

Sprouting School Gardens:
Assessing the Development and Sustainable Use of School Gardens in Victoria

by

Aaren Topley

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Abstract

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School gardens are a place to increase food literacy and food system education, empowering students to take control over their own health and food system. The core components of sustainable school gardens use have been identified within the literature. This study aimed to describe school gardens in School District 61 (SD61) on South Vancouver Island and explore what school stakeholders identified as important to supporting their school garden and what elements of sustainable garden integration were present. To address these questions a school garden survey and observation tool was adapted by a stakeholder group from existing instruments and administered to 24 schools in SD61. Sixteen schools completed the survey (response rate of 64%), and there were 22 garden observations conducted. Descriptive statistics were used to explore the data. The analysis showed that professional development, volunteerism, school garden irrigation, courses that allow teachers and students regular time in the garden, District policy were the weakest supported areas for school gardens, while educational material, administration buy-in, garden committee, networks, technical assistance, and garden upkeep were the highest supported areas. Overall, SD61 could offer further organizational and physical infrastructure, resources, and support to strengthen the institutionalization of gardens. Further research is required, specifically on the surveying, monitoring and evaluation of gardens in order to make continued adjustments to program delivery to ensure their use and longevity.

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Chapter 1: Introduction

Food is not only essential for life and health, it also allows people to express their cultures and values, brings people together, and creates social relationships (Vidgen, 2016). Furthermore, the complex relationship individuals have with their food system is growing and changing in a globalized society (Koc et al., 2012). The simple “act of feeding oneself and others embodies our sovereignty, ownership and empowerment” as societies (Public Interest Civil Society Organizations, 2014, p.1). Since food has a regular role in society and the well-being of people and communities, an understanding of how we educate youth on where their food comes from, how to grow it, and how to evaluate the quality of their food options is a step towards creating healthier citizens (Public Interest Civil Society Organizations, 2014; Vidgen, 2016).

School environments allow for prolonged and extensive explorations into health promoting practices with youth, a factor which can play a role in student development and increase their food literacy (Fox, Cooper, & McKenna, 2004; Story, 1999). Food literacy, which can be strengthened through education, is a component in healthy school environments (Vidgen, 2016). As defined by Vidgen (2016), food literacy is the

inter-related knowledge, skills and behaviours required to plan, manage, select, prepare and eat foods to meet needs and determine food intake.

Food literacy is the scaffolding that empowers individuals, households, communities or nations to protect diet quality through change and support dietary resilience overtime (p.63).

The skills described by Vidgen can be extended beyond cooking to include growing food (Vidgen, 2016). School gardens and cooking programs are two opportunities within the

school setting to develop students' healthy relationship with food and the food system (Powell & Wittman, 2017; Vidgen, 2016).

As a broad concept, food literacy can complement models such as Comprehensive School Health. The Comprehensive School Health model has four domains that promote student and school health; 1) social and physical environments, 2) teaching and learning, 3) policy, and 4) partnerships and services (Joint Consortium for School Health, n.d.; Veugelers & Schwartz, 2010). By interweaving the Comprehensive School Health model with practices that promote food literacy, schools have the audience and teaching structure to create healthy school food environments (Vidgen, 2016).

If integrated into the school setting, school gardens can offer benefits to students. The school garden is a place that allows for the connection of health promoting practices within a comprehensive school health model (social and physical environments), while increasing students' food literacy (teaching and learning). Experts suggested that the benefits of school gardens include: promoting student interest in their food system, increasing their willingness to eat fruits vegetables, strengthening academic performance and time spent on a task, overall classroom behaviour, and increasing students' creativity and attitudes towards learning (Berezowitz, Bontrage Yoder, & Schoeller, 2015; Morris & Zidenberg-Cherr, 2002; Ohly et al., 2016; Ozer, 2007; Powell & Wittman, 2017).

With the potential benefits of school gardens well-articulated there are studies currently emerging about those benefits (Ohly et al., 2016; Ozer, 2007). However, the literature is also emerging that suggests a focus on school garden integration and sustainability in order to maximize those benefits and reach more students. Researchers have already identified a need for more research on the benefits of school gardens,

specifically for study design and reporting to be strengthened (Ohly et al., 2016; Ozer, 2007). In order to facilitate achieving the benefits of school gardens and sustain school gardens across generations of students, schools and school districts need to understand the current school garden infrastructure and environment, including promising policies and practices to sustaining the long term viability or increased use of the gardens. This information will support school garden planning and implementation and potentially their sustained use.

To understand the current infrastructure and environments of school gardens, researchers have conducted studies and developed auditing tools to measure if school gardens have the necessary resources, support, organizational and physical infrastructure, and positive teacher and student experiences to be fully integrated and sustained in the school setting (Black et al., 2015; Boyer, McFarland, Zajicek, & Waliczek, 2011; Burt, Koch, & Contento, 2017; Hazzard, Moreno, Beall, & Zidenberg-Cherr, 2011, 2012; Ozer, 2007; Skinner & Chi, 2012; Summers, 2013). They also offered insight into the core components required to institutionalize school gardens into the school setting. These studies have presented core components necessary to garden integration (a concept similar to institutionalization) including: resources, support, organizational and physical infrastructure, and teacher and student experiences. These core components help to make the garden a learning place for creating meaningful student experiences. The garden becomes a space that is part of the school culture and sustained for future generations of students to enjoy and partake in (Burt et al., 2017). These components and the data collection tools associated with them create a framework through which to evaluate the implementation and integration of school gardens in different contexts.

Understanding how these core components support the integration of school gardens into the school setting and then turning them into action for long term sustainability requires knowledge translation. Knowledge translation is a term used to describe the translation of academic research into tangible community action (Straus, Tetroe, & Graham, 2009). Knowledge translation and exchange relies on on-going relationships and mutual engagement in activities across research, policy and practice partners (Field, Booth, Ilott, & Gerrish, 2014). Ongoing relationships among Island Health, School District 61 (SD61) and food related stakeholders in Victoria BC provided such a vehicle for turning school garden research into action.

School District 61 is located on the southernmost tip of Vancouver Island British Columbia, on the territory of the Lekwungen speaking people from Songhees and Esquimalt Nation. The catchment boundaries of SD61 are in an urban setting covering six municipalities, (Esquimalt, Oak Bay, Victoria, View Royal and a portion of Saanich and Highlands). These municipalities are situated within an entity called the Capital Region. One in every six children in the Capital Region lives in poverty (Sparc BC, 2017). In 2017 SD61 had 27 elementary schools (Kindergarten to Grade Five), 10 middle schools (grades six to eight), and seven secondary schools (grades nine to 12). There was an enrollment of 20,002 students. Of these students, more than 1,000 were international students, 1,617 identify as aboriginal and 2,202 were students with some type of disability (ie. sensory, learning physical). SD61 was selected for this study due to pre-established relationships with the district and community, the size of the school district and the estimated amount of schools with a garden.

School District 61 (SD61), has long had school gardens. The picture of what was

happening in school gardens across SD61 was piecemeal; there was no regular auditing or central data collection about school gardens; what schools had them, what they looked like, and how they were integrated into the school setting. In 2016, SD61, Island Health, community stakeholders (Farm to School BC and Capital Region Food and Agriculture Initiative Roundtable), and the University of Victoria came together to explore how their organizations could individually and collectively support school gardens. Through this collaboration, an Action Research Team was created. In order to support school gardens, the Action Research Team needed to understand what was happening in the District with regards to school gardens. With an understanding of Comprehensive School Health and the desire to enhance implementation and sustainability they decided to explore what were the sustainable components (infrastructure, environments and processes) present with SD61 gardens to gain a better understanding of how community partners could work with the district and their schools to support the development, implementation and maintenance of school gardens for future generations of students.

Purpose

To explore school garden implementation and sustainability components in School District 61.

Research Question

- 1) What school infrastructure, environments (teacher, parent, principal buy-in, community stakeholders) and processes (roles and responsibilities, garden maintenance, student engagement, curriculum integration, school/community engagement) exist in School District 61 related to school gardens?

2) What core components of sustainable school gardens are present in District 61 gardens?

Operational Definitions

School garden:

Any space on school property “which can be used mainly for learning purposes but could also generate some food and income for the school. Gardening projects in schools give... school children the opportunity to grow and harvest their own fruit and vegetables” (Food and Agriculture Organization of the United Nations, 2004; Huys et al., 2017)

School Garden Champion:

An individual or group that manages, maintains, or coordinates the school garden. They have an in-depth understanding of how the school garden operates. Normally, this person is a teacher or staff member but could be a parent or community member.

Sustainable School Garden:

A sustainable school garden has coordination and maintenance of the garden and a positive orientation to learning and institutional change that ensures the attainment of, and continued satisfaction with, the school’s garden for present and future generations (FAO, 1989). Key components of sustainability include: resources, support, organization and physical school garden infrastructure and school-community engagement (Boyer et al., 2011; Brown, O’ Keefe, & Paige, 2017; Bucher, 2017; Burt et al., 2017; Hazzard et al., 2011, 2012; Linnell et al., 2016; Moore, Wilson, Kelly-Richards, & Marston, 2015; Robertson, Krugly-Smolska, & Krugly - Smolska, 1997; Skinner & Chi, 2012; Summers, 2013; Turner et al., 2017; Turner, Eliason, Sandoval, & Chaloupka, 2016).

Chapter 2: Literature Review

This review of relevant literature contextualizes the role food plays in today's society, situating food as a mechanism for empowering individuals and communities to take control of their health and food systems (Desmarais & Wittman, 2014; Koc et al., 2012). Health-promoting strategies and interventions can empower people and communities to engage in their health and food system (Fox et al., 2004; Public Interest Civil Society Organizations, 2014). Within this study, strategies are viewed as an overarching plan to meet a major goal, while interventions are programs, people or processes that help address an issue in order to meet the goal of the strategy.

The school setting is an area that allows for prolonged and extensive exposure to health-promoting strategies and interventions. Comprehensive School Health is used as a framework that supports these strategies and helps to integrate interventions into practice (Veugelers & Schwartz, 2010). When integrated with food literacy, school gardens become a potential health-promoting strategy. The review will argue that school gardens link student empowerment, food literacy, and health outcomes through hands-on, inquiry-based learning. After elucidating the role school gardens have in a school setting and society, literature on how to sustain school gardens for future generations of students is introduced identifying domains and components for garden institutionalization. Finally, the literature review will conclude by presenting insights into how to measure garden activity to promote promising school garden practices, in order to understand the sustainable components (infrastructure, environments and processes) in SD61 school gardens.

Food and Society

Before we explore school health models, school gardens and their benefits and institutionalization of school gardens, we need to first understand the definition of food and its part in today's society. In a globalized world, the human relationship with the food system is complex and ever-changing (Lang & Heasman, 2015). In preparation for the Second International Congress on Nutrition, the Public Civil Society Organization (2014) presented a vision statement on nutrition that states:

It is our common understanding that food is the expression of values, culture, social relations and people's self-determination, and that the act of feeding oneself and others embodies our sovereignty, ownership and empowerment. When nourishing oneself and eating with one's family, friends and community, we reaffirm our cultural identities, our ownership over our life course and our human dignity (p.2).

his statement symbolizes the reaches of food beyond nutrition and beyond three meals a day. Food is part of the fabric of our society, and the act of breaking bread creates commonality among citizens, communities, and societies (Koc et al., 2012).

Comprehensive School Health

Schools offer an opportunity for prolonged and extensive exposure to comprehensive health promotion strategies that have the ability to reach a broad socioeconomic and cultural spectrum of the population (Fox et al., 2004; Story, 1999). Children and youth spend 40 – 45% of their waking time in school, which allows a unique context for learning and behavioural modification (Fox et al., 2004; Storey et al., 2016). Psychosocial theories of health behaviour have enhanced our knowledge of how cognitive and social factors can positively influence human health and offer guidance on

how educational programs can promote behavioural change (Bandura, 1998; Nutbeam, 2000). These theories and research and educational philosophy serve as the foundation for the development of the comprehensive school health framework.

Comprehensive School Health (CSH) offers a framework that builds on supportive social and physical environments and empowers schools and students to practice healthy lifestyle behaviours (Lister-Sharp, Chapman, Stewart-Brown, & Sowden, 1999; Veugelers & Schwartz, 2010). The CSH model supports student and school health in four domains; 1) social and physical environments, 2) teaching and learning, 3) policy, and 4) partnerships and services (Storey et al., 2016; Veugelers & Schwartz, 2010). Using these four domains, schools are able to promote change in the school environment through localized autonomous decision making and the development of multi-level partnerships; all of which support the varied health promotion efforts that reflect the needs of individual schools (McKay et al., 2014). The philosophical underpinning of the education system itself, which is represented within the comprehensive school health framework, is empowerment. Brazilian educator Paulo Freire suggested that the purpose of education should be to empower and liberate people to become engaged citizens in a transforming world rather than teaching passive subjects to be complacent in the world of today (Freire, 1968).

With this in mind and guided by the comprehensive school health framework the school setting is a place where students can be empowered to take control over their own health by facilitating a relationship with their food through access and education as well as a connection with their food system through experiential learning (Carlsson & Williams, 2008). In terms of food as a practice in school, the school setting reaches

beyond direct curriculum instruction and can be a place where children and youth come together to eat and learn about their food system, as seen in different farm to school models (Farm to School BC, 2012; Powell & Wittman, 2017). Even though, many schools in Canada do not provide daily meals and the majority of students bring lunch from home (Henry, Allison, & Garcia, 2003; Tugault-Lafleur, Black, & Barr, 2017). Food that is offered in Canadian schools can occur as a lunch or breakfast program, at events and celebrations and even used to raise funds (Farm to School BC, 2012). Food is a part of our culture (Public Interest Civil Society Organizations, 2014), and should be seen as part of school culture.

Schools and teachers also have a direct role in food education through the curriculum. However, there is a broader CSH informed approach to food that addresses the physical, social and cultural environment, and opportunities for student engagement in food related activities. These activities can include growing and cooking food which can support teachers' ability to help students develop the necessary skills to support healthy eating behaviours. Therefore, through application of the principles and strategies of comprehensive school health the education system can empower students to take control of their own food and eating behaviour, which aligns with the ideals represented in the term food literacy (Lister-Sharp et al., 1999; Ohly et al., 2016).

Food Literacy

Food literacy has recently emerged as an area of interest in the academic literature. The term and the on-going debate about the definition and how it can shape public health practice started in 2001 with Koslasa, Peery, Harris & Shovelin (Vidgen, 2016). In more recent years, there have been two published literature reviews exploring

the term ‘food literacy’ (Cullen, Hatch, Martin, Higgins, & Sheppard, 2015; Vidgen, 2016). Cullen et al. defined food literacy as:

The ability of an individual to understand food in a way that they develop a positive relationship with it, including food skills and practices across the lifespan in order to navigate, engage, and participate within a complex food system. It’s the ability to make decisions to support the achievement of personal health and a sustainable food system considering environmental, social, economic, cultural, and political components (p.143).

This definition is comprised of several key elements; food skills, the concept that the human relationship to food expands beyond the present moment and into a lifetime of experiences of knowledge building, and that food choices have an impact on both the individual and larger more complex food systems. The definition focuses on the individual and places them at the centre as the agent for change. While individual agency is a part of behaviour change (Anderson, Winett, & Wojcik, 2007, Bandura, 1989), school systems are complex and social change thinking needs to reach beyond the individual and explore larger societal discourse and institutions that shape knowledge and skills, either positively or negatively.

Alternatively, Vidgen (2016) defines food literacy as a “collection of inter-related knowledge, skills and behaviours required to plan, manage, select, prepare and eat foods to meet needs and determine food intake. Food literacy is the scaffolding that empowers individuals, households, communities or nations to protect diet quality through change and support dietary resilience overtime” (Vidgen, 2016, p.63). Vidgen’s (2016) definition recognizes the individual’s agency, while simultaneously acknowledging that the act of

coming together as a household, community, or nation is empowering. The act of acquiring food through growing, harvesting, hunting, fishing, and foraging is absent from the aforementioned food literacy definitions, although it could be argued that this was implicit within the definitions.

The development of food literacy and its integration into the school curriculum incorporates growing and preserving food as one way in which schools have been able to empower students by providing hands-on learning including cooking, preserving, and growing their own food (Powell & Wittman, 2017). In the school setting this can be delivered through cooking clubs, home economic classes, nature walks, and school gardens, just to name a few. Through the combination of CSH practices, and food literacy concepts, school gardens can become a place for both health-promoting strategies and food literacy education. Therefore, understanding of the roles that school gardens may play in the school setting is important.

School Gardens

A school garden can provide the linkage between outdoor learning, inquiry-based experiential education, and food literacy education (Powell & Wittman, 2017; Vidgen, 2016) by providing the opportunity for hands-on learning. Furthermore, school health promotion interventions, like school gardens, that increase food knowledge and skills strengthen students' ability to perform healthier lifestyle practices, such as healthy food choices and healthy eating behaviours (Mikkelsen, 2014). By building students' food literacy, including gardening and related skills (planting, maintaining, harvesting, preserving) and supporting students to think critically about the food they consume while engaging in the garden, school garden education can provide them with the building

blocks to shape their food system and health by making educated choices (Cairns, 2017; Powell & Wittman, 2017).

There is a growing amount of evidence pointing to the benefits of school gardens. In 2007 Ozer conducted a literature review on the effects of school gardens on health and well-being of students as an outcome of school gardens engagement. The Ozer (2017) review is cited often; however, it is important to note that it was not a systematic review. Ozer (2007) highlighted that although there were a growing number of studies on benefits of school gardens that there was little peer-reviewed evidence of a direct correlation between school gardens and health. Even though the peer-reviewed evidence was emerging, Ozer's review emphasized a significant amount of anecdotal evidence on the learning outcomes, behavioural changes and life skills developed through school gardens (Ozer, 2007). This statement on the amount of anecdotal evidence is also supported by Ohly et al. (2016).

Subsequently, Ohly et al. (2016) conducted a systemic review with a rigorous methodology and found 40 articles that explored the health and well-being benefits of school gardens. Both qualitative and quantitative research was explored but a divergence between the two was found. The qualitative articles were able to provide evidence of improvements in eating habits and physical activity, and the increased health and well-being of students that had challenges in the classroom setting (Ohly et al 2016). However, quantitative studies provided some evidence only for the "nutritional impacts of school gardening, such as increased preference for, and consumption of, fruits and vegetables" (Ohly et al., 2016 p.32). Many of the studies reviewed used self-reporting which has an increased likelihood of social desirability bias. Overall, Ohly et al. (2016) concluded that

qualitative studies were able to provide more evidence for health and well-being outcomes than quantitative studies.

Both Ozer (2007) and Ohly et al. (2016) demonstrated a need for stronger study designs and reporting in the field of health benefits related to school gardens and demonstrated the need for further research on the topic of school gardens and their relationship with the health and well-being benefits for students. Despite this the literature does elucidate several benefits which are outlined below.

There are several benefits that have been studied with regards to school gardens. These benefits include increased; fruit and vegetable intake, willingness to try new foods, academic perform and life skills and creativity. Numerous studies have been able to find evidence of the impact of school gardens on students' willingness to eat fruits and vegetables (Jaenke et al., 2012; Morgan et al., 2010; Morris & Zidenberg-Cherr, 2002; Ozer, 2007). However; there have been challenges in identifying a correlation between school gardens and an increase in student fruit and vegetable intake. One possible explanation for this is the challenge of measuring intake outside of school hours (Ozer, 2007). The correlation between school gardens and academic performance is also difficult to measure. Research suggests that a stronger indication of students' academic success could be their time spent on a task, their overall classroom behaviour, an increase in creativity and their attitudes towards learning (Berezowitz et al., 2015; Hoyland, Dye, & Lawton, 2009). Research does suggest that school gardens improve hands-on learning and life skills, which in turn strengthens academic performance (Berezowitz et al., 2015; Meyers, Sampson, Weitzman, Rogers, & Kayne, 1989; Pigg, Waliczek, & Zajicek, 2006; Robinson & Zajicek, 2005).

