Educational Food Landscapes
Developing Design Guidelines for School Gardens

by

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A Thesis
presented to
The University of Guelph

In partial fulfilment of requirements
for the degree of
Master of Landscape Architecture

Guelph, Ontario, Canada

ABSTRACT

EDUCATIONAL FOOD LANDSCAPES
DEVELOPING DESIGN GUIDELINES FOR SCHOOL GARDENS

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University of Guelph, 2014

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This study was a qualitative exploratory investigation into the use of gardening as a teaching tool in schools. In addition to educational motivations, school gardening is being driven by public health concerns about rising rates of obesity and diabetes in children; the local food movement and sustainable agriculture; increased interest in children's environmental awareness; and social and community development. This inductive research followed a non-linear path, utilising grounded theory. Data from a focused literature review, a school garden web scan, School Garden Network profiles, school garden guides and manuals, photographs and key informant interviews were analysed using Nvivo software. Analysis of the data led to design guidelines such as: employing timed irrigation systems, bed designs that aid in group instruction, and consideration of the community beyond the school staff and students. These guidelines will aid schools, stakeholders and landscape architects in improving existing school gardens and the design of future successful, multifunctional, inclusive, and educational food landscapes.

Acknowledgements

I would like to thank my thesis advisor Karen Landman for being such a great coach and my committee member Erin Nelson for being my cheering section.

Thanks to all of the research participants who took time out of their busy schedules to talk to me about the great school-gardening projects they are involved with.

Thank you to all of my class mates. I have learned so much from each and every one of you over the last three years. A special thanks to Stephanie Shantz for being my surrogate-twin.

Thanks to Tina, my actual twin, my other sister Monika, and my parents Hannelore and Karl-Heinz for supporting my not-always-clear career path.

Thanks to my two research assistants, Finn the dog and Sawyer the cat, for keeping me company during the writing process of my thesis.

Last but not least, thanks to my loving partner Jacquie Bull for your support, encouragement, mad-editing skills, and most of all patience.

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Chapter 1 Introduction

This study was a qualitative exploratory investigation into the use of gardening as a teaching tool in schools. In addition to educational motivations, school gardening is being driven by public health concerns about rising rates of obesity and diabetes in children; the local food and sustainable agriculture movements; increased interest in children's environmental awareness; and social and community development goals. The purpose of the proposed guidelines, an outcome of this research, is to aid schools, stakeholders, and landscape architects in the design of successful, multifunctional, inclusive, and educational food landscapes.

1.1 Research Goals and Objectives

The question prompting the research: How can landscape architects contribute to the school gardening movement and aid in the development of school food gardens?

The research pursued the following goal: To create site design guidelines for multipurpose, inclusive, community-engaged school food gardens that meet the needs of the primary users as well as the greater community.

The following objectives were employed to achieve this goal:

- To assemble data pertaining to the development, implementation, and use of school gardens from academic and grey literature and key informant interviews

- To create a set of design guidelines for school gardens based on the research findings

1.2 Thesis Overview

This thesis consists of seven chapters. Chapter Two outlines literature reviewed on school gardens. Topics include the historical and cultural context of school gardening; philosophical and theoretical roots and ideas pertaining to school gardens and garden-based learning; motivations behind the use of gardens as a teaching tool; the context of using food as a connecting theme; and school gardens and their relationship to place. Chapter Three reiterates the research goal and objectives, describes the research design of this study and details the data collection methods. Chapter Four describes the results and data sets, introduces the framework for the analysis of those data sets, and summarizes the analysis. Chapter Five introduces a set of design guidelines for school gardens. This is followed by a discussion in Chapter Six and a brief conclusion in Chapter Seven.

Chapter 2 Literature Review

This chapter outlines the literature reviewed on school gardens. It is organized into five sections. The first section puts school gardens and student farms into a historical and cultural context; the second looks at some of the philosophical and theoretical roots and ideas pertaining to school gardens and garden-based learning; the third reviews the motivations behind using school gardens; the fourth focuses on school gardens in the context of using food as a connecting theme; and the fifth spotlights school gardens and their relationship to place.

2.1 History of School Gardens and Garden-Based Learning

The value of gardening in schools was first recognised well over a century ago; there is a rich history of garden-based learning in both Europe and North America (Bowker & Tearle, 2007; Desmond, Grieshop, & Subramaniam, 2004). The existing literature is primarily from a U.S. perspective; where possible, Canadian-specific information has been added. This is not an attempt to trace school garden history to its exact origin but rather focuses on the last two centuries. It begins by examining what was going on leading up to the first school gardening movement during the early twentieth century.

The Old School Garden Movement (1890-1930s)

Emerging from multiple and often discordant ideologies, school gardens used diverse methods of landscaping, gardening, and education to teach children about nature,

green the industrial city, reduce juvenile delinquency, grow vegetables and flowers for sale and local consumption, and instill the ethics of hard work and patriotism (Trelstad, 1997). School gardens in North America flourished from the 1890s well into the twentieth century, evidence of which is recorded in newspapers, national magazines, and annual school reports of the time (Kohlstedt, 2008). Along with the U.S., Britain, Ireland, Australia, and Canada also experienced school gardening movements (Forrest & Ingram, 2003; Robin, 2001).

The nature study, progressive education and social reform movements were all instrumental in the school gardening movement of the early twentieth century. Children's gardening programs existed before this but were individual and locally focused rather than part of a concerted national effort to promote gardening as part of public school education (Lawson, 2005). In Europe, school gardens began being implemented in Germany around 1814, followed by Austria and Sweden in 1869, and France, Russia, and Belgium in 1880; school gardening and agriculture curriculum were increasingly available and sometimes mandatory (Greene, 1910; Lawson, 2005). Concurrently, the pre-school education concept of kindergarten, which often included gardening and nature study, was gaining recognition in Europe and North America (Lawson, 2005).

Educators in the U.S. adopted ideas from Europe, beginning as early as 1879 when the widely-used German manual, *The School Garden, Being a Practical Contribution to Education*, by Erasmus Schwab, was translated into English (Kohlstedt, 2008; Schwab,

1879). Though Schwab advocated for school gardens as a means to teach agriculture and vocational science to older children, the initial push for school gardens in the U.S. came from the nature study movement (Lawson, 2005; Trelstad, 1997). Led by Liberty Hyde Bailey, nature study advocates sought to make learning more interactive by the use of nature in classrooms. Where rural schools had an abundance of nature, school gardens in cities were needed to provide the nature to study for urban-based students (Trelstad, 1997). Concurrently, there were growing concerns among rural families that much of the instruction their children received in school was not practical or relevant; these concerns seemed to focus on two main issues: 1) the lack of an appreciation and understanding of nature, and 2) the lack of meaningful agricultural education. This led to the development of the 4-H, club which persists today (Enfield, 2001). Club members participate in projects that follow the 'learning by doing' tradition and which are mutually educational and relevant to their lives in the real world (Enfield, 2001).

According to Trelstad (1997), it was the progressive reformers who expanded school gardening into a national program that targeted multiple social aims such as city beautification, reduction of juvenile delinquency, improved public health and nutrition, Americanization of immigrant children, and the creation of good working citizens. Whereas the nature study movement had been about education, the progressive reform movement was about social control (Trelstad, 1997). The Children's School Farm in New York City was started in 1902 by the teacher, reformer and philanthropist Fannie Griscom Parsons and ran until 1931 (Warsh, 2011). Parsons viewed the act of gardening as a means to teach important values that she and other reformers believed

would increase a child's potential for success and happiness in urban society. Parsons saw the purpose of the farm as fostering the growth of children rather than teaching them to grow plants and vegetables (Parsons, 1910; Warsh, 2011).

Originally concentrated in rural schools, the use of school gardens in Canada was waning in the late 1800s when it was given a boost by the Macdonald movement, and the establishment of groups of gardens in the eastern provinces of Ontario, Quebec, New Brunswick, Nova Scotia, and P.E.I. (Greene, 1910; Lawson, 2005). The Macdonald schools and teacher training institutes targeted the teaching of scientific agriculture and domestic science, a program often referenced by American school garden promoters to further their cause (Lawson, 2005). Besides mention of the Macdonald movement there is little other literature pertaining to school gardens in Canada; however, primary sources exist as evidence that there was a similar school gardening movement here. For example, a pamphlet published by the Canadian Department of Agriculture in 1916, entitled *The School Garden: As Regarded and Carried on in the Different Provinces* describes school gardens in almost every province, including urban settings such as Edmonton, Alberta.

Before WWI, school gardens were favoured for their versatility, not so much as a subject but as a teaching method, in pursuing a wide range of educational aims including but not limited to: studying science, promoting an appreciation of nature, providing practical agricultural training, and developing civic pride (Gunston & Hawks, 1922; Kohlstedt, 2008). Lawson (2005) points out that the success of the movement

had to do with its broad base of supporters that included teachers, government agencies, institutions, gardening clubs, social reformers and civic groups, who used gardens to address an equally broad base of agendas including the aforementioned educational aims, as well as social, moral, recreational, and environmental ones. Prominent figures of the day, such as the social reformer Jacob Riis, the landscape architect Fredrick Olmsted, and President Woodrow Wilson, supported gardening for contributing to the education, health, industrial training, and general civic mindedness of children (Lawson, 2005).

The school gardening movement both peaked and changed significantly in the U.S during WWI with the formation of the U.S. School Garden Army (USSGA). As newly enlisted 'soldiers of the soil', American children were considered valuable contributors to the war food campaign with the added benefit of achieving educational and health goals as exemplified by the goals of the initiative: to increase food production and to train children in thrift, industry, patriotism, and responsibility. The USSGA was a national program organized by the Bureau of Education and funded by the war department that encouraged local production and consumption as a way to strengthen U.S. stability (Hayden-Smith, 2007; Lawson, 2005). According to Hayden-Smith (2007), war gardening efforts were also seen as a way to instill a traditional American 'producer' ethic in urban populations that were increasingly removed from the food system due to mass culture and consumerism. By the Armistice in 1918 there were several million American youth enlisted and 21 states required agriculture and domestic arts instruction in rural schools, but the program was discontinued when funding was cut after the war,

leading to the decline of school gardens thereafter (Hayden-Smith, 2007). Other factors contributing to the decline, according to Trelstad (1997), were the rise of attractive recreation alternatives for children; the shift in children's gardens from schools to home as many families moved to new suburban areas; and lack of support from the educational profession to integrate gardens into the curriculum in a meaningful way.

School gardening in the U.S. experienced another peak during the second world war as children were once again encouraged to garden for the war effort (Lawson, 2005). There was no organized school garden army but the Office of Education did encourage school victory gardens as well as gardening for the school-lunch program (Lawson, 2005). In Canada children were also encouraged to participate in victory gardens either at home or through their school or church (Mosby, 2014). Similar to many countries, there were labour shortages, especially on farms, and that is where children also gardened. For example, U.S. urban youth were recruited as Victory Farm Volunteers to help out during summer holidays. In Ontario, the government organized a Farm Service Force that was initially set up to mobilize high school students to assist farmers but evolved into seven brigades targeting a range of available labourers. Some that targeted children included the Farm Cadet Brigade which enrolled all young men from 15 to 18 years of age; the Farmerette Brigade which enrolled all young women 16 years old or over in high schools, normal schools, universities and other educational institutions, including the teachers; and the Children's Brigade which enrolled children on farms to assist in production (Coke, 1943; Lawson, 2005).

The Interim (1945-1980s)

School gardening declined again after WWII and there are few accounts in the literature until the 1990s. It did not completely vanish, however, as a small contingent of schools and districts did continue to include school gardening programs. Along with those, a handful of new school gardening initiatives emerged resulting from the counter culture, environmental, and community garden movements of the 1960s, 70s and 80s. Together, these programs, during the interim between the old school garden movement and the new one, helped to lay the foundation for the ultimate resurgence of school gardening as a national movement in the 1990s (Desmond et al., 2004; Lawson, 2005). Two of the most notable programs that persisted despite the waning of school gardens were the Cleveland School Garden Program that ran from 1904-1978 and the Brooklyn Botanical Garden's children's garden program that has been running since 1914 (Brooklyn Botanic Garden, 2013; Lawson, 2005; Mader, 2010). An example of a new program that emerged during the interim period is the Life Lab Science Program that started in 1979 with its first school garden at Green Acres Elementary School in Santa Cruz, California. Since then, the Life Lab Science Program has supported science and garden-based education through publications, professional development and innovative programs, and continues to be in operation today (Life Lab, n.d.).

The New School Garden Movement (1990-2010s)

School gardening experienced a resurgence in the 1990s that continues today, similar to the first school garden movement in its national and international scope, following a rebirth of progressive education along with growing interest in the educational

opportunities of garden-based learning (Bowker & Tearle, 2007; Desmond et al., 2004). California leads the effort to establish gardens in schools boasting over 3000 school gardens in the state since initiating the 'a garden in every school program', following the enactment of school legislation bills promoting instructional school gardens, in 1995 (California Department of Education, 2013). Currently, there seem to be three trends driving the new school garden movement in North America and abroad. In addition to educational motivations, they are public health concerns about rising rates of overweight, obese and diabetic children; the growing local food movement; and increased interest in children's environmental awareness.

In terms of public health concerns there has been an alarming rise in the rates of obesity and Type 2 diabetes worldwide, especially in children. In Canada, for example, the number of people who are overweight or obese has increased dramatically in the last 25 years with the proportion of obese children nearly tripling in that same time frame (Health Canada, 2006). Obesity is a health concern because it is a major risk factor for heart disease, Type 2 diabetes, and a host of other serious diseases and conditions (Health Canada, 2006). Health Canada (2006) suggests that some factors contributing to this phenomenon include poor eating habits and decreased physical activity caused by changes in our food environment, fewer opportunities to be physically active at school, and fewer children and youth walking to and from school. Decreased physical activity correlates to increased sedentary behaviour, which includes recreational screen time such as watching television, playing video games, and spending time on the computer. For this reason the Canadian Sedentary Behaviour

Guidelines recommend limiting daily screen time to 1 hour for the early-years (3- to 4-year-olds) and no more than two hours for children (5- to 11-year olds) and youth (12- to 17-year-olds), however, only 18% of 3- to 4-year-olds, 69% of 5- to 11-year-olds, and 31% of 12- to 17-year-olds in Canada meet these guidelines (2007-09 Canadian Health Measures Survey, 2007-09, cited in Active Healthy Kids Canada, 2013). School gardens are part of greater public health initiatives that aim to counteract these poor health outcomes related to physical activity levels and diet.

The local food movement is gaining ground as eaters are becoming both more aware and more concerned about the provenance of their food; farmers and producers strive to get better returns for their food; and regulators try to secure health, environmental and economic dividends (Morley, Morgan, & Morgan, 2008). Another important facet of the movement is reconnecting with food, food production, and agriculture. It has been suggested that, in light of rapid urbanization and the decline of rural communities, reconnecting with our agricultural heritage is more important than ever. For example, Mayer and Mayer (1974, p. 84) argue that:

> The failure of our secondary schools and liberal arts colleges to teach even rudimentary courses on agriculture means that an enormous majority, even among well-educated Americans, are totally ignorant of an area of knowledge basic to their daily style of life, to their family economics, and indeed to their survival. It also means that our policies of agricultural trade and technical assistance, as important to our foreign relations as food production is to our domestic economy, are discussed in the absence of sound information, if indeed they are discussed at all.

School gardens as a part of food systems and sustainable agriculture education can address this disconnect from agriculture, food production and the food system at every

level from pre-school to post-secondary curricula. Garden-based learning programs that are aligned with the local food movement, such as the Edible Schoolyard Berkeley, often have a focus on food literacy and integrate growing food with preparing, serving, and eating the harvest.

The book *Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder* (Louv, 2006) has both generated and contributed to increased interest in the environmental awareness of children. Louv (2006) points out the human costs of contemporary society's increasing alienation from nature as diminished use of the senses, attention difficulties, and higher rates of emotional illness, the cumulative consequence of which is what the author characterizes as nature-deficit disorder. Childhood has become increasingly de-natured because of shrinking open space, few natural play areas, and less access to nature play. Therefore, Louv extols the virtues of the opposite: nature abundance. Children's positive physical connection to nature contributes to both greater mental and physical health and to the development of the senses, which in turn foster creativity and learning, something many of today's children lack (2006). School gardens are seen by many advocates as a way of reversing the child-nature disconnect and as a replacement to wild spaces where children can experience free exploration of the natural world that is often missing in an era of TV's, video games and concern over safety (American Horticultural Society, 2013). School ground greening initiatives that contribute to nature abundance and focus on reconnecting children with nature, often through the development and support of school gardens, include Learning Grounds and Evergreen in Canada, Natural Learning

Initiative, Project Wild, and Project Learning Tree in the U.S., Learning Through Landscapes in Britain, and ECO School in Europe. Other campaigns include Leave no Child Inside Coalitions and the Children and Nature Network.

2.2 Philosophical Roots and Theoretical Frameworks

There has been a long tradition of gardening in the history of educational ideas. This is evident in the writings of several theorists and philosophers of education who supported gardening as an educational tool and observed their ideas in practical situations with children in schools (Marturano, 1999). Contemporary educational theory frameworks stemming from these ideas pertaining to school gardening include experiential learning, multiple intelligence theory, and integrated curriculum.

Educational Thinkers on Gardening

According to Keatinge (cited in Marturano, 1999), John Amos Comenius (1592-1670) wrote that every school should have a garden where students can observe trees, flowers, and plants and be able to always hear and see something new. In 1839, Friedrich Fröbel (1782-1852) coined the term 'kindergarten' to describe his preschool education program. Fröbel's German schools, unlike many contemporary kindergartens, had gardens that were used for learning as well as a living metaphor for his educational philosophy (Herrington, 1998). Maria Montessori (1870-1952), an Italian educator, was one of the first to recognize that children are experiential learners. Through her work, Montessori came to believe in the potential of gardens to foster an appreciation of nature, and play a role in developing patience, increasing responsibility, and enhancing

moral education (Alexander, North, & Hendren, 1995; Montessori, 1912, 1964). The American philosopher and educational reformer, John Dewey (1859-1952), wrote frequently on the subject of school gardens, proposing progressive ideas that included blurring the boundaries between a student's classroom learning and contact with the natural environment and connecting academic and practical elements together (Dewey, 1900). Dewey has been called the most influential educational theorist of the last century (Kolb, 1984).

Table 1 presents an overview of educational theorists who have made contributions to garden-based learning.

Table 1. Educational Theorists and Their Contributions to Garden-Based Learning (Adapted from Marturano, 1999).

Theorist	Contributions
John Amos Comenius (1592-1670)	▪ Direct experience with things in a child's surroundings through sensory perception leads to the development of knowledge. ▪ Language connects all learning; therefore, the garden is one context for language learning. ▪ The introduction of the picture book and concept of representation in learning.
Jean Rousseau (1712-1778)	▪ Experience is the only teacher and the garden is the setting. ▪ The senses are the entranceway to reason, the training of which occurs in the garden.
Johann Pestalozzi (1746-1827)	▪ The sensory knowledge acquired through direct experience in the garden is an environmental code that makes reading printed material meaningful. ▪ Developed a head-hand-heart-and health model of education that was later adopted by the 4-H program. ▪ Based learning on sense perception and physical activity helping to frame Piaget's theory of sensorimotor intelligence. ▪ Integrated lessons in reading, writing and science using the garden for direct observation.
Frederick Fröbel (1782-1852)	▪ The garden is a budding point of instruction. ▪ Instruction should proceed from that which is near (the garden) to that which is less near. ▪ Gardening teaches consequences of one's actions in an easily observable way. ▪ Language is an organizing thread for the individual learner. The inner life or mind of the child is organized with the outer world of nature through language.
John Dewey (1859-1952)	▪ Gardening is an activity that provides the opportunity for the development of thinking. ▪ The garden is a site and source for primary reading, i.e., the reading of objects and events. ▪ Gardening exemplifies the growth of human knowledge.
Maria Montessori (1870-1952)	▪ Observation training in the garden builds a psychological attachment to the external world. ▪ The activities of gardening make the child aware of his or her influence on the surroundings. ▪ The garden supplied nourishment for physical growth and development.

Theoretical Frameworks and Gardening

Gardens provide an arena for different types of learning. This section looks at theoretical frameworks that have been linked to school gardening such as experiential learning, theories of intelligence, and integrated curriculum.

