# IMPROVING NUTRITIONAL INTAKE THROUGH ENVIRONMENTALLY SUSTAINABLE SCHOOL FOOD PROGRAMS

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## ABSTRACT

Healthy eating supports optimal growth, development, and academic achievement. Food insecurity and overweight are concerns in school-aged children, and food literacy skills are declining. The structure of our society has led to little connection between people and their food, including where it comes from and how to grow and prepare it. This is occurring at the same time the looming environmental crisis is compromising our ability to produce food. Schools can promote healthy eating, yet, at the time of preparing this dissertation, there is no national school food program in Canada. School food programs that do exist often have insufficient funds to operate but should be designed to include healthy food options along with sustainable food system strategies such as teaching about growing, harvesting, and preparing food, along with composting and reducing waste.

In **paper 1**, I conducted a scoping review to determine promising practices for school food programs in Canada. The search included 17 peer-reviewed and 18 grey literature articles covering 23 programs in 10 provinces. School food programs should address social determinants of health, food systems, and environmental and economic sustainability

**Paper 2** describes a cross-sectional assessment of foods that children in grades 4-8 in and around Saskatoon had in their lunches. A School Food Checklist (SFC) and digital photography were used for data collection. Diet quality was compared amongst students in schools of three types: urban schools that have a meal program (n=3), urban schools that do not have a meal program (n=3) and rural schools without a meal program (n=3), with the total sample containing lunches from 773 students. The diet quality of all students needs improvement.

**In Paper 3**, I describe a multi-case study including two Community schools. Data was collected through interviews with teachers and Nutrition Workers, observations, document review of curriculum and policy, and by using the School Food Environment Assessment Tool Checklist. Barriers and facilitators to implementing sustainable food systems were identified. Community Schools are in a strong position to be leaders in the area of school food if they prioritize sustainable food systems, develop supportive policies, and include community members.

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CCHS Canadian Community Health Survey

CHEP Good Food Inc. Formerly Child Hunger and Education Program; however the vision became broader that school food programs so it was renamed to CHEP Good Food Inc. in 2004

HEI Healthy Eating Index

MNF Minimally Nutritious Food

MPS Meal Program School

NMPS No Meal Program School

NMP-RS No Meal Program Rural, rural context

NSLP National School Lunch Program

SES Socio-economic status

SFC School Food Checklist

SFD Slow Food Denver

SFEAT School Food Environment Assessment Tool

S-HEI School-adapted Healthy Eating Index

# CHAPTER 1: INTRODUCTION

There are many health impacts of over-nutrition (overweight, diabetes) and undernutrition (micronutrient deficiencies) despite having a global industrialized food system with unprecedented access to a variety of foods (Tugault-Lafleur, Black, & Barr, 2017; Wittman, Desmarais, & Wiebe, 2010). Ironically, despite massive food production, the food system has been unable to ensure food security and nutritional adequacy for everyone and compromises long-term food security and sustainability (Wiebe & Wipf, 2011). Concerns over diet quality are relevant both globally and locally. For example, In Canada, Canadian Community Health Survey data (CCHS) indicates the diet quality of school-aged children during school hours is poor (Tugault-Lafleur et al., 2017).

Sustainable food systems consider food security, food sovereignty, nutritional adequacy, environmental, economic, and ethical impacts of our food system (Tagtow et al., 2014). Moving towards sustainable food systems is necessary for long-term food security by ensuring that our food production practices protect the very environment that produces our food.

The school environment provides an opportunity to address diet quality while promoting sustainable food systems. Schools play a significant role because children consume a great deal of their food over the course of their schooling and this can contribute to establishing lifelong eating practices (Ballard, 2013; Oostindjer et al., 2017). Combining practical life skills such as cooking and growing food with modeling healthy choices can enhance the connection of children and youth with where food comes from and encourage healthier eating practices (Nowak, Kolouch, Schneyer, & Roberts, 2012). Also, schools can promote a sustainable food system through education, policy, and practice (Rojas et al., 2011). Healthy eating and sustainable food system strategies benefit both human and environmental health.

The purpose of this research is to support healthy eating practices in elementary school children by incorporating sustainable food system practices and promoting healthy environments. The first component focuses on identifying current programs and determining promising practices for school food programs in Canada. The second component investigates the nutritional quality of school lunches to determine if there is a difference between foods offered in schools compared to foods brought from home. It identifies the eating patterns of children in

three elementary school types in the Saskatoon region: schools with a meal program, schools without a meal program, and rural schools. The third component examines current practices in implementing sustainable food system strategies in schools to determine barriers, facilitators, and opportunities for implementing environmentally sustainable strategies and food programs in elementary schools.

## 1.1 Background to the Research

### 1.1.1 Sustainable Food Systems

Humans need resources from the natural environment to survive. This requires healthy soil, adequate water, and healthy ecosystems to grow food. A sustainable food system recognizes that the health of humans depends on healthy ecosystems (Loring, Hinzman, & Neufeld, 2016). In the last 30 years, ecosystems have been compromised for financial gain as "sustainable development has traded off environmental protection for economic development" (FAO, 2012, p. 22). A shift is needed to address concerns about carbon emissions, biodiversity loss, soil health, water quality, and land use (FAO, 2012).

Incorporating sustainable food system practices can help mitigate the environmental impacts of our food system. The Food and Agricultural Organization defines sustainable diets:

> Sustainable Diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources." (FAO, 2012, p. 294).

Sustainable food systems incorporate several strategies to promote planetary and human health. The FAO (2012) recognizes the importance of having a low environmental impact and protecting and respecting biodiversity while ensuring nutritional adequacy and food security. Food should be accessible, affordable, culturally acceptable, and economically fair and produced in a way that considers both present and future generations (FAO, 2012). Similarly, Tagtow et al. (2014) developed a Sustainable, Resilient, and Healthy Food and Water System Framework. This framework includes nutrition and health and environmental stewardship, but it also recognizes the importance of economic vitality and the social, cultural, and ethical capital of food systems (Tagtow et al., 2014).

In addition to sustainable food systems being respectful of the environment, Feenstra (2002) identifies the importance of economic viability for a greater number of people. This means, instead of benefitting a few, the food system would spread the wealth and power and be more decentralized and democratic. They suggests it is important for sustainable food systems to be socially, culturally, and spiritually healthy and describes several important goals of community food systems. These include all community members having access to an adequate, nutritious diet; implementing sustainable production practices; supporting local production and processing; and having more direct links between producers and consumers. Sustainable food system practices align with social, economic, and environmental justice; health; local wisdom; community spirit; and often spiritual traditions (Feenstra, 2002).

### 1.1.2 Urbanization and Globalization of the Food System

There have been large changes in the food system and eating patterns over a short time-period in Canada. In 1901, 60% of the population lived in a rural environment (Statistics Canada, n.d.). In 1941, 59% of the rural population was involved in farming activities, food production, and preparing food from raw ingredients (Statistics Canada, n.d.). Today, the percentage of the population living on farms is less than 2% (Statistics Canada, n.d.). Farms have become larger, and food production has become more industrialized, mechanized, and globalized (Qualman, 2011). The more industrialized and globalized the system has become, the more value and appreciation has been stripped from our food (Wittman et al., 2010).

The current food system in Canada is described as a neoliberal market-driven system (Wiebe & Wipf, 2011). It is characterized by industrialized farming practices that require significant capital investment and is led by large corporations instead of small farms (Wiebe & Wipf, 2011). The underlying assumption for this system is that free markets, unhindered by government regulation, are the most efficient and effective way to distribute food (Muirhead & Nurse-Gupta, 2018). This globalized, industrialized food system has distanced consumers from producers and has left consumers without the information required to make informed choices (Jaffe & Gertler, 2006). Few Canadians understand the globalized food system and the conditions under which their food is produced (Engler-Stringer, 2010; Jaffe & Gertler, 2006).

Modern living creates distance between humans and nature, with people losing sight of our essential connection to the earth to obtain food and supplies required for survival (Scott, Amel, & Manning, 2014). People are insulated from the impacts of their decisions on the

systems that sustain us (Scott et al., 2014). The environmental crisis we are beginning to experience threatens our ability to have food, shelter, and clothing (Scott et al., 2014). It is important to reduce, reuse, and recycle to help preserve resources, but this will not be sufficient to change the dominant perception that humans are separate from the ecosystems required for our survival. When people directly participate in meeting survival needs, their relationship with the natural world becomes more respectful (Elpel, 2009). This feeling of ecological connectedness predicts behaviours that help to protect the environment (Scott et al., 2014).

### 1.1.3 Deskilling and Food Literacy

Deskilling is a consequence of increasing distance between people and where their food is produced (Wittman et al., 2010) and has an impact on health. It includes uninformed food shopping, lost knowledge of food storage, food preservation, cooking, and more (Jaffe & Gertler, 2006). This loss of knowledge impacts the cost of eating, the nutritional quality of food, health, and the environment as people rely on multi-national companies to supply their food needs (Jaffe & Gertler, 2006). Packaged foods often include cheap, energy-dense, nutrient-poor ingredients such as harmful fats, sugar, and salt, have less fibre, and are often wastefully packaged (Monteiro, Moubarac, Cannon, Ng, & Popkin, 2013). Reliance on convenience foods may unintentionally increase fat intake and decrease vegetable and fruit intake, both potentially impacting health status (Engler-Stringer, 2010). As people have shifted towards relying on transnational food and drink companies for their food, there has been an increase in obesity and diabetes (Monteiro et al., 2013). The impact of processed food is significant because, by the early 2000s, ultra-processed foods made up over half of the calories consumed in Canada (Monteiro et al., 2013). Food skills, including the ability to plan, select, and prepare healthy food, may be protective against obesity and other nutrition-related chronic diseases (Slater & Mudryj, 2016).

The concept of food literacy has come in response to the increase in nutrition-related health problems. In a Canadian study, Cullen et al. (2015) conducted a scoping review along with practice-based discussions to formulate a definition of food literacy. According to Cullen et al. (2015):

> Food literacy is 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).

Similarly, Pendergast et al. (2011) identify that food skills include cooking, shopping, and reading nutrition labels. This definition acknowledges the importance food has for health and recognizes the broader context of the food system such as social, economic, environmental, and political factors. Knowledge and skills that enable people to make informed decisions within the social and environmental context will benefit individuals and contribute to a sustainable food system (Cullen et al., 2015). With better food literacy, people can become more aware of the consequences of our food system in order to make decisions that support the kind of food system they would want, rather than supporting the financial interests of multinational companies.