The improvement of hands-on learning has been explored further in the context of school gardens. In a 2017 study conducted by Powell and Wittman, school district interviewees working in British Columbia, Canada expressed their views that school gardens could be considered an entry point into engaging schools in exploring school-based food literacy education and healthy eating programs. School gardens and their use for education are strongly aligned with the BC Government's new curriculum that promotes inquiry-based experiential learning (Powell & Wittman, 2017).

With emerging literature pointing to the benefits of school gardening across both educational and health related outcomes it becomes important to ensure implementation at scale is achieved to maximize student health impact and to ensure schools and students have equal access to garden based education (Durlak and DuPre, 2008). Implementation at scale will depend on understanding the factors that are needed to implementation and sustainability (Brownson & Jones, 2009).

Sustained Implementation of School Gardens

In order to define what a successful or sustained school garden looks like, it is important to understand the core components that help ensure a school garden is integrated and used by a school. Integration refers to the institutionalization of school gardens, where the gardens are a part of the school's regular operational culture and curriculum (Huys et al., 2017). While integration and use is one goal of school garden development within School District 61, the most recent literature on this subject expresses that "it is too simplistic to assume that a garden is either well integrated or not. It is more likely that there is an integration continuum and the degree of integration can be strengthened when components are added or improved" (Burt, Koch, & Contento,

2017, p.1525). This section reviews the current literature on the core components that help sustain a school garden, while acknowledging that peer-reviewed evidence and case studies of these core components are still developing within the literature.

Ohly, Gentry, Wigglesworth, Bethel, Lovell and Garside (2016) conducted a systematic review of the health and well-being impacts of school gardening, synthesising both quantitative and qualitative evidence. After screening for rigour (ie. reviewing quality of data) was applied to the search process the review identified 40 relevant articles. Along with the exploration of health and well-being impacts, Ohly et al. (2016) uncovered that within this data there was information that alluded to how schools were institutionalizing their gardens. Since the Ohly et al. (2016) study one further article has offered a framework for core components of school garden integration/sustainability; Burt, Koch and Contento (2017).

Both Ohly et al. (2016) and Burt et al. (2017) presented frameworks representing core components essential to the development of integrated and sustained school gardens. Ohly et al.'s (2016) original research intention was to explore health and wellness impacts of school gardens; therefore the analysis is not as strong in its recommendations of the components of sustainable school garden integration. However, Ohly et al. (2016) did suggest that the factors which influence success and sustainability include experiential learning style and curriculum integration, supportive and inclusive environments, cultural relevance, support from staff and community volunteer, pressure on staff, and fundraising and resources. Burt et al. (2017) however, did intentionally set out to explore the initialization of the school gardens and utilized a measurement tool incorporating four main domains that influenced school garden development and

sustainability: 1) resources and support, 2) physical garden, 3) student experience, and 4) school community. Each domain highlighted by Ohly et al. (2016) and Burt et al. (2017) included sub-components that would facilitate a school garden becoming successful and integrated into the school community.

While these two researchers explored core components necessary to sustaining a garden, three other studies attempted to measure the sustained use and integration of school gardens by conducting a survey (Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005; Hazzard, Moreno, Beall, & Zidenberg-Cherr, 2011, 2012). All three of these studies used a survey developed by Life Lab and the California School Garden Network (2011) that explored school garden characteristics and integration. This survey has been administered in California and New York. While providing a tool for understanding, this survey was not specifically based in one of the existing frameworks of core components necessary to sustaining a school garden, nor did subsequent studies necessarily explore these components. The survey did however include three areas of focus; current school garden practices, attitudes associated with the use of gardens in schools, and barriers to having and using a school garden in academic instruction (Graham et al., 2005).

While several frameworks and surveys present aspects of the core components to institutionalize school gardens, a summary of the literature offers a more in-depth overarching framework to enhance the understanding of garden sustainability. Four domains of school garden sustainable use emerged from the work of Burt et al. (2017) and Ohly et al. (2016). Within each domain, core components have been presented as specific activities to support the achievement of each domain. Additional literature has

been used to further explore these domains and identify any missing components that Burt et al. (2017) or Ohly et al. (2016) did not include in their research. Therefore, the following sections present a list of domains that support the sustained use of school gardens including: resources, support, organizational and physical garden infrastructure, and teacher and student experiences.

Resources

The domain of Resources incorporates four components: funding, educational material, professional development, networks and technical assistance. Funding was generally cited as necessary to support schools in building and maintaining their garden (Burt et al., 2017; Hazzard et al., 2011; Ohly et al., 2016; Ozer, 2007; Turner et al., 2017, 2016). Turner et al. (2017) found funding needed to come from both a National and Statewide level but they also indicated that school district support was necessary for regular use and integration of the garden into school meal programs.

A continued theme throughout the literature was the importance of educational material, and the use of the garden for education was important. One author even went so far as to state that "implementing and sustaining a garden while lacking standards-based garden curricula may diminish the functionality of the school garden" (Hazzard et al., 2011, p. 412). Teachers require both knowledge of how to maintain a garden and curricula connecting garden based learning to academic subjects. The most successful documented garden programs were found to align the garden with already existing, highly attended and supported academic and nutrition programs (Moore et al., 2015; Summers, 2013; Turner et al., 2017).

Professional development or training opportunities were also cited within the literature as being important. Professional development has the ability to enhance

sustainability, by recruiting additional teachers and staff to participate (Burt et al., 2017). It provides additional time and space for planning and implementing the garden (Burt et al., 2017). Lastly, professional development provides training for teachers on to how to use, maintain and integrate the garden into the school setting. Literature in other areas of health promotion (physical activity and healthy eating) has highlighted the importance of training and the related concept of teacher efficacy to implementation (Masse et al 2012; Naylor et al 2015).

Networks were mentioned within the literature as a support for school gardens but they have not yet been fully explored. When networks were described in the literature, they were presented either in the context of partners engaging with the school garden or social networks within the school community (Burt et al., 2017; Hazzard et al., 2012; Ozer, 2007). The network itself could be seen as an extension of the committee component seen within the support domain. Further research on the role networks can play in supporting school gardens is needed.

Technical assistance spans beyond the resource domain and could also fit within the support domain. In the literature technical assistance was only cited in Burt et al. (2017) as more “intensive technical assistance may be necessary to speed the pace of [the] improvement” (p.1387) of school gardens. While the role of technical assistance is not prominent or well researched in the area of sustained school garden use, it has been regularly cited as an area in school physical activity implementation research (Naylor et al 2015) and the broader implementation science literature (Durlak and Dupre, 2008).

Support

The domain of support has four main components: administrative buy-in, garden committee(s), policy, and volunteerism. Administrative buy-in is mentioned within the

literature as a facilitator of school garden success and integration (Bucher, 2017; Burt et al., 2017; Hazzard et al., 2011; Ohly et al., 2016; Summers, 2013; Turner et al., 2017), whereas administrative push back could lead to teacher frustration and burn out due to constantly having to navigate institutional barriers (Bucher, 2017). Supportive administration was found to enable a garden's long term success by helping teachers navigate garden implementation, and encouraging teachers to use the garden space for academic study (Hazzard et al., 2011). While administrative buy-in sits within the support domain it plays a role in the teacher and student experience domain, and will be further explored within that domain.

Another school garden support identified in the literature is a garden committee. Hazzard, Moreno, Beall, and Zidenberg-Cherr (2011) provided recommendations for the make-up of the garden committee and suggested that the committee should comprise of four groups: teachers, parent/community volunteers, a garden coordinator and a school administrator. In general, the committee helps make sure the garden "becomes a shared responsibility, limiting the possibility of failure because of a burned-out teacher, staff member, or volunteer" (Hazzard et al., 2011, p. 412). While school-level committees are mentioned in the literature, there is little research done on the role district level committees could play in providing further support for school gardens. It is important to note that students were not mentioned within this list purposed by Hazzard et al. 2011, but other articles mention students as one important piece of the garden success (Brown et al., 2017; Skinner & Chi, 2012). Their role will be further discussed related to the component of teacher and student experiences.

Currently, the literature suggests that policies at a national, state and district level can support school garden use and integration, but this finding requires additional research on the type of policies necessary for facilitating school garden success. One study reviewed national, state and district level policies in the US and found that these levels of policy significantly influenced procurement and garden integration into the US's school nutritional service program. This only applies to the US context, because Canadian schools typically do not have in-school nutritional services (Henry et al., 2003; Turner et al., 2017). One researcher has highlighted policy as a facilitator of school gardens, but didn't explore the breadth of coverage or specific policies that enable successful school gardens (Bucher, 2017).

Finally, volunteerism is seen as a component of school garden success and is typically comprised of parent volunteers, community members or community organizations. The literature suggests that volunteers can both benefit the garden's sustainable use and the school-community connection (Ohly et al., 2016). For example, one study explored refugee families' interaction with a school garden and found that the garden provided a space and sense of community within the school for newcomer families (Brown et al., 2017). Volunteers have been cited as increasing the long term use of the garden, increasing school ability and potentially increasing success in applying for grant funding (Boyer et al., 2011; Burt et al., 2017; Hazzard et al., 2011, 2012; Ozer, 2007; Turner et al., 2016). However, volunteers likely require the necessary skills to maintain a garden.

Organizational and Physical Garden Infrastructure

The domain of organizational and physical garden infrastructure consists of five components: garden care and upkeep, one or more paid positions dedicated to the garden,

courses that allow teachers and students regular time in the garden, evaluation and feedback. Garden care and upkeep fit within the physical garden infrastructure aspect of this domain and themselves include several sub-components.

The domain of physical garden infrastructure has been predominantly researched through the California School Garden Survey created by Life Lab and the California School Garden Network (2011). Both Ozer (2007) and Burt et al. (2017) have noted that physical infrastructure consists of the core components of “garden care and upkeep, planning and establishing the physical space, characteristics at the space, crop vitality and diversity” (Burt et al., 2017, p. 1518 & 1523).

Organizational infrastructure comprises of three main components: a paid position dedicated to the garden, courses that allow teachers and students regular time in the garden, and evaluation and feedback. On the other hand, Burt et al. (2017) viewed organizational infrastructure as a core component rather than its own domain. Literature outside of the California School Garden Survey suggests that organizational infrastructure plays a role in the integration of a school garden; if there is someone connected to the garden with a paid position and autonomy to focus their time and professional development on growing the garden and connecting it to academic study, the garden would achieve higher levels of integration. For example, Summers (2013) conducted a personal narrative study of his experience as a paid school garden farmer over a three-year period. At the beginning of his position, organizational support was high, but as the years progressed the organizational structures that supported his position declined and ultimately he left his position due the lack of support within the organizational structure (Summers, 2013). This has been further cited by other case

studies with teachers that explored the barriers to their school garden's success (Bucher, 2017; Robertson & Krugly-Smolka, 1997). Finally, a paid position dedicated to the garden and courses that allow teachers and student regular time in the garden have not been explored enough in the literature to identify if they are both required together or if having only one of the two will suffice.

Evaluation and feedback were cited within Burt et al. (2017) and were viewed as a support for a critical feedback loop; "if an evaluation of [a] garden warrants a change in the layout, a new plan is developed and the loop feeds back to planning" (Burt et al., 2017, p.1523). It was suggested that evaluation should occur after every school year to allow for the fine tuning of a program (Burt et al., 2017).

Teacher and Student Experiences

Teacher and student experiences with the garden are complex. The internal relationship between the teacher and student play a role in school garden engagement, and the external relationships between the teachers, students, support staff, parents, community members, administrators and school district impact their experiences with the garden. The literature finds that a well-integrated school garden supports the long term use for future generations of students; and thus it seems logical that student satisfaction and experiences are incorporated into the use and daily function of the garden. Several areas are suggested as supporting student engagement in the garden including autonomy, age appropriate activities and space for social change and inclusion (Brown et al., 2017; Skinner & Chi, 2012). While the teacher may prescribe activities encouraging students to explore their work and interest in the garden, students also require autonomy to define their own intrinsic motivation to engage with the garden (Skinner & Chi, 2012). While

not explicitly mentioned in the literature, having students as part of decision making committees (ie. the garden committee) may support their autonomy in the garden.

The garden is a space that reaches beyond academic learning and provides a place for social change and inclusion. A few studies found that students and families became more integrated in the broader school community through garden work and care (Boyer et al., 2011; Brown et al., 2017). Specifically they highlighted that being engaged with a school garden could provide confidence and a place for students who did not always succeed in the traditional school setting (Brown et al., 2017; Bucher, 2017; Burt et al., 2017; Skinner & Chi, 2012).

Educators' experience with gardens is another component that can support the integration and use of school gardens. Similar to students, educators require autonomy to be able to integrate curriculum and other activities into the school garden (Bucher, 2017). While autonomy of the educator is important it appears that communication between the educator and administrator is also important. Administrators have the ability to bring other teachers on board, help the educators navigate the institutional structures and provide on-going encouragement and recognition (Hazzard et al., 2011). Though research has been conducted on individual programs, and case studies have been conducted on teacher and student experiences interacting with the school garden, more research is required on the specific relationships between the students, teachers and administrators and how their experiences, relationships and interactions have the ability to shape learning, student engage and long term use.

Components of Sustaining a School Garden

The sections above explored the four main domains that impact the sustainable use of a school garden, which includes; resources, support, organization and physical

school garden infrastructure, and teacher and student experiences. From these domains and their subsequent components, a framework for understanding how to sustain a garden and a definition can be extrapolated.

Table 1. Four domains and nineteen core components of school garden integration.

1. Resources		Funding
		Educational Material
		Professional Development
		Networks
		Technical Assistance
2. Support		Administrative Buy-In
		Garden Committee(s)
		Policy
		Volunteerism
3. Organizational and Physical Garden Infrastructure	Physical Infrastructure	Garden Upkeep and Care (Planning and established physical space, characteristics of the space, crop vitality and diversity)
	Organizational Infrastructure	Paid Position Dedicated to the Garden
		Courses that Allow Teachers and Students Regular Time in The garden
		Evaluation and Feedback
4. Teacher and Student Experiences	Student(s)	Autonomy
		Age Appropriate Activities
		Space for Social Change and Inclusion
	Teacher(s)	Curriculum Autonomy
		Activities Autonomy
		Administrative Support

In 1989, the International Food and Agriculture Organization (FAO) (1989) defined sustainable food and agriculture practices as:

The management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future

generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable (p.65).

This definition is best operationalized in partnership with the four domains. It is therefore proposed that the assessment of the sustainability of a school garden should be concerned with the following factors: the coordination and maintenance of the garden and the positive orientation of learning and institutional change as to ensure the attainment and continued satisfaction with the school's garden for present and future generations, which includes resources, support, organization and physical school garden infrastructure and teacher and student experiences (Boyer et al., 2011; Brown et al., 2017; Bucher, 2017; Burt et al., 2017; Hazzard et al., 2011, 2012; Linnell et al., 2016; Moore et al., 2015; Ohly et al., 2016; Robertson et al., 1997; Skinner & Chi, 2012; Summers, 2013; Turner et al., 2017, 2016).

Measuring Garden Activity

With a framework of domains and core components of sustainable use of a school garden established from the literature, an exploration of how to measure these core components in an individual garden is required. To date, three surveys have been developed to measure garden activity. The first survey by Life Labs and the California School Garden Network (2011) specifically measured school garden integration and sustainable use in an American context. The second survey by Black et al (2015) measured the broader school food environment in a Canadian context, while using a Comprehensive School Health framework. The third was Burt et al. (2017) that

developed a tool and measured how effectively gardens were established, integrated, and sustained in schools.

California School Garden Survey

In 2011, Life Labs and the California School Garden Network conducted the California School Garden Survey. The Life Labs survey was evaluated for content validity and necessary revisions were made (Graham et al., 2005). The questionnaire was developed and then pilot-tested with a randomly selected group of principals (n = 30) who then assessed the clarity and feasibility of completing the questionnaire online, with revisions made as needed (Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005). The purpose of the survey was to understand the factors that supported school gardens and their effective functioning over the long term. The survey addressed the status of school gardens in California. The survey received 552 responses from schools across California. The study concluded that principals' attitudes about school gardens, the amount of resources needed to garden, and the number of barriers associated with gardens all had an effect on the gardens' sustainability (Graham et al., 2005). This information was used to support improvements in school garden programs in the state of California.

School Food Environment Assessment Tool

In 2012, in partnership with the Think&EatGreen@School group, Black et al. (2015) developed the first pilot of the School Food Environment Assessment Tool (SFEAT) in the Vancouver School District. Black et al. (2015) note that SFEAT was "reviewed by co-investigators and project partners to ensure face and content validity and clarity of questions, and were tested for feasibility at six elementary schools from diverse areas of the city and one secondary school during the 2010–2011 school year" (Black et

al., 2015, p. 2381). SFEAT was used to explore six relevant domains identified through stakeholder consultation. The domains are as follows: 1) food gardens, 2) composting systems, 3) food preparation activities, 4) food-related teaching and learning activities, 5) availability of healthy food, and 6) environmentally sustainable food (Black et al., 2015). The theoretical framework used for the SFEAT reflects the comprehensive school health framework and expands upon it by connecting each pillar to an aspect of the school food environment which includes:

(i) The macro-level school health policy environment (e.g. school, district and provincial policies that support food and sustainability initiatives); (ii) the social and physical environment (e.g. design of eating spaces, food gardens and compost systems, what foods are available, where and for what price); (iii) teaching and learning (e.g. where healthy eating, environmentally sustainable food practices, food skills and food literacy are embedded in curricula); and (iv) partnerships and services (e.g. vendors and food-service workers who source, prepare and sell food, or support food related initiatives) (Black et al., p. 2380).

SFEAT can be used to gain further insight into school food environments and measure the effectiveness of interventions to increase student health outcomes, environmental stewardship, and food literacy.

While both the California School Garden Survey and SFEAT add to the body of knowledge on how researchers understand integration of food literacy education programs such as school gardening into the school setting, there are still gaps within the literature, specifically related to the measurement of the institutionalization of school gardens. These gaps include lack of a valid measurement tool that has been replicated

across different contexts (different counties, rural and urban settings, different socio-economic environments and different growing climates) and a lack of understanding about how to use such a valid measurement tool to conduct an assessment and then use the data to effectively institutionalize school gardens on at a school district level.

Garden Resources, Education, and Environment Nexus Tool

The Garden Resource, Education and Environment Nexus (GREEN) tool was established with the purpose to develop measure how school gardens were integrated and in schools. In 2017 Burt et al. conducted a sequential, exploratory, mixed-methods study of New York City elementary and middle schools (n=21). This involved semi-structured interviews of participants, concept mapping, observation of student engagement and a survey. The first data collection was with a survey that was adapted from the California School Garden Survey (n= 54). This was followed by an interview of schools that met the inclusion criteria of the protocol. Students were observed to assess the depth and meaningfulness of their garden engagement. Additional documents were collected to provide further information about the garden. Concept maps were used to comprehend how participants enabled school garden integration and decision making. Together, all of the data was used to verify the 18 components of garden sustainability and identify any missing components. It also allowed for a further understanding of the relationship between components. Finally, after data was collected and analysed a survey was created. Ultimately, Burt et al. (2017) developed a framework which identifies how to operationalize school gardens, providing an evidence-based strategy to successfully integrate school garden. It is important to note that the Burt et al. (2017) study was not published before data was collected for this study and was not able to be used for this

study. However, if used in this study, this framework would have provided a more direct measurement of sustainable use and integration of school gardens.