Experiential Learning

Literature on the subject of school gardens and garden- or farm-based instruction often discusses the benefits of experiential learning. Hands-on or learning by doing are phrases often used to describe an approach to educational lessons that take place in the school garden and encourage valuable experiential learning in a range of subject areas (Blair, 2009; Vallianatos, Gottlieb, & Haase, 2004). For example, according to Risku-Norja, Vieraankivi, and Korpela (2008, p. 7):

> Active participation and learning by doing with their own hands and together with other pupils allows the pupils to use their abilities and skills comprehensively and to learn through their own experiences. When learning is based on positive experiences and on concrete situations, even the difficult matters become understandable with practical examples. Learning becomes interesting, which is crucial in all learning.

The American education theorist David Kolb (1984, p. 38), defines learning from an experiential perspective as "…the process whereby knowledge is created through the translation of experience". The primary purpose of one of the oldest continuously operating student farms in North America, at Berea College in Kentucky, is to provide a practical learning laboratory for students (Clark, 2011). Bramwell, Rosemeyer, and Barker (2011, p. 107) describe student farms as an agrarian version of experiential education that includes many transformations through physical exertion, team building,

tactile and gastronomic experiences, and encounters with what the authors call "the basic, gritty underpinnings of human sustenance".

Experiential learning is a way to ground theory and practice in garden and farm settings. For instance, learning approaches suggested by post-secondary students as most effective for their pursuits in sustainable agriculture and food systems education include the integration of theory and practice, through classroom and fieldwork, learner-centered social arrangements emphasizing peer-to-peer learning, and instruction as facilitation and mentoring (Parr & Trexler, 2011).

According to Knobloch (2003) there were four influential leaders who helped establish a definition for experiential learning in agricultural education during the 1890s through 1940s: John Dewey, Seaman Knapp, Rufus Stimson, and William Lancelot. These four philosophical voices established four 'pillars' that support experiential learning (see Figure 1).

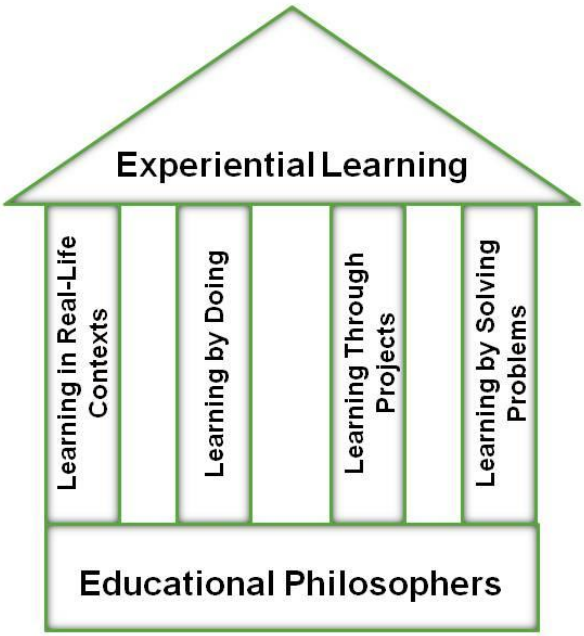


Figure 1. The Pillars of Experiential Learning in Agricultural Education
(adapted from Knobloch, 2003)

Theories of Intelligence

Gardner (1985), a critic of the standard view of intelligence, offers the theory of multiple intelligence in its place. The seven original intelligences first introduced in his book *Frames of Mind: The theory of multiple intelligences*, are linguistic, logical-mathematical, musical, bodily-kinesthetic, spatial, interpersonal, and intrapersonal. An eighth intelligence, naturalistic, was later added to the list (Gardner, 1999). Since "no two people have the exact same intelligences in the same combination" (1999, p. 45) Gardner suggests teachers use a range of diverse pedagogical approaches to reach more students in more effective ways. Garden-based learning offers a means to do this. It also targets the naturalistic intelligence specifically. This is evident by the list of characteristics given to children with the naturalistic intelligence by Professor Leslie

Owen Wilson, from the University of Wisconsin's School of Education. Wilson's list is as follows (cited in Louv, 2006, pp. 74-75):

1. Have keen sensory skills, including sight, sound, smell, taste, and touch.
2. Readily use heightened sensory skills to notice and categorize things in the natural world.
3. Like to be outside, or like outside activities like gardening, nature walks, or field trips geared toward observing nature or natural phenomena.
4. Easily notice patterns in their surroundings—likes, differences, similarities, anomalies.
5. Are interested in and care about animals or plants.
6. Notice things in the environment others often miss.
7. Create, keep, or have collections, logs, or journals about natural objects — these may include written observations, drawings, pictures and photographs, or specimens.
8. Are very interested, from an early age, in television shows, videos, books, or objects from or about nature, science, or animals.
9. Show heightened awareness of and concern for the environment and/or for endangered species.
10. Easily learn characteristics, names, categorizations, and data about objects or species found in the natural world.

Integrated Curriculum

Garden-based learning can provide a context for integrated curriculum which is often associated with real-life problem solving rather than traditional subject-based learning (Subramaniam, 2002). According to Drake (1998), author of *Creating Integrated Curriculum: Proven Ways To Increase Student Learning,* the benefits of integrated curriculum to students are threefold: 1) developing a higher level of thinking; 2)

transferring their learning to the real world; and 3) acquiring the skills they need to become lifelong learners.

2.3 School Garden Motivations

As mentioned above, school gardens are being used to address several issues. This section reviews various motivations behind garden-based learning. The literature revealed six main motivations as follows: learning, the environment, local food, health, practical skills, social development, and community engagement (see Table 2).

Table 2. Summary of Motivations Behind School Gardening

Motivation	Objective
Curriculum	To enhance academic achievement, the curriculum and pedagogical value of schoolyard
Environment	To instill a connection to nature and an environmental stewardship ethic and enhance ecological value of schoolyard
Local Food	To provide education and practice of sustainable agriculture, food systems, and food literacy in connection with the local food movement
Health	To promote healthy lifestyles and nutrition
Practical Skills	To teach practical skills
Social Development	To encourage social development and enhance social value of schoolyards
Community Engagement	To enhance community engagement and development both within the school and broader community

Curriculum

School gardens can provide both a focus and a setting for integrating and delivering many aspects of a school's curriculum (Bowker & Tearle, 2007). There are many initiatives and organizations that are helping to link garden-based learning to existing educational standards. For example, the California Department of Education published a guide entitled *A Child's Garden of Standards: Linking School Gardens to California Education Standards* (2002). Graham, Beall, Lussier, McLaughlin, and Zidenberg-Cherr (2005) found that the most frequent reason for having a school garden was for the enhancement of academic instruction. Literature suggests that science is the subject most often taught by utilizing school gardens. However, teachers may use garden-based education in the form of student gardens or farm visits in a broad range of subjects, including math, social studies, language arts, environmental studies, nutrition, physical education, agriculture, and also as part of community service projects (Desmond et al., 2004; Graham et al., 2005; Risku-Norja et al., 2008). Graham et al. (2005) found that the top three subject areas taught using gardens were science, environmental studies, and nutrition, respectively. Furthermore the authors categorized the use of school gardens by school type, reporting that elementary and kindergarten through eighth grade schools most often used gardens to teach science, environmental studies, and nutrition, while middle schools primarily used them for science instruction and high schools used gardens predominantly for teaching both agricultural studies and science. In comparison, university and college student farms are most often utilised for students studying horticulture, agriculture, and marketing at relatively small scales of production and distribution; however, "students from throughout a spectrum of

disciplines, majors, and programs expressed the relevancy of [student farm] activities to their scholarly pursuits, a testament to the diversity of topics and issues that exist at the intersections between agriculture, society, and the environment" (Parr & Trexler, 2011, p. 178).

The Environment

The following is a definition of environmental education from the world's first conference on environmental education in 1977 (Cited in Canadian Council on Learning, 2009, p. 2):

> A learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action.

Findings from the 2008 Survey of Canadian Attitudes toward Learning (SCAL) illustrate that Canadians support including environmental education in school curricula. The survey data indicates that approximately 46% of Canadians believe it is "important" and 50% believe it is "essential" to include learning about the environment as part of compulsory topics at school (see Figure 2).

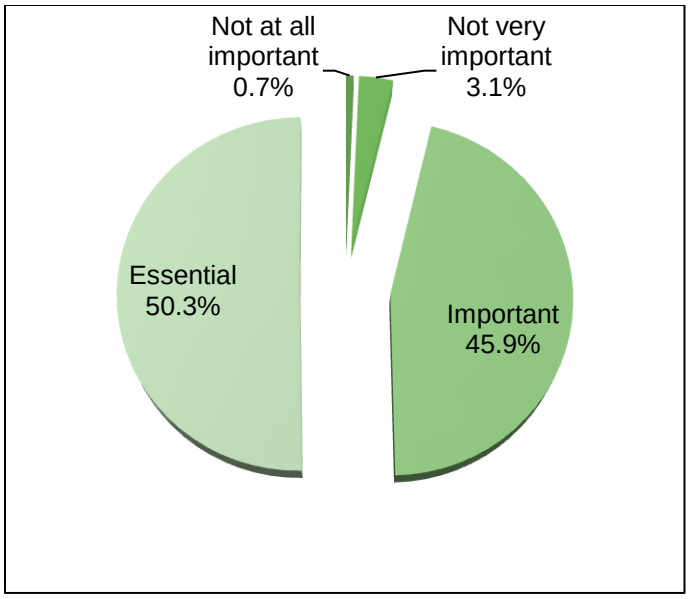


Figure 2. Canadians' Attitudes toward Environmental Learning
Source: Canadian Council on Learning, *Survey of Canadian Attitudes toward Learning* (2008) cited in Canadian Council on Learning (2009).

Environmental education is seen as increasingly important because of what some view as western society's growing disconnect from nature and the environment. This disconnect correlates with what Kellert (2002, p. 120) describes as "the contemporary erosion of direct and spontaneous contact with relatively undisturbed nature, especially among urban and suburban children, and a corresponding substitution of more artificial and symbolic encounters." A similar view is held by Orr (1991), who argues that contemporary western society's declining knowledge of the land is due to the industrialization of agriculture because it resulted in the loss of direct experience of nature through farms; farms are larger and less ecologically diverse, and therefore less interesting and less instructive places. Accordingly, the loss of small farms has meant the direct learning experiences that they used to offer, such as experiencing the relationship between our daily bread and soil, rainfall, animals, biological diversity, and

natural cycles, has also been lost (Orr, 1991). For analogous reasons, Moore (1995) contends that there is a need to recreate viable educational habitats where students can learn lessons of nature on a daily basis, of which gardening is an effective first step.

School gardens can help counter the trend of what Louv (2006) refers to as nature deficit disorder, by exposing students to the lessons previous generations learned on farms, engaging students in the environment in which they live and effectively bringing the outside world into the classroom and vice versa (Kozak & McCreight, 2013). According to Louv (2006), gardening has been a traditional means of establishing a connection between children and nature. Similarly, Desmond et al. (2004, p. 76) believe that garden-based learning can provide a "unique contribution not replicated in other pedagogies" because of the way it engages the student in a stewardship relationship with other living organisms and teaches not only the science of life but also the interconnected nature of the web of life and how everyday actions can have profound effects on the long-term health of the system.

Blair (2009, p. 17) suggests that "gardens ground children in growth and decay, predator–prey relations, pollination, carbon cycles, soil morphology, and microbial life: the simple and the complex simultaneously". Teaching students about ecological systems, helping them become more environmentally aware of global issues and solutions, contributing to ecological intelligence and the development of an environmental ethic and sense of land stewardship are some of the possible outcomes of garden-based environmental education (Blair, 2009; Bowker & Tearle, 2007; Orr,

1991; Ozer, 2007). As such, school gardens can be a local strategy to influence environmental understanding in light of growing concern over environmental problems (Johnson, 2012) . An example of an initiative that endeavours to elevate the awareness of global sustainability issues among school children through gardening is the Schools Global Gardens Network project in the UK (Schools Global Gardens Network, 2010).

Local Food

In some cases school gardens are part of the larger “Farm to School” conversation, which is an international movement that aims to connect schools with local and regional farms in a mutually beneficial relationship beyond the primary aim of getting locally and regionally grown food into school cafeterias (Vallianatos et al., 2004). As a facet of the local food movement, school gardens also address sustainable agriculture and food systems education and can help support local food procurement by both supplying food and generating interest in local food. For example, The Seeds of Solidarity Education Center discovered that interest in purchasing local food in schools seems to be longer lived if there is an onsite school garden (MacLeod, Scott, & Scotia, 2007). Connecting students to local food is a way to counter students' limited awareness of food systems and to increase their understanding of how their actions relate to those systems (Bissonnette & Contento, 2001; Carlsson & Williams, 2008; Harmon & Maretzki, 2006). Put more succinctly, it is a useful approach for linking food consumption to sustainable agriculture (Ozer, 2007).

People's disconnect from the food system is not only a North American phenomenon. Dillon, Rickinson, Sanders, Teamey, and Benefield (2003) found that school-age children in the UK appeared to have a poor knowledge and understanding about various aspects of food and farming. This, along with other research findings, supported making improvements to teaching and learning about food, farming and land management, with school gardens being one of the potential approaches to do so. Farmers participating in a school-farm co-operation in Norway used the school visits as an opportunity to teach students where food comes from, to generate food literacy and awareness, and to highlight concerns about food security and the importance of domestic food production (Risku-Norja et al., 2008).

Growing concern for the state of our food system and the detrimental effects of industrial agriculture are evident by the increasing interest in the study of sustainable agriculture and food systems at post-secondary institutions which has coincided with an increase in both the number of programs available and the number of student farms (Parr & Trexler, 2011). At the University of Yale for instance, the farm came first. The Yale Sustainable Food Project, consisting of a 1-acre market garden, sparked the development of courses related to food and agriculture so that environmental studies students can now graduate with a concentration in sustainable agriculture (Shannon-DiPietro, 2011). Student farms, are places to engage students who are interested in the farm as a place to study environment and food system-related issues as well as those who are interested in sustainable agriculture (Biernbaum, Ngouajio, & Thorp, 2006).

Food literacy can be an important step towards making informed eating choices that can lead to positive health outcomes. 'Food literacy' is a term used to describe a range of food-related knowledge and skills that are needed, and which many individuals in our urbanized society are lacking. The Conference Board of Canada defines the term as "an individual's food-related knowledge, attitudes, and skills" (Howard & Brichta, 2013, p. 2). For the purpose of this research, food literacy has to do with creating closer connections with food, by enhancing food-related skills, knowledge, attitudes and behaviours. There are many indications of food illiteracy in the literature. For example, one author's student claimed strawberry milk comes from pink cows (Kozak & McCreight, 2013). Knowing how food is produced and where it comes from can be an important step toward how individuals value food. School gardening can play an important role in contributing to increased food literacy that positively affects students' food knowledge, attitudes and eating habits by broadening their perspective on food and helping to make it personal to them (Blair, 2009; Canaris, 1995; Koch, Waliczek, & Zajicek, 2006; Parmer, Salisbury-Glennon, Shannon, & Struempler, 2009). Thorp and Townsend (2001, p. 357), who conducted an ethnographic study of a school garden, explain:

> …gardening changes the status of food for all involved. When one gardens, food can no longer be viewed as a mere commodity for consumption; we are brought into the ritual of communal goodness that is found at the intersection of people and plants. Food that we grow with our own hands becomes a portal for personal transformation.

A program that focuses on food is the Edible Schoolyard, the flagship program of which was started at Martin Luther King Jr. Middle School, in Berkeley, California in 1995. The core mission of the edible schoolyard, as stated by its founder Alice Waters, is "to awaken every American child's senses toward a new relationship with food, one in

which deliciousness comes first and good health and well being are the happy result" (2008, p. 38). The Edible Schoolyard has a one-acre organic garden and a kitchen garden where students participate in all aspects of growing, harvesting, and preparation of nutritious and seasonal produce. Students make the connection between growing and eating by such direct experiential activities as making tea from herbs picked straight from the garden, collecting eggs and using them in the day's meal, and boiling and eating freshly picked corn. The idea has since grown into an international movement, called the Edible Schoolyard Project, which had 2923 garden classrooms listed in its network, 71 of which were in Canada, as of February 2014 (The Edible Schoolyard Project, 2013).

Health

Along with increasing food literacy, school gardens can be a tool used to address diet-related health concerns by teaching healthful eating habits and nutrition (Blair, 2009; Graham et al., 2005). Bowker and Tearle (2007, p. 98) studied 67 school gardens in England, Kenya, and India and observed how "children were able to discover, grow and eat fresh food, make informed healthier food choices, and understand how food can start as a seed and end up on the table". Langellotto and Gupta (2012) believe that gardens are prime sites for health interventions that aim to promote such outcomes as healthy BMI and reduced risk of childhood obesity because of the potential for garden-based learning to positively influence eating habits and increase physical activity in children. Furthermore, the authors suggest the following two hypotheses that explain why gardening might promote greater vegetable consumption in children (p. 443):

1. Gardening provides children with increased access to vegetables, and this increased access may result in greater consumption, and
2. Gardening can decrease a child's hesitance to try new foods by exposing children to a broad array of garden-grown vegetables.

Other studies have reported similar findings. Morris (2002 in Libman, 2007) found increased preferences for vegetables in children who participated in programs that integrated nutrition curricula and school gardening. Libman (2007, p. 94) observed gardens as "tools for improving the eating habits and health of youth," stating "[p]ositive social interaction through the processes of growing, sharing, and consuming vegetables may positively influence young gardeners' food consciousness and nutrition". Ratcliffe, Merrigan, Rogers, and Goldberg (2011) reported that gardening students were better able to identify vegetables, experienced increased preference for vegetables, and were more willing to taste vegetables. Gibbs et al. (2013) reported findings indicating the success of a kitchen garden program in Australia in achieving its primary objective of in increasing child appreciation of diverse, healthy foods. Finally, Ozer (2007) makes an interesting observation noting that "eating vegetables in a school garden program is a peer group activity, with the potential benefit of drawing on peer social influence to promote the view of consuming fresh produce as a normative practice" (p. 853). In other words, peer pressure may be a beneficial tool for encouraging healthy eating.

Practical Skills

A wide range of practical skills can also be learned in the context of a farm or garden, such as how to sharpen and use a chainsaw, how to read a soil test, how to apply for organic certification, how to work out in the cold and rain, and how to save seed for next year's planting (Sayre & Clark, 2011). Parr and Trexler (2011) reported that students gained actual technical competencies that they felt were aligned with their values and interests when working and learning about sustainable agriculture and food systems on student farms. While Ruiz-Gallardo, Verde, and Valdés (2013) likewise observed improvement in participating students' skills.

Social Development

School gardens offer social development opportunities such as life skills, self-understanding, increased self esteem, and moral development. For example, youth participants in a year-long garden program improved both their teamwork skills and self-understanding as well as increased their over-all life skills (Robinson & Zajicek, 2005). Life skill constructs measured in the study included working with groups, self-understanding, leadership, decision making, communication, and volunteerism. Likewise, Alexander et al. (1995) found that children in the Master Gardener Classroom Garden Project in the San Antonio Independent School District appeared to have many opportunities to learn valuable lessons about life. These included delayed gratification, independence, cooperation, self esteem, enthusiasm/anticipation, nurturing living things, motivation, pride in their activities, and exposure to role models from different walks of life. Similarly, students taking part in a school-farm co-operation in Norway,

where they participated in farm activities, strengthened their co-operation skills, learned to work together and help each other, and took collective responsibility for the work. Additionally, they also learned to behave in new situations, with new people, learned empathy through caring for young animals, were introduced to the cultural heritage of where they live, and developed respect for nature and positive attitudes towards farming (Risku-Norja et al., 2008). School gardening has also been shown to positively affect students' attitudes toward school and behaviour. Ruiz-Gallardo et al. (2013) reported on the positive outcomes from utilizing garden-based learning with at-risk high school students in Spain. Findings included decreased disruptive episodes in the classroom, increased self-esteem and self-confidence, and a decrease in school failure and drop-out rates.

In the context of college and university student farms, useful but less tangible skills that were learned and/or reinforced for students consisted of leadership, teamwork, tolerance, resilience, flexibility, organization, timeliness, responsibility, ethics, communication and follow-through on a task until completion (Bramwell et al., 2011; Sayre & Clark, 2011). Self-empowerment was an important motivation that students had when choosing a student farm as a place to work and learn about sustainable agriculture and food systems. Students also reported gaining greater autonomy, as individual students and as a student community, in directing their own learning activities and experiences based on their values, interests, and sense of purpose (Parr & Trexler, 2011).