### 1.1.4 Food Security and Food Sovereignty

There are various definitions of food security. The Food and Agriculture Organization (FAO) of the United Nations states that food security exists when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO Rome World Food Summit Secretariat, 1996). Dietitians of Canada's statement on Community Food Security includes considerations about food policy, environmental sustainability, community self-reliance, supporting producers through local and regional food systems, and recognizes the importance of enjoying growing, preparing, and eating food (Slater, 2007). Similar to the Dietitians of Canada definition, Hamm and Bellows' (2003) definition of Community Food Security states:

> Community food security (CFS) is defined as a situation in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice. (p. 37)

Most definitions of food security go beyond ensuring access to sufficient food, and some definitions include the food system's impact on the environment.

It may be surprising that in an affluent country like Canada that produces a lot of food, food insecurity at the household level is a problem. In 2012, *Household Food Insecurity in Canada* reported that 4 million people in Canada, including 1.15 million children (16% of all children under 18 years) experienced some level of food insecurity (Tarasuk, Mitchell, & Dachner, 2014). This is nearly 13% of households. Households with children under 18 years are

at greater risk (15.5% or 1 in 6 children) compared to households without children (11.4%) (Tarasuk et al., 2014).

Food is an essential human need and is a social determinant of health. People who are food insecure are unable to obtain adequate nutritional intake and consume fewer servings of vegetables, fruit, and milk products than those who are food secure (Mikkonen, 2010). Inadequate access to sufficient nutritious food increases the risk of poor health (Office of Nutrition Policy and Promotion, 2007).

A community food security perspective acknowledges that food insecurity is a problem worldwide but addresses it at the community level by using a local food system approach (Hamm & Bellows, 2003). It uses community-specific systems strategies to address issues holistically and may include changing public policy, aligning educational strategies, and addressing transportation and farmland preservation (Hamm & Bellows, 2003). Community food security includes considerations for health, sustainability, social justice, and community self-reliance (Hamm & Bellows, 2003). It promotes a democratic food system which encourages building relationships between producers and consumers through supporting locally produced food. School settings may be an appropriate site for addressing community food security (Hamm & Bellows, 2003).

In contrast to food security, food sovereignty has a broader vision and addresses the power structures and inequalities that lead to health inequities produced by the neoliberal food system (Weiler et al., 2015). The concept of food sovereignty originated from peasants, indigenous communities, and small-scale farmers and workers in the transnational agrarian (Wiebe & Wipf, 2011) movement called La Vía Campesina (Wittman et al., 2010). This movement was created in response to local loss of control of markets, land use, and cultures as a result of the neoliberal food system (Wiebe & Wipf, 2011). In contrast to our current food system, the philosophy behind food sovereignty is that food security cannot be achieved without including food producers in formulating agricultural policies. The philosophy behind food sovereignty considers food as a basic human right and deems liberalized trade as a cause of globalized poverty and hunger. La Via Campesina argues that the inequities in the food system are generating profit for a few at the expense of many, exploiting the most vulnerable, and degrading our natural environment (La Vía Campesina, 1996; Weiler et al., 2015). The concept

of food sovereignty is aligned with a pragmatist-feminist communitarian philosophical perspective, which recognizes the importance of individuals contributing to decision-making that creates, shapes, and impacts the community (Whipps, 2004).

A food sovereignty approach to food production and distribution would address the power structures in the current neoliberal food system. Food sovereignty puts the needs of the people who produce, distribute, and consume foods in a position of influence rather than having the markets dictate food access and distribution (Nyéléni Forum for Food Sovereignty, 2007). It focuses on creating local and regional networks, supporting family farms and farmers' markets, and prioritizing local and national needs (Nyéléni Forum for Food Sovereignty, 2007).

For a sustainable, democratic, socially, and economically just food system, people need to be able to participate in aspects of that system (Rojas et al., 2011). Engaging in sustainable food systems in schools allows global issues to be addressed at a local level (Rojas et al., 2011).

### 1.1.5 School Food Programs in Canada

School-aged children spend many of their waking hours and consume approximately one-third of their daily calories while at school (Garriguet, 2007). Consequently, significant health impacts are resulting from food choices made at school. The school environment is an important site to support healthy food choices. However, Canada is one of the few industrialized countries that does not have a national school food program (Koç & Bas, 2012).

Without a nationally-funded school food program, schools rely primarily on local or regional charities to provide food to children. It is difficult to plan meals and follow nutrition guidelines when relying on donations. A study conducted in Saskatoon, Saskatchewan, looked at the nutritional adequacy of breakfast and lunch items provided to children through CHEP Good Food, Inc.'s school nutrition program over ten years. The research team weighed and analyzed the foods served to children and determined that overall, the breakfast and lunch meals were nutrient-dense and provided 1/3 of the recommended macronutrients and micronutrients (Gougeon, Henry, Ramdath, & Whiting, 2011). The energy content, however, was persistently below requirement (Gougeon et al., 2011). It is encouraging that this meal program served nutrient-dense food; but, there is no way to tell if the meals served reached all the children in need. CHEP Good Food Inc.'s food program demonstrates that it is possible to provide healthy food to children, but resource limitations may not make it possible for all children in need to

benefit. Also, providing food only to children in need may discourage some children from participating because of stigma.

The school environment is positioned to address diet quality: over-nutrition, which leads to overweight and chronic diseases, and under-nutrition resulting from food insecurity. Since these health concerns are national in scope, a National strategy would address these issues across the country. Food Secure Canada is a national organization whose membership includes organizations and individuals working toward eliminating hunger while ensuring healthy and safe food through sustainable food systems (Food Secure Canada, 2017). The Coalition for Healthy School Food, a group of Food Secure Canada, includes close to 60 organizations from across Canada who have been advocating for a Universal Healthy School Food Program so students would be able to access healthy meals every day (Food Secure Canada, 2017). In 2019, the Canadian government announced its plans to develop a Food Policy for Canada, which will promote Canadian food, support local food production initiatives, and work towards reducing waste and food fraud (misrepresenting food) (Agriculture and Agri-Food Canada, 2019). The food policy will also include the government's intention to work with the provinces and territories to work towards developing of a National School Food Program; however, details on what this will include have not been released (Government of Canada, 2019).

### 1.1.6 The Saskatchewan School Context

In Canada, decisions about education fall under provincial jurisdiction, so each province determines education standards for kindergarten through to grade 12. In Saskatchewan, the Ministry of Education determines the curriculum (Ministry of Education, n.d.). Schools can influence how people think about healthy eating and sustainable food systems both through the curriculum and through modeling (Rojas et al., 2011). Education and policy in schools can address healthy eating, food system sustainability, food security, and food sovereignty (Rojas, Orrego, & Shulhan, 2016).

Many provinces have developed nutrition guidelines such as the Saskatchewan guidelines "Nourishing Minds: Eat Well, Learn Well, Live Well" (Saskatchewan Ministry of Education, 2012, 2019). Providing nutrition guidelines, however, does not ensure that foods brought from home will be healthy. In fact, while there is little research on the food brought from home to school in Canada (Taylor et al., 2012), studies from various countries have shown that lunches provided in schools are healthier than foods brought from home (Caruso & Cullen, 2013; Evans,

Greenwood, Thomas, & Cade, 2010; Hubbard, Must, Eliasziw, Folta, & Goldberg, 2014; Hur, Burgess-Champoux, & Reicks, 2011; Johnston, Moreno, El-Mubasher, & Woehler, 2012; Stevens & Nelson, 2011).

In 1980, action was taken to address the issue of urban Indigenous poverty in the core neighbourhoods of Saskatoon, Regina, and Prince Albert. Some schools in neighbourhoods with high rates of poverty were designated as Community Schools and funding was provided to address community needs (Saskatchewan Association for Community Education, n.d.). These schools have Community School Coordinators and Teacher Associates to support community education and a school nutrition program (Saskatchewan Association for Community Education, n.d.). Community School funding and initiatives have changed over time; however, programs including nutrition programs, continue to operate to support students. The funding is currently distributed to schools through the school divisions (Saskatchewan Association for Community Education, n.d.).

CHEP Good Food Inc. is a community organization located in Saskatoon that works to improve access to healthy foods to individuals, schools and communities. Programs include collective kitchens, fresh food markets, gardening, improving infant nutrition, and school food programs (CHEP Good Food Inc., 2019). The organization is funded by the City of Saskatoon, the Ministry of Education, the United Way, and through donations. Schools that provide meal programs draw on multiple sources of funding such as Community School funding, CHEP Good Food Inc., and donations to become sufficient to meet the needs (CHEP Good Food Inc., 2019).

### 1.2. Using Quantitative Methods to Study School Food

Quantitative research can be used to assess the diet quality of school-aged children. In the context of measuring food intake, quantitative research can be used in an attempt to objectively measure what people eat. Researchers analze the data without being involved in the interpretation beyond interpreting the statistical tests (Abusabha & Woelfel, 2003). A random sample is taken from a population so the results of the findings can be generalized to the population that participants were selected from. In order for findings to be generalizable, each person in the population needs to have equal chance of being selected to be in the study (Kremelberg, 2011). Statistical tests are done to determine if findings are significant. Chapter 5

describes a study that uses quantitative research methods to characterize the lunches of children in elementary schools.

## 1.3 Using Qualitative Research to Study School Food

Qualitative research can be used to explore relative, subjective, context-specific perspectives of a situation (Taylor & Francis, 2013). This thesis uses a case study approach using Grounded Theory methodology to develop an understanding of the barriers, facilitators, opportunities, and challenges of incorporating sustainable food programs into curriculum, policy, and practice in a school setting. Other approaches could be used; however, the Grounded Theory analysis processes are well described in the literature (Charmaz, 2005, 2006; Clarke, 2005; Macdonald, 2001; Schreiber & Martin, 2013; Strauss & Corbin, 1997) so, as a novice qualitative researcher, I chose this process to analyze the qualitative data from the case study in Chapter 6. My intent is not to produce a grounded theory, but to use the rigourous analysis process as outlined by Strauss and Corbin (1990). Strauss and Corbin's version is a systematic, qualitative, inductive data collection process, where the researcher starts with an area of study and generates theories by analyzing the data (Strauss & Corbin, 1990). Their perspective recognizes that the researcher interprets meaning from the data and insights may arise from intuition or creative thought (Strauss & Corbin, 1990).

### 1.3.1 Case Study

Case study research is an approach used to study a contemporary situation in a real-life context to understand its complexity (Stake, 2006; Taylor & Francis, 2013; Yin, 2014). Case study research is appropriate for a wide range of situations from investigating an individual or a discrete phenomenon to investigating organizations or cultures (Taylor & Francis, 2013) and may include less defined situations such as studying implementation or change processes (Yin, 1984). Case study research enables an in-depth understanding of the area under study.