Summary

This literature review began by exploring food and its purpose in maintaining life, creating healthy people and sparking social change. The education system also plays a role in shaping society. Models such as Comprehensive School Health offer established methods for the implementation of public health interventions at a school level and food literacy is currently being integrated into CSH to support school based food education (Black et al., 2015; Vidgen, 2016). School gardens are at the intersection between the empowerment of students, CSH, and food literacy education, and provide benefits to student health, well-being, and academic achievement, though this area requires further research. In order for students to achieve the suggested benefits that school garden engagement can bring, they need to be implemented and sustained through integration into school infrastructure, policies and practices. However, their sustained use and integration is complex and best practice models are still being developed and researched (Burt et al., 2017). Understanding the domains and core components associated with school garden use and integration into the school setting is the first step in supporting the scale-up of school gardens. To maximize efforts in integrating a garden, a critical second step for a school district is to establish what is happening within a given district in terms of school gardens and the presence or absence of the domains and components of sustainability. Hence the measurement of school gardens is needed to finding prominent ways of promoting and supporting them. This study attempts to understand whether the current infrastructure, environments, processes and core components of sustainable

school gardens are present in District 61 gardens, while aiming to add the body of knowledge to create a valid school garden measurement tool.

Chapter 3: Methods

The purpose of this study is to understand what features and core components of sustainable school gardens are present in SD61 school gardens. Ultimately the information gathered will be positioned to help inform policy and practice and allow the School District and community partners to create more opportunities for student food literacy education and more school garden support at a district level.

Research Design

This study was an action research project that utilized mixed data collection methods to describe the current context and school garden integration in SD61. Stakeholders were involved in study design, data collection and a discussion of results to ensure the analysis was reflective on the district needs. Padgett (2012) suggest that action research consists of three components; 1) *perspective*, which is embedded throughout the study and shapes it as a whole and on-going process, 2) *partnership*, which works with multi-stakeholders from different backgrounds and different levels of experience with research, and 3) *participation*, which is ideally equal throughout the study (Padgett, 2012). The term ‘action research’ was coined by Kurt Lewin in 1946 and was developed in order to help empower communities to engage in social change (Padgett, 2012). Action research supports the meaning of truth in its practical application, grounding this truth with stakeholders, who in this study included Island Health, community stakeholders (e.g. CRFAIR, Farm to School BC, School District 61) and University of Victoria researchers.

Data Collection

Sampling and Recruitment

All elementary, middle and secondary schools in School District 61 (SD61) that had a school garden at the time of the research and had the capacity to complete the audit were purposively sampled (n=24/44 schools).

The School Garden Survey was administered to 24 schools in School District 61 (SD61) from November to December 2017. Schools that had a school garden were identified in two ways. The first was on April 2017, through the Food Awareness Survey (Appendix A), which was administered by SD61's Health and Safety Coordinator, an Action Research Team member, to 41 schools in SD61. This survey identified that 47.5% of respondents had a school garden. The second stage of identification, was completed through sharing the list of already identified schools with the Action Research Team (which included public health nurses and nutritionists as well as the Farm-to-School coordinator all of who visited the schools regularly). The Action Research Team verified the schools that did have a garden and identified additional schools with gardens.

Once Island Health/UVic Harmonized Ethics and SD61 ethics approval was obtained (J2017-063), the Associate Superintendent of SD61 then emailed all 24 principals in the schools with a school garden informing them about the survey and observation. A Public Health dietitian at Island Health was then identified as the project lead and emailed each principal with an introduction and the survey link. Subsequently, follow up phone calls were made to enhance response rates. The protocol for school contact and exclusion criteria are included in a data flow chart in Appendix B for reference.

Over the one-month period Island Health collected data from 21 respondents. The data set was cleaned of duplicates. Incomplete surveys and errors or discrepancies were removed, leaving the study with 16 schools with a functional garden and a fully completed survey (response rate of 64%). It was predicted that schools with higher engagement in their school garden would be more likely to complete the survey, representing a positive response bias.

Instruments

School Garden Survey:

A survey tool adapted from the School Food Environment Assessment Tool (SFEAT; Black et al., 2015) and from the California School Garden Survey (Life Lab and the California School Garden Network, 2011), was used to assess school gardens.

Questions were adapted based on context specific information and feedback from the Action Research Team (including Island Health, SD61 and community stakeholders) that ensured the survey met their organizational needs (health and education). Content and logical validity of the final instrument was established through a review by key Action Research Team stakeholders, including academic and practice-based experts. The background validity and reliability research is provided for each of the foundational tools in Chapter 2.

School Garden Survey:

The survey was comprised of 38 questions exploring eight areas of interest; 1) Survey Participant Roles, 2) School Garden Infrastructure, 3) School Garden Upkeep, 4) School Gardens and Student Learning, 5) Teachers and Staff involvement in the Garden, 6) Fruit Trees Use 7) Self-Assessment, and 8) Survey Feedback. Response options ranged from yes/no to likert scales (1-5) and priority ratings (top 3). See Appendix D for the

survey. It was categorized this way based on the two adapted surveys and for a presentation format that would make sense to participants; however, the analysis was specifically examining the core domains and components identified from Burt et al. (2017). It was administered online through Fluidsurveys™. Principals were asked to send the survey to their school garden champion and encourage them to participate by completing the survey with them. The school had 45 days (1.5 months) to complete the survey. Informed consent was administered online at the beginning of the survey.

Garden Observation:

School garden observations were used as a form of validation/triangulation of the survey results and to see if there was a relationship between differences of school's description based on the core components and the physical upkeep of their garden. Furthermore, the observation allowed for the ranking of the core components of physical infrastructure. Overall, three areas were observed: characteristics of the garden, garden upkeep and care, and the size of the garden. For the area of garden upkeep and care, garden observers were asked to give a percentage to each of the following areas: weeds in the garden, paths clear from debris, wetness of the soil, health of the plants, and physical maintenance of the garden space. Pictures were taken to document the types of physical infrastructure in each garden and to provide further context to the similarities and difference between gardens.

The garden observation was conducted by a lead researcher or lead public health school liaison at participating schools during spring 2018. These observations did not require the involvement of school staff as the purpose of the observation was to catalogue and confirm the maintenance and aesthetics of the garden in order to validate several of

the online survey responses. These observations also included five out of the eight schools (those with publicly available gardens to observe) that did not complete the survey.

Data Analysis

This descriptive study used both survey and observational methods, in order to understand the current infrastructure, environments, processes and core components of sustainable school gardens are present in District 61 gardens. From the survey, data entered in to Fluidsurveys™ by school principals and champions was exported into Excel, reviewed for accuracy and completeness, and then cleaned and coded. Identifiers were removed and a separate code book was created. Missing or incomplete information was noted and reported.

For the observation, data was input manually into Excel by the Island Health lead, and the lead researcher reviewed the data for accuracy and completeness, and then cleaned and coded it. Identifiers were removed and stored securely in a separate code book. For both the survey and observation data, Excel was used to generate descriptives including type of activities occurring in the garden and then to generate charts and figures to display the data. The Action Research Team then collaboratively reviewed the findings and results to place them into the broader education, health and community context, providing insight for the discussion of the results.

Finally, action research is further strengthened through knowledge translation, which can take the form of reports or presentations that are developed in partnership with community actors. Knowledge translation is a “dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of

knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system” (www.cihr-irsc.gc.ca/e/29418.html accessed July 30, 2017). In order to ensure the usefulness of the research to community members, reports were created for participating SD61 schools, the School District, and Island Health as well as recommendations for improving the sustainable use of school gardens. To ensure the reports supported policy and practice they were being created in partnership with key stakeholders and the School District. The SD61 report addressed high level policy and practice recommendations. Island Health received a report with recommendations on how they could support schools in developing and maintaining sustainable school gardens.

Chapter 4: Results

This chapter presents the findings from the survey and school garden observation to address the research questions. To provide context, demographic information is presented and then descriptive information about school garden infrastructure, environments and processes (e.g. garden maintenance, curriculum integration, and student engagement) is presented. School stakeholders' perceptions of key factors important to school garden use are explored, followed by the integration of each school garden. Survey and observational data are used to describe the core components of garden sustainability throughout this chapter. These core components fit within the six domains; resources, support, organizational and physical garden infrastructure and student and teacher experiences.

School District Demographics

This section explores schools that completed the survey. This provides insight into the role of the participants that completed the survey, and the current engagement and use of the school garden. It also explores the type of physical infrastructure and vegetation that were present in the school gardens.

In School District 61, 41% of all schools had a garden. As shown in Figure 1, a higher number of secondary schools (85%), than middle (70%), and than elementary schools (44%) reported that they have a garden.

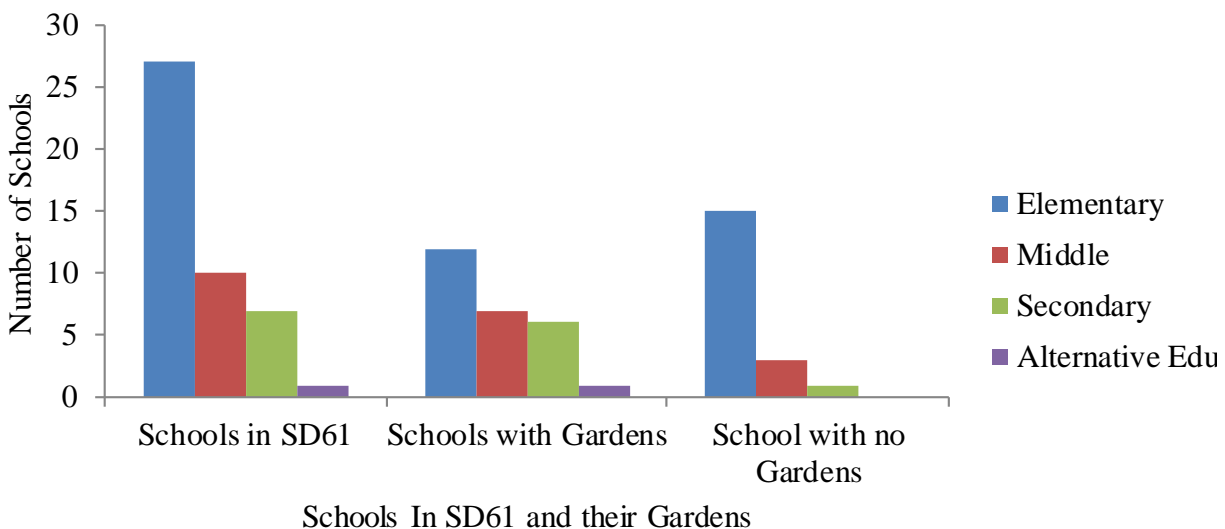


Figure 1. A comparison between all school types in SD61 and schools that have a garden and schools that do not have a garden.

*information on schools that have a garden was found through the school Food Awareness Survey and Action Research Team

The majority of respondents were school staff, with teachers as the most common respondent followed by Principals. One participant was chair of their school's garden committee. As this participant only identified as the garden committee chair from the list of options, they may have been a neighbourhood volunteer. Only one respondent self-identified as a parent. One school had both the Principal and teacher fill out separate surveys; therefore, this graph has 17 respondents. From the school that completed two surveys, one survey had incomplete data.

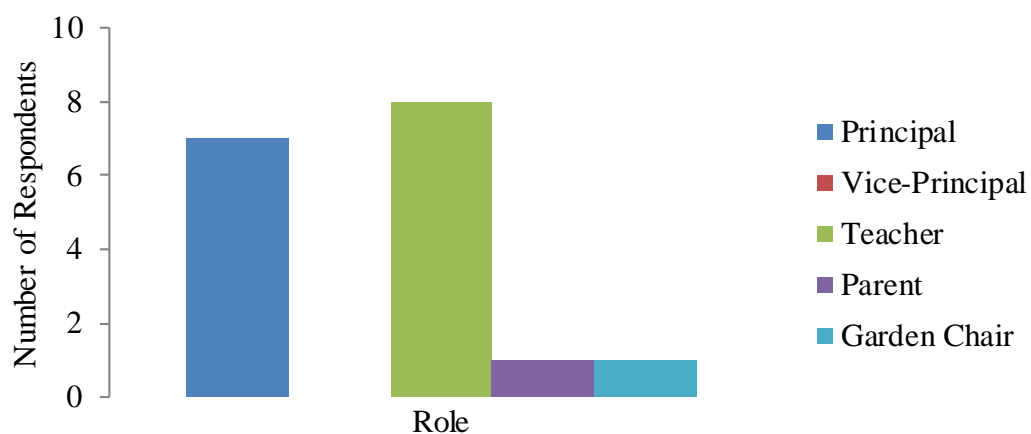


Figure 2. Role of respondents who participated in the survey.

* 'other' option is excluded from the graph.

The survey examined when gardens were created and their most recent annual cost. Nine out of the 16 gardens were created from 2014 onward. Of the 16 school gardens that were identified, there were 6 school gardens that have been sustained for over 5 years.

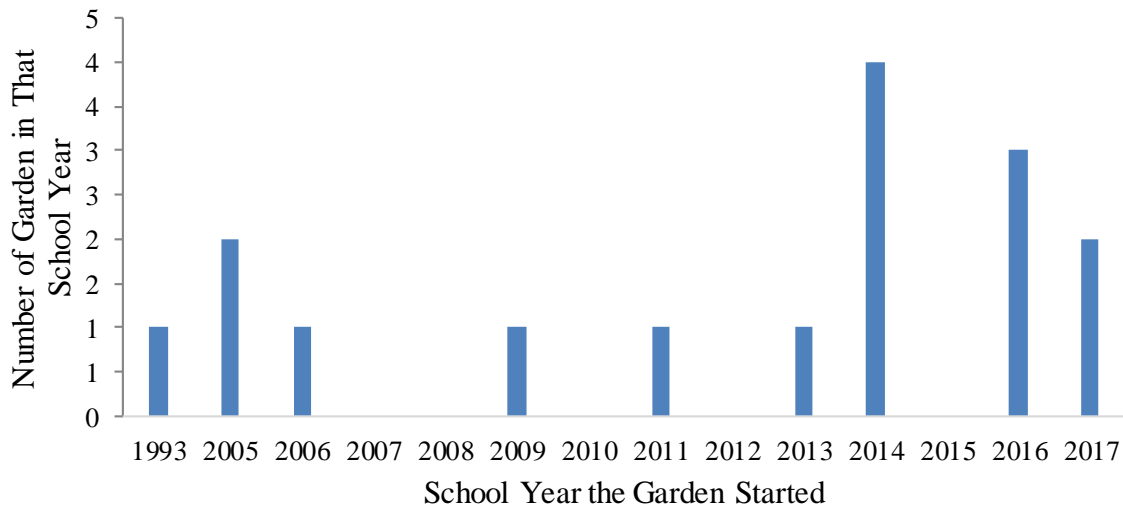


Figure 3. Frequency chart of the number of school gardens created by year.

All of the school gardens had used some amount of funding over the last year.

When examining the cost of school gardens, the average annual cost reported for the year was \$1,531 and the range was from \$20 to \$14,000. Four of the 6 most recent gardens had costs that were above average.

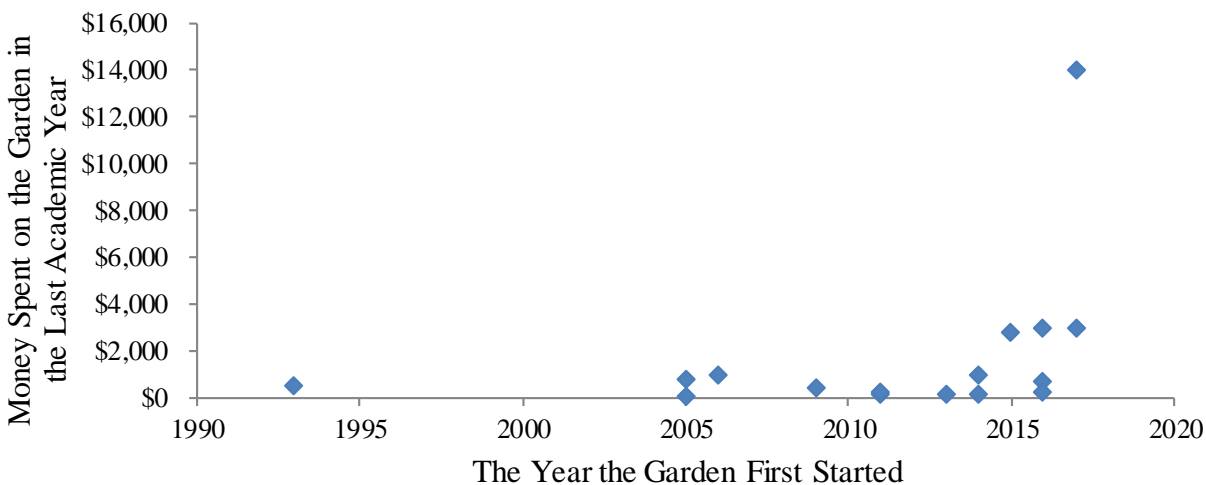


Figure 4. The amount of money spent on the school garden in the last academic year by the year when the garden first started.

School gardens varied in size and shape. Table 1 demonstrates school garden varied greatly in size across the school district and within school type. Secondary schools had a larger foot print because one school garden was 11,220 ft².

Table 2. The size of school gardens in square feet.

	Mean	Median	Range
Elementary (n=7)	562.85 ft ²	420 ft ²	1,306 ft ²
Middle (n=5)	925.6 ft ²	375 ft ²	2,180 ft ²
Secondary (n=3)	4369 ft ²	1,482 ft ²	10,815 ft ²

* Excluded Alternative Ed. (n=1) 2400 ft².

The survey examined the features (physical infrastructure) and vegetation of each school garden. The list below highlights some of the features that were present and how often they appeared in the school gardens.

Features of the garden

- Raised beds were the most common feature among school gardens, with 93% (n=15) of schools having some type of raised garden bed in one or more area of their school garden (see Figure 5).
- Half of the schools had in-ground garden beds (50%) and just over one third (37.5%) of schools had some type of greenhouse or potted plants inside the classroom or outside in the garden.
- Only one school had a garden on their roof.
- The majority of schools had two or more features (81%), with the average number of features within a school garden being between two and three. No school had more than four features present within their garden.
- Half of the schools had deer fencing for the garden (Appendix C). Through descriptive data collected in the survey, the type of deer fencing varied from actual chain link deer fence that was 8 feet tall to metal poles or wood poles with mesh fencing. Some of the school gardens were in internal school courtyards and did not require deer fencing.
- Half of the schools in this survey had some type of irrigation system, and out of those schools 62.5% of them were automated (Appendix C).

Plants grown

- Vegetables were the most commonly reported plant being grown with 93.75% of schools gardens containing vegetables (Appendix C).
- From the 16 schools surveyed 68.75% had some type of native plant area and a majority also had some type of nature area, with 45.45% of them being a camas meadow or Garry Oak area (Appendix C).