Community Engagement

Most people within contemporary North American society define community in terms of specific relationships, usually with family and friends, including co-workers (Putnam, 2001). According to Boyes-Watson (2005), community is a distinct type of social bond that can be characterized by a sense of mutuality, care, connection, identity, awareness and obligation to others. Moreover, this bond acts to motivate certain behaviours amongst people who have a sense of trust and affinity with each other. This connection can be relied on to meet certain needs in a "pattern of loose reciprocity rooted in ongoing and enduring relationships" Boyes-Watson (2005, p. 362). In other words, community is important.

Research suggests that the concept of community is a loaded one because of both positive and negative associations, as well as changing perceptions of what community is (Kingsley & Townsend, 2006). The deficiency of community connection beyond the immediate realm of friends and family illustrates a breakdown of the kind of social ties that form what is known as social capital (Coleman, 1988). Add to that a changing definition of community that no longer includes place, but is rather a perception of personal connectedness, and the result is a notion of community beyond locality that consists of a range of groups and networks within which a person feels a sense of belonging (Boyes-Watson, 2005; McCold & Wachtel, 1998). It is not surprising then that in some instances geographic or place-based communities are lacking in social capital.

The lack of place-based community social capital is described by Boyes-Watson (2005) as a phenomenon that is characteristic of modern life, in which the sense of personal connectedness among people who live near to one another is taken for granted or nonexistent. In both cases, the residents of the area have lost a vital asset in that any activities centered on place, such as public safety on streets, the quality of shared spaces, or neighbors lending one another a hand, can be diminished. Community gardens, and therefore school gardens with a community focus, lend themselves to improving this deficiency because they can fill the niche of place-based affiliation and can also serve as a venue for community gathering and engagement in neighbourhoods that are lacking other kinds of neutral ground.

There is evidence that garden design and location have an influence on building social capital, as illustrated by Kingsley and Townsend (2006) in their paper *'Dig in' to Social Capital: Community Gardens as Mechanisms for Growing Urban Social Connectedness.* Kingsley and Townsend revealed that members of a community garden in Melbourne, Australia found that the location of the garden in a public park was beneficial with respondents noting that it allowed for greater interaction with other community members who were using the park for other reasons. The placement of the garden also allowed for a feeling of security because it was in a visible and highly-used space. Additionally, the research noted that the design of the garden itself was highly effective in promoting social contact by bringing people closer together in what was described as a "nice social area" during work bees (2006, p. 532). A key element to community building is that the community actually uses the space. Getting people into

spaces in a social setting can be dependent on the design as well as people's perceptions of that space and its intended uses.

Findings from a qualitative study of a community garden in Melbourne, Australia conducted by Kingsley and Townsend (2006) suggest that being a member of the community garden offered additional benefits beyond the expected ones, such as physical exercise from the act of gardening and having fresh food from growing one's own produce. The benefits experienced by member gardeners included: increased social cohesion, defined as the sharing of values enabling identification of common aims and the sharing of codes of behaviour governing relationships; social support, by means of having people to turn to in times of crisis; and social connections, by way of developing social bonds and networks. School garden projects have the potential to reach out to the broader school, social, and geographic communities and accomplish similar benefits.

An example of community gardens is used here to illustrate how school gardens may be used as venues to build community, by applying DeLind's (2002) ideas from *Place, Work, and Civic Agriculture: Common Fields for Cultivation.* Community gardens, as a form of civic agriculture, can help to move "toward a more holistic reintegration of people and place", creating both common ties to place as well as physical engagement with the place (DeLind, 2002, p. 217). As the term 'community garden' suggests, there is a certain sense of belonging that is part and parcel to being a member. Civic agriculture, and thus the community garden, according to DeLind, lends itself as both "a

tool and a venue for nurturing a sense of belonging to a place and an organic sense of citizenship; grounding people in a common purpose" (2002, p. 217). Another part of civic agriculture focuses on agricultural literacy by way of individuals engaging in agriculture; they learn about food production and become more aware of the overall food system (Lyson and Raymer, 2000, in Saldivar-Tanaka & Krasny, 2004). School gardens as part of both the school and broader community can act as a tool and a venue for grounding people in a common purpose, either to improve the school yard and the curriculum, to campaign for funds, to buy plants and tools or build facilities such as bake oven, or to rally volunteers to help plant, weed, and harvest and otherwise maintain the garden. Whatever the ultimate goal, food, and thus the growing of food, is always a great tool of engagement.

Table 3 presents a summary of the motivations behind school gardens and the benefits associated with them.

Table 3. Summary of School Garden Motivations and Benefits

Motivation	Benefits	References
Curriculum To enhance academic achievement, the curriculum and pedagogical value of schoolyard	Increased learning opportunities	Bell, 2001;
	Academic Instruction in science, environmental studies, nutrition, agricultural studies, math, social studies, physical education, and community service	Desmond et al., 2004: Graham et al., 2005; Risku-Norja et al., 2008
	Enrichment of language arts	Desmond et al., 2004
	Extracurricular activities	Graham et al., 2005
	Improved academic performance	Williams & Dixon, 2013
Environment To instil a connection to nature and an environmental stewardship ethic and enhance ecological value of schoolyard	Plant diversification	Dyment and Bell, 2008;
	Increased contact and connection with natural environment	Bell, 2001; Kozak & McCreight, 2013; Louv 2006; Malone & Tranter, 2003; Moore 1995;
	Ecological literacy including ecological systems, environmental stewardship, environmental ethics, awareness of global environmental issues	Blair, 2009; Bowker & Tearle, 2007; Desmond et al., 2004; Johnson, 2012; Orr, 1991; Ozer, 2007;
	Increased respect for nature	Risku-Norja et al., 2008
Local Food To provide education and practice of sustainable agriculture, food systems, and food literacy in connection with the local food movement	Increased food literacy	Blair, 2009; Canaris, 1995; Koch et al., 2006; Parmer et al., 2009; Risku-Norja, 2008; Waters, 2008
	Increased food system awareness	Bissonnette & Contento, 2001; Carlsson & Williams, 2008; Harmon & Maretzki, 2006
	Linking food consumption to sustainable agriculture	Ozer, 2007
	Highlight concerns about food security and the importance of domestic food production	Risku-Norja et al., 2008
	Learn about sustainable agriculture	Biernbaum, Ngouajio, & Thorp, 2006
	Positive attitudes toward farming	Risku-Norja et al., 2008
Health To promote healthy life styles and nutrition	Positively influence healthy eating habits and nutrition	Blair, 2009; Bowker & Tearle, 2007; Gibbs et al., 21013; Graham et al., 2005; Langellotto & Gupta; Libman 2007; Merrigan et al., 2011; Ozer, 2007
	Physical exercise	Kingsley & Townsend, Libman 2007
Practical Skills To teach practical skills	Learning new practical skills and technical competencies	Sayre & Clark, 2011; Parr & Trexler, 2011
	Improved practical skills	Ruiz-Gallardo et al., 2013
Social Development To encourage social development and enhance social value of schoolyard	Promotion of social inclusion and positive social interaction	Dyment and Bell, 2008; Libman, 2007
	Positive impacts on attitudes and behaviour, decreased disruptive behaviour	Dyment and Bell, 2008; Ruiz-Gallardo et al., 2013; Williams & Dixon, 2013
	Enhanced interactions between students and teachers	Dyment and Bell, 2008
	Improved cooperation, teamwork and communication; Collective responsibility; Conducive to students who may have difficulty interacting with others while learning indoors	Alexander et al., 1995; Desmond et al., 2004; Dyment & Bell**, 2008; Risku-Norja et al., 2008; Robinson & Zajicek, 2005; Ruiz-Gallardo et al., 2013; Sayre & Clark ,2011
	Service learning and volunteerism	Robinson & Zajicek, 2005
	Improved self esteem, self understanding, and self empowerment	Alexander et al., 1995; Desmond et al., 2004; Parr & Trexler, 2011; Robinson & Zajicek, 2005; Ruiz-Gallardo et al., 2013
	Enthusiasm/anticipation, motivation, pride in activities, delayed gratification	Alexander et al., 1995;
	Exposure to role models from different walks of life	Alexander et al., 1995;
	Independence, leadership, decision making	Alexander et al., 1995; Robinson & Zajicek, 2005; Sayre & Clark, 2011
Community Engagement To enhance community engagement and development both within the school and broader community	Cultural heritage	Risku-Norja et al., 2008
	Fostering community connections and building social capital	Dyment and Bell, 2008; Kingsley & Townsend, 2006
	Reintegration of people and place; Grounding people in a common purpose	DeLind, 2002
	Sense of belonging, bond with place, ownership	Blair, 2009; DeLind, 2002

2.4 Food as a Connecting Theme

The previous section illustrates how food and the growing of food is being used to integrate diverse subjects. This is because everyone needs to eat and has a connection to food and therefore can relate to others on the topic. Harvey (2011) describes food as the great connector because people come together over growing, cooking and eating food. Therefore Harvey includes building food-based social capital as one of five opportunities for improving Toronto parks by using food as an engagement tool. What better way to activate a park than to get people together over food or park-based food projects (Harvey, 2011)? This idea could easily transfer to a school garden or farm setting that includes community engagement in its vision.

Urban and peri-urban agricultural sites such as school gardens and farms may also help build strong communities by improving attitudes toward the neighbourhood they serve, in the form of community gardens and other food-based programs, activities and initiatives. By way of example, Armstrong (2000) attributes having a community garden in a neighbourhood—as reported by garden coordinators—to the improved attitudes of residents toward their neighbourhood in 51% of the 63 New York state gardens studied.

Another example is Dufferin Grove Park in Toronto, where food is a central and important part of the social scene. This is evident by the myriad forms it takes, including a weekly farmers' market, a community kitchen, a cafe, bake ovens, pizza night and Friday Night Suppers held throughout most of the year. The Friends of Dufferin Grove Park group use food to enliven much of the social scene and activities around the park,

as well as to raise funds for other park projects (Park, 2012). School gardens and farms can help engage the community by providing facilities, space for gathering, and programming events and other opportunities for engagement.

2.5 Gardens and Place

> Gardens are intensely local. Everything except possibly the purchased plants and seeds are part of the natural local environment. The clouds, rain, and sun, the seasonal cycle, the soil and its myriad organisms, the insects, arachnids, birds, reptiles, and mammals that visit the garden teach about place. Even if some of the weeds, insects, and birds are not native to a place, these immigrant flora and fauna are as locally adapted as the children themselves (Blair, 2009, p. 17).

In opposition to formal playgrounds or sports fields which may delimit many children's natural experiences, a well-designed school garden, according to Blair (2009, p. 17) "can readily improve on the complexity of that experience and provide the repetitive access, meanings, and associations needed to create a bond with a place". Additionally school gardens can be a frequent, if not daily, experience for students that they can feel a connection to and ownership of (Blair, 2009).

According to Oldenburg (1997), the term 'third places' refers to informal gathering places and derives from considering our homes to be the 'first' places in our lives, and our work places the 'second'. Oldenburg argues that third places serve a variety of functions that are important to individuals, as well as the communities they live in, and that the most needed of these places are the ones that balance the increased privatization of home life. Furthermore:

> 'Third places' also suggest the stability of the tripod in contrast to the relative instability of the bipod. Life without community has produced, for many, a life style consisting mainly of a home-to-work-and-back-again shuttle. Social well-being and psychological health depend upon community (Oldenburg, 1997, p. 7).

Baum and Palmer (2002) shift this definition slightly and use it to denote places in communities where people meet that are outside the domestic and commercial spheres. In either definition of third place, gardens have the potential to fit the bill. Gardens could constitute essential third places that are vital to facilitating the establishment and maintenance of loose ties and networks for communities (Baum & Palmer, 2002). Furthermore, Baum and Palmer (2002) also stipulate that an increasing amount of literature correlates the 'quality' of place to the interactions and trust within communities. 'Quality' community gardens can be integral to the wellbeing of a geographic community, simply by providing the necessary venue, mentioned above, for social interaction and social capital building to occur.

Summary

This chapter presented literature pertaining to school gardening by reviewing garden-based education in the context of history and culture; philosophical and theoretical roots and ideas; the motivations behind its use; using food as a connecting theme; and school gardens and their relationship to place. The next chapter outlines the research strategy used to conduct this study.

Chapter 3 Methods

This study was an exploratory investigation into food gardens as a teaching tool in Canadian schools, with Ontario as the focus of study. The aim was to collect primary data from school food garden key informants along with data from secondary sources, and to analyse and synthesize the findings into a set of design guidelines for landscape architects and other school garden stakeholders. The following section reiterates the research goal and objectives, describes the research design of this study and provides details on the collection of data.

3.1 Goals and Objectives

The question prompting the research: How can landscape architects contribute to the school gardening movement and aid in the development of school food gardens?

The research pursued the following goal: To create site design guidelines for multipurpose, inclusive, community-engaged school food gardens that meet the needs of the primary users as well as the greater community.

The following objectives were employed to achieve this goal:

- To assemble data pertaining to the development, implementation, and use of school gardens from academic and grey literature and key informant interviews
- To create a set of design guidelines for school gardens based on the research findings

3.2 Research Strategy

This was a qualitative study utilizing a primarily inductive approach and grounded theory. The research path was non-linear and iterative in nature; there was a cyclic relationship between data collection, sampling, and data analysis (Neuman & Robson, 2009). Figure 3 provides an illustration of the research process followed by an outline and description of the data collection methods used to meet the research objectives listed above. Methods used to meet the research objectives were as follows:

- A focused literature review exploring outdoor education, children's garden design, greening school grounds, garden manuals and other related resources for relevant data applicable to school garden design.
- A scan of existing relevant school garden examples via publicly available sources such as online garden profiles, news articles, blogs, organization websites, and published literature.
- Key informant interviews with identified garden experts who had firsthand experience with one or more specific school garden, such as garden educators, facilitators, lead teachers, or members of affiliated organizations that support school gardens.
- Development of design guidelines through an analysis and synthesis of findings.

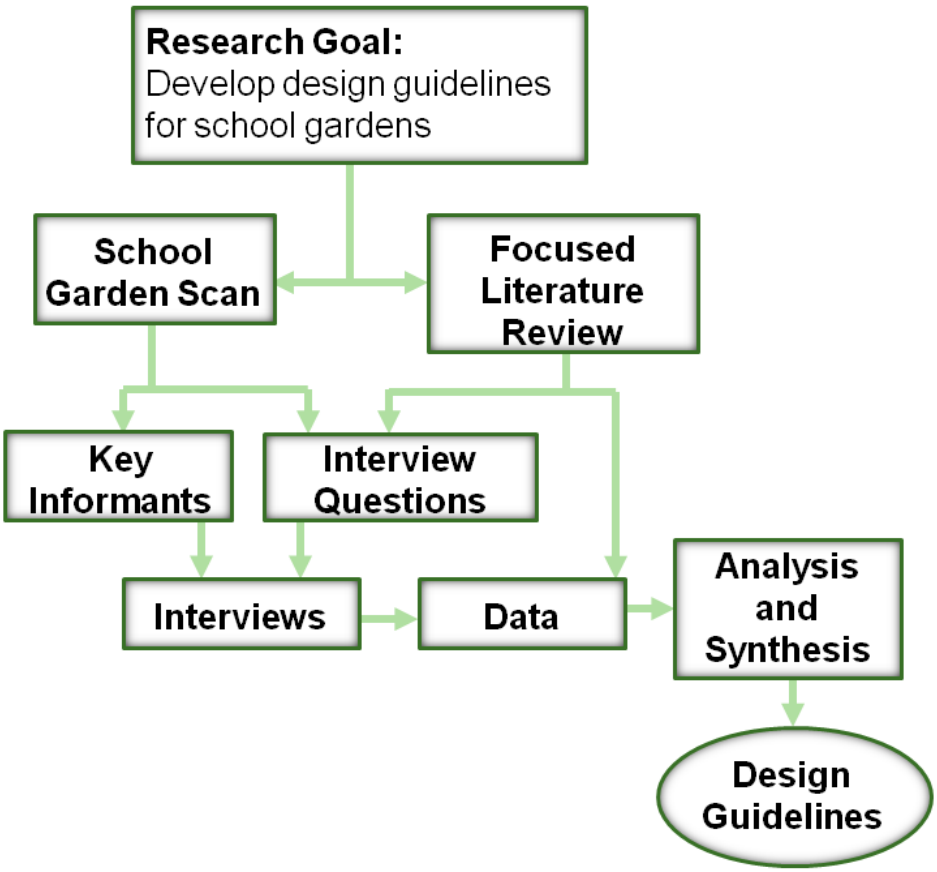


Figure 3. Research Strategy Diagram

Focused Literature Review and School Garden Scan

A focused literature review and a scan of existing school gardens were undertaken concurrently. Both the review and the scan involved analysis of secondary sources. Findings were then used to identify existing examples to learn from, to establish criteria for selecting potential key informants, and to generate data to inform the development of design guidelines.

Topics reviewed included educational design, school garden design, children's garden design, landscape design in general, community gardens, and design guidelines or principles. Sources reviewed included school garden, community garden, and other food-related organization websites and publications; garden profiles on garden networks websites; design books and magazines; academic papers; Master of Landscape Architecture theses; and school or community garden manuals, tool-kits and similar publicly available resources.

The scan of existing gardens was used to produce a master list of school garden projects linked to available data such as articles, blogs, photos, profile pages and the like. The two main sources for the master list were the following online networks with school garden profiles:

- The School Garden Network (www.schoolgardennetwork.ca), a newly-launched Canadian site which at the time had 29 garden profiles, and
- The Edible Schoolyard Project Network (www.edibleschoolyard.org) a U.S.-based site which had a total of 2915 "Garden Classrooms" listed, 71 of which were in Canada.

Publicly available, secondary source data about gardens on the master list were analyzed to identify opportunities, challenges, design features, design solutions, strategies used to achieve specific goals, and other findings to contribute to the development of design guidelines. The garden scan was also used to generate topics

and formulate questions for the interviews. From the master list, a short list was generated by identifying successful, sustainable projects that fit a set of criteria (see below). The short list was used to identify potential interviewees for the key informant interview portion of the research.

Key Informant Interviews

Key informant interviews were used as a data collection method because, according to Deming and Swaffield (2011), they can yield rich and relevant data. Key informants were identified based on their involvement in specific garden projects across Canada. These garden projects were selected from the school garden short list for further study based on the following criteria and considerations:

- The project was established in or before 2012, so as to have had at least three years of experience to draw from.
- The project grew food and also had a strong food education component.
- The project had staying power; this was ascertained by it being fairly well documented, affiliated with other organizations, and having a web presence (such as a blog or link to the school's homepage).
- The researcher was able to identify and contact a key player involved in the project.

Semi-structured interviews were then conducted with those key informants who were willing and able to participate. A semi-structured interview technique was chosen to

provide for both flexibility and organization. An adaptable approach was beneficial because it provided opportunity for respondents to interpret the questions and expand on their experiences and knowledge in a way that might have been limited by more structured straight-forward questions. This approach also allowed the researcher to customize the interviews in regards to specific contexts. Some structure was considered necessary to help direct the interview; an interview guide was utilised to help steer the conversation and stay on topic. The questions that respondents were asked pertained to the specific school gardens with which they were involved. Questions included basic information about the garden, such as history, date of establishment, reasons for starting the project, garden size, garden location, and the goal and vision of the project; information about users and uses such as number of students involved, age and grade range, subjects taught, activities, and other users beyond the school population; descriptions of the garden design and layout; and future plans (see Appendix A).

Interviews were conducted via multiple means to allow for respondents to participate in a way most convenient and comfortable for them; this included in-person, telephone, Skype audio chat, or e-mail. Interviews ranged from approximately 30 to 60 minutes in duration and were recorded and later transcribed for analysis. Several of the key informants were contacted with follow-up questions and to inquire about providing photos. Photos were used as a means to make site observations in lieu of visiting the gardens.

Analysis, Synthesis and Development of Design Guidelines

A framework was developed to code and analyse the results. The analysed results were then synthesised into a set of design guidelines. Goals, common concerns and challenges, activities, users, and existing conditions and resources that could be addressed using design solutions were identified and used to inform the guidelines. The guidelines included solutions, recommendations, considerations and approaches that designers and landscape architects could choose from and apply to specific school garden sites.

Summary

This chapter outlined the research strategy by reiterating the research goal and objectives, describing the research design, and providing details on the methods of data collection. The next chapter describes the results, analysis, and development of design guidelines.

Chapter 4 Results and Analysis

This chapter describes the results and data sets, introduces the framework for the analysis, and summarizes the analysis. The results and analysis were used to develop the proposed design guidelines described in the next chapter.

4.1 Results

The research produced six data sets: 1) a focused literature review; 2) a garden web scan; 3) a set of school garden profiles from an on-line network; 4) a collection of school garden guides; 5) a set of photos; and 6) transcribed key informant interviews.