Case studies can use many types of methods and can include mixed-method and multiple-method designs (Morse, 2003; Taylor & Francis, 2013). Data sources vary and can include but are not limited to, interviews, observations, documents, and artifacts and may contain both qualitative and quantitative data (Yin, 2014). Data is generated from multiple sources to allow the data to converge through triangulation (Taylor & Francis, 2013; Yin, 2014).

Case study research may be explanatory or exploratory. Explanatory research tends to ask "how" and "why" questions, whereas exploratory research tends to ask "what" questions (Yin, 2014). The types of strategies used to collect data will depend on the research questions being asked.

Case studies can contain single or multiple cases. Single case studies include only one case and are frequently used in situations where the case is rare or unusual, is common, is longitudinal, or is used to observe a new phenomenon (Yin, 2014). In contrast, multiple-case studies contain more than one case, provide more evidence, and are often considered more robust (Yin, 2014). Even a study containing two cases can provide more complete data than a single case study design (Yin, 2014).

When doing multi-case research, it is important that the cases be similar in some ways (Stake, 2006). Each case is studied to gain a clearer understanding of the complexity and uniqueness of the case by understanding similarities and differences in each case. Stake (2006) refers to a group of cases as a quintain (kwin-ton), and the goal of multi-case research is to generate a clearer understanding of the quintain. Analyzing the similarities between cases provides an understanding of the quintain while recognizing differences speaks to the complexity of the situation.

### 1.4 Purpose and Objectives of the Study

The goal of my research was to assess aspects of the school food environment in Canada, with the overall inention being to improve the health of school children. Understanding the Canadian context can help to determine strategies for improving nutritional intake through environmentally sustainable school food programs. The objectives of my research were:

1. to identify promising practices for school meal programs in Canada
2. to describe the current school-time food intake patterns of elementary children (grades 4-8) in 3 school types: schools with a meal program, schools without a meal program, and rural schools
3. to identify barriers, facilitators, and opportunities to adopting sustainable food systems and food programs in schools.

These objectives are addressed in the following chapters in this thesis. To address objective 1, I discuss a scoping review I conducted to determine promising practices for Canadian school food programs in paper 1, which is in Chapter 4. This study provides an overview of the types of programs and evaluation methods that are currently being used in Canada, along with the extent to which school food programs include curriculum integration and environmental sustainability components. Due to the limited depth and breath of data in Canada, I also consulted literature to develop a framework for consideration of school food programs.

Objective 2 seeks to describe and quantify the current eating practices of elementary school children in three school types to inform the scope of future interventions. To address objective 2, I describe a study I conducted to compare the diet quality of school meals versus foods brought home in paper 2, which is in Chapter 5. To address objective 3, I describe a case study I conducted in paper 3, which is in Chapter 6.

By understanding promising practices, current intake patterns, and sustainable food system strategies in schools, I will be able to identify opportunities for interventions so schools can support sustainable food system and food program initiatives which can lead to health, environmental, economic, and social benefits. Figure 1.1 outlines how each of these research components are related to each other and what they contribute to my overall thesis.

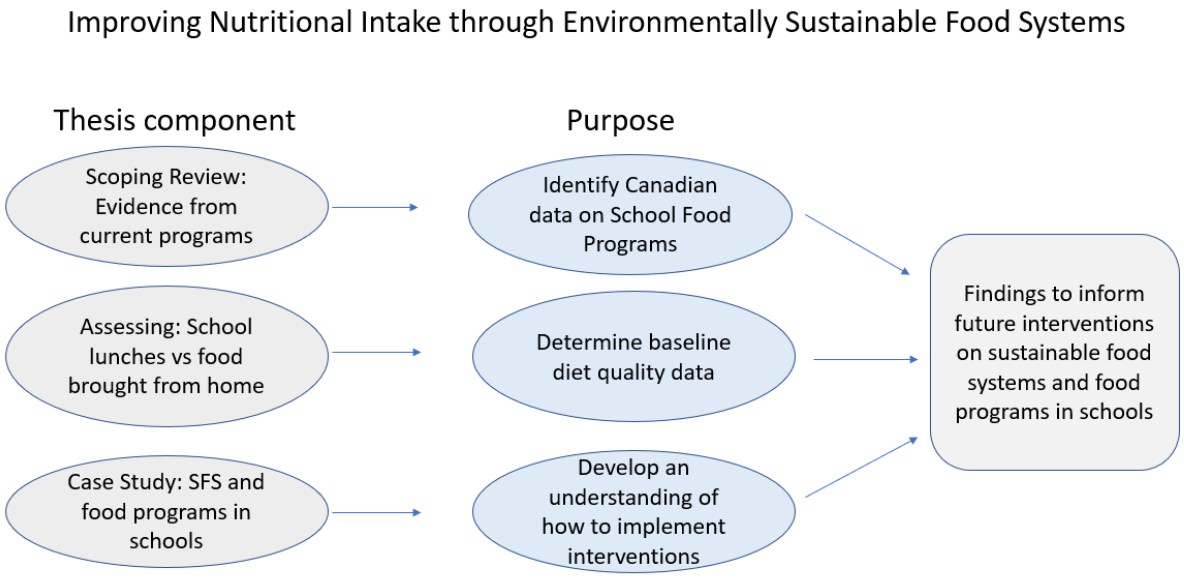



***Figure 1.1: Organization of Thesis***

## 1.5 Organization of the Thesis

This thesis follows a manuscript-based format. A manuscript-based thesis is a thesis that includes manuscripts that have or will be submitted for publication. This format complies with the University of Saskatchewan's requirements (University of Saskatchewan, 2019). Each manuscript has its own chapter with the overall thesis being cohesive (University of Saskatchewan, 2019). Chapters 4 and 5, as described above, contain papers that have been submitted for publication. Chapter 6 is the case study that will be revised and submitted for publication after the thesis is finalized.

Chapter 1 described the extent of the problem and need for research. Chapter 2 is a review of the literature covering topics pertinent to the objectives listed above and provides the background literature for the studies described in Chapters 4, 5, and 6. Chapter 3 covers the methods pertinent to the studies in Chapters 4, 5, and 6, but does not repeat the methods section described in these chapters. Chapter 7 is the discussion and conclusion of the thesis where I consider the findings of all three studies.

# CHAPTER 2: LITERATURE REVIEW

The review of the literature includes four broad areas: dietary intake patterns, assessing diet quality, sustainable school food, and frameworks and models. This chapter starts by discussing the dietary patterns of school-aged children to establish the importance and relevance of addressing diet quality in this age group. I include a discussion of dietary assessment methods, including digital photography, the School Food Checklist, and the Healthy Eating Index that are used in paper 2 in order to give a background of how they were developed and tested.

In Section 2.3, I discuss sustainable food systems in schools to provide background information for paper 3. The first section describes different phases of school food programs and recognizes that incorporating sustainable food system strategies in school food programs in an emerging approach. Sustainable food systems can be incorporated into several areas of curriculum, policy, and practice.

Frameworks and models about sustainable food systems in schools provide guidance on what strategies can be included and how these strategies can manifest in the school context. I used the Socio-ecological Framework in paper 3 to understand the barriers and facilitators of adopting sustainable food system strategies in schools. The School Logic Model and the School Food Environment Assessment Tool Checklist are described because they were used to inform the case study that is described in paper 3.

## 2.1 Dietary Intake Patterns of Children

Prior to the 2019 revisions, Eating Well with Canada's Food Guide broke foods down into four food groups: Vegetables and Fruit, Grain Products, Milk and Alternatives, and Meat and Alternatives (Health Canada, 2007). It was developed to help people design their eating plan so they would obtain adequate vitamins, minerals, and other nutrients (Health Canada, 2007). The 2007 version of Eating Well with Canada's Food Guide recommended that children aged 10-14 eat six servings of vegetables and fruit and 3-4 servings of dairy products daily, six serving of grain products and 1-2 servings of meat and alternatives (Health Canada, 2007).

Healthy eating among school-aged children supports optimal growth and development, can maximize academic achievement (Faught, Williams, Willows, Asbridge, & Veugelers, 2017), establishes lifelong healthy eating patterns (Ballard, 2013), and mitigates long-term chronic disease risk including obesity (Shields, 2006), diabetes, cancer, and heart disease (World

Health Organization, 2003). Despite the importance of healthy eating for children, in 2004, only 43.6% of Canadian children 12 to 19 years old consumed five or more servings of vegetables and fruit daily (Statistics Canada, 2016). Also, a later study noted that between 22-25% of calories consumed by 9 to 18-year-olds in Canada came from minimally nutritious foods (MNFs), foods that nutritional professionals recommend to be limited in consumption (Office of Nutrition Policy and Promotion, 2007).

A study done in Saskatoon, Saskatchewan, indicated that dietary intake of school-aged children was not better than what was reported in the CCHS (Engler-Stringer, Muhajarine, Le, del Canto, & Ridalls, n.d.). Of students aged 10-14 years, 83.2% did not meet recommendations for grain products, 79.2% did not meet recommendations for vegetables and fruit, 52.7% did not meet recommendations for milk products, and 33.9% did not meet recommendations for meat and alternatives (Engler-Stringer et al., n.d.).

The 2007 version of Eating Well with Canada's Food Guide recommended limiting MNFs high in calories, fat, sugar, and sodium (Health Canada, 2007). It specifically lists the following foods in this category: cakes, pastries, chocolate, candies, cookies, granola bars, donuts, muffins, ice cream, French fries, potato chips, nacho chips, fruit flavoured drinks, soft drinks, sports drinks, energy drinks, and sweetened hot or cold drinks. The CCHS found that between 22-25% of calories of 9 to 18-year-olds come from foods that are recommended to be limited (Office of Nutrition Policy and Promotion, 2007).

The new food guide released in early 2019 does not give specific recommendations on the number of servings to have from each food group. Instead, it recommends having plenty of vegetables and fruit and shows half a plate filled with these (Health Canada, 2019). Guiding principles for the new food guide include recommending healthy staples such as vegetables and fruit, whole grains, plant-based protein-rich foods, increasing the ratio of unsaturated fats to saturated fats and drinking water (Government of Canada, 2017). Foods high in sodium, sugar, or saturated fat should be limited, and sugar-sweetened beverages should be avoided (Government of Canada, 2017). In addition to encouraging healthy foods and discouraging MNFs, it recognizes the importance of planning, preparing, and sharing meals with others, including cultural foods, and recommends eating mindfully (Health Canada, 2019).

