lunches. Students who bring the least garbage are recognized by their classes.
	YR.37 3.3	Each class has a green bin and we help them sort their food related waste in the correct bin. Classes participated in the Healthy Litterless Lunch Challenge in January.The Grade 2/3 class won and each child received their own litterless lunch prize.
Events & Campaigns	DD.2 3.3	Enforced Boomerang Lunch. Eco Club has promoted this on bulletin board and announcements, and as activities during the Eco Olympics. We have also done a month-long school-wide campaign to track how well each class was reducing their waste.
	HD.7 3.3	boomerang lunches everyday for April, composting every day
	HD.8	Every classroom has a green cart and these are collected twice a week throughout the year. Every class has recycling volunteers that bring the green carts to the custodian to empty, We also held a "Waste Free Lunch" week initiative.
	PD.11 3.12	As part of the Region of Peel's Waste Reduction Campaign, we participated in 2 whole school waste audits. These were communicated through posters around school, bulletin board, and whole school assembly with detailed slide show. Diversion rate 75.2%
	PD.18 3.3	- organic waste bin in the cafeteria and staff room -reusable container campaign
	YR.33	3.3 Every week (starting November), our school encourages students to participate in Meatless Monday and Trash less Tuesday. We also have compost bins in all lunchrooms and multiple compost and recycling bins in the cafeteria.
		3.11 Every week (starting November), our school encourages students to participate in Meatless Monday and Trash less Tuesday. We also have compost bins in all lunchrooms and multiple compost and recycling bins in the cafeteria.
Tech/Electronic	YR.44 3.11	Weekly announcements - 'What goes where' Wednesdays with each class tracking their answers on the sheet provided. Information on school T.V monitor and bulletin boards. Appreciations on Fridays to classes that have sorted effectively that week.
Critiques & Barriers	YR.35 3.12	We realize that waste management continues to be an issue at our school and will be a focus again next year. This year we had several of our monthly google slide shows that focused on waste management. Our division rate was 52% - room to improve!

Appendix 9 Final Theme & Code Framework

Theme	Code	Case	Description	Top Relationships
Formal/Curriculum Learning	Science and Technology		Curriculum expectations relate explicitly to aspect of EE.	Plants & Soil Energy Water Conservation Structures
	Social Studies		Curriculum expectations relate explicitly to aspect of EE.	Community Inform others Personal accountability Energy
	Literacy		Curriculum expectations can be connected to aspects of EE	Writing letters Research/Reading Inform others
Non-Formal Learning	Monitor & Feedback		Observations to generate a record of actions taken and used to adjust actions towards desired behaviour	Assemblies Announcements Checklists Energy Waste
	Extracurricular Activities		Student groups working together to accomplish goals outside of structured class time	Eco/Green Team Garden Club Art Club
Facility Attributes	Garbage Recycling & Organics		Designated bins for sorting waste	Blue Black Compost Green Carts/Bin Vermicompost Red-Wriggler worms
	Indoor/Outdoor linkages		Connections made between natural spaces on school grounds and within the school facility including types of access to school grounds	Courtyard Seedlings Compost
	Energy		Energy as related to types and function within systems (types of energy, electricity, uses)	Efficiency Conservation Sources Renewable
Cross Cutting	Signage, Bulletin Boards & Posters		Methods used to inform and communicate that are updated and changed. Assisting in explanation and meaning making through labeling	Data/Results Best practices Reminders Events & Campaigns Correct bin usage Electronics Gardens
	Campaigns, Events & Challenges		Whole school activities implemented to achieve a goal in support of a specific occasion(s) and can be competitive in nature	Fundraising Earth Hour/Week/ Month Energy Waste
	Incentive & Reward		Methods used to encourage active support and participation	Recognition Tangible prizes (trophies, party)

	Gardens & Outdoor Learning Space		Designated area for formal & non-formal learning Planting and maintaining gardens on school grounds	Groves Inquiry Mindfulness Science & Tech Community Circles Pollinator Food Community Location
Partnerships	Municipality		Regional or local	Energy Gardens Waste
	Third Party Organization		Community groups, organizations & businesses	Energy conservation Water conservation, Nurseries