Focused Literature Review

Literature reviewed included design-related and peer-reviewed articles and books on topics such as outdoor environments for children, greening school grounds, and landscapes for learning. A summary table was created to communicate the findings (See Table 4).

Table 4. Focused Literature Review

Design Guideline	Description	Reference
Cultivate a spirit of learning	Students learn side-by-side with other students, teachers, families, and community members and vise versa	Kozak and McCreight (2013)
Include students throughout the process	Not for students but by students; students will be invested in the success of the project if it is their idea	Kozak and McCreight (2013); Wake (2007)
Capacity and resources	"The school district does not have the staff necessary to maintain the gardens; therefore, it is very important that the design of the gardens reflect the capacity of the school to take care of them".	Brink and Yost (2004, p. 217)
A sense of permanence is important for longevity	Landmarks may help in establishing both an identity and a legacy	Stine (1997)
A special sense of place	A place that is valued, where students and teachers learn because it "mirrors the ideas, values, attitudes, and cultures of those who live there"	Malaguzzi (1984) cited in Stine (1997, p. xii)
Remember it is a process	Places evolve over time, pathways develop, plants change; working in a space over time will provide feedback about what works and what does not. Design that takes time is like a journey that has the goal of developing congruency between people and place.	Stine (1997)
Allow space for change	Leave/provide room for experimentation and flexibility	Stine (1997)
Take into account size considerations	Small spaces may be used for intensive production utilizing such methods as companion planting, vertical gardening, and succession planting	Baker (2002)

School Garden Profiles

The School Garden Network (SGN) is an initiative of Nutrients for Life Canada, a registered Canadian charity that develops educational resources including lesson plans that focus on sustainable food security. It is a web-based network that provides space to showcase existing school gardens for the purpose of fostering collaboration, innovation and best practices on their site (Nutrients For Life, 2014). At the time of data collection there were 29 school gardens that had chosen to post a profile on the site; this involved

filling out a questionnaire and posting photos. There were 14 questions that range from listing the garden type to offering advice to other schools considering starting or expanding their own garden. Out of the 29 profiles, 27 were detailed enough to use as data; these were analysed for applicability to design guidelines such as how summer maintenance is managed, advice offered to other schools, what classes use the garden and how, and what the biggest challenges were. For the remainder of this chapter all school garden network profiles will be referred to as SGN profiles.

School Garden Manuals

Twenty-one manuals, guides, books, online resources, and tool-kits, either published or available online and pertaining specifically to school gardens or related projects such as community gardens, schoolyard greening, or student farms, were identified. These manuals were produced and published by or in partnership with a variety of organizations such as university co-operative extension programs, not-for-profit healthy eating and lifestyle initiatives, schoolyard greening groups, food and agriculture organizations, government bodies, environmental education centres, school garden and garden-based learning advocacy groups, botanical gardens, and Master Gardener groups. The information provided ranged from basic practical considerations such as sun, water and soil, to more in-depth descriptions and directions for site selection and analysis, plant recommendations, garden type pros and cons, and design principles. For the remainder of this chapter all manuals, guides, books, online resources, and tool-kits will be referred to as manuals (see Table 5 for a complete list).

Table 5. List of Guides and Manuals

#	Title, Date, Author, Organization	Acronym
1	All Hands in the Dirt: A Guide to Designing and Creating Natural School Grounds (n.d.); Holmes and Collyer; Evergreen	
2	Children's Gardens: A Field Guide for Teachers, Parents and Volunteers (1999); Bremner and Pusey; UC Cooperative Extension Common Ground Garden Program	
3	Community Gardening Manual (2007); Toronto Community Housing	TCH
4	Create the Garden Guide (n.d.); Chicago Botanical Garden	CBG
5	Creating an Outdoor Classroom (3rd Edition) (2005); Life Cycles Project Society	LCPS
6	Creating Gardens of Goodness (n.d.); Sly and Eichorn; Annie's Foods and Center for Ecoliteracy	
7	Cultivating Healthy Communities through School Gardens (2004); Habib and Spaulding; Seeds of Solidarity Education Center	
8	Design Ideas for the Outdoor Classroom (n.d.); Evergreen	EG
9	Gardens for Learning: Creating and Sustaining your School Garden (2006); California School Gardening Network	CSGN
10	Getting Started: A Guide for Creating School Gardens as Outdoor Classrooms (2007); Life Labs Science Program	LLSP
11	A Guide to Growing School Gardens in Alberta (2011); Shields-Ramsay and Ramsay; Government of Alberta	
12	How Does Our Garden Grow? (1997); Laura Berman; Food Share Metro Toronto	
13	How to Grow a School Garden (2012); Arden Bucklin-Sporer and Rachel Kathleen Pringle	
14	How to Start a School Garden (n.d); Alliance for a Healthier Generation	AHG
15	Nova Scotia School Garden Resource Guide (2011); Nova Scotia Department of Agriculture	NSDA
16	Plant a Seed and Watch it Grow (n.d.); Master Gardener Association San Diego County	MGASDC
17	School Year Gardens: A Toolkit for High Schools to Grow Foods from September to June (2007); Smith and Hamir; The Richmond Fruit Tree Sharing Project Society	
18	Setting up and Running a School Garden: A Manual for Teachers, Parents, and Communities (2005); Food and Agriculture Organization of the United Nations	FAO
19	Site Design (2014); Cornell Garden Based Learning, Cornell University	CU
20	SPEC's School Gardens Start-Up Guide (n.d.); Society Promoting Environmental Conservation	SPEC
21	Starting a Student Farm (2011); Sayre and Clark	

Photographs

The study also produced a collection of school garden photos from the garden web scan, the garden profiles, the garden guides, and from several of the key informants. These photographs were used as a means of conducting observations in lieu of visiting the garden sites.

Key Informant Interviews

Eighteen key informant interviews were conducted. Seven of the key informants (KIs) were the lead teachers, six were involved through a non-profit organization partnering with the school, four were garden educators/facilitators who partnered with the school through a non-profit to deliver programming, and one was a community volunteer who helped with construction and design (see Table 6).

Table 6. Key Informants and Their Roles

Key Informants	**#**
Lead Teacher	7
Non-profit Organization Employee	6
Garden Educator/Facilitator	4
Community member	1
Total	**18**

KIs interviewed were from British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario (see Appendix B for a map of garden locations). They represented both public and private schools, serving both primary and secondary students located in municipalities that range from under 1,000 to over 1,000,000 residents. KIs were de-

identified and each given a randomly-selected letter to represent them; they range from KI-A to KI-R. Table 7 provides a brief description of each interview participant.

School Garden Projects Reported on by Key Informants

The school garden projects that the KIs reported on ranged from involvement with a single garden site to eight sites. Several of the school garden projects were initiated by non-profit organizations, parents, and/or community members, usually in combination. One of them emerged from a parenting program, run by a health organization and taking place in a marginalized neighbourhood that was predominantly social housing with a high newcomer population. That garden project was developed as a way for the parent group to become empowered, engaged in the community and comfortable interacting with the administration, voicing their concerns, and advocating for their children. It was facilitated by a garden educator who also worked with students at another school. Another project evolved out of the initiators from two organizations wanting to develop a farm to school program in their area. The high school was identified as a good candidate based on location; it was close to surrounding farmland and had a high percentage of fast food outlets within walking distance. The idea was to get local food offerings in the cafeteria. When sourcing local, fresh food was both difficult and pricey the idea of growing the food at the school to use in the cafeteria presented itself. A youth outreach organization started and facilitates another of the gardens along with five others in at-risk neighbourhoods in the same city. Two programs were based on the Edible Schoolyard model with one being a multi-school garden

Table 7. Description of Key Informants*

KI Letter	Description
A	Works for a non-profit organization that is involved with several projects in the same municipality
B	Is a retiree who has volunteered and worked with multiple schools in the same municipality
C	Works for a non-profit organization that initiated the project with an employee from public health, the principal, and a lead teacher at a high school
D	Started and facilitates a non-profit edible education program and NGO in partnership with several elementary schools
E	Is a teacher who initiated and runs the project through several technical classes at a high school
F	Developed and facilitates an edible education program in partnership with the parents and staff at an elementary school
G	Is a garden educator who facilitates programming at two elementary schools in a large city through a non-profit organization and the school board
H	Is the teacher who initiated and ran the project at a school for students with learning disabilities
I	Are the lead teachers who initiated and run the program at a high school
J	Works for a non-profit organization that supports local food and healthy eating in partnership with the school board with several projects in the same municipality
K	Is the lead teacher and project initiator at a high school
L	Is a garden educator who facilitates garden-based learning at an inner-city elementary school through a partnership program between the school board and a non-profit organization that works with at-risk children and youth
M	Is one of the lead teachers who initiated and ran the garden program at an elementary school
N	Works for a non-profit organization focused on poverty prevention and alleviation that is involved with several school garden projects in the same municipality
O	Is a member of a non-profit organization that initiated and facilitates school/community gardens
P	Is a teacher who sponsors a student club that initiated the project at a high school
Q	Works for a non-profit organization that offers food growing and environmental education programs in several inner-city schools
R	Is the lead teacher and initiator of the project at a high school

*All KIs were single interviewees except for KI-I, which was a group of three.

program at the elementary level and another being a single school program, also at the elementary level. One organization with a mandate to support local food and healthy eating for kids, that was already working in the schools through school meals, expanded by adding school gardens to the initiative. It works with the school district providing gardening classes for the teachers and their students, generally on a weekly basis, and helps them maintain the gardens and incorporate them into lesson plans, as well as use food from the gardens in cooking classes. A community, environmental organization that works on a wide range of issues, such as waste reduction, teacher and student education, youth environmental leadership, food growing, and local food procurement practices in places like school cafeterias, has two community gardens that include learning plots that neighbour three schools. An organization focused on poverty prevention and alleviation established gardens at seven different schools, with the primary purpose of growing food for the local food bank.

School garden projects not initiated by an external organization were frequently initiated and run by teachers, often by a single high school teacher with the help of his or her students. For example, a home economics teacher was inspired to start a garden upon realizing how many kids do not garden in the city, do not spend a lot of time outside and do not ever get dirty. The teacher dug a garden with the students so that they could actually see how food is grown and also use it in the classroom. Similarly, another teacher developed a garden site and built a greenhouse to teach both a gardening and foods program. A high school green industries teacher developed and grew the garden

along with other schoolyard enhancements over the course of several years with students going through the program. Another project began after a teacher attended a workshop and returned with grow lights and seeds. The teacher helped students establish home gardens with the plants they grew; this eventually led to the building of a greenhouse and school garden beds. A group of teachers and school staff initiated a program after volunteering with students at community gardens and deciding it was something they wanted to have at the school. KI-H described starting the garden after a student asked how to grow pickles because it dawned on the teacher that students were lacking that experiential form of teaching. Instead of explaining the process, the teacher took the class outside, planted some cucumbers and then, later, they made pickles.

Of the projects reported on, one was student initiated through a high school environmental club that started when a student proposed placing solar panels on the roof of the school. The next project the club undertook was a community greenhouse, which then expanded into a community garden, outdoor classroom and aquaponics system.

Gardens described by each KI were diverse. Some were in-ground, while most utilised as many as 15 framed raised-beds, and others had a combination of both. A common size for framed raised-beds was 4 foot x 8 foot with varying heights. Most raised beds were rectangular but there were a few unique shapes at some of the schools, such as tiered beds, octagonal beds, and an E-shaped bed. One large in-ground garden was divided into 18 8 foot x 8 foot plots that aided the teacher in dividing up tasks,

monitoring students, evaluating the work being done, and facilitating cultivation and harvesting. To make the most of garden space, trellises were often used, including growing plants along fence lines and using the fence as support for them. There were often also edible perennial plantings, fruit-bearing shrubs, vines, or trees, permaculture features, and other additional planted areas such as pollinator and habitat gardens. Several gardens were established in a previously under-utilised area, such as one high school garden which was located in an L-shaped space that covered roughly 8000 square feet. Other common features include compost areas, garden sheds, greenhouses, outdoor classrooms, seating, covered areas for either shade or rain protection, and signage. Projects that were community/school hybrids also included member plots where community members either rented garden plot or were allotted one in exchange for tending the school plots over the summer.

Garden users ranged from kindergarten-age to grade twelve students, and from students in one class using the garden for formal learning to all the students in the school using it in some way. Other garden users included students in garden clubs, after-school or summer programs, high school students collecting volunteer hours or hired to tend the garden over the summer, community members without a yard in which to garden, post-secondary student volunteers, parents, Aboriginal elders, seniors, and students from other schools. At hybrid community/school gardens, community members use the space to grow their own garden plots and, at one school, even care for the school's garden plots over the summer. Some classes literally used the garden spaces as outdoor classrooms when there was available seating to do so. Many programs

working with at-risk youth, high-needs youth, students with special needs, learning disabilities, or behaviour problems utilised the gardens as well.

At high schools, it was more common for a single class or program to be the primary users of the garden. At one, the students in the sustainable resources class were the primary users; the photography class used the garden as subject matter, and other students used it as an informal seating area and a place to hang out. The students in the green industries program at another high school were the primary users and maintainers of the garden, while other students benefited from the landscaping and seating areas installed and maintained by the green industry students, including an outdoor classroom and orchard. That school also had a hospitality program that used some of the harvest from that program. A Home Economics program, garden club, and after-school cooking program were the main users of the garden at another high school. At one K to 12 school large a variety of classes were taught in the garden with the goal to have every student in the school use the garden in one way or another. The same was true for many of the other elementary schools. Theoretically, all the students participated in garden programming at two schools that shared a garden educator, but it depended on which teachers signed-up. One of the edible-education programs was directed at the grade three students, but included the rest of the school in other projects throughout the year.

School garden activities extended from general garden maintenance such as planting, weeding, seeding, watering, and harvesting, to grade-specific curriculum-linked activities. Science topics covered in the garden ranged from life-cycles, biodiversity, and

composting, to looking at plant parts, growing seasons, and soil samples. To teach ancient cultures in social studies, a group of teachers and students gathered un-thrashed grain and demonstrated how to thrash and sift it. Teachers and educators also used the gardens for math concepts like measuring, art projects like painting signs or murals, language assignments such as keeping garden journals, writing different pieces from the perspective of different animals, and teaching food literacy such as addressing food miles and where food comes from. One KI reported that he used the garden as an extension for teaching math and science and would test the pH of the soil if the lesson was on acids and bases. If they were covering volume in math, the class would measure and calculate the volume of the dump truck bucket and the volume of the garden beds to figure out how many dump trucks of prime topsoil would be needed to fill all of the beds and how much it would cost. Practical student garden projects included designing and building garden features such as framed raised-beds, trellises, greenhouse shelving, bee boxes, bird houses or feeders, and wind chimes. One teacher also mentioned the benefit of getting daily physical exercise from doing some building or moving soil. In schools without greenhouses, teachers and students grew seedlings for the garden in their classrooms during the winter and spring.

Food grown in the gardens was either used by the students growing it, by other classes in the school, or donated to food banks or local elders. A school with a culinary program partnered with the garden coordinator to bring the cooking students into the garden to harvest and then prepare food such as kale chips or pesto. One garden educator did a workshop on sauerkraut that included harvesting and fermenting cabbage. In other

schools, the cafeterias used some of the harvest and/or saved food scraps for the compost. Programs based on the edible schoolyard incorporate cooking into the programming. At one school, fall food preparation included the making of jam, salsa, and pickles to be sold along with produce to the community. Several other schools also held markets to sell plants, produce, or prepared food.

Several of the schools held special garden events. For example, at one school, they throw a big community garden launch every year where people from the area can participate in planting and preparing the gardens for the growing season. Harvest feasts were also common and included feeding the entire school and even the community. For example, in September the students prepared a feast for the community with soups, bannock, desserts, veggie trays, fruit drinks and herb teas from produce harvested from the school gardens. Another school holds an annual garden festival for the students and community and offers harvest soup and spaghetti lunches.

4.2 Analysis

A grounded theory approach was used to analyse the findings. Grounded theory involves building theory from the ground up and is supported by the data (Neuman & Robson, 2009). It was chosen because part of the goal was to apply lessons learned from real projects. Transcribed interview data and secondary source data were analysed via a process of coding, ordering, categorizing, grouping, clustering, questioning, reordering and reflecting with the purpose of interpreting the data and "actively crafting an understanding" of existing school gardens (Deming & Swaffield,

2011, p. 155; Janesick, 1994). Nvivo software was used to support the analysis. The focus of the analysis was to learn about how different gardens are designed, developed, and used; to identify both common design elements and innovative ones; to identify what seems to be working and what is not; and to explore how design solutions may be implemented, or are being implemented, to achieve project goals. Lessons learned were translated into design guidelines.

Figure 4 presents the framework, developed during preliminary analysis, used to categorize and analyse the data.

Figure 4. Analysis Framework

4.2.1 Visioning and Goals

This category refers to overarching design guidelines that encompass the vision and goals of the project as well as pre-planning considerations. Sub-categories include setting goals, spirit of learning, starting small, creating a special sense of place, and reflecting local conditions.

Goal Setting

According to Holmes and Collyer (n.d.) the goals and objectives of the project should strike a balance between the "dream-able and the do-able"; they should reflect a desire to maximize the potential of the site together with a recognition of limitations - limitations of the site itself, the people involved, and the resources available, including money, expertise, and planting materials and tools. Table 8 outlines some strategies for goal setting.

Spirit of Learning

Cultivate a spirit of learning; students learn side-by-side with other students, teachers, families, and community members and vice versa (Kozak & McCreight, 2013).

Start Small

"Start small" was a common piece of advice in all of the data. Four of the KIs, 3 profiles and 8 of the manuals recommended starting small. For example, KI-G advised:

Start small is definitely advice that somebody gave me a few years ago. It’s hard to follow because you get excited about what you can do, but don’t be afraid to just start

with a few containers or a little bit of a garden and take it from there. Do that successfully and then expand rather than starting something huge and failing and everyone's let down…

Table 8. Some Strategies for Setting Goals (adapted from Holmes & Collyer, n.d.)

Strategy	Description
Set goals according to needs and wants	Most of your plans should flow from this simple but important concept.
Set short-term and long-term goals	Develop five-year plan for your project and set goals to be achieved by the end of each year. Then establish objectives to achieve those yearly goals. Be sure to build in strategies for sustaining the momentum of the project over time.
Set goals according to areas of interest	Look at what people are interested in doing. Capture their interest and ambition by setting goals related to the areas where they have the most energy.
Set goals according to priority	When prioritizing goals, consider the issues that are of greatest appeal or concern; the issues that are most pressing; the influence of other activities taking place in the surrounding area; the likelihood that a particular initiative will be successful; and the impact that a particular effort will have.
Take time to set precise objectives	Objectives describe the short-term and long-term activities that are necessary to reach the overall goals and can provide a benchmark for evaluating progress and success. Each goal should be accompanied by concrete, precise, measurable objectives that provide an action plan for reaching that goal.

Special Sense of Place

Create a special sense of place that is valued, where students and teachers learn because it "mirrors the ideas, values, attitudes, and cultures of those who live there" (Malaguzzi, 1984, cited in Stine, 1997, p. xii). Several of the KIs described the gardens as a calming place for students to be or a special oasis away from the indoor classrooms or busy streets.

Reflect local conditions

Every garden project is unique and should reflect local conditions, the needs of the site, and the needs and interests of the community (Holmes & Collyer, n.d.; Spaulding & Habib, 2004). Reflecting local conditions could be seen in a garden described by KI-E, where a white picket fence, entranceway and gate match the surrounding residences. It was also evident in planting selections made by projects that were in neighbourhoods with a lot of cultural diversity, where they planted vegetables that reflected the different cuisines of the residents.

4.2.2 Planning and Design Process

Participatory and Inclusive Design

Recommendations to use a participatory or inclusive design process were numerous in the manuals (CSGN, 2010; Holmes & Collyer, n.d.; LCPS, 2005; CBG, n.d.; Shields-Ramsay & Ramsay, 2011). Doing so entails inviting everyone who might have an interest in the school grounds, or may be affected by them, to provide input and participate; this includes teachers, caretakers, parents, the principal, school administrators, neighbours living adjacent to the school and, most importantly, students. Working together to create a collective vision, to determine the agenda and, later on, to carry it out helps to ensure a design that represents all who use the garden. It can also be important in developing the appropriate adaptations to the garden to meet the needs of individuals with special needs or disabilities because they will be able to share first-hand knowledge of the importance of having the appropriate containers, access, and

tools for all to enjoy and fully participate in the garden. School gardens should not only be for students but by students; including them throughout the process means they will be more invested in the success of the project, especially if it was their idea (Kozak & McCreight, 2013). KI-A described the participatory design process as:

> … really helpful because it does bring awareness, it brings a whole community together, so it wasn't like there was no garden, all of a sudden there's a garden so those children, parents, and the community were aware of it so I think that element was really important… I think allowing the larger group to decide what they like, what would work, the number of kids, the number of people using it, how they want to use it, that all helps inform the type of design, like what you're going to end up going with.