## 2.2 Assessing Diet Quality

Assessing children's food intake can be done in many ways, including through food records, food frequency questionnaires, meal observations, weighted records, digital photography, and the School Food Checklist (SFC) (Tugault-Lafleur, Black, & Barr, 2017). There are challenges with each method. Errors in self-reported data can occur when using food records or food frequency questionnaires, and meal observations and weighted records are costly and time-consuming (Tugault-Lafleur et al., 2017). Understanding the strengths and limitations of techniques helps determine the method most appropriate for the area of study (Tugault-Lafleur et al., 2017).

### 2.2.1 Digital Photography

Digital photography is a method of assessing dietary intake by taking pictures of food. Swanson (2008) took pictures from 16 inches above food trays at an approximate angle of 45˚. Advantages are that it is quick and does not put much burden on participants (Tugault-Lafleur et al., 2017). A limitation of digital photography is that it does not capture spilled, wasted, or traded foods (Tugault-Lafleur et al., 2017). Digital photography to assess foods eaten in schools has been judged to be feasible (Mitchell, Miles, Brennan, & Matthews, 2010; Swanson, 2008; Williamson et al., 2003). Swanson (2008) found digital photography to be useful in determining the cafeteria consumption of elementary school students by comparing the foods served to what was returned. Not all foods are easy to quantify; however, as they had difficulty assessing condiment use (Swanson, 2008). Williamson et al. (2003) compared digital photography to food weighing in test foods and found digital photography to be an accurate and valid method of determining portion sizes. Tugault et al. (2017) conducted a systematic review of methods used to assess children's diet in schools and concluded that using digital photography to assess food intake has acceptable accuracy and acceptable interrater reliability (Tugault-Lafleur et al., 2017). The accuracy of this method may vary, depending on whether children eat home-packed or school meals or if students take the photos themselves (Tugault-Lafleur et al., 2017).

### 2.2.2 School Food Checklist

The SFC is a one page form listing foods, beverages, and portion sizes of foods commonly eaten. The SFC is an efficient way to record foods and beverages consumed in elementary schools (Kremer, Bell, & Swinburn, 2006). Kremer et al. (2006) compared data

obtained from the SFC to weighed records and determined that the SFC had good accuracy and reliability (Kremer et al., 2006). The SFC has been used in other studies and was found to be an accurate and efficient method of obtaining dietary information in schools (Hubbard et al., 2014; Kremer et al., 2006; Mitchell et al., 2010).

Mitchell et al. (2010) assessed inter-rater reliability using the SFC by having more than one person assess the lunches. They assessed intra-rater reliability by having the same auditor assess the lunch more than once on the same day. Both inter-rater and intra-rater reliability showed strong agreement. Interrater reliability is improved when this method is combined with digital photography (Tugault-Lafleur et al., 2017).

The SFC, nevertheless, does pose challenges. When tested, researchers found fair to strong inter-rater and intra-rater reliability comparing the portion estimates of real food compared to photographs, except for leftovers. The SFC may encourage variation in raters; it may overestimate bread portions and fruit drinks; it may underestimate fat spreads, crackers, granola bars, and fruits; and it may be difficult to capture foods not on the checklist (Tugault-Lafleur et al., 2017). Estimating portion sizes of leftovers is less accurate than obtaining nutrition information from packaged foods, especially when containers are not opened (Mitchell et al., 2010). Errors in estimating leftovers are not a significant concern; however, if leftovers are assessed infrequently (Mitchell et al., 2010).

### 2.2.3 Healthy Eating Index

In order to evaluate the diets of school-aged children, the data collected through the methods above must be analyzed. The Healthy Eating Index (HEI) can be used by researchers to assess the quality of the diet overall by considering healthy components such as the healthy food groups, along with unhealthier factors such as saturated fat and sodium. Several dietary components are considered to give an aggregate diet quality score. This provides a more accurate picture of the overall diet quality than just looking at one dietary factor alone. The HEI was designed to assess diet quality, monitor changes in intake patterns, and measure changes as a result of population health interventions (Kennedy, Ohls, Carlson, & Fleming, 1995). There are several iterations of the Healthy Eating Index, and the development process is discussed below.

The HEI was initially designed in the United States to align with the USDA Food Guide Pyramid (Kennedy et al., 1995). It contained ten categories with the first five components of the

measure based on five food groups: grains, vegetables, fruits, milk, and meat (Kennedy et al., 1995). Components 6-10 were based on overall fat, saturated fat, cholesterol, sodium, and variety, respectively (Kennedy et al., 1995). Since each component is given a score out of 10, the result is a continuous variable up to a possible score of 100.

The HEI was adapted from the American version to include Canadian recommendations from the 1992 version of Canada's Food Guide to Healthy Eating. This version grouped fruits and vegetables and allocated a possible 20 points to this category (Dubois, Girard, & Bergeron, 2000). Adjustments were made to reflect the importance of including a variety of healthy foods in the diet by allocating two points for every one portion consumed out of each food group (Dubois et al., 2000).

The Canadian version of the HEI is not adapted as frequently as the American version; however, it was further adapted following the release of Eating Well with Canada's Food Guide in 2007 (Woodruff & Hanning, 2010). In this version, diet quality scores are calculated by allocating 10 points each for grains, milk products, meat and alternatives, other foods, total fat, saturated fat, cholesterol, and variety, while twenty points are allocated to vegetables and fruits (Woodruff & Hanning, 2010). This version of the HEI was further adapted and used to analyze the data from the 2004 version of the Canadian Community Health Survey. This version of the HEI incorporates other recommendations beyond food group servings from Eating Well with Canada's Food Guide (Garriguet, 2009). It assigns 60 points for nutritional adequacy- up to 10 points each for vegetables and fruit, milk and alternatives, meat and alternatives, as well as unsaturated fats, and up to 5 points each for whole fruit, dark green and orange vegetables, grain products, and whole grains (Garriguet, 2009). Food and food components that are recommended to be limited are assigned 40 points, with smaller quantities of these components having higher scores: 10 points for both saturated fat and sodium and 20 points for other foods (Garriguet, 2009). The Canadian version of the HEI has a strong foundation on which to base an index and has been tested for both content and construct validity (Garriguet, 2009).

Once researchers generate food intake data, the HEI may provide a way to assess diet quality in school-aged children in a school context. The HEI has been adapted and used to examine the diets of Canadian children and adolescents (Glanville & McIntyre, 2006) and used to assess foods eaten at school (Tugault-Lafleur et al., 2017). The adequacy component includes

the four food groups, whole fruit, dark green and orange vegetables, whole grains, and unsaturated fat (Tugault-Lafleur et al., 2017). Moderation components include servings of "other foods" along with the sodium component (Tugault-Lafleur et al., 2017). Other foods are MNFs that correspond to Canada's Food Guide to Healthy Eating "other foods" and are higher in fat, sugar, and/or salt (Tugault-Lafleur et al., 2017). Higher scores are given to moderation components that are consumed in lower amounts.

Possible HEI scores range from 0 to 100. A score ≤ 50 indicates that the diet is poor, a score of 50 – 80 indicates the diet needs improvement, and a score > 80 indicates a good score (Glanville & McIntyre, 2006). The single continuous measure makes the HEI easy to interpret and use in statistical analyses (Dubois et al., 2000).

Digital photography and the SCF provide an efficient way to collect data on what students bring to school in their lunches. Pictures of the foods students brought eliminated the reliance on recall, kept the burden on the school low, and provided a record that the research assistants could refer to if the data on the SFC needed verification. The HEI provides a way to compare results as it gives an overall composite score to the foods brought rather than comparing individual food groups or food components.

## 2.3 Sustainable Food Systems in Schools

### 2.3.1 Phases of School Food Programs

The development of school food programs in high-income countries has followed three phases (Oostindjer et al., 2017). The first phase occurred between 1850 to 1950 and focused on providing calories, regardless of food quality, to reduce hunger (Oostindjer et al., 2017). Foods were often high in fat and sugar, and low in nutrients. Food production after the Second World War became more intensive, increasing food availability (Oostindjer et al., 2017). The second phase of school food program development, which started around 1970 in some countries, and more recently in others, shifted from addressing hunger to encouraging healthier, more nutrient-dense, lower-calorie foods in response to concerns about poor dietary quality (Oostindjer et al., 2017). During this phase, some countries initiated school nutrition guidelines, which promoted high-quality food (Oostindjer et al., 2017). The third phase of school food programs, which is in its infancy in most countries, including Canada, involves integrating health and environmental sustainability concerns more closely into school food programs (Oostindjer et al., 2017).

Integrating health means addressing both the nutritional quality of diets overall and promoting health through addressing the social and environmental determinants of health. This third phase has represented a shift towards school food programs that incorporate food system and societal issues into meals along with curricular integration.

The shift toward the third phase of school food programs around the world includes broadening the scope of school food program components to look beyond diet quality. Garret and Feenstra (nd) developed a framework for achieving sustainability in a community food system that included three components: Social Equity and Human Health; Environmental Health; and Economic Vitality (Garret & Feenstra, nd). This is similar to a framework by Tagtow et al. (2014) that identified the components necessary for sustainable food and water systems: nutrition and health; environmental stewardship; economic vitality; and social, cultural and ethical capital (Tagtow et al., 2014). For Canada to shift into the third phase, as described by Oostindjer et al. (2017), these themes should be included in school food programs. It is important for Canada to make this shift as we face significant future environmental challenges as a result of climate change (IPCC, 2018).

### 2.3.2 Components Included in Sustainable Food Systems

Several initiatives can be included in a school setting to improve nutritional intake while promoting food system sustainability. Sustainable food system strategies are food production practices that protect natural resources and support healthy ecosystems (Tagtow et al., 2014). In a school context, these strategies may include growing gardens and fruit trees, composting systems, food programs that offer local foods, and initiatives that reduce the environmental impact of food production (Rojas et al., 2011). The curriculum can support these strategies by incorporating experiential learning components, and by addressing the impact of the conventional food system on greenhouse gas emissions and climate change (Rojas et al., 2011). Also, developing relationships between schools and local producers and incorporating local foods into classrooms can cultivate understanding and increase the connection between consumers and their food (Rojas et al., 2011). Including sustainable food system strategies in schools will be context-specific and may include a variety of different components.

### 2.3.3 Sustainable Food System Strategies in Schools

The school environment is an opportunity to address sustainable food systems through education, policy, and practice, which can impact food sustainability, food security, and food sovereignty (Rojas et al., 2011). The Think&EatGreen@School project in Vancouver, for example, used a collaborative, community-based action research approach to work towards these goals (Rojas et al., 2016). The project invited community members to be active and informed decision-makers in all aspects of the food cycle to develop a democratic and just food system (Rojas et al., 2016). The researchers' goal was to help people make informed decisions, eat responsibly, and to overcome the distance and disconnection inherent in our current food system so people could understand the environmental impacts of their decisions.