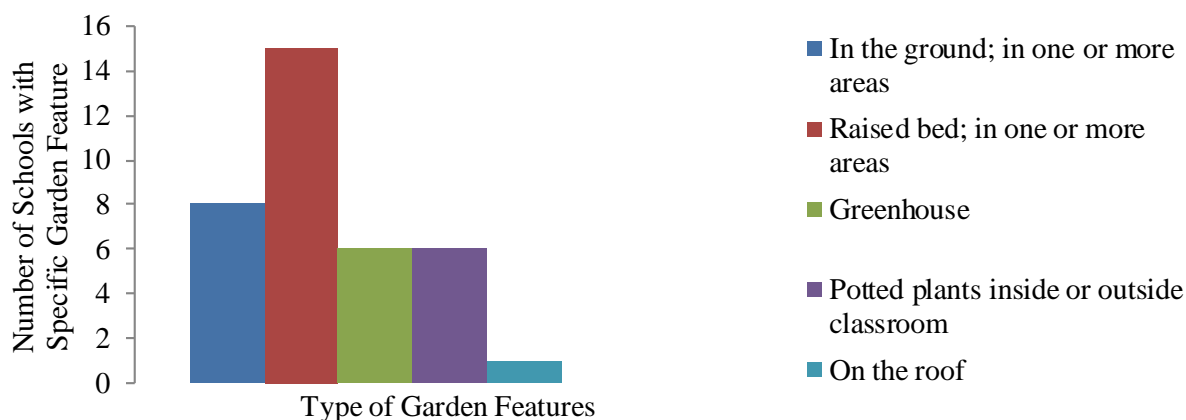


Figure 5. Type of larger features within the schools' gardens.

* 'off campus garden' option excluded from graph because no schools selected the option

Figure 6 data was derived from observing the school gardens of the 16 schools that completed the survey and five schools with gardens that did not complete the survey. The schools that completed the survey ranked higher in their overall school garden upkeep. Schools that did not complete the survey did not rank as high.

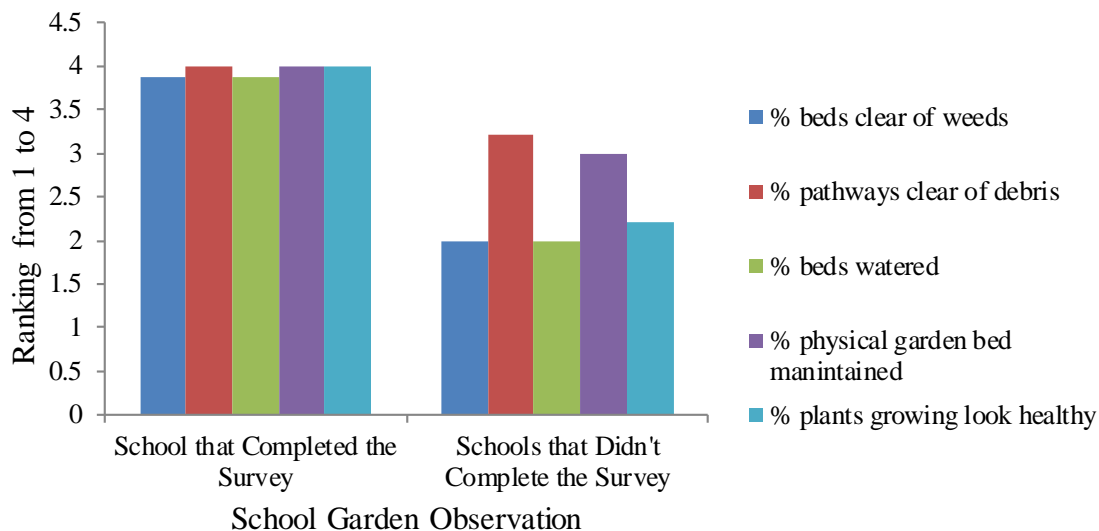


Figure 6. Observation of schools' garden upkeep, where schools were given a score from 1 to 4.

Student engagement was present in the school gardens. The survey, reported student engagement in the gardens was low, with approximately 68% of the schools reported low engagement (less than 25% of the student body having regular engagement). The survey defined regular engagement as every 2-3 weeks or more during the growing season, typically September to October and April through June.

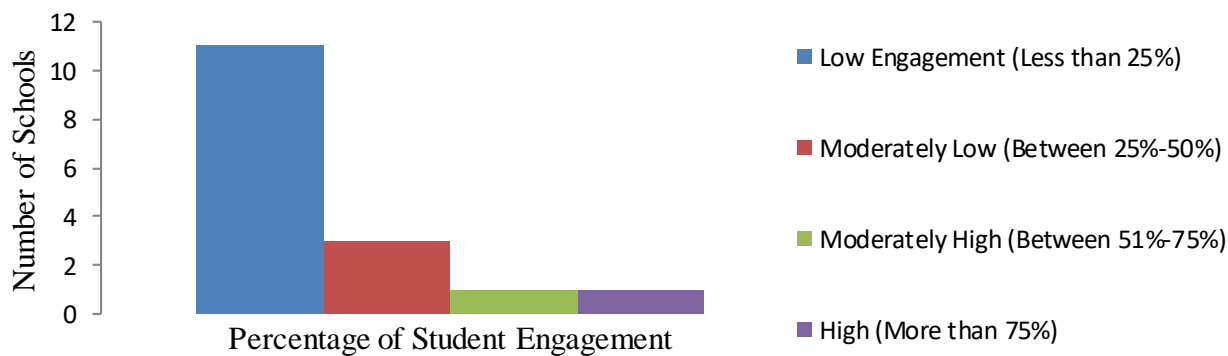


Figure 7. Schools reported the percentage of students that regularly engaged in the garden (every 2-3 weeks).

Most schools (93.75%) noted that they use the garden during class instruction time. Science education was the highest reported academic instructional use, with 62.5% of schools expressing that they used the garden for the subject (Appendix C). Art Education was the second highest ranked subject with nine schools indicating they used the garden for the subject. Only one school reported that they did not use the garden for academic purposes. The ‘other’ option uncovered that school gardens are also used for Indigenous education, enjoyment and getting students outdoors (exposure to nature), as well as for sustainability studies.

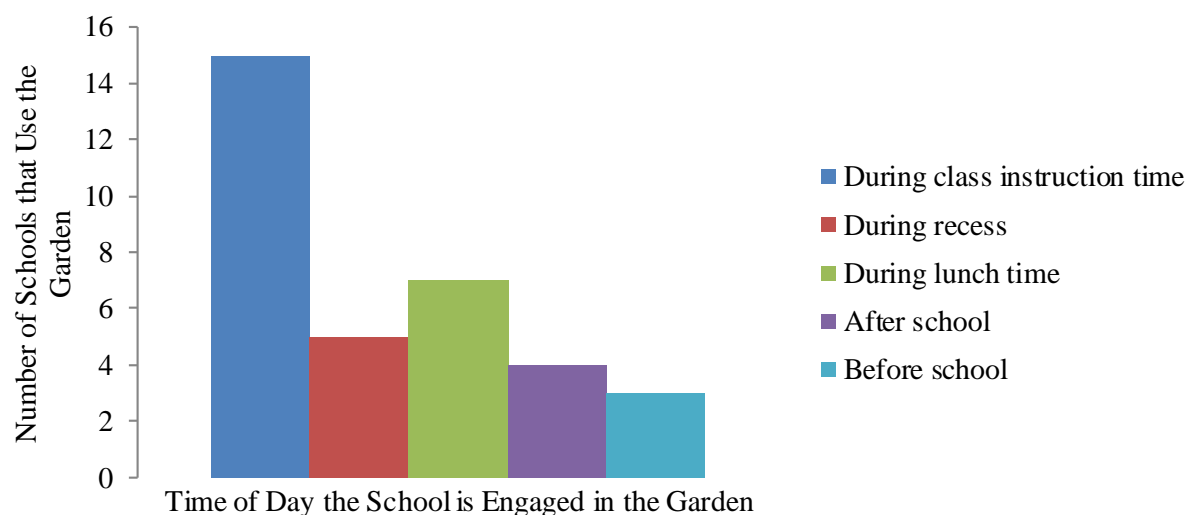


Figure 8. Different activities during the day that the garden is used for.

* ‘Non-school community uses’ option is excluded from graph because no school selected this option and ‘other’ is excluded and used to provide descriptive information.

Schools reported that they used their gardens for a variety of activities, with academic instruction being the most common activity. The average number of activities schools used their garden for was three. Only three schools used their garden for five or

more activities during the school year. Schools were able to select the ‘other’ option with this question and describe missing activities not listed in the survey. Nine schools selected the other category but did not add a missing category; rather they provided more detail about what they did for a specific category already offered. For instance, one school wrote about the garden being used for teaching the students garden skills or using the bounty for an ad-hoc meal with students. 68.75% of schools reported that they harvested for consumption or ate produce during school time or garden time (Appendix C). One school described this activity as “students can graze” (Appendix C).

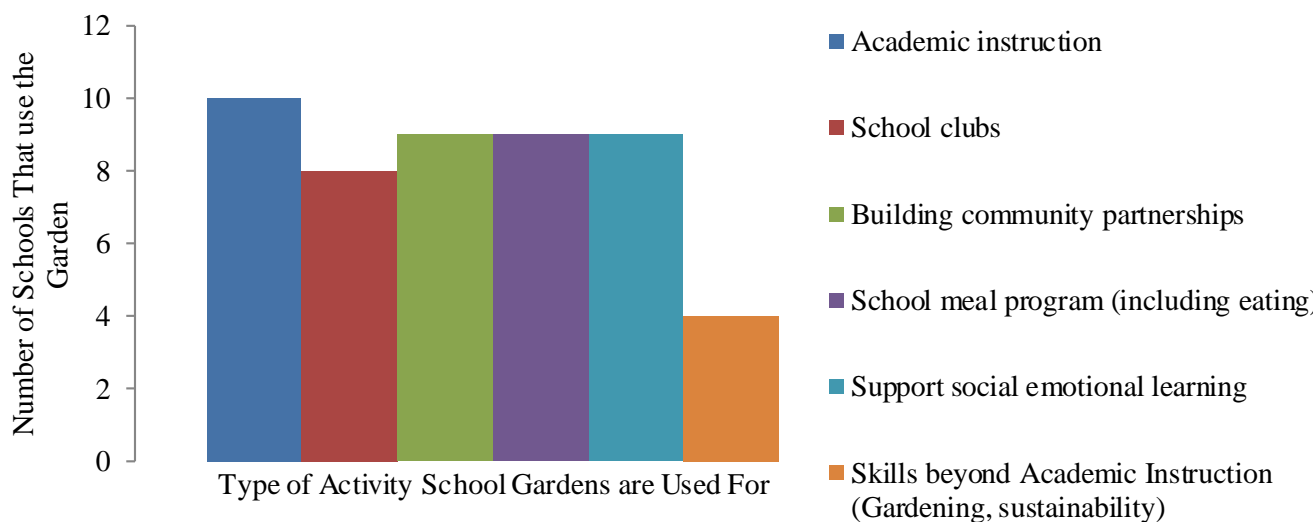


Figure 9. Bar graph of what the garden is used for.

*‘other’ option is excluded from the graph.

As shown in Figure 10, 75% of teachers created their own lesson plans to engage students in the garden for academic instruction. Websites were another highly reported source for teachers to find resources about school garden education. Through the descriptive option in the survey, three schools mentioned Lifecycles Project Society as a

resource for school garden educational material. Text books were used the least out of all material.

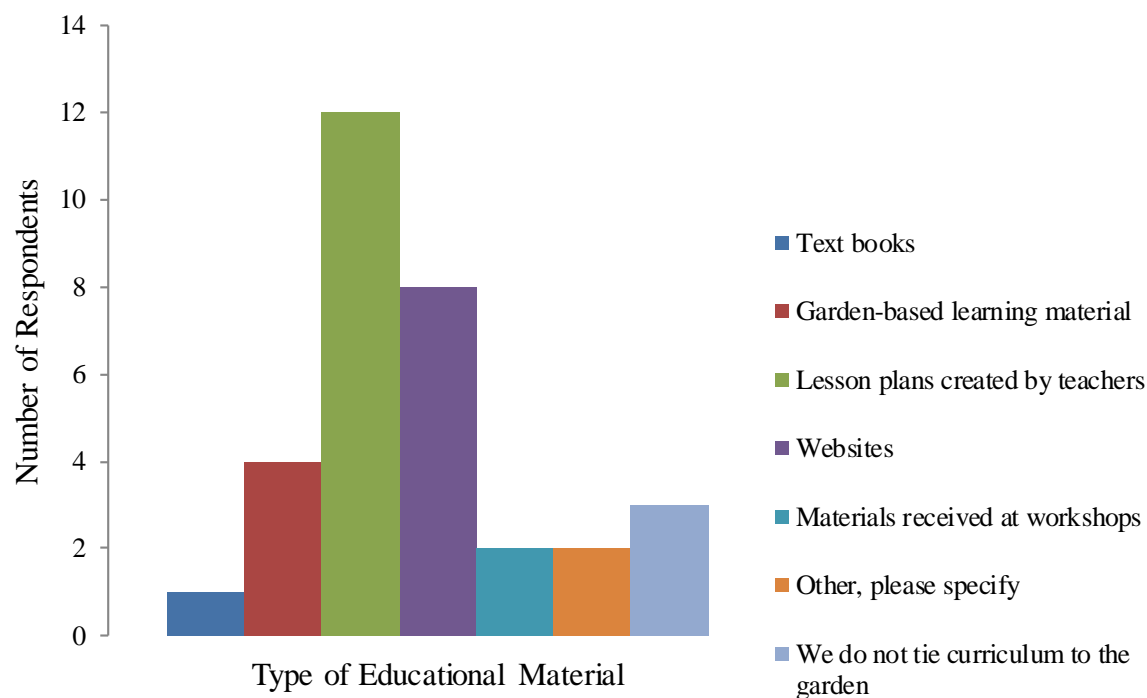


Figure 10. The type of educational resources and materials used to teach core academic subjects in the garden.

When asked about garden-related professional development days, three-quarters of school staff reported receiving none. 37% of staff reported some type of workshops outside of professional development days. Five schools selected the ‘other’ option. Two schools elaborated that the number of teachers engaging in professional development was low. One school said they attended conservation workshops, while another school said they learned alongside students. Finally, one school provided the name of a ten-month long workshop that they attended, which was on general gardening.

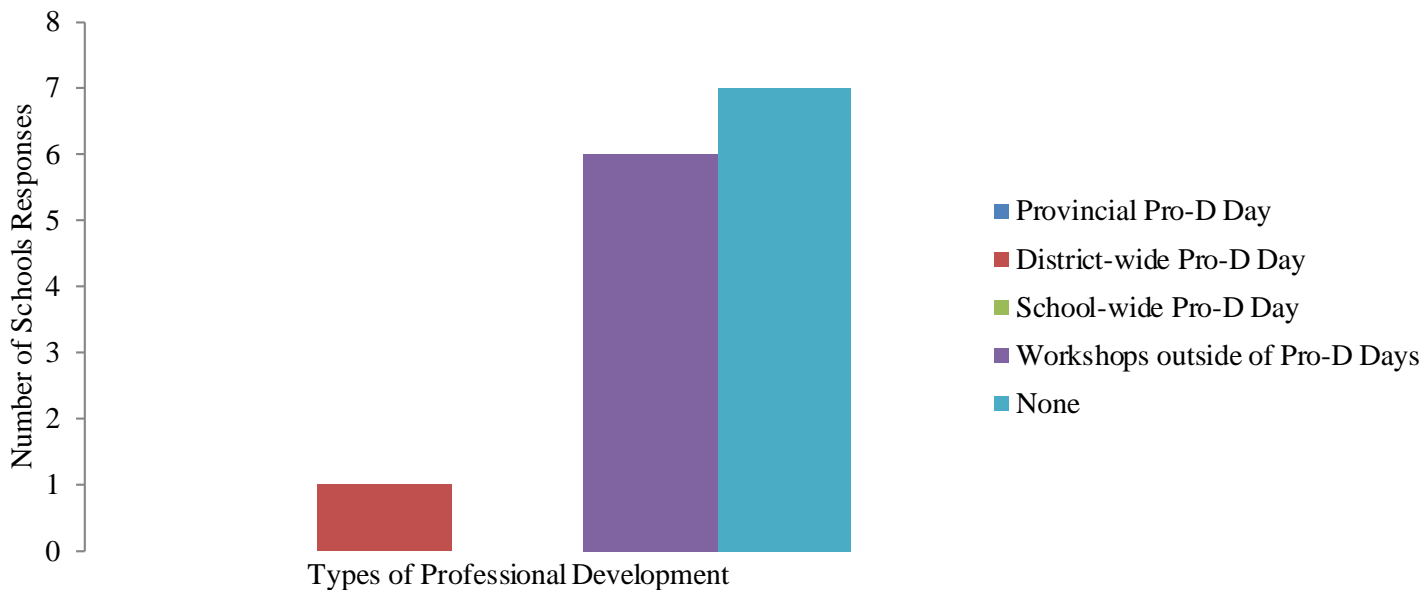


Figure 11. The type of garden-based professional development school received over the last three years. *‘other’ option is excluded from this graph

The majority of schools had one or two people managing and making decisions about the garden (range 1-4 people). Teachers and students had the highest involvement in managing the school garden during the school year.

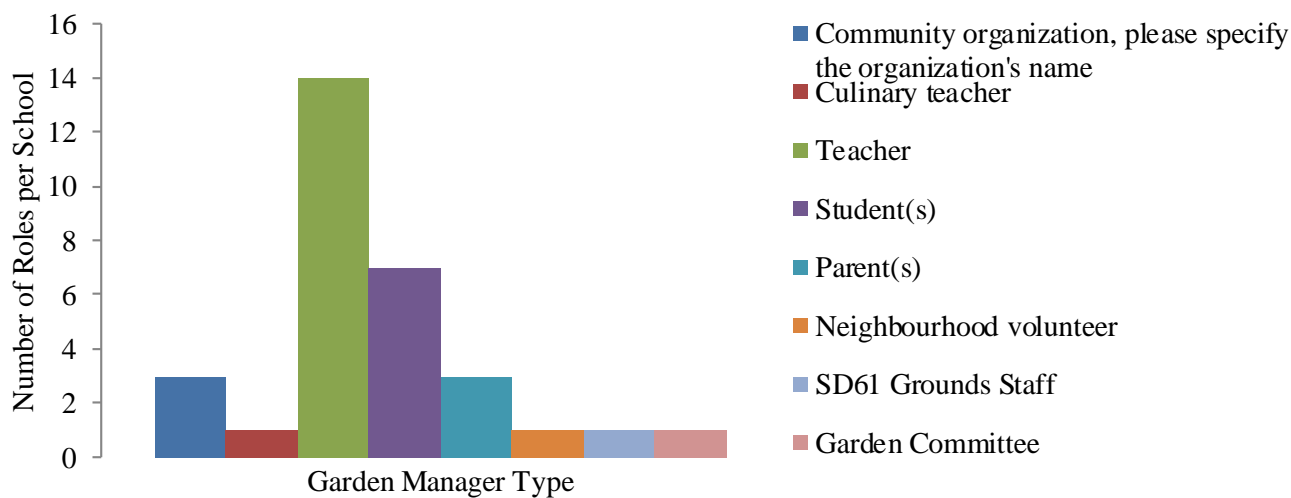


Figure 12. The types of people responsible for managing the school garden.

* ‘farmer or market gardener’ and ‘master gardener/landscaper’ were excluded because no one selected these options.

** SD61 grounds staff and garden committee member were added

Overall, garden team size and makeup varied. The average garden team was made of two to three people with different roles. Parents were more involved at the elementary school level, while teachers and students were more involved at the middle and secondary school level. Community organizations were highly involved at the secondary school level.