Table 9 outlines some of the benefits and challenges of a participatory approach.

Table 9. Benefits and Challenges of a Participatory Approach (Holmes & Collyer, n.d.)

Benefits	Challenges
▪ More hands to help ▪ Decisions are representative of the school community and its neighbours ▪ Diverse skills will help identify creative and tailored solutions ▪ Strong sense of involvement and ownership ▪ Greater likelihood of long-term support and, therefore, success	▪ The upfront planning time can frustrate those eager to get their hands in the dirt ▪ It takes time and skill to bring more voices and opinions together

Design principles

Design principles were only addressed by a few of the manuals and only in-depth by one. None of the key informants addressed design principles directly but some spoke about using artwork to add colour, arbors for both shade and aesthetic appeal, and other features, such as vertical elements. According to Wake (2007, p. 36):

> [t]he garden design should embrace principles of unity, repetition, and rhythm so that it flows, creating coherent connections between parts, rather than disparate sections. A focus on designing spaces rather than things to go in them is important to avoid over-scripting and cluttering.

Design Drawings/ Mapping

A plan drawing can be a critical and valuable communication tool to illustrate the plan and vision for the garden for everyone involved, as well as for potential funders, because it will show how serious the project is and that careful consideration has been put into it (CBG, n.d.). It can also be used as a tool for community engagement and to get more people involved in the design process, as was the case at one of the school gardens. There, individuals in the parent group that was involved with starting the garden created designs to fit the designated site; the group then voted on their favorites. The top three were taken and redrawn by a landscape architect, and then the rest of the school community voted on which design to pursue (see Appendix C for an example of the ballot).

Responsive Design

According to Holmes and Collyer (n.d.) responsive design means creating a design process that takes into account and responds to both the school's ecological and community setting, with the understanding that both nature and communities are constantly changing and evolving. This means adapting when conditions change in the schoolyard, in the school community, and in the greater community. For example, incoming members may bring in new skills and resources, while departing members may leave a skills gap; both these scenarios require adaptation.

> A responsive design process involves periodically taking stock of the challenges and opportunities brought about by changes in the natural environment and community and responding to them. In so doing, you will be able to keep your eyes on your long-term goals while adjusting, when necessary, the numerous elements that are helping you to achieve those goals (Holmes & Collyer, n.d.).

4.2.3 Practical Considerations

This category is about existing physical characteristics and garden needs that are taken into consideration during site selection and analysis. Site selection was one of the most important design decisions for many of the projects, with visibility and water access being two of the most pressing concerns. Site selection and analysis are also extremely important because once the garden is established any unanticipated challenges of the site will have to be dealt with. For example, KI-E described using water from a city owned facility next door "…but now we have someone different at the city and they don't let us use their water. We have a tank at the vegetable garden that we have to figure out how to fill up. So far I've been getting the fire department to fill up our tank for us. Then it's hand-watered". Other practical considerations referred to in almost all the manuals were sun, soil, and water, while others added drainage, wind, and microclimate as part of the site analysis and selection. Shade was another concern that was often discussed, along with sunlight; both were important because most food plants require full sun whereas students may require protection from the sun. Therefore, having sun and shade is essential depending on the climate of the site. Wildlife attraction and deterrence was site specific.

Water

> Easy access to running water is essential. This can be as simple as a single hose faucet located in a convenient spot. Teachers may prefer to teach watering methods by use of watering cans or hoses. This gives students experience on how much and how often to water to obtain healthy crops. Hand watering is difficult during weekends, holidays, and vacations. Automated systems assist the teachers by eliminating the drudgery of hand watering when students are not available (MGASDC, n.d.)

Most of the KIs reported watering as one of the biggest challenges. According to KI-H, the importance of having a "very good, easily managed watering program" was integral to the garden's success. KI-O recounted, at one of the schools "we had a big problem because March break happened; we were growing all these seedlings and then March break happened and the seedlings went a week without any attention and half of them died. We didn't think about that, right". Improving the watering system was a common desire at many of the gardens, both to reduce labour and to improve watering consistency.

Accessing water was problematic at some of the garden sites. Some of the users had to roll out and hook up a long hose every time they needed water. One site lost access to municipal water when there was staff turn-around at the city department. Now there is a tank that needs to be filled regularly, currently by the fire department, which is used to fill watering cans. One of the hybrid programs uses a series of rain barrels connected to a garden shed that are either filled by rain or by a hose from which gardeners then fill watering cans. Rain harvesting was used at other sites as well, with varying degrees of success.

> Many of the gardens were watered by hand. According to KI-E, during certain summers watering ends up being a lot of work: everyday you're out there watering, that was taking sometimes 2 hours to hand-water. That's a big issue to consider when you are installing [the garden] because it becomes a bigger issue than what you think it's going to be. You might think it'll rain a couple times a week or so, but it doesn't always happen that way.

Similarly KI-G explained:

> Watering is always a challenge. I'm only there one day a week and I try to do as much watering with the kids as I can if it's needed. We've tried having some of the parents doing it; we've had parents watering the seedlings inside the first couple of years. I think last year one of the classes took that on and that worked pretty well too. In terms of the actual garden we've got a couple of different groups of parents and the boys and girls club coming in on their set days during the summer. During the school year we've had some parents doing it but it's always, there's never been a really great system for it. That's definitely something that we negotiate in the early spring and try to figure out and sort of figure out something but not always the ideal… We do watering cans and we also have a hose that just reaches into the garden and I think there's a sprinkler that they sometimes use in the summer.

Several of the sites had irrigation systems, either attached to sprinklers, or drip tape, and a few were automated or on a timer. KI-C described their system of a timed irrigation system of two sprinkler heads per raised-bed garden as very helpful, especially over the summer when everyone is on holidays. Other K-Is involved with projects that had irrigation in place were also very happy with them, and in some cases where only some beds had irrigation systems in place, were working toward installing more. This was reinforced by a recommendation from one of the SGN profiles that stated, "Get a timed irrigation system. I wouldn't dream of starting a school garden without one." Installing irrigation is important to consider before laying out the garden. For example KI-L described what happened when the beds were laid out without an irrigation system in mind: "It is an awkward design… there are beds running this way

and that way; it's not very consistent, so it can be difficult." At gardens that have irrigation systems, students could still hand-water as part of the programming but the garden operators spent less time procuring and managing labour, using the irrigation system when no one was in the garden. Other water management techniques and practices mentioned included having drought-tolerant plantings, heavy mulching, building soil to have more organic matter, and infrequent deep watering versus frequent shallow watering.

Sunlight and Soil

As with water, sunlight and soil are absolutely necessary requirements for starting a school garden. Generally, the manuals recommend around 6-8 hours of direct sunlight for growing most vegetables, to be aware of potential shade when locating garden beds, and to orient the beds along a north-south axis so that the row or long dimension runs north to south (Bremner & Pusey, 1999; CSGN, 2010; MGASDC, n.d.). For the most part, gardens did not have a problem getting enough sunlight, and those that did have some shade planted accordingly. For example KI-G said, "there’s a chunk of the garden that is pretty shady so it’s always something to deal with so I put things like radishes and kale and lettuce in there". Schoolyards were often perfect for gardens because of their lack of shade. At one of the gardens the schoolyard was the only place that children could garden because all the housing areas were forested, so had too much shade for easy backyard food gardening. The decision to have a garden in-ground or in raised-beds was often based on soil conditions. If the school was located on a previously farmed or undeveloped property and the soil was uncontaminated then an in-

ground garden was an option; otherwise, framed raised-beds with imported soil were used.

Vandalism

One of the greatest concerns expressed by parents and teachers in developing school grounds is the potential for vandalism, which can be minimized through good site design and community involvement (Holmes & Collyer, n.d.). Deterring vandalism can also come down to site selection, signage, management, and ownership. For example, putting the garden in a place where there are lots of people, creating signage that tells the community whose garden it is, developing a sense of ownership among the students, and keeping the garden neat to show that people care about the space are all helpful (LLSP, 2007; LCPS, 2005; TCH, 2007). See Figure 5 for an example of a garden sign. If vegetables are being stolen, especially in a neighbourhood where food security is an issue, a suggestion is to set aside a plot near the entrance to the garden for people who truly need the food and are not malicious vandals. Include a sign that says something along the lines of "If you need food today, then please pick from this plot only" (Berman, 1997).

Garden Alert!

In front of the James Bay Community Centre, you may have noticed a small but important addition to the site. Students in Division 14 at James Bay Community School planned and planted a small organic vegetable garden. The garden belongs to the students, who were involved with the project right from the first seeds planted inside the classroom. Through the spring, they have learned about where food comes from, and learned organic gardening techniques -- all in a practical, hands-on setting.

Because vandalism of the garden is a concern (we have had a few plants ripped up already), it is important that the community knows about the project. We are not requesting around the clock surveillance, but are simply letting neighbours know about the garden, and who it belongs to. If you see anything destructive going on, feel free to inform the police.

If you want to know more about the garden, or are interested in helping out during the summer season call Mark from the Growing Schools project at LifeCycles: 383-5800

Figure 5. Garden Sign Sample (LCPS, 2005)

Many KIs reported that, before the garden projects were established, vandalism was definitely a concern; however, most of the KIs only reported minor instances of vandalism, if any, once projects were established. Reports of vandalism included minor graffiti, vegetable theft, and one smashed pumpkin. The worst reports were at a high school garden that was located at the back of the school where it was not very visible and where garden features were broken and vegetables were stolen. At a more remote elementary school, an entire planting of garlic was taken. KI-O reported that the shed that they have not yet been able to cover with a mural (due to lack of funding) gets tagged occasionally. At one site, teachers were concerned that the garden would get

vandalized by local youth in the area because the school was somewhat isolated on one side of a semi dead-end street. They decided to place the garden in a very visible location at the front of the school and use signage or artwork to show ownership. Both these strategies were common at many of the schools. Another strategy included involving the students as much as possible. Signage that welcomes people and lets them know how to respect the garden is going to be an addition to the school where all the garlic was stolen; the signage will say, "this garden is for everyone, please feel free to try the peas or the beans but remember it is a school garden". KI-E recounted that, when they first started, there were concerns about vandalism and every time they would plant something people would say things like, “you know you’re just going to attract vagrants, they’re going to be doing drugs in there and there’s going to be people hanging out", but there has been hardly any vandalism at all, "like very, very, very little". The worst KI-E has seen in 10 years was a little bit of graffiti:

> …I think it’s where we’re located too. It’s part of a neighbourhood so the neighbours like what they see happening, so actually the neighbours around here their houses look better they see what’s going on so they look out to see if there’s any trouble. The students do too. Since there are so many students that go through here now, they’re the ones who have done the work, so they don’t like when people mess up what they’ve been working on, so there’s a lot more ownership in the property rather than just being like a thoroughfare or just people [loitering] there’s more ownership. Plus there are places for students to sit, we put in a lot of seating areas and picnic areas…

Where gardens are visible and where students and surrounding communities have taken ownership, vandalism is minimal.

Visibility and Accessibility

Visibility refers to seeing the garden and accessibility refers to getting to the garden. Visibility is important for both safety reasons and community awareness, and accessibility is important for ease of use and for maximizing and diversifying users. Manual recommendations ranged from having the entire garden visible from the road, with no obstructions or blind spots so that Police could easily survey the grounds; to making sure the garden was in a central, visible location, so it would not be neglected; to placing the garden where all students, teachers, parents, and community members could enjoy its beauty (CSGN, 2010; LLSP, 2007; LCPS, 2005). Many of the gardens were situated at the front of the school for maximum visibility. Locating the garden nearest to the prime user group was often helpful in motivating students to use the garden. One garden, located in an inner courtyard that could only be reached by going through the school, could be seen from inside and was a unique example where the garden was in a secure and safe place for the primary users.

Wildlife

Existing wildlife may both contribute to learning opportunities and cause damage to the garden. Some of the KIs reported needing to build rabbit or deer fences, while one urban site needed to change composting techniques due to attracting unwanted scavengers (i.e. rats). Beneficial wildlife that programs aimed to attract included birds, bees, butterflies, and other pollinators.

Other Existing Features

Other existing features touched on by the manuals but not by any of the KIs included wind protection, drainage, traffic, vegetation, and built structures.

4.2.4 Users and Accessibility

This section reviews findings that related to adapting the gardens for different user groups and increasing accessibility.

Enabling Access

Schools that wish to accommodate students with mobility challenges or promote gardening with elders, grandparents, and local seniors need to consider enabling features, such as the height of garden beds, wheelchair and scooter access, pathway width and treatment, and seating. Pathways that are wheelchair accessible will also accommodate wheelbarrows, garden carts, and strollers. Pathways that are level or have less than a 5% slope and are paved or made out of crushed stone screening will be wheelchair accessible. Mulch is a popular garden path treatment that may hinder wheelchair access but is a good surface treatment to absorb falls.

Size, Space, and Scale

The following is a list of considerations from the Master Gardeners Association of San Diego County (n.d.) that need to be addressed when planning the size of a garden:

- Numbers of teachers and students who will use the garden
- Kinds of plants to be included and their space requirements

- Size of pathways
- Space for storage to hold tools and supplies
- Area for composting
- Room for greenhouse or cold frame
- Spaces for permanent plantings such as vines, trees, and shrubs
- Areas to place tables for class instruction and for potting benches
- Number and sizes of beds
- Resources and materials available for construction and start-up costs
- Start up money and annual budget available for garden expenses

Space around garden beds was an important consideration when using the beds to teach. This meant having enough room for all the students in a class to gather around and see a demonstration, for example.

Paying attention to scale came up in the interviews when discussing garden bed width, especially for younger students who, being smaller, may not be able to reach certain areas of the beds that adults take for granted. What was not mentioned directly was how the scale of children affects their perceptions. According to Tai, Haque, McLellan, and Knight (2006), adults tend to see the world on a large scale while children are much more attentive and intrigued by the miniscule details that give an object beauty or interest. This theory was supported by descriptions of what the students were attracted to in the garden – things they could touch and interact with, things on the ground, and things they

could go inside or under. For example, reflecting on grade three students, KI-D said: "The students love planting the seeds, they absolutely love popping the peas into the holes, covering them up and mulching, they love harvesting of course". KI-J said:

> The students are always drawn to the flowers. We'll always have some sort of circular herb garden and especially having something like an herb spiral; something they can actually walk through the plants, once they work out that you can touch them and smell them then they really like the herb garden, also, because they can walk through it, they think that's fun.

At another elementary school program, KI-F reported:

> In the fall they love the bean archway. Last year we also planted a tunnel of sunflowers that were 15-feet high and they loved sitting under there of course. It just depends, in the fall we had pumpkins growing so they loved watching the pumpkins.

4.2.5 Garden Features

This section reviews common physical features reported by KIs, including garden beds; pathways, mulch and edging; compost areas; storage; shade and rain cover structures; signage, labels, and artwork; entranceways and fencing; rain harvesting; seating and gathering areas; and additional features. It also looks at unique and innovative features and permanent, impermanent and flexible features.

Garden Beds

Garden plot width recommendations ranged from 3-foot to 4-foot wide. This is so they can be worked from both sides without students needing to step into the growing area

where plants may get damaged and soil compacted. It also makes it easier for younger students to reach (Berman, 1997; Evergreen, 2014; LLSP, 2007). Size and shape of beds may vary according to space available and the number of students using each bed, and may have to be adjusted to fit space available and desired width of walkways (MGASDC, n.d.). KI-L advised to "[c]onsider how wide beds are going to be, not everyone can reach the middle of a 5-foot bed. What is the wingspan of your gardeners? What will be easier on their bodies?" Bed shape recommendations included arranging plots in rows, squares, rectangles, circles or spirals; atypical-shaped plots may be an efficient use of space in an oddly-shaped site, as well as providing visual interest (Berman, 1997; Evergreen, 2014). It was also recommended to orient plots along a north-south axis, with the longest sides running from north to south to give plants maximum exposure to the sun and minimize shading problems (Berman, 1997).

Several of the garden projects were hybrid gardens, meaning they were both school and community gardens either with separate member plots or with a communal garden. This model is a good way to involve the community in the project, especially in areas where there may be limited access to gardens such as in dense urban neighbourhoods; it is also beneficial over the summer months when community members can tend the garden space while using it for their own vegetables (Evergreen, 2014).

Most of the school gardens had communal growing areas, either shared by a class, the entire school, or both the school and the community. In a communal garden, students share the work of cultivating, planting and harvesting; it encourages group participation

and cooperation and ensures a shared harvest. Ideally the size of a communal plot depends on the space available and the number of students who are gardening at the same time so there is room for everyone without being crowded. Communal gardens also work well with younger children, herb gardens, cut-flower growing areas, pumpkin patches and theme gardens (Bremner & Pusey, 1999; LLSP, 2007). An example is the hybrid garden KI-E tends with students:

> The garden is one communal garden. Basically it's between us and the church [group] because they have quite a big group of people that come in once a week. So it gets taken care of between those two groups. When school starts back up in the fall the students take over.

None of the KIs reported on students tending individual plots; however, it is an option listed in the manuals and was very much a part of the old school garden movement in the early 1900s. In some schools each class is given their own plot, or small groups or individual students may have a plot for an experiment, or an extracurricular club may have a plot (Bremner & Pusey, 1999;; MGASDC, n.d.).

In-ground gardens were usually created on existing soil, with the preservation and development of soil being the foundation of the garden's development, productivity, and overall success if it is large in scale (Sly & Eichorn, n.d.). Different methods can be employed for growing vegetables in ground-level beds; for three examples, see Table 10. An example of an in-ground garden was the one established by KI-K:

> The garden is probably, I would say, about 12 feet by 40 feet, it's just a square, and not even a great square, because it's been made by the kids. We made it bigger; we dug more of a trench line for our herbs and things, so it's a weird shape. The goal is to make it bigger. This year we're

attempting, we've laid down all kinds of plastic around the garden and we put tires on it and we're hoping to kill the grass in a natural way and then have a bigger garden next year.

Table 10. In-Ground Techniques (adapted from Bremner & Pusey, 1999)

Method	Description
Flat Beds	The entire surface of the beds are level with the surrounding garden area
Double Row Bed and Furrow	The garden is arranged in rows or beds 18- to 20-inches wide separated by furrows of about the same width, which are used for watering, then vegetables are planted in lines two inches from each edge of the bed
Hill and Basin Planting	A space saver used for growing vining plants such as cucumber, melon and squash that uses circular furrows with hills of soil 4- to 18-inches high and about 2-feet in diameter made by scooping soil to form a basin around it

Most gardens with raised-beds were framed; one garden had mounded unframed raised-beds as well as framed beds. Raised-beds were manly constructed out of wood and ranged in width, length and height, though many were 4-foot by 8-foot and 8- to 20-inches deep based on the width of lumber used. This is because a simple, low four foot by eight foot framed raised-bed can be easily made out of three pieces of lumber requiring only two cuts. A 4-foot width seems to be manageable and provide a good amount of growing space, though may be too wide for some users. Reasons for recommending the use of framed raised-beds were: if existing soil is poor or the only space available is paved with asphalt or concrete; to create better soil conditions such as fertility and drainage; to raise the soil and plants to a comfortable reach for people who cannot garden comfortably at ground level; for a neat and aesthetic garden; and to

create a clear sense of where the garden starts and stops. In areas with cool, wet spring weather, soil in raised beds drains and warms more quickly so you can get started planting earlier (Bremner & Pusey, 1999; CSGN, 2010; Evergreen, 2014; Sly & Eichorn, n.d.). Two raised beds, three feet wide by eight feet long, is the minimum required for work with a group of 25 children and 2-foot high beds are wheelchair accessible (LCPS, 2005). If a raised bed is on compacted or no soil it will need to be at least 18-inches deep (Spaulding & Habib, 2004). KI-J said most of their beds were ten to twelve inches deep but were on top of soil; some that were for potatoes were 30-inches deep. KI-Q explained why they use framed raised-beds:

> In terms of bed design it's really good for kids to know where to walk. So you want raised beds even if they are not hugely tall, just to give little kids, they need to know where it's okay to walk so they're not stepping on the plants. A mulched pathway with raised-beds is kind of an ideal demarcation, and you want your beds to be tall enough that they walk around them or if there's plant material make sure the plant material is tough enough if they cut corners, which they will do. So soft edges using thyme, or creeping crops like that, oregano, or whatever, that are sensory, edge sort of things. It's good for little kids, it's good to mark of and protect the other plants in the beds, the annuals that are maybe more tender.