Incorporating food into existing curricula can enhance the teaching of many subjects. Strategies include teaching practical life skills such as cooking, growing, and composting; math can be taught through ratios and fractions found in recipes; and food can be the topic of writing, art, and history (Rojas et al., 2016). Physical education can include gardening and community service while science can cover topics such as cycles of growth, predator-prey relations, pollination, microorganisms, decomposition, botany, and the carbon cycle (Blair, 2009; Rojas et al., 2016).

Incorporating gardening into the curriculum provides experiential learning for students and can improve test scores and school behaviour (Blair, 2009). Teaching about the natural environment can be incorporated by discussing clouds, rain, sun, seasons, weather, insects, weeds, birds, and mammals (Blair, 2009). Hands-on connection with nature can develop visual-spatial skills, language, science, math, body awareness, and personal skills (Miller, 2007; Ohly et al., 2016). Nowak et al. (2012) describe a program in Colorado which includes a farm stand on school grounds, so students learn about the seasonality of their area; they learn how to market a small business and sell goods, and they learn how to budget and purchase supplies. These experiences can reinforce and enhance the existing curriculum.

People who develop a greater understanding and appreciation for the natural world as children may develop pro-environmental behaviours as adults (Gifford & Nilsson, 2014). Students who garden were found to a have a sense of responsibility towards the environment (Skelly & Bradley, 2007), and these gardening experiences may impact their attitudes about the

environment when they are adults (Blair, 2009). Interactions between students, plants, animals, and natural systems are particularly effective as these experiences cause students to refine their relationship with other organisms and better understand the complex interactions that occur in natural systems (Rojas et al., 2016). Being involved with the whole process- from planning to harvesting to preparing and sharing - builds a sense of connection, including with the natural environment, communities, and ecosystems (Rojas et al., 2016).

Other countries have studied the impact of sustainable food system strategies in schools. The Food for Life Partnership in the United Kingdom studied the impact of a multi-component program that included sustainable food system strategies on the fruit and vegetable intake of students aged 9 to 11 in a primary school setting (Jones et al., 2012). Strategies included promoting local, seasonal, organic, fair trade, and ensuring animals were treated well. The researchers also included reforms in other areas: food procurement and preparation, gardening, cooking, and farm-based education. Higher vegetable and fruit intake were reported in schools that used a range of sustainable food system strategies (Jones et al., 2012).

School gardening is associated with a variety of health benefits beyond improved nutritional intake**.** Teachers reported increased student wellbeing and personal achievement as a result of gardening (Buck, 2016). School gardening can provide an opportunity to break down social barriers between students and may be a place for students with learning disabilities or behaviour problems to find peace (Buck, 2016; Ohly et al., 2016). Through experience and teacher support, students can take risks, which leads to improvements in self-confidence (Miller, 2007).

Gardening programs help develop a positive relationship with healthy food. Slow Food Denver (SFD) has a multidisciplinary program for school-aged children that integrates gardening, cooking, science, and social studies to increase food literacy (Nowak et al., 2012). The goal of SFD is to empower children so they can control how their food is grown, how it tastes, and how it is cooked and prepared (Nowak et al., 2012). Nowak et al. (2012) found that children will eat a wider variety of foods and will value healthy foods more when involved with all aspects, including growing, tasting, and sharing. This program includes what they refer to as “taste education” to broaden food preferences. Positive experiences with vegetables while gardening, harvesting, and preparing food can improve the relationship with food and,

consequently, nutritional intake (Libman, 2007). Gardening programs help students build agency as students gain the resources, knowledge, and skills necessary to increase their capacity to grow and choose what to eat (Libman, 2007).

Some studies have found vegetable and fruit gardening beneficial; however, some have found conflicting results. Ohly and colleagues (2016) conducted a systematic review containing 40 studies in four countries (UK, Portugal, USA and Australia) showing that qualitative data might indicate improvements in intake; however, these results were poorly supported in quantitative studies. Only two studies provided both qualitative and quantitative data and the quality of quantitative studies overall was a concern. Finding limited nutritional benefits of gardening programs in quantitative studies may be because there was no improvement, because there were deficiencies in study design, or because the study period was too short (Ohly et al., 2016).

Gardening can increase knowledge and preferences for fruit and vegetables, especially if combined with parental support (Buck, 2016). Davis et al. (2015) reviewed 13 school gardening studies and found that most demonstrated an increase in vegetable intake, although some showed no increase. This research also found that students in gardening programs showed an increased preference for and had more positive attitudes towards fresh foods (Davis, Spaniol, & Somerset, 2015). Students who participated in gardening programs also had a greater willingness to taste and prepare vegetables and fruit (Davis et al., 2015)

Many benefits have been documented in implementing sustainable food system strategies in schools. Despite this, some teachers feel they are not equipped to do this (Rojas et al., 2016). It is important to identify barriers, facilitators, and challenges, and design strategies to overcome them (Rojas et al., 2016).

Including sustainable food system strategies in curriculum, policy, and practice in the school context provides an opportunity to both teach about food and sustainable food systems and take action on climate change.

## 2.4 School Frameworks and Models

Addressing school food through sustainable food systems is a complex issue, and it can be challenging to identify all essential components. The following section describes frameworks and models that help clarify what components to consider to address these issues strategically.

### 2.4.1 Sustainable Food Systems

In discussing sustainable food systems, it is important to determine how this term is defined. The definition of sustainability was discussed in chapter 1 and can be summarized as referring to the ability of a system to continue without compromising its ability to maintain itself in the future (Gussow & Clancy, 1986; Tagtow et al., 2014). Sustainability in this thesis refers specifically to the impact on systems, especially natural systems and ecosystems, and their ability to continue to produce food in the future.

Adopting sustainable food systems in schools does not mean that schools will be self-sufficient in producing foods. It means schools would provide opportunities to connect students and staff to where food comes from, who produces it and develop the understanding that humans are connected to nature (Rojas et al., 2016).

### 2.4.2 Sustainable, Resilient, and Healthy Food and Water Systems Framework

The Sustainable, Resilient, and Healthy Food and Water Systems Framework provides high-level concepts of components to include in sustainable food systems (Tagtow et al., 2014). It includes four categories: Environmental Stewardship, Nutrition and Health, Social, Cultural, and Ethical Capital, and Economic Vitality (Tagtow et al., 2014). Food system sustainability is a broad concept. The four categories demonstrate the complexity of factors that impact whether a food system is sustainable. Each of these categories contains components that make up the category, providing details about what each category includes. The authors view food systems' sustainability from a systems perspective, so all impacts of an approach are considered and evaluated and compared to other approaches to minimize unintentional negative consequences (Tagtow et al., 2014). Table 2.1 includes the categories and components included in this framework.

*Table 2.1:Sustainable, Resilient and Healthy Food and Water Systems Framework Categories and Components*

| Environmental Stewardship | Nutrition and Health | Social, Cultural, and Ethical Capital | Economic Vitality |
|---|---|---|---|
| • Conserves protects and renews natural resources (soil, water, air, energy, biodiversity)<br>• Supports vibrant ecosystems<br>• Promotes a low carbon footprint<br>• Mitigates climate change | • Assures dietary diversity<br>• Assures safety of food and water supplies<br>• Assures optimal access to food and water to meet nutritional requirements | • Promotes cultural diversity<br>• Empowers social responsibility and community engagement<br>• Advances the ethical, humane, and fair treatment of individuals and animals | • Builds community wealth<br>• Is economically viable and sustainable |

From: Tagtow et al. (2014)

A challenge of applying this framework is agreeing on how components can be achieved, especially when the factors determining environmental impact are complex. It is difficult to determine what food products have a lower environmental impact. Organic production may lead to lower greenhouse gas emissions, but lower yields require more land for production and the overall environmental impacts also depend on other factors such as the crop being produced and the distance the final product travels (Venkat, 2012). This makes choosing the most sustainable option challenging. When empowering social responsibility, for example, is the focus on the local community or with the broader, global community? How can farther-reaching consequences be considered when people are disconnected from the food system? The information may not be readily available to enable meeting this goal.

The authors of this framework recognize the importance of viewing sustainability from a systems perspective (Tagtow et al., 2014); however, the framework does not give any clues about how this is applied in practice. This framework does not indicate whether all of the factors in the framework are weighted equally in importance and impact. In a system, one component can impact multiple other components. It is not known, for example, if it is more impactful to

protect environmental stewardship over economic vitality or what components within these impact others or have the greatest impact.

### 2.4.3 Community Food Systems Framework

In contrast to the broad, high-level framework presented by Tagtow et al. (2014), Garret and Feenstra present a Community Food System Framework which has a more local focus (Garret & Feenstra, nd). It was created in response to the industrialized food system to encourage communities to adopt sustainable food system strategies from production to consumption (Garret & Feenstra, nd). This framework includes Environmental Health; Social Equity and Human Health; and Economic Vitality (Garret & Feenstra, nd). It recognizes the importance of considering food process, distribution, and marketing, food production, and food consumption (Garret & Feenstra, nd). Like the framework by Tagtow et al. (2014), the broad focus of this framework does not lead to specific instructions regarding how to make environmentally sustainable choices. Within the document, however, it identifies strategies such as supporting family farms, reducing food miles, creating jobs in the local community, and improving the living and working conditions for food workers (Garret & Feenstra, nd). The document describes the process of developing community food system projects.

The Community Food System document and framework provides broad areas of consideration, along with specific process suggestions and focuses on participation by residents. Although this document recognizes the importance of sustainability, it has more of a food sovereignty perspective and encourages consumers to become informed and to support local producers. There is no date on this document, so it is not known when this framework was developed. Because the focus of the framework is local, it does not consider the broader impact of local decisions. Although they call the framework a systems framework, there is little in the document that discusses how one system impacts another. Similar to the framework by Tagtow et al. (2014), it does not weigh the impact of one component over another.

The framework by Tagtow et al. (2014) has a broad, high-level focus. The framework by Garret and Feenstra (n.d) has a local focus. Combining these two frameworks provides the opportunity to trace food system sustainability from the local to the global.