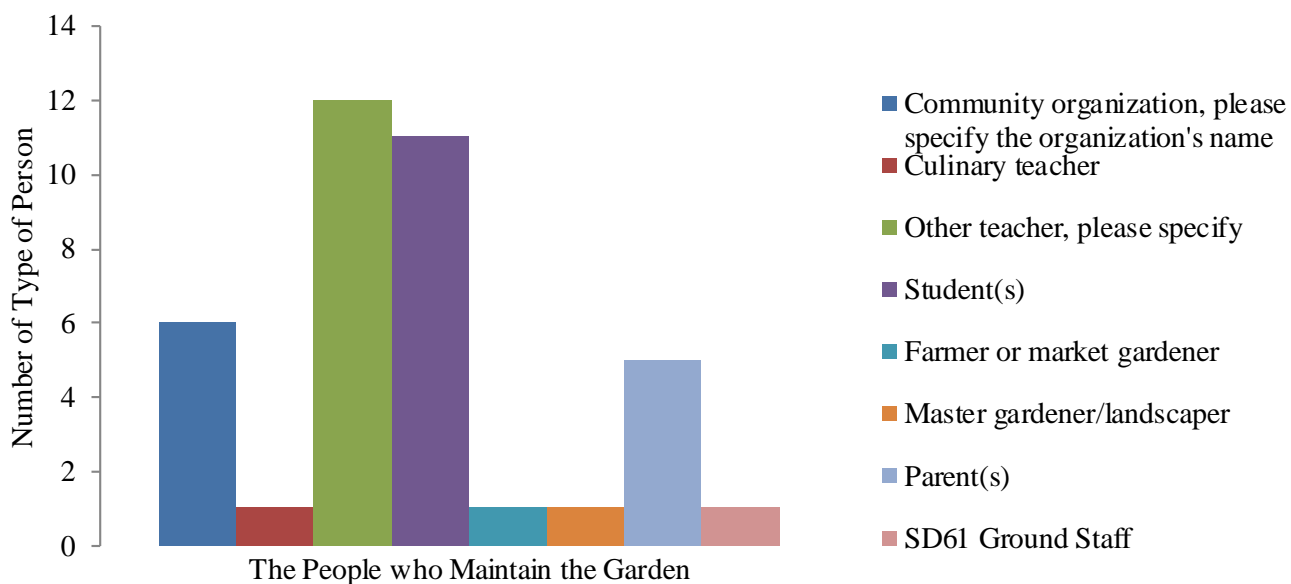


Figure 13. An overview of who maintains the school garden during the school year.

* 'neighbourhood volunteer' option was excluded because no selected this option.

** SD61 grounds staff was added

A little over one third of the schools did not maintain their garden in the summertime. Out of the schools that did report maintaining their garden during the summer, teachers and parents were the most likely to maintain the garden, followed by community organizations.

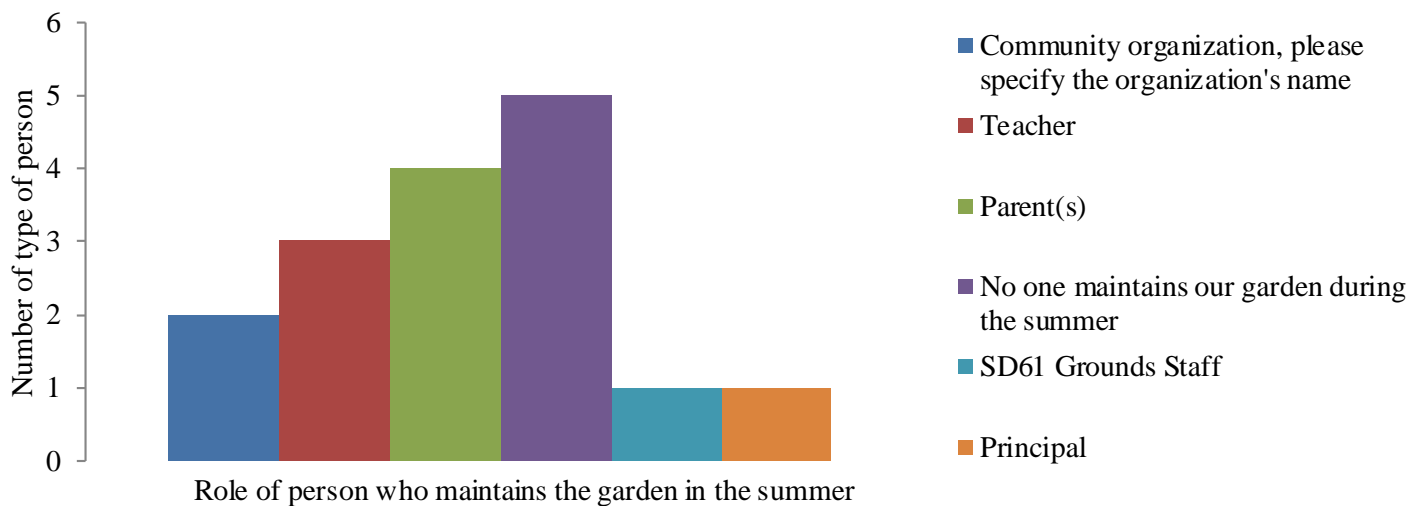


Figure 14. An overview of who maintains the garden during the summer.

*No one indicated culinary arts teacher, home economics teacher, farmer or market gardener, master gardener/landscaper, or neighbourhood volunteer.

** SD61 Ground staff and principal were added

School Stakeholder Perceptions of Garden Sustainability

Schools were asked to express how important each activity was in sustaining their school garden over the last year. Financial support and curriculum ties were rated of the highest importance for the school garden sustainability. Time scheduled in the day for instruction and educational material linking students to the garden ranked in the middle. Professional development ranked the lowest.

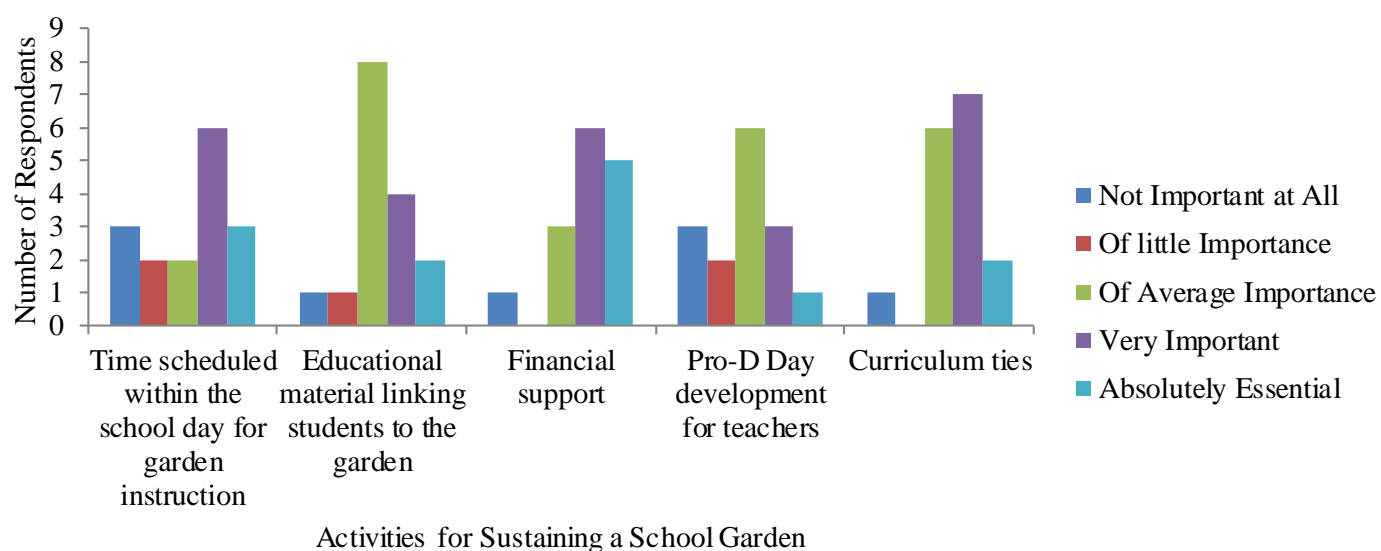
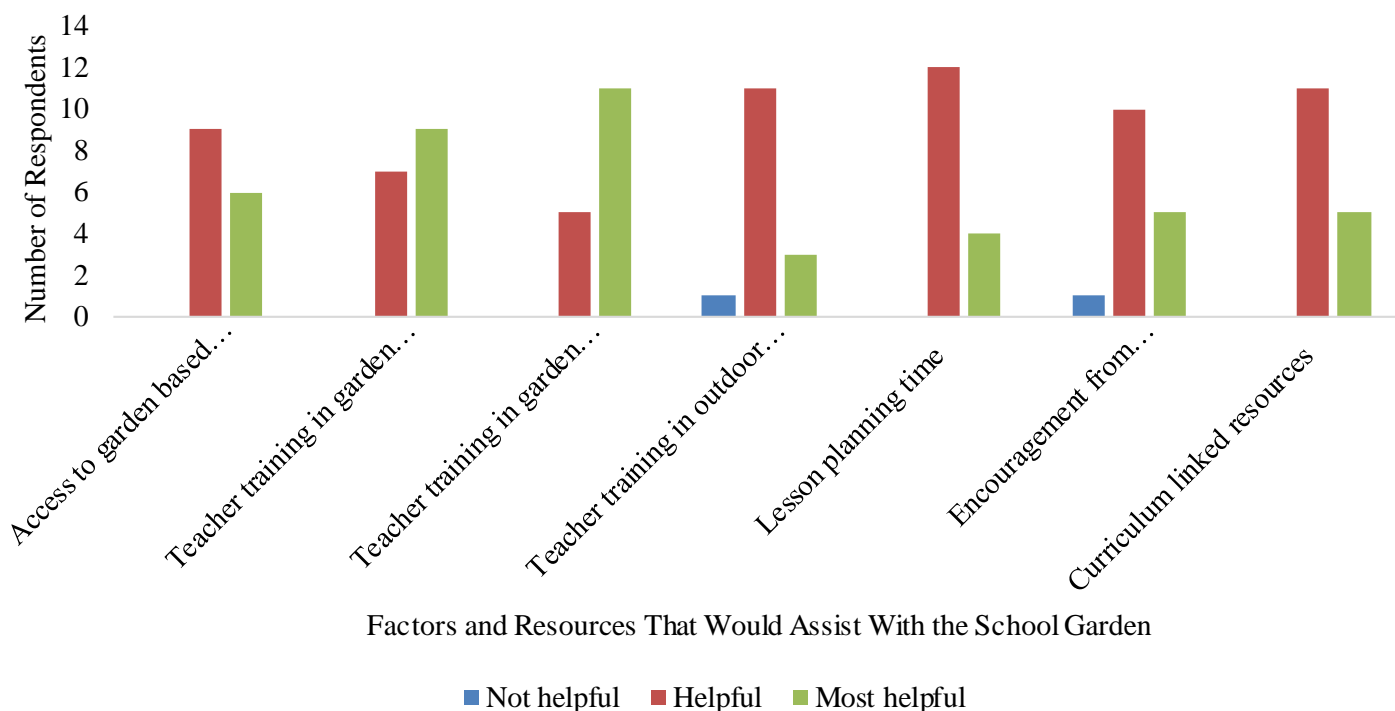


Figure 15. Rating of importance over the last school year.

* Administration support, Community organization(s), Parent(s), Teacher(s), Student(s), and Farmer(s) or market gardener(s) results can be found in figure 19

When schools were asked to look to the future and consider what factors would most assist in sustaining their garden, respondents ranked teacher training in garden-based learning instruction and teacher training in garden skills as the most important factor. Curriculum linked resources, encouragement from administration to use the garden as an instructional tool, lesson planning time and access to garden based education

material were ranked in the middle as key factors in assisting the garden. Teacher training in outdoor classroom management was ranked the lowest.



Factors and Resources That Would Assist With the School Garden

■ Not helpful ■ Helpful ■ Most helpful

Figure 16. Rating of the factors/resources that would assist the school garden being used as an academic instructional tool.

*Time scheduled within the school day for garden instruction, educational material linking students to the garden, financial support, professional development for teachers and curriculum ties results can be found in figure 17

In examining the question of roles in the garden, teacher and student engagement were ranked as absolutely essential in developing a sustainable garden. Administration support was another key factor in developing a sustainable garden, while farmer(s) or market gardener(s) were considered not as important. Respondents varied in their assessment of the importance of parents and community organizations, with some noting they were absolutely essential and others reporting that they were of little importance to sustaining the school garden.

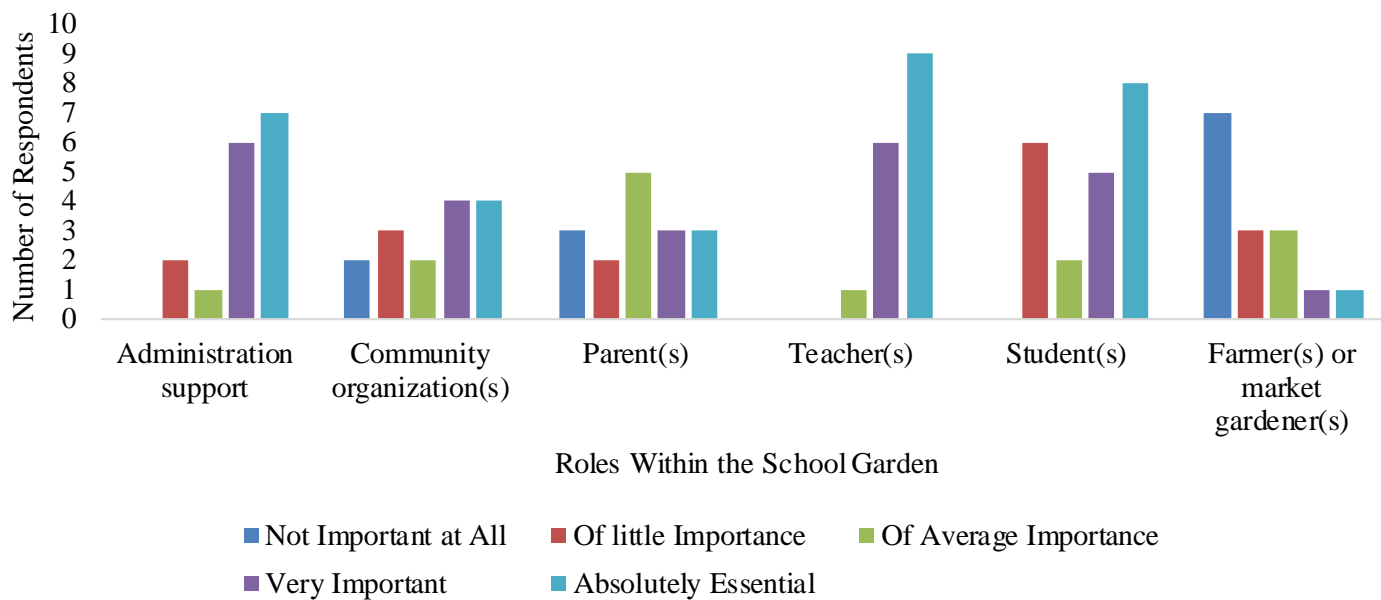


Figure 17. Rating of how important each role has been in developing a sustainable garden over the last year.

* Time scheduled within the school day for garden instruction, Educational material linking students to the garden, Financial support, Pro-D Day development for teachers, Curriculum ties results are in figure 16

School Garden Integration

Each school garden was compared to the four domains of school garden integration and twelve components were explored. Out of the 20 components outlined by Ohly et al. (2016) and Burt et al. (2017), 8 areas were not collected by the survey, leaving 12 components to evaluate. Sustainability factors that exist at a district level, were not addressed in the survey. The Action Research Team feedback was used to provide information about district level factors. Funding was not dealt with like the other components. The specific amount reported for expenditures over the last year was expressed as an average value, rather than a yes/no that funding was in place. The funding component was not expressed as integrated because there is currently no established evidence or practice-based of specific amount of funding required to determine a gardens success.

In Table 2, 50% of the schools had more then half of the 12 components explored in the survey. No school had more than seven missing components. School gardens that were newly established were more likely to have a higher number of components.

Professional development (56.25%), volunteerism (50%), school garden irrigation (50%), courses that allow teachers and students regular time in the garden (31.25%), District policy (0%) were the least common components present within the district. Educational material (81.25%), administration buy-in (81.25%), and garden committee (68.75%) ranked in the middle. Finally, networks (100%), technical assistance (100%), and garden upkeep (100%) were the highest component throughout the district; however, networks and technical assistance are created at a provincial level and are available to every school across the entire region.

Table 3. School gardens that have components within the four domains.

Domains	Core Components	Elementary (n=7)	Middle (n=5)	Secondary (n=3)	Total (n=16)
Resources	Funding	\$760	\$3,450	\$1,400	\$1,531
Resources	Educational Material	7/7 (100%)	4/5 (80%)	2/4 (50%)	13/16 (81.25%)
Resources	Professional Development	3/7 (42.86%)	4/5 (80%)	1/4 (25%)	8/16 (50%)
Resources	Networks	7/7 (100%)	5/5 (100%)	4/4 (100%)	16/16 (100%)
Resources	Technical Assistance	7/7 (100%)	5/5 (100%)	4/4 (100%)	16/16 (100%)
Support	Administrative Buy-In	6/7 (85.71%)	4/5 (80%)	3/4 (75%)	13/16 (81.25%)
Support	Garden Committee(s)	6/7 (85.71%)	3/5 (60%)	2/4 (50%)	11/16 (68.75%)
Support	Policy	0/7 (0%)	0/5 (0%)	0/4 (0%)	0/16 (0%)
Support	Volunteerism	2/7 (28.57%)	3/5 (60%)	3/4 (75%)	8/16 (50%)
Physical Infrastructure	Garden Upkeep and Care	7/7 (100%)	5/5 (100%)	4/4 (100%)	16/16 (100%)
Physical Infrastructure	Garden Irrigation	3/7 (42.86%)	2/5 (40%)	3/4 (75%)	8/16 (50%)
Organizational Infrastructure	Paid Position Dedicated to the Garden	Unknown	Unknown	Unknown	Unknown
Organizational Infrastructure	Courses that Allow Teachers and Students Regular Time in The garden	2/7 (28.57%)	2/5 (40%)	1/4 (25%)	5/16 (31.25%)
Organizational Infrastructure	Evaluation and Feedback	Unknown	Unknown	Unknown	Unknown
Student(s)	Autonomy	Unknown	Unknown	Unknown	Unknown
Student(s)	Age Appropriate Activities	Unknown	Unknown	Unknown	Unknown
Student(s)	Space for Social Change and Inclusion	Unknown	Unknown	Unknown	Unknown
Teacher(s)	Curriculum Autonomy	Unknown	Unknown	Unknown	Unknown
Teacher(s)	Activities Autonomy	Unknown	Unknown	Unknown	Unknown
Teacher(s)	Administrative Support	Unknown	Unknown	Unknown	Unknown

*Funding has been averaged

**Schools were coded based on if they had the component or not

*** Schools were considered integrated if they had 8 or more of the components.

Summary

Almost half of the schools in School District 61 have some type of school garden. Out of the schools that had a garden, teachers and principals were more likely to complete the survey. Schools spent anywhere between \$20 to \$14,000 on their garden in the last year. School gardens varied in features, which was confirmed by the school garden observations that showed each school garden looked different. From the observations, it appeared that schools that completed the survey were more likely to have well maintained gardens, while schools that did not complete the survey tended to have less well maintained gardens.

Overall, student engagement in the garden was low, but the students that did participate in the garden did engage with it regularly. Students tended to engage in the garden during class time. To support student's interaction in the gardens, teachers developed their own lesson plans, but had little professional development support. Teachers and students both played a role in the maintenance and management of the garden, along with administrators, parents and community partners.

From the participants that completed the survey, there was a general desire to see increased support for teachers engaging in the garden which includes training in garden-based learning instruction and teacher training in garden skills. Financial support and curriculum ties were identified as two resources that impacted the sustainability of the garden over the last school year.