KI-R reported on repurposing old red cedar wharf ties (5 by 12 inches and 16- feet long) which worked out well and will last longer than other types of wood, the 5-inch wide frame is also great because "you can sit on the edge and work and you're not on your knees. High school students have got their fashion to consider, it's helpful in that regard any way". KI-Q described using a clay-based product called an earth block to construct raised-beds with the students: "It was great building material, really interesting".

Gardening in containers is ideal for those with little to no garden space, or for gardeners who are unable to maintain a large garden area. Common containers are clay and plastic pots, and large wooden or plastic barrels; buckets can be used to create an indoor/outdoor garden by growing plants in buckets with handles, or pots with wheels, and moving them indoors at night (Bremner & Pusey, 1999; California School Garden Network (CSGN), 2010; Evergreen, 2014). KI-I described incorporating container gardening into the program:

> It's great for kids to see that you don't need a big garden plot to grow a lot of vegetables. We go over to Mr. Sub and they just throw out all the plastic pails that they get, which is a waste, so we use those and drill holes in them and grow potatoes in them too, to show that if you just have a back porch or a stoop you can a few pails and put some potatoes in or a couple tomato plants.

Pathways and Edging

One recommendation for pathways was 4- to 6-feet wide for centre paths and 3- to 4-feet wide for lateral ones, while another was at least $2^1/_2$ -feet wide to allow children to gather around, kneel, and work (LCPS, 2005; MGASDC, n.d.).

Edge treatments were very important in most of the projects, especially for younger and newbie gardeners. Putting edges around in-ground garden beds helped to delineate the beds and clearly mark where the pathways were so new gardeners knew where to walk and where not to step. According to KI-E:

> …some of the parents built wooden edges around the beds which has really been a huge help… we had some mulch and stuff marking the paths, but that inevitably gets grown over and mulch does not stay where you put it especially when it's under the feet of six year olds... it was really hard to see, even for me, who knows where the plots are, where you are allowed to walk and where you are not, so getting the garden edges in

> there was a huge help… Now [the students] know if they are walking on the garden bed because they can see it and they are doing it more consciously, whereas before you had no idea where the edges of the garden beds were.

Compost Areas

Composting is a valuable addition to a school gardening program but it needs to be properly managed. Most gardens had some sort of composting set-up, the most effective of which seemed to be a three-bin system; some of the programs without a three-bin system were planning on building one. With a three-bin system the main bin is where you add and mix the materials and the additional bins act as storage for either green or brown materials (see Figure 6). It is an effective system for schools because everything needed is contained, convenient to access, and it all looks tidy (Evergreen, 2014). A few of the schools had multiple types of composting systems, some of which were experimental, such as vermiculture (worm bin), thermal-compost bins, and rotational anaerobic compost bins. Compost bins were frequently wooden (untreated), some were made of old pallets, one school had a straw bale frame, and a few had donated plastic bins. According to KI-B, schools are not always good at composting, for example, at

> …one of the schools that was an early adopter, they had all their buckets in their classrooms and all the students would dutifully put all their apples cores and compostable waste in the buckets and they'd go and dump it in this one pile near the fence, so it was all wet material, all green material, it became smelly and attracted rats, so the school admin got rid of it.

Several other KIs reported similar management and maintenance issues.

Photo Courtesy of Elin Marley

Figure 6. Three-bin Composter

Making and using compost was recommended as an excellent way to demonstrate the cycle of growth and decay found in nature and as a school-wide program to both reduce waste generated by the school and create fertile soil for the garden. It involves regular maintenance to function properly and should be located where it will be easy to maintain, close to a hose, close to your gardens where it will be used, with good drainage, away from tree roots, and out of the way of active play zones (Bramwell, Rosemeyer, & Barker, 2011; Bremner & Pusey, 1999; LLSP, 2007; LCPS, 2005; Spaulding & Habib, 2004). An alternative to an outdoor composting system is vermiculture. Having a well-managed worm bin can create great compost, can be done indoors year-round, requires little space, and is more accessible for those without access to an outside composter (Evergreen, 2014; LLSP, 2007; LCPS, 2005; Spaulding & Habib, 2004). KI-C reported that their "compost system is working well but could be

better," commenting that a yearly workshop with the incoming sustainable resources class, who are the primary users of the garden, would be a helpful way to address management issues.

Storage and other Outbuildings

Tool storage, often in the form of a garden shed, is an important feature to include in a garden plan. It provides a safe place to keep tools and supplies, and allows easy access to tools and equipment by volunteers and other groups using the site over the summer (Evergreen, 2014; LLSP, 2007; TCH, 2007). Most of the KIs reported having a garden shed near the garden and, if there was not one, there were plans to install one. For example, KI-D said, "[w]e need our own sheds because we're taking up the custodians' storage space with our wheelbarrows". Some of the sheds were built by high school construction classes either at the school with the garden or by another school. Artwork and signage were also posted or painted directly on the sheds. Shed roofs were used to demonstrate rainwater harvesting at several locations and a small barn was used to house a green roof at another.

Shade or Rain Cover Structures

Many of the sites relied on existing mature trees to provide shade and did not require a built structure to do so. Depending on the climate, others had pergolas or covered areas for sun and/or rain protection. One of the schools that experienced a lot of rain relied on the greenhouse as a protected classroom area.

Sitting and Gathering

Some of the gardens had formal outdoor classroom space, while others had more informal gathering spaces. For example, KI-L explained,

> [t]here's no formal outdoor classroom space in the garden; groups just meet out in the garden. There is one area with Linden tree stumps that acts as the 'office' where groups sometimes meet. Sometimes teachers use a grassy space right by the garden for classes when the weather is nice but the garden doesn't really have space for that.

By contrast, KI-Q suggested, " [i]n terms of design, you really want a staging area, an area where kids can sit in a circle, or gather round in a semi-circle or something". Seating took the form of shaded grassy areas near the garden, to logs, large stones, straw bales, benches, picnic tables and wide garden frame edges. At some hybrid gardens the seating was moveable and put away after use. One of the high school programs installed an outdoor classroom that other classes in the school use. KIs reported that seating was a nice thing to have for visitors and students alike; where there was seating, students would use the space more to hang out, socialize, eat lunch, or do school work. While most sites were conducive to seating there were a few where it was problematic. For example, in one case there was misuse of the space and minor vandalism when a picnic table was introduced, so it was removed. Several of the manual recommendations for gatherings included providing at least enough seating to accommodate a group of ten students; providing a diverse choice of seating and table options, allowing for variety, versatility and creative use of spaces; using seating to enhance the environment and as part of an outdoor classroom; and using straw bales as a dual purpose feature first for seating and then for mulch (AHG, n.d.; Bremner & Pusey, 1999; Evergreen, 2014; MGASDC, n.d.).

Rain Harvesting

Several of the projects had one or more rain barrels that were often connected to shed roofs. Not very many of the manuals mentioned rain harvesting and, if they did, it was very briefly. KI-F described plans for a rain harvesting system utilizing a donated 450 litre rain barrel that would collect water from half pipes attached to the fencing. Rainwater harvesting was frequently linked to teaching sustainable resources and water conservation. Two of the KIs commented on having problems with rain barrels not working out in scenarios where it was not clear who was in charge of managing them. Where rain barrels were being used as a class project or part of the garden programming, they seemed to be a useful addition to the garden.

Signage, Labels and Artwork

Almost every garden had at least one sign. Berman (1997) recommends all school gardens have a sign or signs to give the site an identity within the school, to let neighbours know what the new addition is all about, to identify the garden as an outdoor learning area, to announce times the garden is open, and to provide rules and guidelines for using the space. Shed walls and fences were often used to post signs; sometimes signs were posted on the frames of raised beds. For the most part, students participated in making and painting signs and labels. KI-Q said, "I actually avoid signs that are not connected to the educational aspect, either through the process of making them or the sign itself". Signs were used to identify the gardens and their users, to label different plants and crops and other educational information, to communicate garden rules and other information about the garden, and to display a contact number to call

with questions, concerns or to report vandalism (see Figure 7 for a sample of garden rules to post on a sign). KI-I reported having several student-made signs, stating, "[we] try to have as much signage as we can to promote [the garden]". A few of the KIs reported having signs removed, damaged, or weathered.

Garden Rules

- Walk on the paths and not on the beds
- Always walk when in the garden
- Keep tools off the paths
- Place sharp edges or points of tools face down
- Ask before using any tool
- Clean tools and put them away when finished
- Wash hands after gardening
- Wash fruit or vegetables before eating
- Respect the plants, the animals, the nonliving things and each other
- Ask before you pick

Figure 7. Sample of Some Garden Rules (adapted from FAO, 2005; LLSP, 2007)

Student painted signs were not the only form of creativity in the gardens. Many of the gardens also had other forms of student art on display. "Art in the garden adds to the beauty and provides an ideal place to display students' projects. Sculpture, murals, and other art forms will add beautiful elements. Allow sufficient space to place art projects throughout the garden" (MGASDC, n.d.). Many of the school gardens have regular art

projects in the garden, including murals and sculptures. At a small elementary school garden there is a caterpillar made of student-painted wooden circles installed on an existing fence. One high school garden invites local elementary schools to contribute a mural, bench or other creative piece to add colour, variety, and promote engagement by the wider school community. One KI suggested having students paint and create artwork on bed frames before putting them together. Local artists have also contributed to designing murals and signs; one such mural was designed as a paint-by-number and painted by students. KI-O explained:

> Some of the gardens have pollinator art like butterflies and bees cut out of wood on the fence because we do an art piece called pollinator party to educate about why pollinators are important and the students or adults in the community will paint them and then install them onto the fence.

Fencing and Entranceways

The choice to fence or not to fence was very site specific, as some of the gardens were entirely fenced, partially fenced or not fenced at all, and both reasons and styles differed greatly. Using existing fences as trellising for plants or as a venue for displaying artwork were both common. In most instances fences were used to demarcate the garden rather than to keep people out. At one elementary school garden the fence was intended to keep students in. At a high school garden, the decision to put a tall chain-link fence around the entire project to deter vandalism was later regretted because they wanted the garden to be inclusive; now, they unlock and open the gate every morning. In this example the fence created a sense of enclosure and was quite effective in making the garden feel like a special oasis. It was also turned into an asset when, in an attempt to soften the harsh fence, local elementary schools in the city were invited to

participate in creating artwork for the fence. Other schools used fences as trellising for climbing plants such as peas. Fences can also "be helpful for keeping out unwanted dogs, bicycles, basketballs, and the occasional thief" (Bremner & Pusey, 1999, p. 12).

KI-L described the entrance area as:

> …well maintained with raised beds, flowers, and interesting plants on display to be aesthetically pleasing and eye catching, such as broccoli, nice peas, and nasturtiums which are edible flowers. I try to lure football players in and have them eat the [edible] flowers. There's also companion planting that looks quite nice. Kids are drawn to it and students that aren't involved with the garden often come and check it out. People pass by the entrance on their way to the [sports] field or parking lot so having an impressive display gives students a sense of pride and appreciation of the garden. If it looks nice it, sows the seed of interest and maybe they'll end up getting involved in the garden or gardening.

Considerations provided by the manuals included using pergolas or other structures; creating a living archway with small shrubs, trees and vines growing around an entrance structure; having a large reception area where bulk materials such as mulch and compost may be unloaded; and providing instructional space where students receive information before entering the main garden (Evergreen, 2014; MGASDC, n.d.).

Animals

For many students in urban areas, having animals on school grounds may be their only experience with animals and livestock typically found on a farm. This also provides a number of natural learning experiences (Evergreen, 2014). Two of the high school programs had livestock, both had laying hens and one also had ducks and pygmy goats, while one of the elementary school programs raised a chicken with the class.

KI-E explained the addition of the chickens followed by the goats to the program:

> The chickens were a really good start. They're really easy. The kids love them. They're really good for kids with autism and things like that. They just gravitate towards them and it calms them right down, it's really good for them. Even kids with anger issues usually calm right down… [The goats are] looked after, the neighbours haven't complained, the neighbours actually like it, they'll bring their kids by, or their grandkids by, or stuff like that, and they know that they're not mistreated. I think if it's done well and you can get the whole community to buy into it, if you make it part of the community… it's a good thing; it's like a teaching tool, not just for the school but for the community.

Additional Features

Additional garden features reported by KIs included greenhouses, a pizza themed and shaped garden, and wash sinks. Future additions included plans for a labyrinth, and a sauerkraut fermentation pit. Other sources had examples of human sundials, weather stations, harvest areas, and kitchen areas.

Permanent, Impermanent and Flexible Features

Creating a balance between permanent features and structures and temporary or impermanent features may be an important factor. Permanent structures such as raised-garden beds, gazebos, pergolas and greenhouses need to be thoughtfully places, whereas moveable features can be more easily relocated or removed.

Moveable and temporary features allow for flexibility and change; this also leaves space for experimentation and innovation. Annual vegetable beds are an example of flexible space; every year they can be planted differently giving new students the opportunity to

help design them. Another example is using moveable season extension features; KI-F described, "We have a hoop house… that can actually be moved around as we rotate the garden space… Then we recently built a long poly tunnel, so one whole section…we've already started [in February] so it's a way to start early crops and extend the season". The same program also created a bean tunnel with sticks from the nearby forest. Seasonal features such as this may be rebuilt every year with a new group of students.

4.2.6 Plant Selection

Edible plants were planted at all of the sites; however, many of the gardens also included other types of plants and planting areas. Depending on the climate where the gardens were located, and on site-conditions, there were common annual vegetables, heritage varieties, and culturally linked vegetables; herbs, flowers, edible flowers, perennial vegetables, berry shrubs and vines, fruit trees, and grains; native plants, and pollinator and habitat plantings; and sensory gardens. Many of the manuals were regionally produced and therefore valuable to school gardens in those areas; others recommended researching plants that grow locally and contacting local horticultural clubs or nurseries for more information. They also encouraged selecting plants based on the goals of the project. A simple way of selecting vegetables is to choose plants that everyone enjoys eating (Evergreen, 2014). However, vegetable selection was based on a variety of other reasons such as how the garden was managed over the summer; what grew well in that particular garden; lessons learned from previous seasons; experimenting with new and unusual varieties (to the students and community);

choosing food plants linked to the cultural cuisines of users; choosing vegetables not readily available at the grocery store; growing heritage varieties; and basing selection on the needs of cooking classes or cafeterias.

Planting with the school year as a strategy was common with KIs; this involves planting vegetables to maximize gardening opportunities during the school year and to reduce summer maintenance by choosing vegetables that either grow quickly, such as lettuce and radishes, and/or those that can be planted in the spring and harvested in the fall such as squash (Evergreen, 2014; LCPS, 2005).

Perennial fruits and vegetables that KIs reported growing included asparagus, rhubarb, strawberries, blueberries, currants, haskap berries, apple and pear trees, and various herbs. Native perennials were used for habitat gardens and as edible plantings such as service, salal, and elderberries. Working in partnership with the conservation authority, one garden had specific plants based on what larvae feed on them. Pollinator gardens were common and often utilised native species as well; however, some favoured showy flowers. One program in particular was recognized as a bee-friendly farm and actively promoted supporting bees with its plantings. Edible flowers like nasturtiums and Johnny-jump-ups were also planted.

KI-H on edible perennials:

> I found that as the years went on and as we got bigger I started to really push perennials versus annuals and the whole food forest versus a garden so doing the apple trees and doing the berry bushes, because it became less management and they would be there every year and people

> started to realize that they were there every year. So when I had the apple pick in the fall every year the community started to know that it was always going to be there or the berry bushes along the fence or whatever. If you're doing constant annuals, if you're rotating tomatoes and peppers and things they're not always in the same spot, they don't always do as well and etc. etc. That permanence of garden and in that case that permanence of plants was way more valuable than I thought and I had to admit I didn't really think of gardens in that way. I didn't really think of food producing as really… as perennials really being that important.

KI-Q on planting strategy:

> I'm always kind of keeping my plantings as diverse as possible…I like having something in every bed that's a different plant part and a different harvest date and things like that. …it's whatever gets [the students] planting and engaged with the process and caring about the outcome and all that stuff…there is always something to taste from April on…I use sorrel, red currents, stevia as a summer crop, to have a high value tasting experience. Even if the kid has only one visit, they're going to remember it, they're like, oh, I ate something green and it tasted incredible. I'm always in favour of loose, open, gregarious plantings…I think you can turn kids off by being too structured and formalistic and they just need the experiential connection. When you think about it…that hour in the garden could be the only time that they smell something natural, get to taste something from the land and have that kind of sensory experience with all five senses. [The plantings are] also informed in terms of seasonality, trying to get a salad crop off the land in spring and a root crop, and… tomatoes, small fruits, mouse melons, peppers, small bites off the long season crops in fall. In the height of summer maybe there's not that much to harvest for the community, maybe it's mostly leafy greens, but those are the plants that actually cost them the most…given different cultural backgrounds those are sometimes hard plants to find, it's the leafy greens that are culturally relevant.

KI-D reported, "we did the three sisters companion planting (corn, beans and squash), it worked really well and [was] super beautiful. It showed how we could use other plants to support other plants".

Tables 11 provides examples of kid-friendly plant selections and Table 12 lists additional planting strategies.

Table 11. Kid Friendly Plant Selection (adapted from LCPS 2005)

Planting Criteria	**Plants**
Attracts Birds, Butterflies, or other Pollinators	Plants with nectar sources like wild columbine, honeysuckle, bee balm and pineapple sage will attract bees, butterflies and other pollinators. Seeding plants like sunflowers and millet or berry shrubs like raspberry, blueberry, and loganberry will attract birds.
Has Colourful Fruit and/or Flowers	Vegetables such as purple peas, tomatoes, and strawberries are brightly coloured, as are marigolds, and edible flowers such as nasturtiums, borage, and calendula.
Is Fast Growing or Has Large Fruit	Brassicas such as collard greens, broccoli and cauliflower are large as are members of the squash family such as pumpkin, zucchini and cucumber. Fast growing vegetables are lettuce and other greens, radishes, and beans (especially pole varieties).

Table 12. Planting Strategies

Strategy	Description and Example of Plants	References
Companion Planting	Companion planting, a technique where particular combinations of plants are grown together to take advantage of their natural relationships, is recommended for small spaces, as a natural insect repellent, to attract beneficial insects, or to nourish other plants.	Bremner and Pusey (1999);LLSP, 2007; Evergreen (2014)
To Attract Pollinators	Plants with nectar sources and/or bright flowers will help attract pollinators and native flowering plants will attract and support native pollinators.	AHG, n.d.; LLSP, 2007; Spaulding and Habib (2004)
For Habitat and Other Native Species Benefits	Select native species as hedges, borders, or other plantings because they are often drought tolerant and need little or no watering, to preserve a part of our natural history, and to provide better habitat for native butterflies, birds and bees.	LCPS, 2005
For Pest Control	Plants may be selected because they attract beneficial insects that eat destructive insects or deter other pests from eating your vegetables. For example grow nasturtiums near leaf crops to act as a trap plant for aphids or at the base of fruit trees to drive away woolly aphids.	Bremner and Pusey (1999); Evergreen (2014); LCPS, 2005; Spaulding and Habib (2004)
For Vertical Gardens	Climbing plants such as runner beans, peas, gourds, chayote, passion fruit, kiwi, grapes, and flowering vines are best for trellis gardens, while smaller plants such as herbs, lettuces, and leafy greens grow well in hanging wall gardens.	Sly and Eichorn (n.d.)
For Small Spaces and High yields	Techniques such as companion planting, succession planting, interplanting, and vertical planting can increase productivity.	Bremner and Pusey (1999)
For Microclimate	Heat loving plants like tomatoes and basil will grow well against brick walls that absorb heat from the sun while shadier areas might be perfect for spinach or lettuce.	Spaulding and Habib (2004)

4.2.7 Management and Maintenance

Summer maintenance and watering are two of the biggest challenges mentioned in the key informant interviews. Besides weeding and watering the garden, other common garden features that require regular management and maintenance are composting and rain harvesting systems.