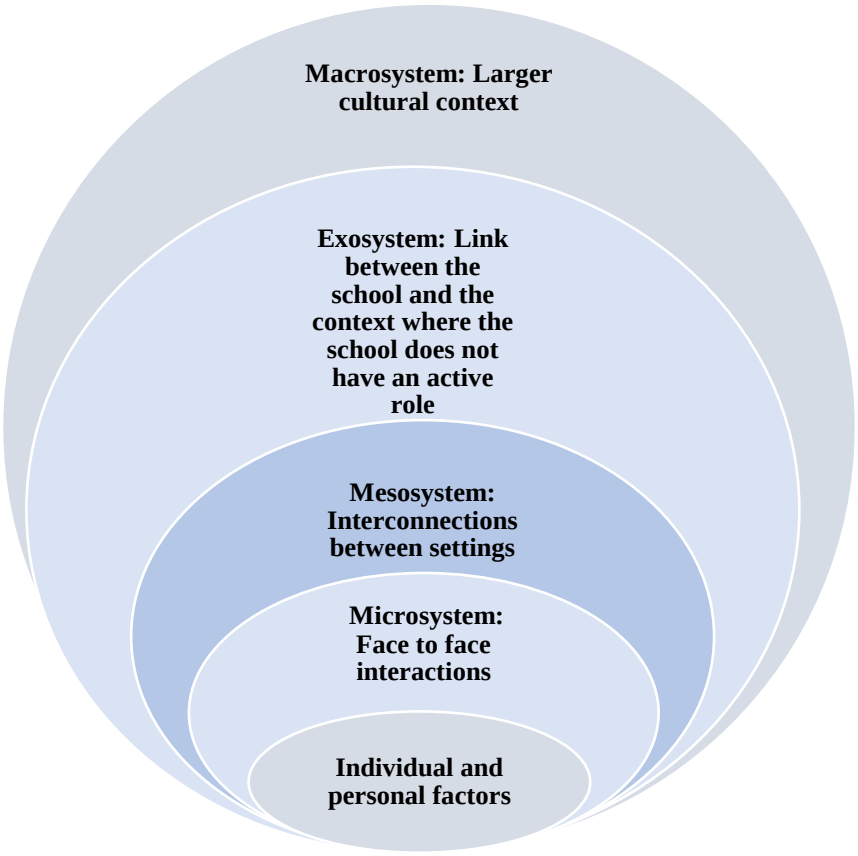
### 2.4.4 Socio-ecological Framework

The Socio-ecological Framework was developed as a theoretical perspective for research in human development (Bronfenbrenner, 1981). It recognizes individual personal factors, the environment the person is in, and the interaction between the person and the environment (Bronfenbrenner, 1981). This framework focuses on the whole system and assumes that behaviours are embedded in social systems and environmental contexts and not just the result of individual choice. It recognizes interconnections between components in a level and components between levels and provides an opportunity to investigate whole system change (McLeroy, Bibeau, Steckler, & Glanz, 1988). In this framework, the individual and the environment influence each other; this is known as reciprocal causation (McLeroy et al., 1988).

The Socio-ecological Framework can be used to understand the environmental influences impacting health-related choices. Factors that influence food choices, for example, can occur at the individual, organizational, and community level (McLeroy et al., 1988). Individual and personal factors that impact choices include attitude, preferences, knowledge, age, sex, skill, and lifestyle (Story, Kaphingst, Robinson, Brien, & Glanz, 2008). The Microsystem refers to the immediate setting and includes face-to-face interactions (McLeroy et al., 1988; Onwuegbuzie, Collins, & Frels, 2013). The Mesosystem refers to the interrelationships or interconnections between settings (McLeroy et al., 1988; Onwuegbuzie et al., 2013). The Exosystem refers to the larger social system that a person may or may not participate in (McLaren & Hawe, 2005; McLeroy et al., 1988) or the Macrosystem, refers to the cultural beliefs that influence the other systems such as food norms, eating patterns, food marketing, food system, and food assistance programs (Story et al., 2008).

The Socio-ecological Framework has been adapted to better understand the complex factors that impact food choice (Story et al., 2008). In this adapted version, the framework included individual factors, social environments, physical environments, and macro-level settings such as cultural norms and values (Story et al., 2008). It has also been used to study factors influencing food choice in the school setting (Townsend & Foster, 2013). In this study, the framework was broken down into six levels: biologically determined factors, student intrapersonal, student interpersonal, school environment, school community, and local or national level policies.

The Socio-ecological Framework may help consider barriers and facilitators to sustainable food system strategies at school. Organizations such as schools are strategic environments to consider because children spend the majority of their waking hours there and the school environment can exert significant influence on lifestyle behaviours such as food choice (McLeroy et al., 1988). Figure 2.1 depicts a Socio-ecological framework I adapted that could be used in the school context. It considers the students' individual and personal factors and face-to-face interactions that occur within the school environment. This would also include modeling of eating behaviours, food practices in the school, school social norms, and what is taught in the classroom. The Mesosystem includes interconnections between the school and external organizations such as the school division, Ministry of Education, and CHEP Good Food Inc. The latter is a non-profit organization that helps to administer food programs to Community Schools. The Exosystem includes the interactions between the school and contexts that the school does not have an active role in influencing. This includes local businesses and the organizations that provide food donations and the local food environment of the school. The Macrosystem encompasses the broader cultural environment, including cultural norms and values, eating patterns, food marketing, food system, and food assistance programs.




**Macrosystem: Larger cultural context** including cultural norms and values, eating patterns, food marketing, food system, food assistance programs

**Exosystem: Link between school and context where the school does not have an active role:** Volunteer organizations, donors, businesses, the built environment

**Mesosystem: Interconnections between settings:** Community, school division, Ministry of Education (policies and curriculum), Health Promoting School, CHEP Good Food Inc.

**Microsystem: Face to interactions:** Teachers, students, health nurse, nursing students, school food practices, role modeling, social norms, curriculum and how content is taught

**Individual and personal factors:** Attitude, preferences, knowledge, age, sex, skill, lifestyle

***Figure 2.1: Socio-ecological Framework for the School Context***

Although the Socio-ecological Framework helps identify levels of influence, it does not provide any guidance on how to address these factors. For instance, identifying that student interpersonal factors influence lunch choices (Townsend & Foster, 2013) does not give clues on how to influence these factors to impact food choice. The Socio-ecological Framework provides a broad perspective and recognizes that several components impact choice; however, it does not provide clarity on how different factors interact or how, from a systems perspective, one factor will impact another. The framework helps to identify at which level factors influence; however, it does not provide any way to identify the extent of the impact. This Framework can contribute to a greater understanding of factors that contribute to health-related choices; however, due to limitations to the framework, further investigation is required to determine the best course of action to address the identified factors.

### 2.4.5 School Logic Model

The Think & Eat Green at School Logic Model depicts the components that were included in a study conducted by Rojas et al. (2011). The model includes components of sustainable food system strategies categorized into policies, practice, and pedagogy. This model is useful to categorize sustainable food system practices in schools, and specifically to identify implemented components and other potential opportunities.

According to the model, policies that support sustainable food systems in schools may include local food procurement practices and policies to reduce greenhouse gas emissions or other negative environmental impacts. Massive amounts of food are consumed each day in schools, so any positive change towards eating healthy and sustainable food systems will both have an immediate benefit and support long-term positive impacts as children learn lifelong habits (Ballard, 2013). For schools that serve food, procurement practices offer teachers the opportunity to either distance students from or connect students to food. Considerations for procurement practices include where the food is produced and if it was produced in a sustainable manner (Carlsson & Williams, 2008).

School practices can impact the understanding of sustainable food systems by modeling appropriate and effective strategies. Also, children can engage in the whole food cycle at school: growing, harvesting, preparing, cooking, eating, composting, recycling, and disposing of waste. Through pedagogy, the curriculum provides an opportunity for children to learn about the relationships between food, health, and the environment. Food is a practical topic, and so experiential learning strategies can be used to enhance learning (Ballard, 2013; Rojas et al., 2016). Strategies identified in this model include connecting the classroom to outdoor activities, including education on food systems, discussing the impact that food has on the environment and health, and recognizing that food connects many things (Chapman, Rojas, & Black, n.d.).

Curriculum, policy, and practice are essential components to consider for implementing sustainable food systems in the school context. This model, however, makes many assumptions. It assumes that the curriculum is supportive of sustainable food systems when the curriculum may not be under the school's control, and this strategy may not be possible. It assumes the school has the infrastructure, equipment, staffing, and resources for healthy and sustainable food preparation and production. From this model, it appears that that the school is an independent,

stand-alone organization, when, in fact, it is embedded in a local community and may have many partners to support programs. Also, food practices in the school create a food culture, and the social environment impacts students' choices (Rojas et al., 2011).

### 2.4.6 School Food Environment Assessment Tool

In addition to the School Logic Model, there may be a benefit in characterizing sustainable food system strategies in schools (Black et al., 2015). The School Food Environment Assessment Tool is a qualitative tool used to capture sustainable food system strategies to assess the school's level of engagement on each of six domains: food gardens, composting systems, food preparation activities, food-related teaching and learning activities, availability of healthy foods, and availability of environmentally sustainable foods (Black et al., 2015). The SFEAT can be used to monitor progress and inspire positive changes (Black et al., 2015). It is helpful to have a checklist of items that describe the many components that can be included in sustainable food systems at schools. Some of the categories, however, are difficult to score. The tool asks what year programs were established, but the school environment experiences many changes from year to year, so a program that is in operation one year may not continue the next. An evaluation would need to be done every year to be an accurate reflection of the school context. It is also not clear whether schools should be motivated to create new programs or to put their efforts towards continuing existing programs. This tool does make it possible to collect consistent data; however, this data would need to be updated regularly to be accurate.

Frameworks and models can guide the components to consider, and the Socio-ecological Framework can be used to develop insight into the barriers and facilitators to adopting sustainable food system strategies in schools. The SFEAT provides a systematic way to monitor and record progress in adopting sustainable food system strategies. Using the frameworks, models, and tools previously described builds on the understanding in this area.

## 2.5 Conclusions

Changes in the food system over the last century have disconnected people from how their food is produced. Deskilling and an increase in prepackaged and convenience foods is a consequence of this shift. This kind of eating has increased diet-related diseases. Food insecurity and a lack of food skills may affect access to adequate, healthy food. CCHS data indicates that the diet quality of school-aged children is poor. Children's food accessibility in schools has a

large impact on eating habits in the long term, and thus, schools are an ideal place to reinforce the importance of healthy eating using sustainable food systems strategies. Sustainable food system strategies may be enacted through curriculum, policies, and practices to improve diet quality, food literacy, food sovereignty, and environmental sustainability of the food system. Incorporating food programs and sustainable food system strategies in schools provides a community response to a global problem.