When schools were individually compared to the 12 components that were explored in the survey, 50% of the schools had more than half of the components. It

appeared that gardens that were initiated earlier had less components that were important to integration.

Chapter 5: Discussion

This study explored the school garden context and infrastructure in School District 61 (SD61) and the components of an integrated or sustained garden that were present in an urban school district in British Columbia, Canada. Through a literature review, resource, support, organizational and physical infrastructure, and teacher and student experiences were identified as the domains necessary to institutionalize school gardens. Principals and school garden champions were surveyed about their school gardens. Based on the fairly high response rate (64%) the findings are likely representative of all SD61 schools gardens over the last year and thus have external validity (Guittet, Giraudeau, & Ravaud, 2005). The findings presented in this study add to an emerging literature base dedicated to the implementation and sustainable use of school gardens. The following discussion explores each of the domains in comparison to the literature and provides recommendations on how SD61 and its schools can further integrate gardens into the school setting.

The Four Domains and Core Components for the Sustained Use of School Gardens

The survey addressed 12 components of school garden sustainability proposed by Burt et al. (2017), and Ohly et al. (2016). Of these components the survey was able to explore three domains, which included: resources, support, organizational and physical infrastructure. While these three domains existed within every school that has a garden that was being used in this sample, each garden varied in how they implemented, maintained and managed their garden. This ultimately impacts the overall use and integration of the garden into the school setting. Without in-depth interviews exploring domain of teacher and student experiences it is difficult to get a complete picture of how

well institutionalized each garden is. However, the survey was able to uncover some key gaps that the literature suggests would benefit the overall experience of teachers and student and the likelihood of the gardens being sustained and used for future generation. The literature by Burt et al. (2017) suggested that each area plays an important role in the sustained used and integration of a school garden into a school setting but it is not as simple as check-list of integrated or not. Therefore, recommendations to support garden institutionalization must recognize the complexity of changing a school culture to integrate a garden.

Resources

Within the domain of resources, the survey addressed funding, professional development and educational material specifically. The Action Research Team agreed that networks and technical assistance were present at a district and provincial level. This was confirmed, as the lead researcher of this study both worked for the network and was considered the technical assistant within the district.

All schools that completed the survey indicated that funding was the most significant barrier to sustaining the garden and that if funding was available it would be the most important facilitator of sustaining the garden. This aligns with the literature that suggests funding may be one of the most important factors in predicting school gardens' sustainable use (Burt et al., 2017; Hazzard et al., 2011, 2012). Practically speaking, schools require some type of financial support to build a garden. While each respondent indicated that they had funding over the last year to implement their school garden, it is unclear if there is specific amount required to sustain the garden. It appears that the amount of funding required to sustain a school garden has changed over time with newer gardens reporting a higher funding amount. However, even the school gardens that had

been operating for over a decade reported expenditures in the last year; garden expenditures ranged anywhere \$20 to \$14,000.

Beyond funding, the literature clearly states that curricula tied to the garden is another major sustainable use factor and the lack of standard-based garden curriculum can negatively impact the functionality of the school garden (Hazzard et al., 2011). This study showed that the majority of teachers were developing their own lesson plans. To develop these lesson plans, resources mainly came from websites. This survey did not review the quality of educational material available to teachers or the quality of lesson plans developed by individual teachers. While this study cannot judge the quality of academic instruction and material that is tied to the garden, it shows that there is a lack of standards and supports for garden lesson planning and education development. To further understand the current gap in academic garden-based educational material, additional research should be conducted on the quality of learning material teachers are developing and whether teachers are already working together to share plans and develop promising practices. Future research should review individual teachers' lesson plans and establish what resources are available provincially, potentially offering standardized teaching materials.

Professional development is another area in the domain of resources worth exploring (Burt et al., 2017). Almost half of respondents hadn't received any type of formal or informal school garden professional development, and those who received training mostly accessed it outside of the public education professional development system. Perhaps not surprisingly it was ranked low on the list of specific supports that were important to the garden development during the past year. However, when schools

were asked what would assist their garden the most, professional development, specifically teacher training in garden-based educational instruction and teacher training in garden skills was ranked the highest. While this study did not conduct an environmental scan of school garden professional development opportunities accessible in BC, the differences between the amount of professional development teachers received and desire for further professional development reflects the lack of standardized professional development available. This gap could impact garden sustainability, as teachers may not be aware of proper techniques of gardening, garden lesson plan development or how to sustain their school's garden.

Support

The support domain includes components such as administrative buy-in, garden committee, policy and volunteerism (Burt et al., 2017). The survey was able to explore administrative buy-in, garden committees and some aspects of volunteerism. At the district level there is currently no school garden policy and the survey did not capture if there are garden policies at an individual school level.

Administrator buy-in is considered a key aspect of the sustainable use of gardens (Bucher, 2017; Burt et al., 2017; Hazzard et al., 2011; Summers, 2013; Turner et al., 2017). The survey ranked administrators as an important factor in sustaining their school garden over the last year. Furthermore, half of the survey respondents were administrators and observations showed that the gardens were well cared for, which suggests that administrator buy-in was present and an important factor. However, there is some inherent bias within the data and fully exploring this question would require confidential interviews with school garden champions asking them about administration support.

Garden committees can help ensure the sustained use of the school garden, allowing all those involved to share the responsibilities of maintaining and using the garden, and limiting the potential of burn-out (Hazzard et al., 2011). The survey uncovered that many schools had teams that were made up of two or three different school-based stakeholders. Teachers and students were the most common stakeholder with a role and they along with school administrators had the most prominent roles in maintaining and managing the garden in the past year. The literature suggests that the school garden committee should comprise of teachers, parent/community volunteers, a garden coordinator and a school administrator (Hazzard et al., 2011). Broader involvement was not consistent as each school had different types of stakeholders involved outside of administrators, teachers and students. Using the Comprehensive School Health model and establishing a structure to encouraging schools to develop a robust committee has the potential to sustain the use and integration of school gardens while reducing teacher burn out (Hazzard et al., 2011).

Volunteerism, specifically parent volunteerism was considered another component of sustained garden use. Boyer et al. (2011) and Brown et al. (2017) both explored the role of parents within a school garden program and suggested that they provide a sense of community within the garden space that bridges socio-economic factors. In this study, parents were more likely to be involved in elementary school gardens during the school year but were still seen by some schools as less important than administrators, teachers or students in the sustained use of a garden. Half of the schools had a community partner, parent and/or neighbourhood volunteer engaged in their garden. It seems as though volunteerism may be an area to strengthen among the schools.

As it is up to each individual school to foster volunteer relationships, it could be advantageous for the school district to support the engagement of volunteers and direct volunteers to schools. By creating a stronger incentive and support for building a school garden committee, volunteers may be able to play a larger role in garden sustainability. As future gardens are built within the school district, it may be beneficial to ensure that each garden has a core committee that meets regularly, which would allow additional people to be engaged in supporting its long term use. Volunteerism may not be the only route for garden support. Community organizations do play a role in maintenance and management of the garden. While this study did not intimately explore the relationship between school gardens and community organizations; the literature has shown that community organizations have the ability to offer an alternative support beyond volunteerism (Hazzard et al., 2011; Powell & Wittman, 2017).

Organizational and Physical School Garden Infrastructure

The literature also shows that organizational infrastructure is important to integration of a school garden into the school setting (Burt et al., 2017; Ozer, 2007). One key area of organizational infrastructure is teachers having time within the school day to teach and work within the garden (Bucher, 2017; Robertson et al., 1997; Summers, 2013). When survey participants were asked to rank their top three sustainability elements related to their school garden, time scheduled in the garden was considered the second most important. An environmental scan of individual schools would be required to understand how much time per day each teacher was in the garden. The survey showed that the use of the gardens was irregular, perhaps reflecting a lack of organizational infrastructure.

Physical school garden infrastructure was explored by the survey, specifically relating to garden care and upkeep including: planning and establishing the physical space, characteristics of the space, crop vitality and diversity, and the availability of an irrigation system. The literature suggests that when a garden starts out there is more focus on physical garden infrastructure, and with time the focus shifts to the integration of the garden and additional aspects (Burt et al., 2017). The observation of the school gardens demonstrated that school gardens were very well kept (e.g. plants were healthy, well-watered, with minimal weeds), which to some extent undermines the idea that complete integration is necessary to physically sustain a school garden. Gardens varied greatly in size and infrastructure. However, the survey uncovered that there were still key barriers to the physical infrastructure of the gardens including summer maintenance, fencing and watering systems.

Almost one third of schools were not maintaining their garden over the summer. This may seem more problematic than it is. For instance, if schools plan their crops knowing they will only harvest up until June and again in September or October, then little maintenance could be required over the summer. However, the yield in September or October will be low if no one is maintaining the garden in the summer; this means the garden will be used only in a short window of time during the school year. Little research is available on maintenance and use of school gardens during the summer; however, the Action Research Team felt it was an important aspect to explore. Due to the lack of information about this subject, this is a potential area for further research. Meanwhile, two district level supports could be implemented to mitigate the challenge of summer maintenance. The first is for the school district to develop a garden guide that specifically

explores how to grow a garden that does not need maintenance over the summer, while the second would be a summer garden maintenance program that could be administered by the District's facilities staff, a community organization or potentially a summer employment program for students.

Watering a garden can take a considerable amount of time, especially during the summer. One barrier to sustaining a garden was the current water infrastructure available to school gardens. Only half of gardens had access to a water irrigation system. This means that half of gardens required hand watering or watering by hose. Of the gardens that had an irrigation system, about two-thirds were automated; thus the other third required individuals to water regularly. During the school year this may only be required once a week to keep plants alive, while during the summer watering could be required as frequently as every second day. This requires a staff person or regular volunteer during the summer. By installing automated irrigation systems in every school garden, the school district would likely improve garden sustainability. This is another area of research that has not been explored in the literature but the Action Research Team deemed important; however the gray literature, specifically school garden guides, does discuss the watering of a garden (Farm to School BC, 2012).

Student and Teacher Experience

The engagement and experiences of both students and teachers are a core component of the long term use of a school garden identified in the literature (Brown et al., 2017; Bucher, 2017; Burt et al., 2017; Skinner & Chi, 2012). While this survey did not gather data on students' and teachers' experience with the garden, it did explore the role they played and how they were valued in the sustained use of the garden.

Teachers and administrators were more likely than students, parents and community organizations to maintain, manage and make decisions about the school garden. Teachers, students and administrators were a prominent aspect to sustaining the school garden. Even though community organizations, parents and volunteers were considered to play a moderate role and be of some importance in sustaining school gardens, the support of those in the inner circle of the school environment (students, teachers, administrators) seem to be of greater importance in its development and sustained use.

On average, only 31.25% of students were engaged in the garden regularly. This is considered one of the weakest components of the garden integration that was expressed in the survey. Due to the construct of the questions it is challenging to tell if similar to students, a small number of teachers are engaged in the garden. Based on the literature, it is assumed that teachers with interest in the garden are more likely to be engaged (Bucher, 2017; Burt et al., 2017; Skinner & Chi, 2012). Therefore, further support is required in engaging more teachers and students. One narrative study in the literature discussed how a dedicated position was able to spend their time sparking teacher's interest in the garden, while providing a link between the garden and curriculum (Summers, 2013). As a full time position may not be feasible at every school or at the district level, community organizations may be the bridging link from gardening to education. In the literature several studies have been conducted on state wide or regional organizations that fund, train and link gardens to curriculum (Graham et al., 2005; Hazzard et al., 2011, 2012). This area should be further explored in a Canadian context and with School District 61.

The literature suggests that the garden can be considered a place for further student engagement and inclusion. While, this area was not completely explored in the survey, the little exploration conducted suggests that more support is required to engage students and teachers in the garden more regularly. To understand the barriers to engagement and type of opportunities required to assist engagement an additional case study could be conducted on experiences of students and teachers with their school gardens.

Strengths and Limitations

The School Garden Survey response rate was strong with 64% of schools with gardens responding. Guittet, Giraudeau and Ravaud (2005) stated that a 30 to 40% response rate is common for school-based surveys or audits. There are several potential reasons this survey received a higher response rate than the average school-based survey or audit. The first is due to the protocol for dissemination of and follow up on the survey. Island Health played an important role in administering the survey and conducting follow up phone calls and emails. The second potential reason for a high response rate is that during the time the survey was administered SD61 Facilities Managements accidentally ordered the wrong type of garden equipment for their grounds staff. They distributed the equipment to schools with gardens, notified schools by email and thanked schools for participating in the survey in the process. Although this was not planned or implemented with the knowledge of the research team it could have acted as an incentive for schools to complete the survey. Further, the observations showed that schools that completed the survey had immaculate gardens, which may indicate a higher interest and engagement with their garden, and a bias in the results. From the eight schools with gardens that did not complete the survey, five of them were accessible to be observed. Only one of the

five schools had a well-maintained garden based on the observation criteria. The other four did not have anything growing or the garden was covered in weeds. It was clear that these four gardens were not used that school year. An additional follow-up case study of the schools that didn't take part in the survey could uncover additional core components necessary in sustaining school gardens in SD61.

The six main limitations to this study are listed below:

- 1) The survey and observation conditions present a limitation. One of the first issues faced in school-based research is negotiating access to the project setting, which includes the length of time required to complete the audit and whether portions of the audit can be done without the entire team present. The audit/observations were conducted by a small team of people following training and reliability was not assessed. In addition, this project used self-report on-line surveys and there was no researcher present during the time the survey was administered. Participants couldn't ask clarifying questions during the survey. There are known biases in self-report (e.g. memory, positive response bias, etc.) (Kelley, Clark, Brown, & Sitzia, 2003). Participants may over- or under- state the state of their garden, and they may be more prone to distractions and competing priorities increasing the risk of errors (Kelley et al., 2003). Observation of the school garden itself was useful as a way to validate some of the answers and to mitigate some of the limitations of the online survey. In fact, the observations showed that gardens were well maintained regardless of their integration. A further limitation was the time period for reporting and volunteer awareness. The time a garden was built was logged but it may be that there was a previous garden that wasn't maintained that individuals were unaware of.

2) Action research presents another limitation. Action research involves stakeholders or communities actively in research in order to create social change (Atwel, Kemmis, & Weeks, 1998). Due to the participatory nature of action research, several limitations can occur. These include; 1) the time spent building and maintaining informal networks and relationships to have a successful research project, 2) finding a balance between stakeholder needs and researcher needs, and 3) the scope of flexibility within the project plan to adapt timeframes and processes to suit the situation (Mackenzie, Tan, Hoverman, & Baldwin, 2012). In order to mitigate these limitations, frequent and transparent stakeholder communication was required, in particular with the school district, to ensure the highest level of support was available for the study (Mackenzie et al., 2012).

3) As the lead researcher works for a non-profit that funds and manages the region's network of farm-to-school programs including school gardens, there was a risk of bias present through the research project. This bias may have taken the form of pre-established relationships with schools which affected the response rate as well as a positive response bias (answering what they expected the researcher wanted to hear) and interpretation bias within the reporting process itself whereby reports to the School District and Island Health favoured having increased support for school gardens. To mitigate these biases, Island Health was the primary contact for dissemination and follow up with schools to complete the survey. Furthermore, the researcher followed the ethics protocol and worked with the Action Research Team when decisions for survey design, process and reporting were made.

4) Even with a high response rate, inconsistencies within the data are present. In spring 2017 it was estimated that 24 schools had a school garden. From the time this master list of schools with a garden was administered, two schools said their garden was no longer in use and two schools reported starting their school garden that year. Without regular annualized auditing of the status of school gardens in SD61 it is challenging to provide an exact number of school gardens within the district. Further research is required on the history of school gardens in SD61 and on-going monitoring of their development.

5) The quality of data will change depending on the person who fills out the survey, which demonstrated itself as true when comparing the two schools that had two different school garden champions complete the survey. Of these two schools the majority of responses were consistent, while occasionally responses varied, especially responses that required an opinion from the participants. As school environments are complex and ever changing, it is difficult to truly capture a picture of what is occurring in school gardens. A follow up case study is recommended for schools that performed well and poorly on sustaining their school garden.

6) Finally, the generalizability of the data should be viewed in the context of the limitation that the study only represents schools with gardens in School District 61 and for the survey itself the 16 schools that responded. Victoria BC has a mild climate and there are a number of stakeholder groups in action and collaborating related to food and healthy eating in the schools. Thus the generalizability of the findings to schools in different climate zones or with different District engagement may not be appropriate.

Conclusion

It was clear that the school environment played an important role in the development and sustained use of school gardens. As the number of schools building school gardens increases in SD61, it is important for the District to continue to monitor and support school gardens to ensure sustainable development. This survey indicated that school gardens were mostly used for academic study and yet teachers were responsible for developing their own lesson plans, with external support mostly from websites. Teachers and students were considered the most pivotal stakeholders in school gardens so creating policies or school practices that support their ability to seamlessly engage in school gardens should be a priority for strengthening garden sustainability (Bucher, 2017; Burt et al., 2017; Skinner & Chi, 2012). This includes curriculum development, professional training, and allotted time within the day for engaging with the garden. General maintenance and upkeep of a school garden is part of the longevity, and while respondents had well maintained gardens, further exploration is needed to determine if the remaining gardens and gardeners are similar or need supports to sustain themselves. Consistent with the literature, both financial support and organizational infrastructure played a role in the schools' ability to use their gardens over the long term (Burt et al., 2017; Hazzard et al., 2011; Ozer, 2007; Turner et al., 2017, 2016)

Recommendations for Practice

To support the sustainability and integration of school gardens, school districts could offer financial support either directly to the school or by acquiring necessary infrastructure such as automated irrigation systems. Furthermore, integrating the school garden into already existing programs and classes may promote the ability to support the

growth of the school gardens within the District. The school gardens should be interwoven into already existing activities and classes. This will stop the garden from being seen as a standalone additional activity for the school. The support of garden guides and educational material could increase teachers' ability to seamlessly engage the garden with classroom activities and curriculum. Professional development is another area to promote teachers' ability to tie curriculum into the school garden. The aggregation of volunteers could allow the district to strategically direct community partners to school gardens that require additional support. Regular monitoring and feedback on the development of school gardens would provide a feedback loop to administrators on how their school gardens are sustaining and how to effectively create additional channels of support. Finally, to embed these recommendations into the current infrastructure of schools it is important that strategic direction is developed at the district level, setting long term and short term goals for school garden institutionalization. Therefore, it is suggested that a district garden working group is created. This group could work with the District to explore five areas to further support school gardens, these include: professional development, volunteerism, school garden irrigation, courses that allow teachers and students regular time in the garden and District level policy.

Recommendations for Future Research

Overall, there is a plethora of additional research that could be conducted within this field. A few important areas of additional study are developing a standardized survey to measure individual and district-wide school garden integration and help to understand the experiences of students and teacher that support school gardens. Further research is needed on the type of educational material required to support integrating school gardens

into classrooms and academic instruction. Additional research on the monitoring and evaluation of school gardens could be framed as feedback loops that would allow changes to be made in the program delivery of school garden programs to ensure they are used to their maximal potential.

There are no specific goals to reach that allow a district to say all gardens are fully integrated and sustained because the school system and environments are too complex, and currently school gardens are not fully embraced at a federal or provincial level. However, the sustainability components and barriers can be added or removed at a district level to ensure the integration and use of a school garden. Knowing that there are finite resources and time at the district level requires strategic and intentional decision-making within school districts and schools when it comes to adapting and fully integrating different components. In the end, the first step is the reflection and acknowledgement that work is happening and understanding how we can learn from and build off this work to have school gardens reach their full potential.