General Management

KI-H commented on the importance of having systems in place and dedicated people involved to keep the garden maintained: "…if you're trying to start a garden at a school or you're trying to get a system going at a school, it's less about budget, it's less about logistics and more about who's going to do it, how are they going to share responsibilities". KI-E, who has heard from neighbours about how much of a great addition the garden is to the community, stated that, "…you want to have a maintenance plan". Some recommendations for project management from the manuals were to schedule class use of the garden and other spaces such as outdoor classrooms; post garden maintenance tasks; create a day-by-day garden calendar to record gardening responsibilities; develop a work schedule for volunteers; schedule gardening days; plan a holiday and summer maintenance program; and create a supply-ordering system (LLSP, 2001). Including a kiosk or bulletin board in the design of the garden is a way to communicate schedules and garden tasks.

Management of the garden is a consideration that needs to be addressed during the design process. Design decisions that may help to ease garden maintenance and

management include site and plant selection, materials used, how the garden will be watered, and signage. Design may also be based on how many people are available to help with maintenance and what their skills are. An important consideration, pointed out by KI-N, was that too much buy-in to the idea of planting with the school-year or planting low-maintenance perennials may be misleading. KI-N was concerned that:

> people put too much weight on how easy it can be, such as planting things that just need a little bit of maintenance or we'll plant things that are all ready in the [fall], that's really idealistic, and those things don't really exist; everything needs some sort of maintenance even a permaculture garden, or native plants, or perennials, to keep them to the standards of schools they need maintenance… I think unfortunately often [the idea] gets sold [without a full understanding]. I worry about people spreading that idea because I haven't seen that work anywhere. It gets to a place where there are weeds that have taken over and then… it's not acceptable to [the principal or school board]. I think you can do that, but for sure some of our sites have suffered by getting the traditional, throw some tomatoes, throw some peppers in, throw some of this in and you're done kind of treatment and you can be very intentional about it and be very thoughtful about how you plant things but that doesn't mean it doesn't need good management or it doesn't take away those other factors.

Summer Management

Summer management strategies reported by SGN profiles included summer camps, gardening clubs, and community groups taking over garden maintenance and programming; a lead teacher or parent taking on responsibility and organizing work bees with teachers, staff, students, parents, and other volunteers; sign-up rotations with families signing up for a week or two over the summer; and some programs, especially ones based on using a greenhouse over the winter, shutting down for the season, either by sending seedlings home with students or cover-cropping outdoor beds. The manuals suggested similar strategies (see Table 13 for examples). The last two strategies might

be options if the person/s responsible for the garden over the summer leaves the school or neighbourhood, or are away for a summer and there is no one else available.

Table 13. Summer Management Strategies

Strategy	Source
Organize students and their families to volunteer to water and maintain the area for one-week periods during the summer. Reward their time with a share of fruits, vegetables or flowers at harvest time.	Holmes and Collyer (n.d.); LCPS (2005); LLSP (2007); Spaulding and Habib (2004)
Ask neighbours for a helping hand.	Holmes and Collyer (n.d.)
Invite a local gardening or conservation organization to donate some time and energy.	Holmes and Collyer (n.d.)
Co-ordinate with summer school, out of school care programs, or city recreation programs to incorporate use and maintenance of the area into their curricula.	Holmes and Collyer (n.d.); LCPS (2005); LLSP (2007); Spaulding and Habib (2004);
Cover the garden with a heavy layer of straw to prevent weed growth and turn it into the soil when gardening begins or remove in spring and compost.	Bremner and Pusey (1999)
Sow a cover crop of green manure, such as alfalfa, barley or soybeans; it may need to be watered initially to establish. Turn it back into the soil in early September.	Bremner and Pusey (1999); LCPS (2005)

KIs reported several strategies with varying degrees of success; some were similar to those reported in the SNG profiles and the manual recommendations. It was common for a lead teacher to take on responsibility and organize volunteers; a partner organization to continue programming the space through various summer programs with some hired students to tend the garden; summer camps run through nearby community centres or municipal parks and recreation departments; or local community members or groups to use and tend the garden over the summer. At one of the school gardens they put in six community plots around the perimeter of the school garden

because there are no other community gardens in the town. In exchange for a plot, the community members tend the schools garden over the summer when they are there working on their own plot. This partnership (hybrid model) has been very successful with the members, who even harvest from the school gardens and preserve food for the students.

KI-A explained a strategy that combined parent volunteers, a children's club, and a child care facility: "…we opened it up to the broader community because we wanted it to be part of the community and have that larger community ownership". Three main groups took care of the garden; the Boys and Girls Club took care of it one day a week, the nearby daycare on another day, and some of the parents took a couple of days each; the work and responsibility was shared. The parent volunteers were also welcome to harvest and use some of the produce; the Boys and Girls Club would harvest produce on the day they were at the garden and make a snack; the daycare children might look at some of the things growing in the garden and maybe get to taste it; and the rest of the harvest went to the food bank. KI-E described another strategy:

> The students will be involved with it right up until the end of June and then it's usually me and volunteers over the summer that keep it going and keep it watered and harvested and things like that. The garden is one communal garden. Basically it's between us and the church because they have quite a big group of people that come in once a week. So it gets taken care of between those two groups. When school starts back up in the fall the students take over. There are six [courses] a year that are looking after it… in the fall there are three [classes] that can go out and do the harvesting and in the spring there are another three… that can get it set-up and do the planting and watering and keep it going until the end of June, and do repairs to the fencing, or whatever is needed out there.

Watering and Irrigation

Several manuals recommended installing irrigation systems; for example, one states "[i]f you lack time and want to save water, think about installing a drip irrigation system, especially for deeper-rooted, longer-season plants such as tomatoes, squash, flowers, and perennials "(CFE, N.D). One of the profiles recommended to, "[g]et a timed irrigation system. I wouldn't dream of starting a school garden without one." While KI-C described their irrigation system as "…very helpful, especially over the summer, when the teachers and students are on holidays. Even though the summer camps are using the garden, it's a lot of responsibility to ask them to do the watering".

Design Based on Resources

Thinking about how the garden will be tended and maintained before it is built is important so that stakeholders make sure they have the resources to manage it properly; this includes both funding and labour. For example, many of the school projects have composting, but not all of them are functioning well or properly maintained.

4.2.8 Evolution and Longevity

Evolving Process

Creating and running a garden program is an evolving process. Places evolve over time, pathways develop, plants change; working in a space over time will provide

feedback about what works and what does not. Design that takes time is like a journey that has the goal of developing congruency between people and place (Stine, 1997). This theory was evident by the list of future plans and projects given by KIs. KI-I described the evolution of their garden as follows:

> Over the past four seasons, every year there's been quite a bit of expansion and we keep expanding what we are dong every single year. This is because student interest is high and we want to keep finding new opportunities for our students that are so beneficial for them. Just coming up with new and innovative things to do with them and add to what they are doing. Sometimes they have suggestions for us for things that they would like to see and we've had teachers enquire about certain areas out there… We have a short term plan and we have a long term plan and we just keep on trucking along. It's always evolving… we just find things that work really good, in one growing season, or how we want to modify and adapt for the next.

Legacy

A sense of permanence may be important for longevity of the project. Although most of the gardens were not threatened by loss of land, it is a real possibility. One of the high school projects had to be defended when the school wanted to expand its parking lot. Creating a sense of permanence, both physically and in the minds of the school and greater community, so that the program is highly valued is a way to prolong its life span. Landmarks may help in establishing both an identity and a legacy (Stine, 1997). Physical structures like greenhouses, pergolas, and entranceways are examples of landmarks. Permanence can also take the form of buy-in, a sense of ownership, and pride among students, faculty, parents, administration and the greater community.

Long-term plans

Keep it fresh so that each new group of students gets to be involved in contributing in some way in order to maintain the project's momentum. For example, one project at a high school involved building a state-of-the-art greenhouse. The work, including fundraising, was student led and engaged many community members who volunteered their time to help build the greenhouse. It was a successful project and is a great feature of the schoolyard; however, now it is complete (See Appendix D for a description). To maintain engagement, other projects are continuously undertaken by different students, such as building exterior, raised-beds around the greenhouse, installing an aquaponics system inside of it, and designing and building custom shelving. Another way to achieve ongoing additions or projects for students is to do them annually, such as building arches out of sticks and growing pole beans on them to create a shaded tunnel.

Chapter 5 School Garden Design Guidelines

The results and analysis presented in the previous chapter show that school gardens range from simple to complex and require numerous considerations in their planning, design, and on-going maintenance. This chapter will outline a set of guidelines to aid landscape architects and school garden stakeholders in designing multipurpose, inclusive, community-engaged school food gardens that meet the needs of the primary users as well as the greater community. The guidelines are presented in eight categories following the framework presented in the last chapter as follows: visioning and goals, planning and design process, practical considerations, users and accessibility, garden features, plant selection, management and maintenance, and evolution and longevity. There are 52 guidelines in all.

5.1 Visioning and Goals

- **Use the goals and objectives** of the project to guide the design.
- **Cultivate a spirit of learning.** Every step of the project is a learning opportunity.
- **Start small,** but not too small. The project needs to generate momentum, so build it in stages.
- **Create a special sense of place**. The garden is a unique classroom for the school and community.
- **Reflect local conditions.** The garden design should be an expression of the local built, natural, historic and cultural conditions, and reflect the interests of its participants. This might mean growing heirloom varieties of vegetables at a 100

year-old school site; planting culturally-appropriate food plants; using a fence style that matches the surrounding residential neighbourhood; or using plants that are native to the region.

- **Design for the garden to be a teaching environment.** Growing food to donate or for the cafeteria may be a goal of the project; however, do not lose sight of the most important one – school gardens are teaching tools, and educating students should be the top priority. It should be noted that these secondary goals, mentioned above, may be integrated into the learning outcomes especially in a high school setting where students may be learning production and management processes.

5.2 Planning and Design Process

- **Use a participatory and inclusive design process**. Involve all future users of the site, especially the students, to develop outdoor-classroom design principles with stakeholders.
- **Develop a master plan drawing** for the project to use as a communication tool.
- **Employ a responsive design strategy** so that the project can adapt and change with shifting conditions, particularly through phasing. This means building the garden in stages.

5.3 Practical Considerations

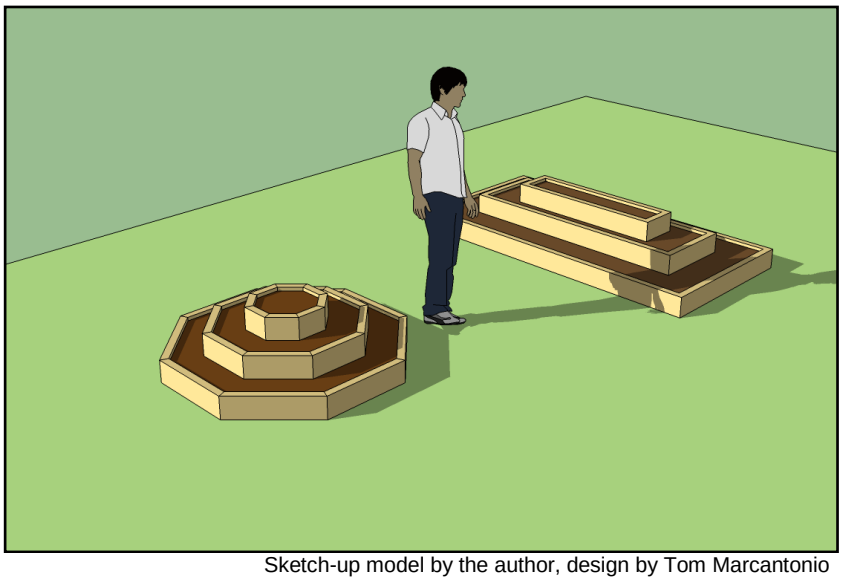
- **Confirm water access.** Water access is essential for irrigation, so it is important to ensure the garden is located close to a water source and confirm ongoing access with the owner (if it is not the school board).
- **Conduct a shade study and test the soil.** Sunlight and soil are absolutely necessary requirements. Soil can be amended or imported; however, sunlight cannot. Choose a site with 6-8 hours of direct sunlight.
- **Do not be deterred by the fear of vandalism.** Even if vandalism is an existing problem at the site, it need not be a deterrent. There are multiple ways of addressing the issue; animating and using the space are the most effective. Developing a sense of ownership amongst the students and greater community is also important. Painting murals on walls will deter tagging. Signage and fencing are other strategies.
- **Select the best location for visibility and accessibility.** Site selection is one of the most important design decisions. Visibility is important for both safety reasons and community awareness, and accessibility is important for ease of use and for maximizing and diversifying users.
- **Think about wildlife.** Existing wildlife may contribute to learning opportunities, but may also cause damage to the garden; develop ways to attract beneficial wildlife and deter pests. Fences may need to be used in case of deer and rabbits.
- **Consider other existing conditions.** Additional considerations include wind protection, drainage, traffic, existing vegetation, and built structures.

5.4 Garden Elements

- **Choose the best garden bed style for the site.** This might include in-ground, framed raised-beds, planters and containers or a combination of garden bed styles. In-ground gardens are an option when soil conditions are good. Choose framed raised-beds when existing soil is poor or the only space available is paved with asphalt or concrete. Others reasons to use framed raised-beds include: improving soil fertility and/or drainage, raising the soil and plants to a comfortable reach for people who cannot garden easily at ground level, to create a neat and aesthetic garden, to communicate a clear sense of where the garden starts and stops, and, in regions with cool wet spring weather, to allow soil to drain and warm more quickly allowing for earlier planting. The size and height of the beds should be based on the needs of the users. Use containers to pilot a gardening program or if there is little to no garden space. Containers may also be used to demonstrate gardening in small spaces or for experiments. Common containers are clay and plastic pots, and large wooden or plastic barrels. Buckets can be used to create an indoor/outdoor garden by growing plants in buckets with handles, or pots with wheels, and moving them indoors at night; be sure to create drainage holes if there are none.
- **Size and shape the beds to suit the users and the site.** Size and shape the beds according to space available, age range of students, number of students using each bed, and desired width of walkways. Planting beds should be 3-feet wide for young children and up to 4-feet wide for older children. This allows them

to be worked from both sides without students needing to step into the growing area where plants may get damaged and soil compacted.

- **Have a demonstration bed** such as a tiered raised-bed that the entire class can gather around for instruction and discussion (See Figure 8). For a description and discussion of the octogarden and tiered garden beds shown below see Appendix E.



Sketch-up model by the author, design by Tom Marcantonio

Figure 8. Tiered garden beds

- **Orient the plots for maximum sun.** If possible, orient plots along a north-south axis, with the longest sides running from north to south, to give plants maximum exposure to the sun and minimize shading problems.
- **Delineate the garden beds.** Edge treatments around in-ground beds are important for younger and new gardeners; these treatments delineate the beds

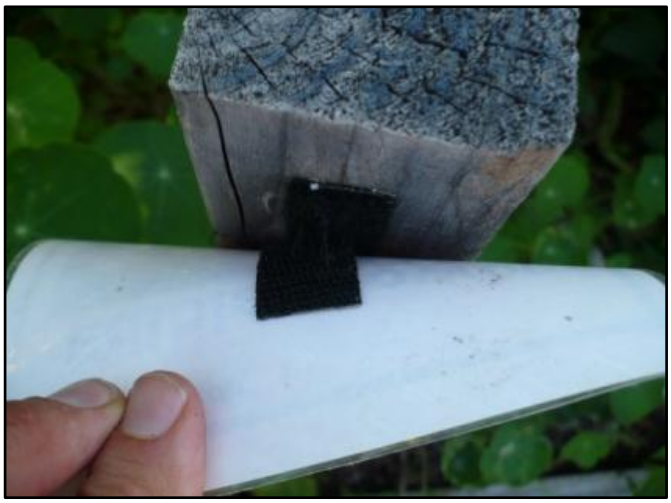
and clearly mark where the pathways are so that users know where to walk and where not to step.

- **Design a hierarchical pathway system.** Pathways to and from the garden and around the garden features help communicate where to walk and shape the space. In a learning garden, pathways should be wide enough to accommodate groups of students. A width of 6 feet for centre paths and 3 to 4 feet for lateral ones is a good guideline.
- **Include space for composting.** Making and using compost is an excellent way to demonstrate the cycle of growth and decay found in nature and to both reduce waste generated by the school and create fertile soil for the garden. Plan where the composting area will go even if it will be a later addition. Composting requires regular maintenance to function properly and should be located where it will be easy to maintain, close to a hose, close to your gardens where it will be used, in a space with good drainage, and out of the way of active play zones. Provide instructional signage and maintenance schedules to help with management.
- **Consider vermiculture.** An alternative to an outdoor composting system is vermiculture. Having a well-managed worm bin can create great compost, can be done indoors year-round, requires little space, and is more accessible for those without access to an outside composter.
- **Plan for tool storage.** Tool storage, often in the form of a garden shed, is an important feature to include in a garden plan. It provides a safe place to keep tools and supplies, and allows easy access to tools and equipment for volunteers and other groups using the site over the summer. The garden shed can be easily

made into a multifunctional structure, as the roof can be used to demonstrate rain harvesting or green roofs, and walls can house murals, signs, or white boards for class instruction.

- **Think about sun and rain protection.** A shade structure or shelter where classes can meet is important, depending on available resources. Existing mature deciduous trees can provide excellent shade, so a structure may not be required. However, a tree should not be considered shelter from rain or lightning.
- **Include space for gathering.** It is important to have a gathering area. This may be a formal outdoor classroom or an informal open space. Having both a sheltered space and an open sunny space would be ideal with either permanent or moveable seating. This can also be used as flex space where fold-up tables can be set up for workshops, celebrations, and other events.
- **Provide seating.** A grassy area near the garden, logs, large stones, straw bales, benches, picnic tables and wide garden-frame edges are all great options. Moveable seating that can be put away after use is an alternative if vandalism is an issue and for flexibility.
- **Collect rain water.** Rainwater harvesting is a beneficial addition to the garden and a great learning opportunity; put systems in place to make sure it is cared for, such as instructional signage.
- **Use signage to communicate.** Signage can give the site an identity within the school; let neighbours know what the new addition is all about; identify the garden as an outdoor learning area; announce times the garden is open; provide rules and guidelines for using the space; and display a contact number to call

with questions and concerns or to report vandalism. Shed walls and fences can be used to post signs and students can participate in making and painting them. Instructional signage can contribute to the learning environment and help new users navigate the space and understand how things like compost and rain barrels work and need to be maintained. A useful method is to have permanent wooden posts with laminated signs affixed with Velcro (See Figure 9).



Source: www.lifelab.org

Figure 9. Removable Velcro Sign

- **Allow space for art projects.** Art in the form of sculpture, murals, and mosaics add colour and beauty to the garden.
- **Collaborate with technical classes.** Technical classes can help design and build sheds, benches, wildlife houses, trellising and other garden features.
- **Use fencing strategically.** The use of fencing to demarcate the garden need not look prison-like nor fully enclosed. Use new or existing fences as trellising for

plants or as a venue for displaying artwork, to create a sense of enclosure, to mitigate views of and/or noise from traffic or parking areas, and to keep out unwanted dogs, wildlife, or stray balls.

- **Create an entrance feature.** Even if the garden is not fenced it can still have an entrance feature. An aesthetic and eye-catching entrance can attract people to the garden, and be a meeting area and place to post information and garden schedules. Use an arbor or other structure; create a living archway with small shrubs, trees and vines growing around an entrance structure. It can have a large reception area where bulk materials such as mulch and compost may be unloaded, and can provide instructional space where students receive information before entering the main garden.
- **Carefully consider the addition of livestock.** Animals are a great addition, but need full-time care. For many students in urban areas, having animals on school grounds may be their only interaction with animals typically found on a farm. Animals can provide a number of natural learning experiences, but their health and wellbeing should be paramount.
- **Leave room for future additions and projects.** Additional garden features that can enhance the food garden include an edible native plant garden, a food forest, a sensory garden, habitat gardens, pollinator gardens, butterfly gardens, and cut-flowers. Other learning features to consider include a human sundial, weather station, harvest area, and outdoor kitchen and dining area.
- **Create a balance between permanent and temporary features.** Permanent structures such as raised-garden beds, gazebos, pergolas and greenhouses

need to be thoughtfully placed, whereas moveable features can be more easily relocated or removed. Moveable and temporary features allow for flexibility and change; this also leaves space for experimentation and innovation. Annual vegetable beds are an example of flexible space; every year they can be planted differently, thereby giving new students the opportunity to help design them. Other examples include creating a living tunnel or tripod out of climbing plants like pole beans, or an enclosure with giant sunflowers. Seasonal features such as these may be recreated every year with a new group of students.