This review has outlined many benefits of incorporating healthy food through sustainable food system strategies in schools. There are as yet no national policies or food programs to support these initiatives; however, the national government announced in early 2019 funding for a Food Policy for Canada and its intention to work with the provinces and territories to establish a National School Food Program, indicating a growing interest in this area. Currently, there are provincial guidelines; however, in some cases, schools may address these concerns locally. There is no central database to catalog existing programs or to evaluate their effectiveness. In fact, it is not known how the diet quality of students who participate in school food programs compares to that of the students who do not, nor is it known how the diet patterns of urban versus rural students differ.

Substantial changes are required to improve school food intake and to develop food systems that are more environmentally friendly. A case study approach using Grounded Theory methodology could be used to understand the barriers, facilitators, opportunities, and challenges of incorporating sustainable food programs into curriculum, policy, and practice in a school setting. This information would help schools move towards providing a curriculum-integrated sustainable school food program to improve nutritional intake while protecting the environment.

# CHAPTER 3: METHODS

In this chapter, I discuss the methods that I used in the research described in later chapters. First, I discuss scoping reviews and the data extraction methods I used for paper 1. Other details about the methods for the scoping review are provided in chapter 4. Next, I describe the research questions for the study comparing the diet quality of lunches and comparing school meals versus foods brought from home. Other details about the methods used in this study are described in chapter 5. Lastly, I provide background information for the case study that I describe in chapter 6. This study identifies the barriers and facilitators of adopting sustainable food system strategies in schools.

## 3.1 Scoping Review

A scoping review is a kind of literature review that helps give an idea of the amount and type of research that has been done in a particular area (Arksey & O'Malley, 2005). It is similar to a systematic review; however, scoping reviews tend to focus on broader topics, may include a variety of study designs, are less likely to assess the quality of the studies, and may include published and unpublished literature (Arksey & O'Malley, 2005). The depth of the scoping review is dependent on the purpose. For instance, it can be used to rapidly map an area to get an idea of what has been done, to identify research gaps, or to determine if a systematic review has been done or would be beneficial (Arksey & O'Malley, 2005). It can also be done to summarize research findings to distribute to interested parties, including policymakers, consumers, or practitioners (Arksey & O'Malley, 2005). The scoping review in this study was a rapid review to determine the types of research that have been done on school food programs in Canada.

The purpose of the scoping review was to identify school food programs in Canada that have been evaluated. The goal was to examine program evaluations and determine promising practices in Canada for school food programs in elementary and high schools. In the process, practices that contribute to the third phase of school food programs (those that consider both health and environmental sustainability), were identified.

A discussion of the scoping review is included in the paper presented in Chapter 4. This section covers details of data extraction not covered in the paper.

The components selected for inclusion which are commonly evaluated in school food programs include educational outcomes; behaviour (including attention and attendance);

improving nutritional intake; and improving food insecurity. Broader concepts of environmental sustainability such as using reusable dishes and waste reduction were included to capture the move towards phase three of school food programs as described by Oostindjer et al. (2017). Drawing from the sustainability frameworks described by Garret and Feenstra (n.d.) and Tagtow et al. (2014) several components were identified. These include increasing environmental knowledge; strengthening food systems or food system knowledge or food literacy, attitudes, and practices; increasing cultural knowledge, attitudes and practices; social benefits such as improving attendance or social interaction; improving health equity and addressing the economic feasibility of the program were identified as important components. We did not include strategies that specifically addressed peer influence or used peer mentors or focused on the existence or adherence to school food policies. Table 3.1 provides a summary of the list of questions that were used during the data extraction process.

***Table 3.1: Scoping Review Data Extraction Questions***

| **Question:** | **Checklist options:** |
|---|---|
| What is the name/location of the program? | Open-ended |
| In what grades did the intervention take place? | Open-ended |
| What were the intervention characteristics? | Breakfast, snack, lunch, milk, fruit, vegetable, garden, other (open-ended) |
| Was food cooked on-site or brought into the school? | Brought in, prepared on-site, not specified, other (open-ended) |
| Who funded the meal program? | Government, non-governmental organization, parents, not specified, other (open-ended) |
| Were environmental impact or sustainability considered (bagged lunches, waste, containers, use of plastics? | No, yes (open-ended) |
| Was there a theory behind the program mentioned? | No, yes (open-ended) |
| What was the method of evaluation? | All questions have the option of being open-ended:<br>Survey, food frequency questionnaire, 24-hour recall, measurement form (food intake, behaviour, mental health), focus group, interview, other |
| What were the evaluation outcomes? | All questions have the option of being open-ended: |

| | |
|---|---|
| | Behaviour: attention, tardiness, drop out<br>Nutrition: measuring changes in intake<br>Educational: learning reading, math, attendance<br>Social aspects: behaviour, mental well-being, social interaction<br>Strengthen local food systems<br>Food system knowledge, attitudes, practices<br>Cultural knowledge, attitudes, practices<br>Food security<br>Food literacy<br>Health equity<br>Is it economically feasible?<br>Other |
| What was the conclusion? | Open-ended response |

This section is a background discussion of the data extraction details that are pertinent but not described in the scoping review paper in Chapter 4. The next section discusses pertinent methods for the study discussed in Chapter 5.

## 3.2 Comparing Diet Quality of School Meals Versus Food Brought from Home

The study described in Chapter 5 was a cross-sectional research study looking at what elementary school children in grades 4-8 had in their lunches. It was comprised of groups of students in three categories: students who participated in meal programs in Saskatoon (MPS), students who did not participate in meal programs in Saskatoon and brought food from home (NMPS), and students in rural schools who did not participate in meal programs (NMP-RS).

### 3.2.2 Research Questions

This research project answered the following questions:

1. What is the food group composition of MPS, NMPS, and NMP-RS students' lunches?
2. What are the differences in food composition of MPS, NMPS, and NMP-RS students' lunches?
3. How does the food group composition of MPS, NMPS, and NMP-RS students' lunches follow the recommendations of Eating Well with Canada's Food Guide (2007)? (This version of the food guide was used because the 2019 version had not yet been released when this study took place.)
4. What is the quality of MPS, NMPS, and NMP-RS students' lunches?

5. In the lunches of MPS, NMPS and NMP-RS students, what percentage of calories make up processed and convenience foods?

To answer question 1, "What is the food group composition of MPS, NMPS, and NMP-RS students' lunches?" I determined the number of servings from each of the food group categories on Canada's Food Guide for Healthy Eating (2007) by school type. This component is descriptive.

To answer question 2," What are the differences in food composition of MPS, NMPS, and NMP-RS students' lunches? I compared to see if there was a difference in the number of servings of each food group based on whether students eat school meals or bring food from home. For example, I compared the difference in vegetable and fruit intake in the three groups. Since the number of food guide servings does not capture all the food (it does not capture "other" or minimally nutritious foods), it cannot be assumed that eating less of one food group would result in an increase in consumption of another as it is possible that the child may choose an "other" minimally nutritious food instead.

To answer question 3, "How does the food group composition of MPS, NMPS, and NMP-RS students' lunches follow the recommendations of Eating Well with Canada's Food Guide (2007)?" I compared the intake patterns of the MPS, NMPS, and NMP-RS children with recommendations from Eating Well with Canada's Food Guide (2007). I assumed children should obtain a minimum of one-third of daily recommendations while at school (Tugault-Lafleur et al., 2017). I then compared what children brought, what children had access to through the meal program or a combination of what children brought and had access to through the meal program with Food Guide recommendations. From this, I determined the proportion of students meeting the recommendations in each of the three groups.

Table 3.2 includes the daily recommendations of Eating Well with Canada's Food Guide along with 1/3 daily intake from each of the food groups. The focus of this research was on school-aged children aged 8-13; however, the majority of the students participating in the study are 9-13, so this age category was used. The Kruskal Wallis H or the Mann-Whitney U test was used to determine if there is a difference between the food children brought and recommended amounts.

*Table 3.2: Recommended Number of Food Guide Servings per day, ages 4-13*

| | **Daily Recommended Ages 4-8** | **1/3 Daily Recommended Ages 4-8** | **Daily Recommended Ages 9-13** | **1/3 Daily Recommended Ages 9-13** |
|---|---|---|---|---|
| Vegetables and Fruit | 5 | 1.7 | 6 | 2 |
| Grain Products | 4 | 1.3 | 6 | 2 |
| Milk and Alternatives | 2 | 0.7 | 3-4 | 1-1.3 |
| Meat and Alternatives | 1 | 0.3 | 1-2 | 0.3-0.6 |

(Health Canada, 2007)

To answer question 4, "What is the quality of MPS, NMPS, and NMP-RS students' lunches?" I calculated the HEI using a version of the HEI that was adapted by Tugault-Lafleur for school-time intake (Tugault-Lafleur et al., 2017) and can be found in Appendix A.1. I then determined if there was a difference in the HEI in the three groups. Comparisons were made using Mann Whitney U and Kruskal-Wallis H tests. The HEI scores were also analyzed as a categorical variable using chi-squared distributions. Scores can fall into one of three categories: a score $\leq 50$ indicates that the diet is poor, a score 50 – 80 indicates the diet needs improvement, and a score $> 80$ indicates a healthy diet (Garriguet, 2009). The Kruskal Wallis H test was run to determine if there were differences in the Healthy Eating Index (HEI) scores between the three groups.

Question 5 asked, "In the lunches of MPS, NMPS and NMP-RS students, what percentage of calories make up processed and convenience foods?" To answer this question, the Kruskal Wallis H test was used to compare to see if there were differences in calories, sodium, and MNFs in students who participated in meal programs, those that did not participate in meal programs and rural schools.

### 3.3 Case Study: Sustainable food Systems and Food Programs in Elementary Schools

This section provides background information for a case study that I describe in Chapter 6. The case study examines barriers and facilitators to adopting sustainable food systems and food programs in schools. This research investigated the situation in two schools. The purpose of the case study was to identify how to make systems changes in schools to incorporate

sustainable food systems strategies and school food programs. Each school context is unique, and challenges are quite different, and by including two schools, I was able to identify both common issues and individual school issues. Through multi-case research, it is possible to discern how each phenomenon appears in different contexts (LaVallee, 2014). School data was analyzed together because these schools had many similarities, with the main difference being school infrastructure.

There is no prescribed way of doing case study research, so it is important to plan and be systematic in gathering, recording, analysing, and presenting data (Taylor & Francis, 2013). Planning includes identifying the study question, the units of analysis, and how to interpret the research findings (Yin, 2014). The study questions can be found below. The unit of analysis refers to defining and bounding that determines the "case" that is being studied (Yin, 2014) and is discussed below under case selection. The process of data analysis describes how findings were processed to determine conclusions.