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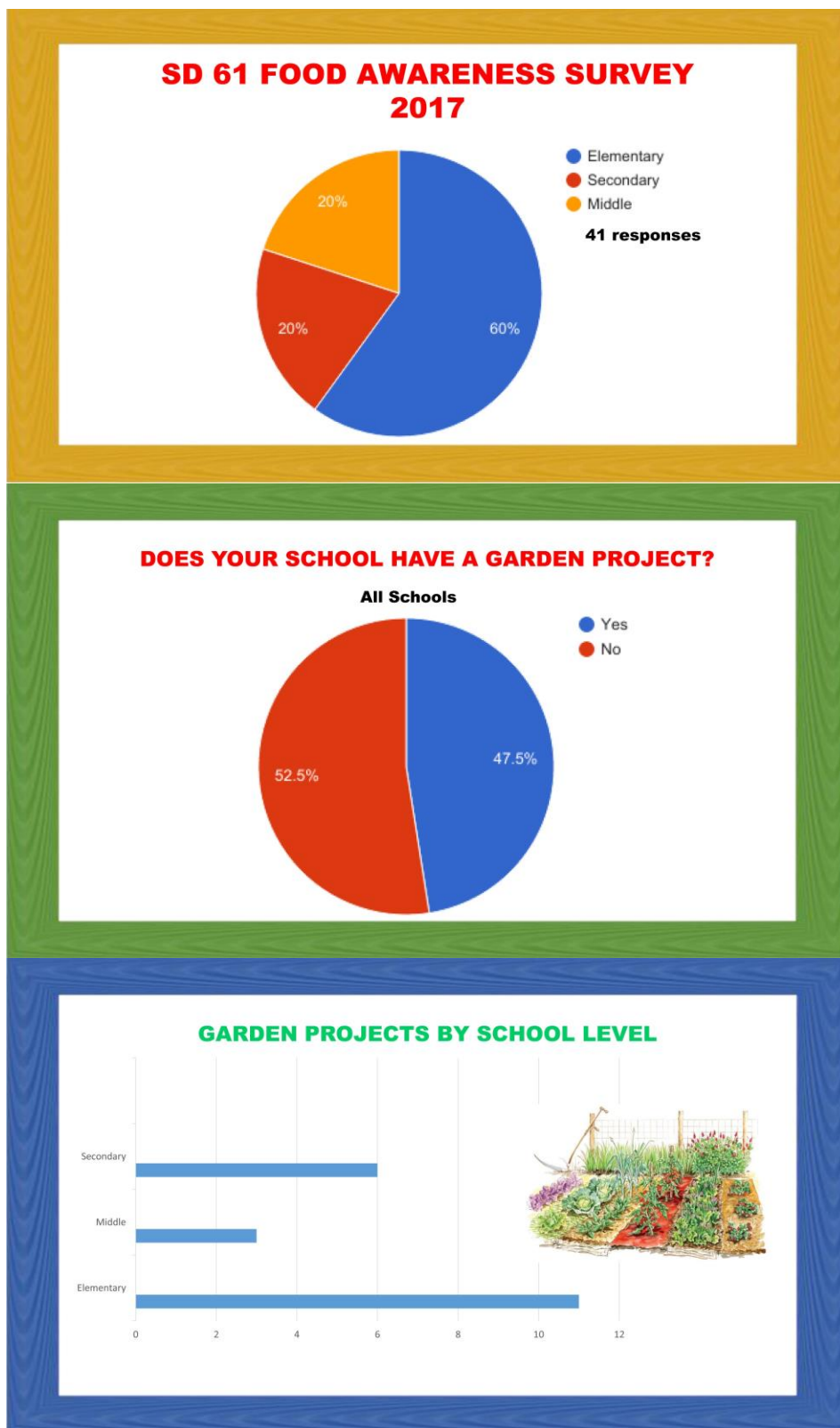
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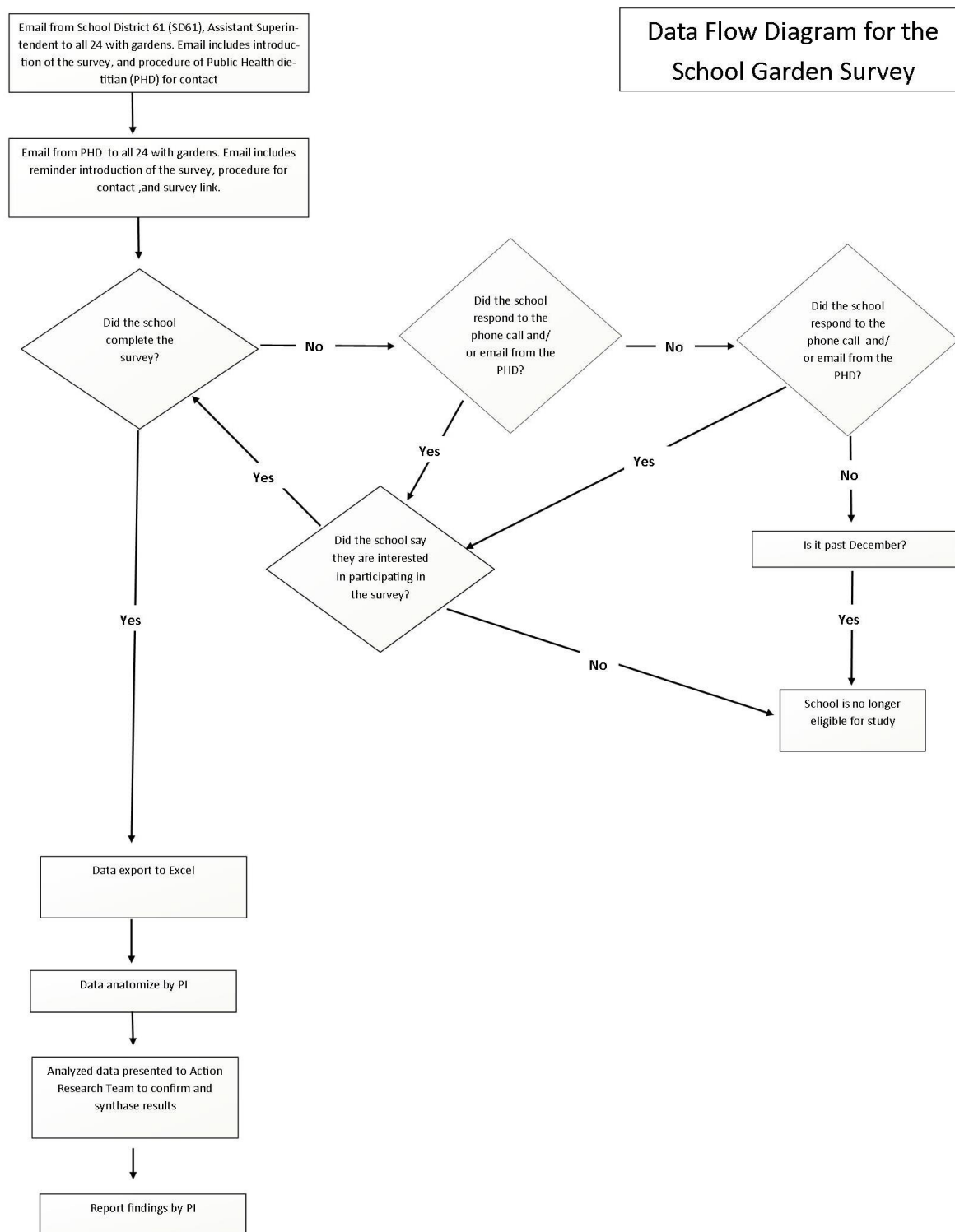
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Appendix A



Appendix B



Appendix C

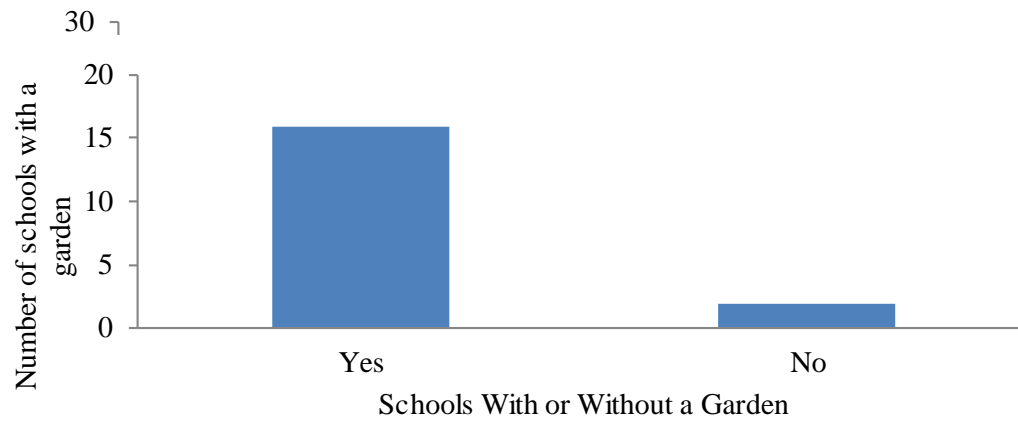


Figure 18. Schools that completed the survey that have a garden compared to those who had a garden that is no longer in use.

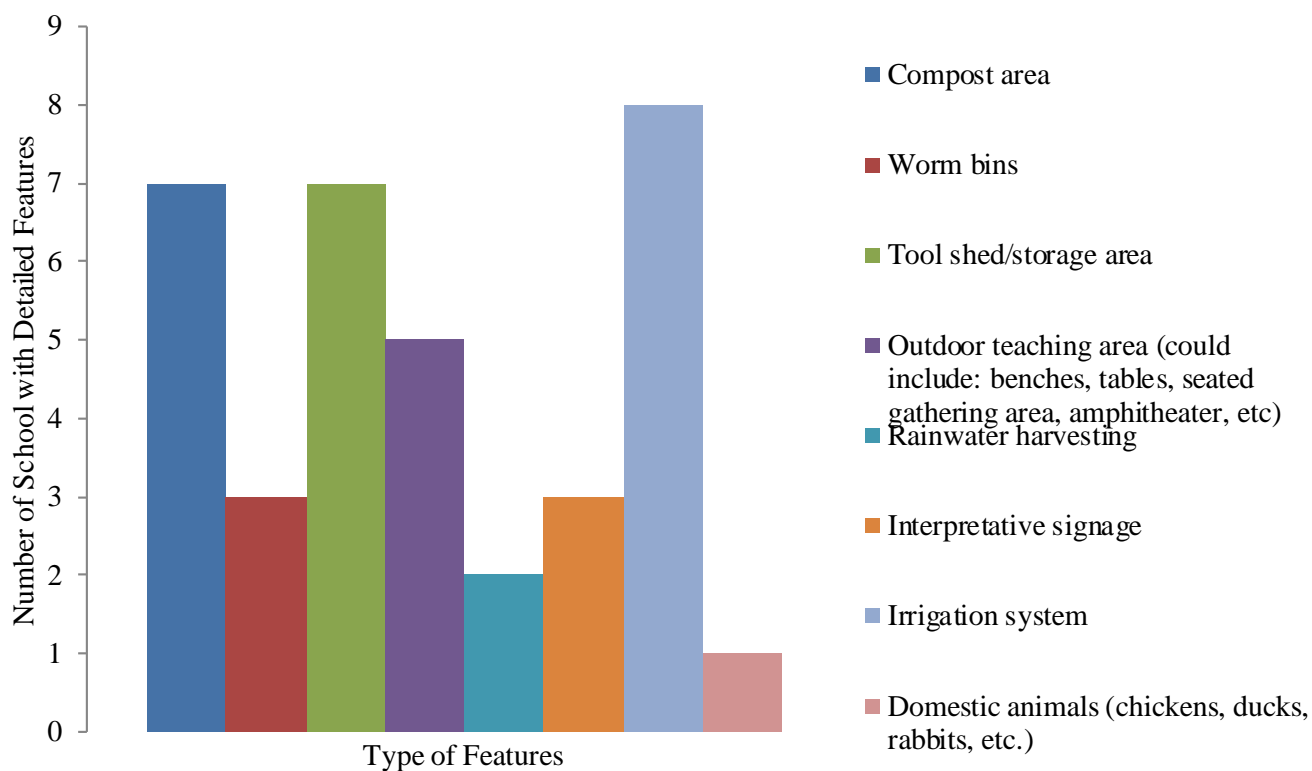


Figure 19. Detailed features present within a school garden.

* Options excluded from graph because no school selected this feature; washing sinks, outdoor food prep/kitchen area, solar panels, pond and bee hive.

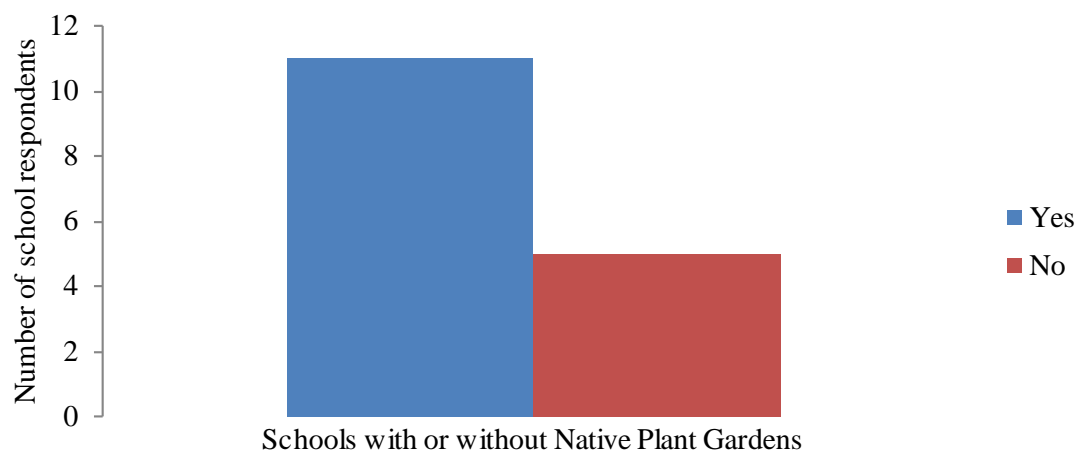


Figure 20. A comparison of schools with or without a native plant garden or area.

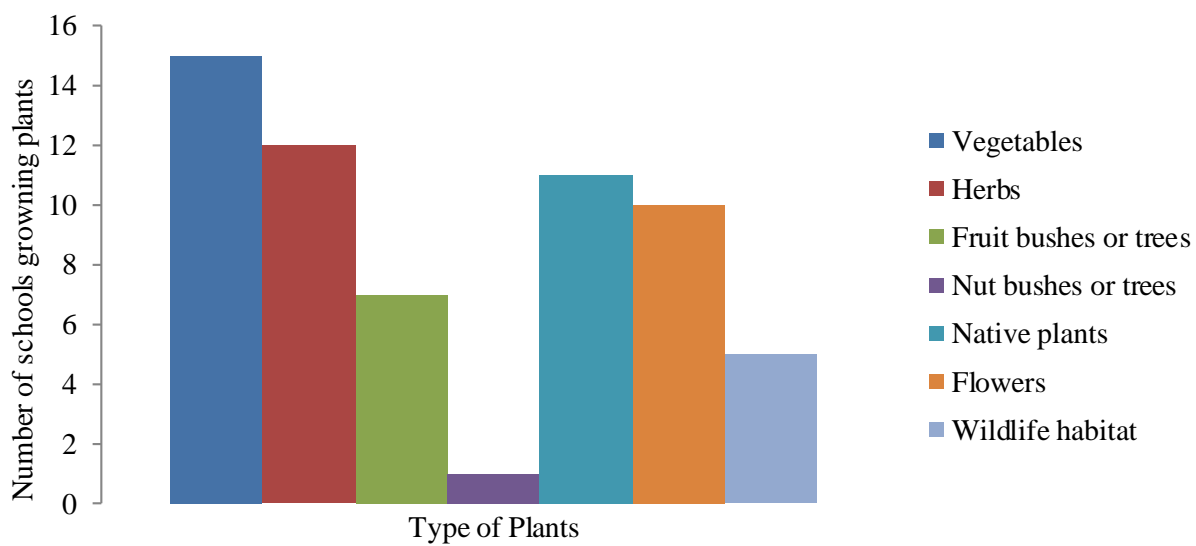


Figure 21. A list of the types of plants growing in the school garden.

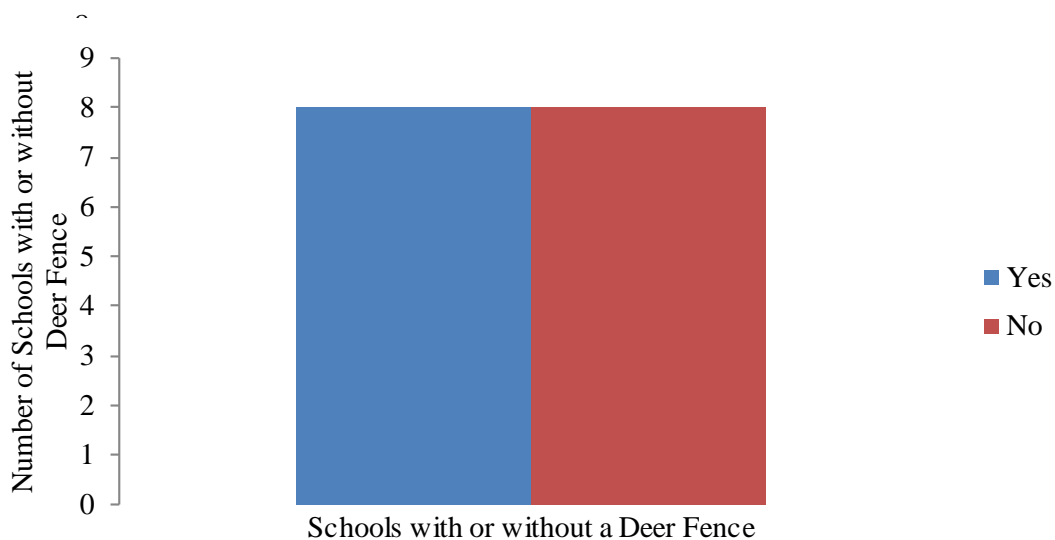


Figure 22. School gardens with or without fencing.

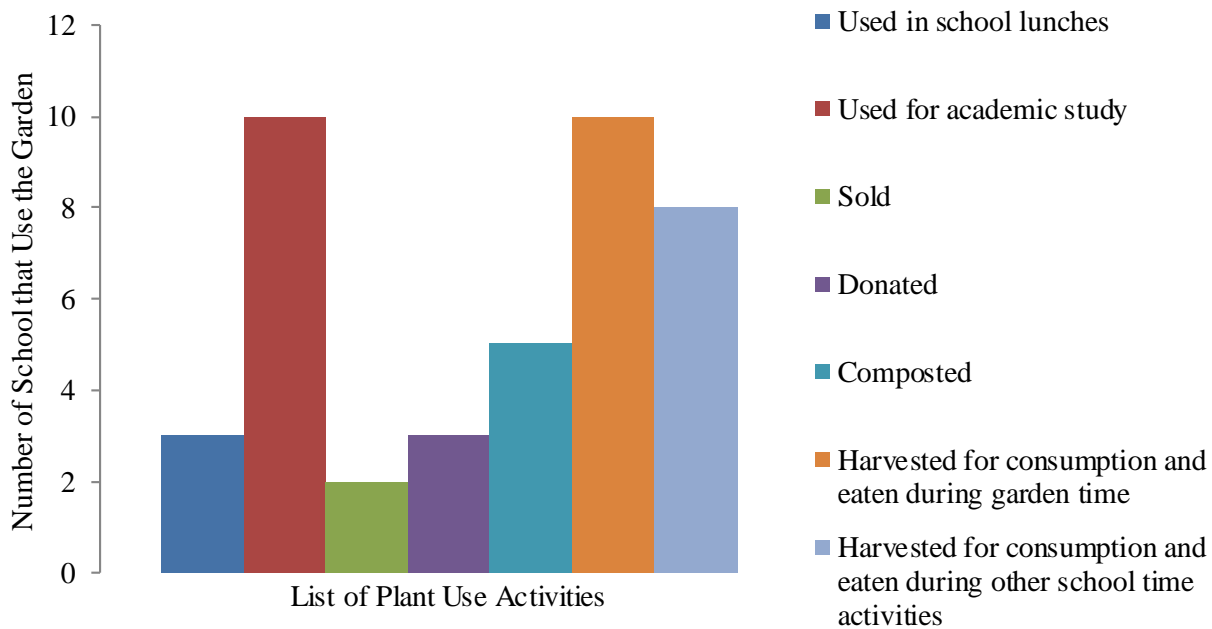


Figure 23. A bar graph that shows what the plants in the school garden are used for after they are grown.