5.5 Users and Accessibility

- **Enable access.** Consider enabling features, such as the height of garden beds, wheelchair and scooter access, pathway width and treatment, and seating to accommodate students with mobility challenges. Promote gardening with elders, grandparents, and local seniors. Pathways that are wheelchair accessible will also accommodate wheelbarrows, garden carts, and strollers. Pathways that are level or have less than a 5% slope and are paved or made out of crushed stone screenings will be wheelchair accessible.
- **Provide space.** Make sure there is enough room for all the students in a class to gather around at least one of the garden beds for instructional purposes.
- **Think about scale.** Adults and children tend to see the world differently; adults see the big picture, while children are much more attentive to details. Think about how children of different ages and heights see and where their gaze falls.

5.6 Plant Selection

- **Consult local resources.** Research plants that grow in the region and contact local horticultural clubs, nurseries, or conservation authorities for more information.
- **Choose plants based on the goals of the project.** Depending on the climate and on site conditions these may include common annual vegetables, heritage varieties, culturally-appropriate vegetables, herbs, annual flowers, edible flowers, perennial vegetables, berry shrubs and vines, fruit trees, grains, native plants, pollinator and habitat plantings, and sensory gardens. Vegetable selection may also be based on how the garden will be managed over the summer; what grows well in that particular garden; what students like; lessons learned from previous seasons; experimenting with new and unusual varieties (to the students and community); choosing food plants linked to the cultural cuisines of users; choosing vegetables not readily available at the grocery store; growing heritage varieties; and based on the needs of cooking classes or cafeterias.
- **Consider other edible plants.** For example, perennials such as asparagus, rhubarb, and strawberries, or fruit bearing plants such as blueberries, raspberries, currants, or haskap berries, or fruit trees such as apple and pear trees. Develop a management plan to ensure they become well-established and properly cared for over the years.
- **Experiment.** Planting annual vegetables and flowers every year is a chance to apply lessons learned from previous seasons and also to try new things.

5.7 Management and Maintenance

- **Design with a feasible management plan in mind.** Management of the garden is a consideration that needs to be addressed during the design process; the success of the garden will depend on good design and appropriate maintenance. Design decisions that may help to ease garden maintenance and management include site and plant selection, materials used, how the garden will be watered, and signage. Ways to manage the garden include scheduling class use of the garden and other spaces such as outdoor classrooms; posting garden maintenance tasks; creating a day-by-day garden calendar to record gardening responsibilities; developing a work schedule for volunteers; scheduling gardening days; planning a holiday and summer maintenance program; and creating a supply-ordering system.
- **Include a kiosk or bulletin board** in the design of the garden to post schedules, garden tasks and other information.
- **Design based on capacity and resources.** Think about how the garden will be tended and maintained before it is built. Make sure there are available resources for it to be properly managed; this includes consideration of seasonality, funding, equipment and labour. Base design on how many people are available to help with maintenance and what their skills are.
- **Build systems that will help with maintenance.** It may be easier to get funding for physical items than for wages, and it can be easier to get volunteers to help with building than with regular hand watering, so installing an irrigation system could be a good option. While the task of watering can provide an educational

opportunity for students, the challenges with dependable irrigating, at the right time and with the right amount, override this opportunity. An irrigation system is a vital addition that allows for consistent and efficient watering when no volunteers are available. It can be turned off if teachers or facilitators want to use watering as an activity.

- **Have a summer management strategy** and a back-up. Some examples of successful summer management strategies include having summer programs, gardening clubs, and/or other community groups take over garden maintenance and programming; having a designated garden coordinator to organize volunteers and scheduling; having community members oversee the school plots in a hybrid garden; and hiring summer students to maintain the garden.

5.8 Evolution and Longevity

- **Let the garden evolve.** Creating and running a garden program is an evolving process. Working in the garden space over time will provide feedback about what works and what does not, and improvements can be made over time. Develop a process that allows the program to be re-evaluated on a regular basis.
- **Establish a legacy.** Creating a sense of permanence so that the program is highly valued by the school and the greater community is a way to prolong its life span. Physical structures like greenhouses, pergolas, and entranceways are examples of landmarks that help to do this. Permanence can also take the form of buy-in, a sense of ownership, and pride among students, faculty, parents, administration and the greater community.

- **Consider a hybrid garden model.** Community member plots on the site help to animate the space and engage the greater community. Before adopting this model, make sure that there is interest from a population of residents who want to garden but do not have a place to do so.
- **Keep it fresh.** To maintain engagement, each new group of students needs to be involved in contributing in a meaningful way.

Table 14 summarizes the proposed school garden design guidelines into a checklist:

Table 14. Design Guideline Checklist

Category	#	Guideline	
Visioning and Goals	1	Use the goals and objectives of the project to guide the design	
	2	Cultivate a spirit of learning	
	3	Start small, but not too small	
	4	Create a special sense of place	
	5	Reflect local conditions	
	6	Design for the garden to be a teaching environment	
Planning and Design Process	7	Use a participatory and inclusive design process	
	8	Develop a master plan drawing	
	9	Employ a responsive design strategy	
Practical Considerations	10	Confirm water access	
	11	Conduct a shade study and test the soil	
	12	Do not be deterred by the fear of vandalism	
	13	Select the best location for visibility and accessibility	
	14	Think about wildlife	
	15	Consider other existing conditions	
Garden Elements	16	Choose the best garden bed style for the site	
	17	Size and shape the beds to suit the users and the site	
	18	Have a demonstration bed	
	19	Orient the plots for maximum sun	
	20	Delineate the garden beds	
	21	Consider a hybrid garden model	
	22	Design a hierarchical pathway system	
	23	Include space for composting	
	24	Consider vermiculture	
	25	Plan for tool storage	
	26	Think about sun and rain protection	
	27	Include space for gathering	
	28	Provide seating	
	29	Collect rain water	
	30	Use signage to communicate	
	31	Allow space for art projects	
	32	Collaborate with technical classes	
	33	Use fencing strategically	
	34	Create an entrance feature	
	35	Carefully consider the addition of livestock	
	36	Leave room for future additions and projects	
	37	Create a balance between permanent and temporary features	
Uses, Users and Accessibility	38	Enable access	
	39	Provide space	
	40	Think about scale	
Plant Selection	41	Consult local resources	
	42	Choose plants based on the goals of the project	
	43	Consider other edible plants	
	44	Experiment	
Management and Maintenance	45	Design with a feasible management plan in mind	
	46	Include a kiosk or bulletin board	
	47	Design based on capacity and resources	
	48	Build systems that will help with maintenance	
	49	Have a summer management strategy and a back-up	
Evolution and Longevity	50	Let the garden evolve	
	51	Establish a legacy	
	52	Keep it fresh	

Chapter 6 Discussion

6.1 The Right Fit

By arranging the garden elements with functional and aesthetic purposes in mind, a well thought out design can go a long way towards creating a rich learning environment for the students. The proposed guidelines presented in the preceding chapter are intended to facilitate this process; however, a well-designed site cannot, in and of itself, address the myriad of potential obstacles faced by many school garden projects. Though the literature review presented well-supported evidence of the efficacy of using gardens as an educational tool, it should be noted that it does not mean they are necessarily desirable additions at every school. School garden projects should be carefully considered, and established when the fit is right for the school and the surrounding community. Only then will good design elevate the project.

6.2 Landscape Architects and School Garden Design

Landscape architects are uniquely positioned to help elevate school garden projects by contributing their expertise during the design and planning stages. Specifically, landscape architects can apply their abilities of conducting site inventory and analysis, spatial design, facilitation skills, and experience in balancing environmental, economic and social needs while designing outdoor spaces. Having a landscape architect at the design table will go a long way to creating a strong design and implementation plan. Landscape architects can also create a master plan drawing that will be a useful communication tool for the project that can also be helpful for fundraising.

6.3 Long Term Sustainability

Unfortunately, the potential for instability is a very real threat to school garden projects, especially when the success and momentum of the project rests upon one person or one small group. That is why even seemingly successful projects can eventually fail. For example, many projects suffer when the lead teacher leaves the school and there is no one else to run the garden. For this reason, having multiple layers of engagement and increasing the multifunctionality of the site, and therefore its use, are strategies for success. "The beauty of this system is that when one user group becomes inactive, the others will continue to support the project" (Bucklin-Sporer & Pringle, 2010, p.49). KI-C offered the following, similar, advice:

> It takes a lot longer than maybe you think it should… because it's such a collaborative process, but that's really important because there's so many people that could potentially be using a garden space like this at a school. It's important to involve them all from the start to make sure that everybody's ideas are heard and considered… it really makes the project stronger… Having partners makes the project that much more sustainable in the long run, working in the school setting specifically, there tends to be a fair bit of turnover from school to school, depending on the district and how they like to do things, they like to rotate and shuffle principals around quite a bit. Having a program or plan in place that makes it sustainable past the person who initiated it, so it's not all resting on one person's shoulder's, so it's easy for the next or new principal, or the new teacher, or the new grounds keeper to… step in and understand where you came from and where you're going, so that it's ultimately sustainable.

Being aware of the social, political, and cultural milieu is another way to increase the longevity of a school garden project. Every Key Informant interviewed reported having either experienced or observed barriers and challenges such as a lack of community engagement, political pressure, policy hurdles, or competition for funds. For example, a

very successful school garden project that had engaged the students and was becoming economically sustainable ran into a road block when a local businessperson with political clout claimed to be economically threatened by the garden organizers' fundraising efforts. As of the writing of this paper, the future of that project is uncertain.

6.4 Effectiveness of the Research Process

Overall, the research process used to develop the school garden design guidelines presented in this document proved to be effective. It could possibly have been improved upon by visiting the school garden sites. Conducting observations along with recording the layout of existing school gardens via photographs and layout sketches would have added another layer of data and potential for comparison. However, given the limitations of time and resources, the methods used provided adequate information to develop the guidelines.

6.5 Future Research

A future step beyond the work presented here will be to apply and test the proposed design guidelines in order to evaluate their efficacy and to refine them. Future research could include applying the guidelines to the design of one or more school garden sites. A second area for future research could be to look at specific garden bed designs. The various garden bed designs in use, as reported by the KIs, as well as those recommended in the manuals, could be studied with a focus on assessing how well they

work in teaching situations. Improving the capacity of groups and organizations that are attempting to network and share resources and ideas among school garden projects is a third future area for research.

6.6 Promotion of School Gardens in Canada

The School Garden Network has had no new entries since the author's first visit to the site in November of 2013, whereas the number of Canadian garden classroom profiles listed on the Edible Schoolyard Project site has increased from 71 to 98. This may be an indication of the former network being less active, or possibly entirely inactive. Based on several key informant interviews, there seems to be a need for school garden projects to connect, share resources, and help promote the school garden movement in Canada in a more consolidated manner. Online networks like the two mentioned above are attempting to do that; however, the one with the most potential to connect projects within Canada still only has 29 profiles, a tally smaller than the number of school gardens in the Greater Toronto Area (GTA) alone. The Imagine a Garden in Every School Campaign (www.agardenineveryschool.ca) has mapped 33 in the GTA and 58 in total, all in Southern Ontario, and Sustain Ontario recently released the Ontario Edible Education Network Action Plan, so the potential to connect school gardening projects and promote the benefits of garden-based learning is increasing. This is especially important for projects in both smaller and more isolated communities, where theirs is the only school garden in the area. For example, KI-I said:

> Being open to different ideas and networking with people is also very beneficial… when we were starting it was very challenging for us to find

> people close to us who had done this. We found that we had to network with people who were quite far away from us.

Networking and sharing of ideas and resources, including sharing design guidelines such as proposed here, has the potential to strengthen and promote school gardening in Canada.

Chapter 7 Conclusion

The aim of the study presented in this thesis was to create site design guidelines for multipurpose, inclusive, community-engaged school food gardens that would meet the needs of the primary users as well as the greater community. Data pertaining to the development, implementation, and use of school gardens from academic and grey literature and key informant interviews was assembled and analysed. The synthesis of that data was developed into a set of design guidelines for school gardens. These design guidelines will contribute to the school gardening movement by helping to enhance the functionality and use of these educational food landscapes.

These guidelines are not intended to be used alone. Rather, they are meant to complement the increasing number of valuable school garden resources that are becoming available. For example, school boards are beginning to develop garden policies that outline step-by-step directions and guidelines (For an example of the Vancouver School Board's policy visit www.vsb.bc.ca/district-policy/io-garden-policy). It is important to consult documents such as these as they describe specific policies that may affect some elements of the design, such as listing elements that are not allowed or illuminating safety concerns and other suggestions. Existing school garden projects can help shape these policies by becoming model examples.

There are many inspiring examples of school garden projects across Canada, such as those reported by the Key Informants in this study. The literature illustrates both the long history of gardening as an educational tool and the many benefits and motivations

driving the movement. The future looks promising for both existing and emerging school gardens and garden-based education as support continues to grow and foster their development. An increasing number of regionally specific resources (NSDA, 2011; Shields-Ramsay & Ramsay, 2011; Smith & Hamir, 2007), policies such as that of the Vancouver School Board, the work being done by national, provincial, and regional organizations such as Evergreen, Sustain Ontario, and the Society Promoting Environmental Conservation, along with research such as that presented here are helping to do that.

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Appendix A: Key Informant Interview Guide

1. Provide some introductory information about the school garden. Such as:

- The history of the garden
- When it was established
- Who initiated the project (i.e. teachers, parents, students)
- Who was involved in designing the garden
- The garden project vision statement, goals, and or objectives
- The reasons for starting the garden

2. Provide some information on garden users and uses. Such as:

- How many students use the garden
- What ages and/or grades use the garden
- What kinds of activities occur in the garden
- What subjects/lessons are taught in the garden
- Who else uses the garden (i.e. parents, community members, volunteers, seniors)?

3. **Describe the garden layout and design.** Such as:

- How large is the garden?
- Where is the garden located in relation to the school?
- What are some of the features of the garden? How and when are they used? Are there features that students are particularly drawn to?
- How does the garden function? What's working? What's not working?
- Are there areas that are used more frequently? Used less frequently?
- Are there any problem areas? Were there any issues or concerns that have been resolved?
- Does the garden site reflect the values or vision of the school, the students, and/or the community in any way?
- Were there any unanticipated outcomes, either positive or negative?
- How is the site designed to facilitate different user groups? Can everyone who wishes to use the garden access it? Are there features that make it accessible to users of different ages, sizes, and abilities?
- Are there publicly accessible areas versus for school use only? How is accessibility communicated (i.e. signage, fencing)?
- How has the garden changed over time?
- Can you provide a garden plan, map, or other images?

4. Describe any changes that are planned for the future. Such as:

- What are the long term plans for the garden?
- Are there any current plans, projects, or additions in the works?
- Is there a master plan or concept drawing?
- How much input do students have in making plans, changes or additions?
- Are there any obstacles to making desired changes?

5. Insights and Lessons Learned. Such as:

- What advice would you give to schools wanting to start or improve their garden?
- Have there been any accomplishments or achievements that standout?
- What would you change or do differently?
- What have you learned?

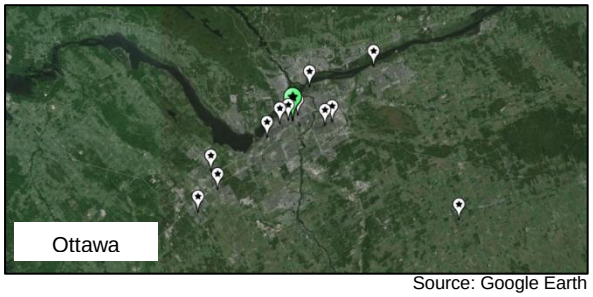
Appendix B: Garden Locations

Maps showing location of gardens listed in School Garden Scan nationwide, and in the Vancouver, Toronto, and Ottawa areas. Green icons represent location of gardens associated with key Informants.

Source: Google Earth

Source: Google Earth

Source: Google Earth



Source: Google Earth

Appendix C: Garden Ballot Sample

Blake School Garden

NEEDS YOUR VOTE!

Blake School is working to build a school food garden for school children and the community. A garden is a great way to teach and educate children about science, food and the environment.

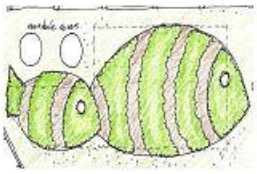
Benefits for your child:

- Exercise
- Help picky eaters & healthy eating habits
- Learning how food grows
- Learning about responsibility and caring for others

We need **parents/guardians** help to choose a garden design.

Please put a check (✓) under the design you like. Please return to your child's teacher by Friday March 4th, 2011.

Parents: ask your child(ren) what they are learning about the garden.



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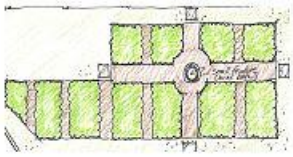

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Green= Planting Area
Brown = Path
Garden size:
9x 4 m (30x 13 feet)

Student Name: _____

Parent Signature: _____

Courtesy of South Riverdale Community Health Centre, Toronto, ON

Appendix D: Geodesic Greenhouse

The greenhouse is a state-of-the-art, low energy greenhouse that operates all year round. The students did a lot of research made connections with a group in Colorado based on research from the University of Manitoba in Winnipeg. The Colorado group took the plans from the university and made prototypes in the United States and they shared the plans with the high school students. The geodesic dome captures the radiation of the sun no matter where it is in the sky and is 70% more efficient. The fabrication classes designed custom some pie shaped shelving units for it.

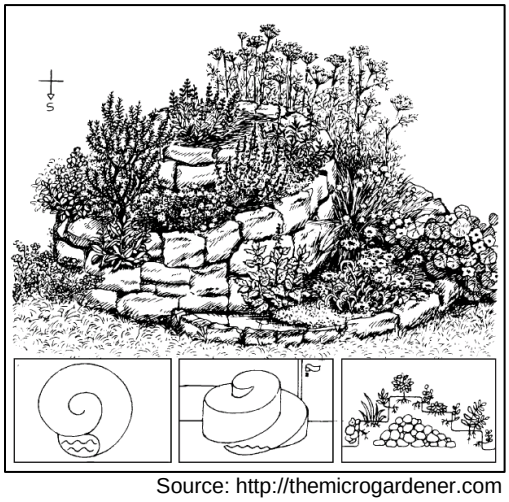
Image courtesy of Steven Schultz

The greenhouse has seven features that make it unique:

1. The polycarbonate panels are UV protected, extremely strong (can withstand 500lbs/sq ft pressure), hail will not damage them, they have up to an R5 rating, which means high insulation value, but still allow 70% of the solar radiation to shine through.
2. A large tank of water acts as a thermal mass and regulates the temperature inside the greenhouse so it doesn't get too hot or too cold.
3. A sub terrestrial heating and cooling system which draws moist warm air underground, especially on the warm winter days, then circulates the warm air back into the greenhouse in the evenings using fans.
4. The North side of the greenhouse has a reflex covering that is basically an insulated sheet with aluminum on it, so in the winter when the sun is really low, instead of letting the solar radiation and the light bounce escape it hits that reflex covering and is directed back into the greenhouse.
5. The vents are controlled by pistons filled with bee's wax, an invention from Israel, where the vents open and close from the expansion and contraction of the beeswax.
6. All the electrical systems are powered by solar panels.
7. The greenhouse is insulated with Styrofoam in the walls but it also goes 6 feet vertically underground and 6 feet horizontally to keep the frost out.

Appendix E: Garden Bed Designs

The tiered-garden beds were designed by Tom Marcantonio. The octogarden design is based on a permaculture spiral. A permaculture organization had built several of this style of garden on school grounds out of repurposed bricks, unfortunately some bricks were removed and used maliciously. That is the reason Tom came up with the octogarden; to recreate the spiral without loose parts. According to Tom, a little octagarden that has an approximately 5-foot base diameter has numerous growing conditions. For example, the top is warmer and drier so that is where in a traditional permaculture spiral the rosemary is planted. The design is also modifiable as two of the sides can be lengthened. Other benefits of the design include: the built frames are easy to transport, not a lot of materials are required; and the bottom centre of the tier can be filled with rough material, saving the topsoil for the garden. Below is an image of a permaculture spiral on the left and an octogarden on the right.



Source: http://themicrogardener.com

Image courtesy of Tom Marcantonio

Tom also has come up with a standard garden width of 36-inch wide for it to not get stepped on. He also recommends raised-beds for everybody and 20-inch pathways for the feeder pathways and 3 to 4 feet for the main centre paths. If you already have a 4-foot wide framed-raised bed he recommends putting a 32-inch wide frame on top of it and then a 24-inch wide frame, followed by a 12-inch wide frame on the top; like a wedding cake.