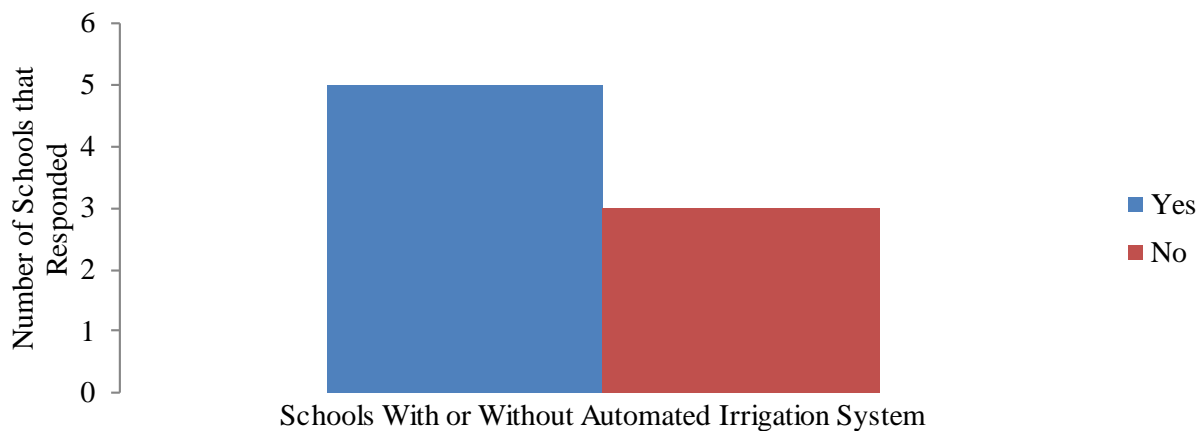


Figure 24. A graph chart comparing the number of schools that have an irrigation system that is automated compared to those that do not have an automated irrigation system.

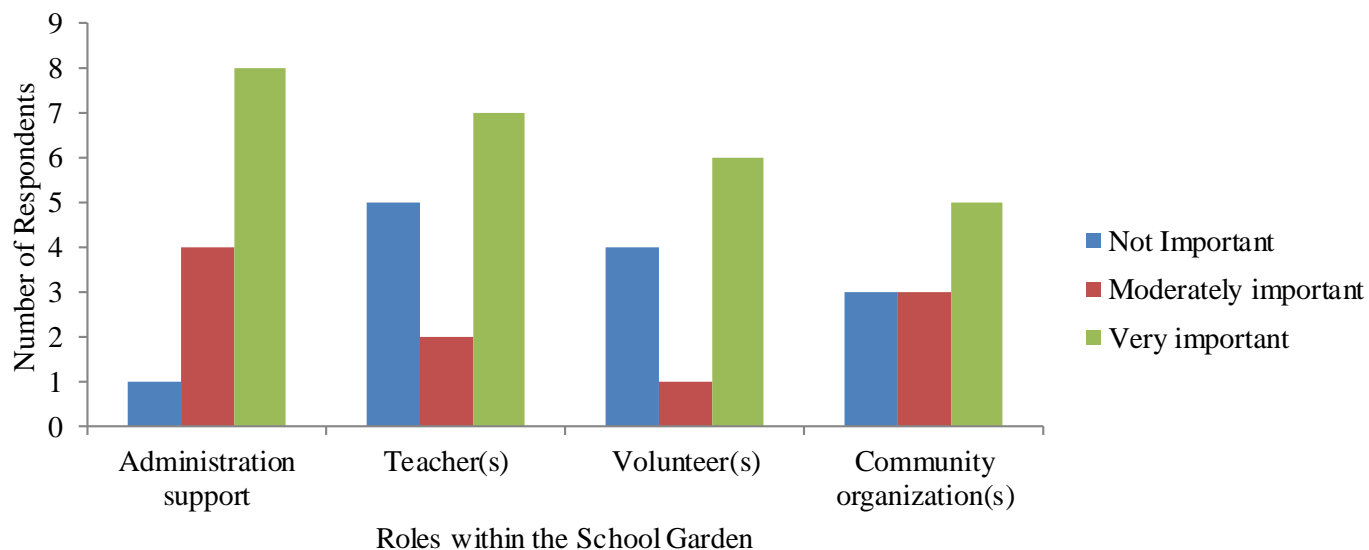


Figure 25. Ranking of the top three elements of the school garden.

* Time schedule within the school day for garden instruction, Educational material linking students to the garden, Financial support, Pro-D Day development for teachers and Curriculum ties results are in figure26

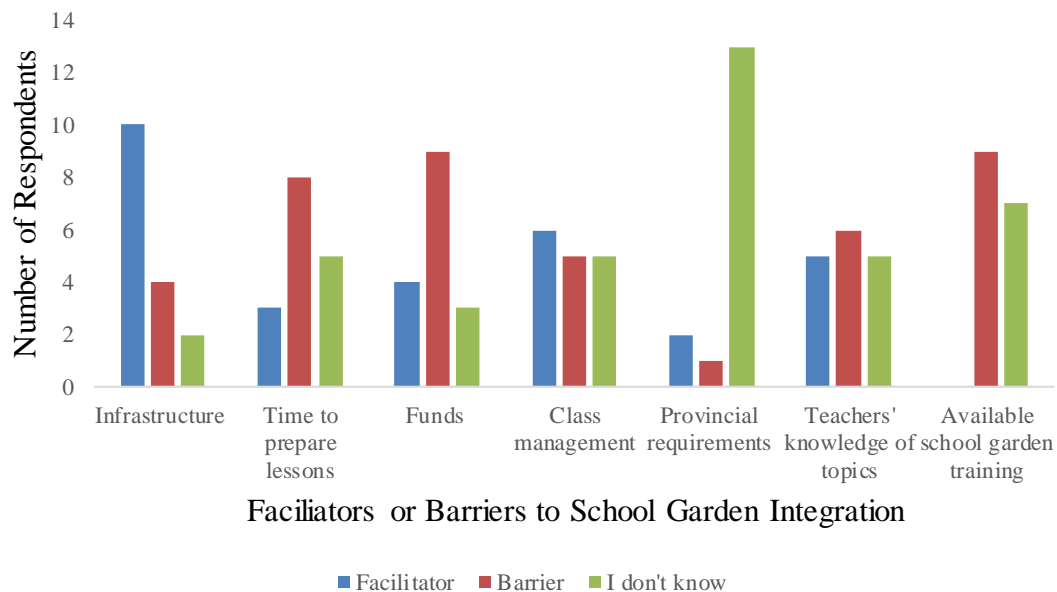


Figure 26. Participant reflection of facilitators and barriers to school garden integration.

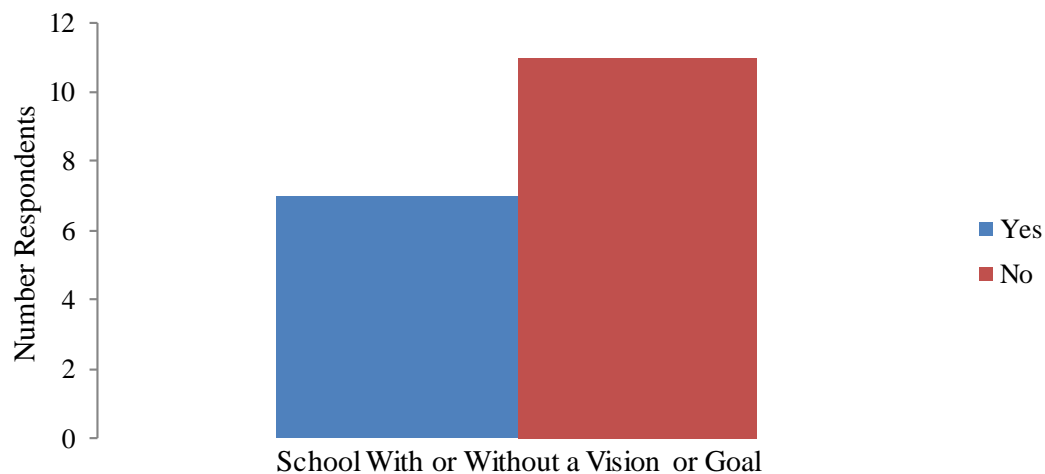


Figure 27. Schools that either have a vision or goal or do not have vision or goal for their garden.

Appendix D



**University
of Victoria**

School Garden Survey

Protocol version number/version date: V5/18.09.17

ONLINE CONSENT

You are invited to participate in this research study by completing an online survey. This survey will take about 30 minutes to complete if you have a school garden and 5 minutes to complete if you had a school garden that is no longer in use. This online survey can be completed during school's hours and should be completed with an administrator (principal or vice principal) and in collaboration with the person who is in charge of overseeing your school garden (school garden champion).

The purpose of this study is to understand the current status and sustainability of school gardens in SD61; specifically what sustainability components and facilitators and barriers to sustain a school garden are present. Ultimately the information gathered will help inform policy and practice and allow the School District and community partners to create more opportunities for student food literacy education and food access. If desired, your school will receive a short report on your school gardens; its strengths and weaknesses and recommendations for improving your school gardens' sustainability. You are being asked to participate in this study because you are a school principal and/or a school garden champion in School District 61.

The research team consists of three people who will have access to the data: Aaren Topley (UVIC, Masters Student), Dr. Patti-Jean Naylor (UVIC, Associate Professor School of Exercise Science, Physical and Health Education), Janelle Hatch (Island Health, Healthy Schools Coordinator). In order to provide your school with an individual report, school data will not be de-identified at the initial stages of research; however, for further analysis and dissemination of the broader research and education stakeholder community all information will be de-identified. Your individual school and school garden information will never be shared publically but raw data will be available to School District 61 and Island Health in order to better support school gardens.

FluidSurvey is an online survey tool used by researchers at UVIC. The survey data is inputted into a Canadian-based platform.

There is no personal information gather in this survey and it does not identify individuals,

or use phrases that could identify you or other individuals that provide data. There are limits to anonymity of the individuals that provide the school-level data; however, based on the size of the school district, the specific roles of individuals in the school and the fact that a school-level report will be produced.

Data will be stored on a secure UVIC research network drive and will be available for access by School District 61, UVIC Researchers and Island Health. All data will be retained for a minimum of five years following the last publication, after which point it will be destroyed.

Additionally, during the observation phase of this study photos will be taken of the school garden. Photos will only be of the garden and will not have people in them. The photos may be used for thesis dissertations, presentations to the public and private spheres (ex. Stakeholders, city hall, academic conferences etc.), and through publishable material include reports, academic journals and media releases.

You have the right to exit the survey at any time for any reason. Participating in this survey does not waive any of your legal rights to research related harm.

By beginning/clicking/starting this survey, I am providing my consent, and I understand that my data cannot be withdrawn once I begin.

1. Name of School: _____

2. Does your school have food school garden?

Yes

The garden is no longer in use (link to Q 3 and 38)

1.0 Survey Roles

3. Administrator (Principal or Vice-Principal Only): How would you describe your role in your school garden?

4. Garden champion only: How would you describe your role in your school garden?

1.1 General Information

5. To the best of your knowledge how long has your school garden been operating?
(when was it first created)

_____ [estimated to the closest amount in years]

Comments: _____

6. Select all of the following characteristics of a school garden that are present in yours.
(select all that apply)

- In the ground; in one or more areas
- Planters/pots
- Raised bed; in one or more areas
- Greenhouse
- Potted plants inside or outside classroom
- On the roof
- Off school campus
- Other [describe]

7. What type of plants exist/will be grown in your school garden this academic year?

- Vegetables
- Herbs
- Fruits ornamentals
- Nuts
- Native plants
- Flower
- Wildlife habitat
- Other [____ describe ____]

8. What features does your garden have? (select all that apply)

- Sinks
- Food prep/kitchen area
- Weather station
- Compost area
- Worm bins
- Tool shed/storage area
- Outdoor teaching area (benches, tables, seated gathering area, amphitheater etc)

- Rainwater harvesting
 - Solar panels
 - Pond
 - Interpretative signage
 - Automated irrigation system
 - Greenhouse
 - Bee hive
 - Domestic animals (chickens, ducks, rabbits, etc.)
 - Other features (not listed above) [describe]
9. If your school has an area of the grounds dedicated to native plants, what is being grown?
CHECK ALL THAT APPLY
- Medicine Wheel
 - Camas Meadow
 - Nature area or nature classroom
 - Other native ecosystem [describe]
10. Is your garden surrounded by deer fencing?
- Yes (go to #) No (go to #)
- Comment: _____

1.2 School Garden Upkeep

11. Who maintains your garden during the school year?
CHECK ALL THAT APPLY
- Community organization [name(s)]
 - Community volunteer
 - Culinary teacher
 - Home Ec. teachers
 - Other teacher: _____
 - Students
 - Working farmer or market gardener
 - Master gardener/landscaper
 - Parent(s)
 - Other: _____
12. Who manages (makes decisions and implements them) your garden during the school year?

- Community organization [name(s)]
- Community volunteer
- Culinary Teacher
- Home Ec. Teachers
- Other Teacher: _____
- Students
- Working farmer or market gardener
- Master gardener/landscaper
- Parent(s)
- Other: _____

13. Who maintains your garden during the summer?

CHECK ALL THAT APPLY

- Community Organization [name(s)]
- Community volunteer
- Culinary Teacher
- Home Ec. Teachers
- Other Teacher: _____
- Students
- Working Farmers or market gardener
- Masters Gardener/landscaper
- Parent(s)
- No one maintains the garden during the summer
- Other: _____

1.3 School Gardens and Student Learning

14. How are the plants grown in the garden used? (select all that apply)

- Used in school lunch
- Used for academic study
- Sold
- Donated
- Composted
- Harvested for consumption and eaten during garden time
- Harvested for consumption and eaten during other school time activities
- Other [describe]

15. When is the garden used? (select all that apply)
- During class instruction time
 - During recess
 - After school
 - Before school
 - Summer program/camp
 - Non-school community uses
 - Other [describe]
16. What grade level(s) participate in garden programming at your school? (select all that apply)
- Pre-K
 - Kindergarten
 - 1st
 - 2nd
 - 3rd
 - 4th
 - 5th
 - 6th
 - 7th
 - 8th
 - 9th
 - 10th
 - 11th
 - 12th
17. Approximately what percentage of students at your school participate in learning activities in the garden ONCE PER year or more?
- Less than 25%
 - Between 25% -50%
 - Between 51% -75%
 - More than 75%
 - I don't know
18. Approximately what percentage of students at your school REGULARLY participate in learning activities in the garden? Regularly is defined as every 2-3 weeks or more during the growing season, typically Sept to October and April through June)
- Less than 25%
 - Between 25% -50%
 - Between 51% -75%

- More than 75%
- I don't know

19. How many classes are in your school?

20. Please estimate how many classes are using the garden for teaching and learning in a school year?

21. What academic and non-academic subjects is the garden used for?

- Mathematics
- Science
- English
- Social Studies
- History
- Art
- Computer Technology
- Languages
- Environmental Studies
- Health
- Home Economics
- Nutrition
- Physical Education
- Special Education
- Business/Enterprise
- Service learning/community service
- Flex Studies
- Agriculture studies
- Other [____ describe ____]

3. Teachers and Staffs involvement in the Garden

22. Rate the level of contact/ engagement in the garden of the following stakeholders have

	Never	somewhat often	Often	more often	most
Teachers					

Culinary teachers					
Home Ec. teachers					
Educational Assistant					
Parent volunteer					
Community Organization					
Working farmers and market gardens					
Community volunteers					
Master Gardens					
Older students					
Other [name]					

23. How many teachers are in your school?

24. Estimate how many teachers are involved the garden at some point during the school year or summer?

5.3 Fruit Trees

25. Do you have fruit trees?

Yes

No (link to next section)

29a. If yes, tell us about the fruit trees?

Type/s: _____ Number of fruit trees: [drop box with numbers]

26. If the fruit is used, how is the fruit being used?

CHECK ALL THAT APPLY

- Frozen and used throughout the school year
- Dehydrated and used throughout the school year
- Canned and used throughout the school year
- Baked or made into other ready to eat dishes
- Sold (fresh or processed fruit) as a fundraiser?
- Donated to community organizations
- We don't use the fruit
- We just let people eat it as they wish
- Other: [describe]

27. How many classes incorporate the fruit tree/s into teaching and learning?

28. If your fruit trees and/or bushes are maintained during the school year or summer, who maintains them?

CHECK ALL THAT APPLY

- Facilities staff
- Teacher/s
- Educational Assistant/s
- Parent/s
- Community organization/s Please describe: _____
- Other: _____

Part 6: Self-Assessment

29. Does your school have vision and/or goal statements for the school garden?

Yes

No

30. If yes, what are the vision and/or goals for your school garden?

31. To what extent is each of the following a significant facilitator or barrier to integrating your school garden into teaching and learning at your school?

	Facilitator	Barrier	I don't know
Physical Infrastructure			
Time to prepare lessons			
Funds			
Class management			
Provincial requirements			
Teachers knowledge of topics			

32. Rate the benefit of each of the following related to your school garden sustainability in the past year?

	Less Beneficial	Beneficial	Most Beneficial
Admin Support			
Community organization			
Parents			
Teachers			
Student			
Working farmer or market garden			
Time scheduled within the school day for garden instruction			
Educational material linking students to the garden			
Financial support			

Pro-D Day development for teachers			
Other:			

36a. Select the top three elements and rank them from 1 being the most important to 3 the least beneficial your school garden overall

	RANK (1, 2 or 3)
Admin Support	
Teachers	
Volunteers	
Time schedule within the school day for garden instruction	
Educational material linking students to the garden	
Financial support	
Pro-D Day development for teachers	
Community Organizations	
other	

33. Rate the factors/resources that would assist your school garden being used as an academic instructional tool.

	Less helpful	Helpful	Most helpful
Access to garden based curriculum/education material			
Teacher training in garden skills			
Teacher training in garden based learning instruction			
Teacher training in outdoor classroom management			
Lesson planning time			

Encouragement from admin to use the garden as an instructional tool			
Other			

Part 7. Survey Feedback

Island Health is considering tracking gardens over time – we would like your feedback. How could we improve this survey?

Only complete the next questions, if you had a garden and it is no longer in use.

34. What is the main reason your garden is no longer in use?

- The teacher or staff that took care of the garden left the school
- The teacher or staff taking care of the garden was no longer able to take care of it
- The community partner couldn't provide enough volunteers to take care of it
- We could no longer afford the community partner who could help take care of it
- We no longer wanted the community partner to take care of it
- It was built in an inappropriate area (eg. in the shade, no water access)
- We no longer had the resources to take care of it
- It was too challenging to water regularly
- Other (please describe)_____

Thank you for participating in our survey! The information you provided will help us support your school garden and other school gardens in the district for long term sustainability.