### 3.3.1 Data Analysis

Grounded Theory is a qualitative methodology used to generate theories by systematically gathering and analyzing data (Clarke, 2005; Fraser et al., 2016; Glaser & Strauss, 1967). Other approaches could be used; however, the Grounded Theory analysis processes are well described in the literature (Charmaz, 2005, 2006; Clarke, 2005; Macdonald, 2001; Schreiber & Martin, 2013; Strauss & Corbin, 1997) so, as a novice qualitative researcher, I chose this process to analyze the qualitative data from the case study in Chapter 6. My intent is not to produce a grounded theory, but to use the rigourous analysis process as outlined by Strauss and Corbin (1990).

I used open coding, which is the process of finding labels for blocks of similar data (Corbin & Strauss, 2008). Coding may be done for more than one line at a time, depending on the type of information presented (Miles, 1994). Where the initial data analysis process breaks the data into categories of data that contain the same theme, axial coding compares categories together so concepts can be further developed (Corbin & Strauss, 2008). With this approach, I used a constructivist perspective, which recognizes that categories come from the researcher's interpretation, rather than from the data itself (Charmaz, 2005). During the analysis process, the

researcher is encouraged to make a note of his/her ideas or intuitions that surface (Corbin & Strauss, 2008).

Decisions about coding the data were accompanied by memo-writing. Memo-writing is the process of writing notes during the research process to help develop and compare ideas and to make decisions about further data gathering (Corbin & Strauss, 2008). This was done during the coding process to document how coding decisions were made. Memos capture the researcher's thoughts, comparisons, connections, and help generate new ideas while making the process of analysis concrete.

Other components of qualitative data analysis include theoretical sampling and theoretical sensitivity (Corbin & Strauss, 2008; Strauss & Corbin, 1990). Theoretical sampling is a process of concurrently analyzing data and deciding what data to collect next to generate information about the concepts the researcher wants to learn about (Corbin, 2015). When analyzing the data in the case study, if more detail was needed about what respondents reported, I would consult with the appropriate person to clarify. Theoretical sensitivity is a component that has been associated with Grounded Theory and has been described as "the ability to give meaning to data" (Strauss & Corbin, 1990)( p. 42), or to discern what data are relevant. Theoretical sensitivity may come from many sources, including literature, professional experience, personal experience, and through the analytic process (Strauss & Corbin, 1990). The importance of theoretical sensitivity justifies intertwining data collection and data analysis. My theoretical sensitivity came from my previous knowledge about nutrition, school food programs, sustainable food systems in schools, and my knowledge about school contexts, for example.

Glasser and Strauss first developed Grounded Theory (Glaser & Strauss, 1967); however, Strauss further articulated pragmatism and symbolic interactionism (Corbin, 2015). Pragmatism refers to learning about concepts in their natural settings (Corbin, 2015). Symbolic interactionism refers to how understanding is created through the use of symbols and through action and interaction, and self-reflection (Corbin, 2015). The concepts of pragmatism and symbolic interactionism were the bases of Grounded Theory. These concepts were applied in the case study by interviewing participants to gain an understanding of their perspectives working in the area of school food in their current setting.

### 3.3.2 Generalizability

Qualitative research seeks to develop a deeper understanding of the unique nature of a specific situation or context (Stake, 1995). This is unlike quantitative research, which compares many cases in order to make generalizations (Stake, 1995). In qualitative research, the researcher interprets the findings, and in contrast, quantitative studies limit personal interpretation of results by using statistical analysis (Stake, 1995). Qualitative and quantitative studies are used for different purposes, so the findings are used in different ways. The concept of transferability of findings in qualitative research refers to learning about a specific case and providing enough detail that the reader can determine how the findings may apply to other similar situations (Stake, 1995). Using qualitative research provides a more in-depth understanding of the setting to help schools move towards adopting a curriculum-integrated sustainable school food program to improve nutritional intake while protecting the environment.

### 3.3.3 Research Questions

The objective of the case study was to understand the capacity for elementary schools (grades 3-8) to implement curriculum integrated sustainable food systems and food programs and to determine what is required to make system changes to incorporate these strategies. The case study is exploratory and answers the following research questions:

1. What are the current practices around sustainable food systems and school food programs in schools?
2. What would school staff like to do in relation to sustainable food system strategies?
3. What are the barriers, facilitators, and opportunities for adopting curriculum integrated sustainable food systems and food programs in elementary schools?
4. What supports are required to help schools incorporate sustainable food systems strategies and food programs into their practices?

### 3.3.4 Philosophical Assumptions

In this study, I used a pragmatic, constructivist perspective. A pragmatic perspective is well-suited for mixed-methods research, given it focuses on the knowledge problem and is not bound to any particular philosophical lens (DePoy, 2016). A constructivist perspective recognizes that there can be multiple versions of reality that are impacted by the person's social circumstances – position, privilege and other factors – which influence the interpretation of

reality (Taylor & Francis, 2013). This is relevant for this study because I bring my own lens when analyzing the data. I am a dietitian with expertise in nutrition and population health, and I would identify my perspective as pragmatic, feminist, and communitarian (Whipps, 2004) so aspects of my interpretation would be different than someone with a different perspective.

### 3.3.5 Frameworks

The essential components of sustainable food systems and food programs must be determined before they can be identified in a school context. To make these components explicit, I began my analysis considering the framework that I developed in my scoping review on Best Practices for School Food Programs in Canada. This framework was adapted from Garret and Feenstra (nd) and Tagtow et al. (2014) and informed by the scoping review findings. It contained three components: Social Determinants of Health, Systems and Sustainability, and Economic Sustainability. I then categorized the components from the School Food Environment Checklist (Black et al., 2015) into my Best Practices Framework. Table 3.3 contains the components of sustainable food systems and food programs that were considered in the initial case study analysis. This information was shared with the key informants before their interview, so they were aware of possible initiatives of interest.

*Table 3.3:Case Study Analytical Framework*

| **Promising Practices for School Food Programs Framework** (Everitt, nd) | **School Food Checklist (Black et al., 2015)** |
|---|---|
| **Social Determinants of Health**<br>Improves nutritional intake<br>Addresses food literacy<br>Promotes health equity<br>Addresses stigma<br>Promotes cultural diversity and cultural acceptability | Food preparation activities integrated into the curriculum using local ingredients<br>Teach about food and nutrition<br>Availability of healthy food (milk program, farm to school, breakfast, lunch, food fundraisers, special food days)<br>Food system education<br>Health and environmental impacts of food<br>Food is the grand connector |
| **Systems and Sustainability**<br>Conserves and protects the natural environment<br>Incorporates local foods and businesses<br>Reduces waste<br>Includes gardening<br>Promotes connectedness to community and natural environment | School garden (teaching about healthy eating, food prep, gardening, science, or other subjects)<br>Strengthen connection of garden and classroom<br>Composting system (waste from the kitchen, cooking classes, students'and staff food, school garden, yard waste)<br>Availability of environmentally sustainable foods (minimally processed, locally grown, organic, seasonal, vegetarian) |

| | |
|---|---|
| | Food purchasing policies (minimally processed, locally sourced, less packaging and single-serve packages, condiments in bulk, reusable dishes)<br>Recycling<br>Events on environmental sustainability<br>Reduction in GHG emission and negative environmental impact<br>Food garden maintenance and management plan |
| **Economic Sustainability**<br>Sufficient resources to staff programs, Build capacity<br>Monitor and evaluate programs | Affordability |

### 3.3.6 Data Collection

Many data sources can be used in case study research. The School Food Logic Model identifies three areas where schools can incorporate sustainable food system strategies: curriculum, policies, and practices (Chapman et al., n.d.). Typically, case study analysis uses multiple data sources that are used to triangulate findings. This study uses ten semi-structured interviews, curriculum and policy document review, observations, and the School Food Environment Assessment Tool checklist.

Interview participants consisted of principals, teachers, and nutrition workers. The following questions were asked in the interviews:

1. What are the current curriculum, policies (written or unwritten) and current practices that exist around sustainable food systems (SFS) and school food?
2. What do you see as the priorities around school food and sustainable food systems? What supports these priorities?
3. What are the barriers to addressing these priorities?
4. What could be done to minimize barriers and enhance supports to make implementation (of sustainable food system strategies or a school food program) successful?

The document review looked at the written policy and curriculum. Policies were reviewed to determine if there were policies that supported or hindered sustainable food systems or school food programs. The curriculum was reviewed to determine where food literacy, the impact of food on health and the environment, and experiential learning components were included.

The School Food Environment Assessment Tool (SFEAT) was used for systematically recording current practices. I completed it, with the assistance of school staff. It included questions on food gardens, composting systems, recycling and waste reduction systems, food preparation activities, food-related learning, and availability of healthy food (Black et al., 2015).

Observations were used to provide more detail on the components assessed in the SFEAT. Potential or existing gardens were observed to determine the current or possible future garden (indoor or outdoor) infrastructure. Composting programs were reviewed to determine the current or possible future composting infrastructure. Current and potential food preparation space, including kitchens, fridge, and freezer space, food preparation areas, dishwasher space, and storage and eating space were observed. Each component was assessed for how infrastructure acts as a barrier or facilitator to developing sustainable food system strategies and food programs in schools.

### 3.3.7 Data Analysis

Interviews were transcribed and coded inductively using open coding and constant comparative analysis. Categories came from my interpretation. When coding, I first broke the data down into categories, and in the second round, I further refined each category. During data analysis, I wrote memos to help process, develop, and compare ideas.

### 3.3.8 Quality of Data

This study is a qualitative multiple case study using two cases to understand better how to implement sustainable food system practices and food programs in schools. It uses a pragmatic, constructivist perspective with a Grounded Theory approach to data analysis. A constructivist approach recognizes that reality is socially constructed and there can be multiple interpretations with no way of establishing consensus or the "best" perspective (Stake, 1995). This section discusses data quality considerations that are relevant for this type of study.

Methodological triangulation is a strategy that is used to collect data from more than one source to increase confidence in the findings (Stake, 1995). In this study, data was collected from written policy and curriculum and was compared to interview data, direct observation, and the SFEAT Checklist to increase confidence in the findings.

Member checking is a process where the person interviewed reviews the data that was gathered to ensure it is accurate (Stake, 1995). In this study, the information on the SFEAT Checklist was compiled and sent to the principals for verification. In addition, once all of the data was collected and analyzed, the findings were presented to each school individually so they could comment, clarify, and ensure the findings applied to their setting. Suggested changes were incorporated. Once the paper was in its final stages, it was forwarded to the principals for review and approval.

Qualitative research aims to develop a deep understanding of the unique nature of a specific situation or context (Stake, 1995). This is unlike quantitative research, which compares many cases in order to make generalizations (Stake, 1995). Details are provided in the study so the reader can determine if the findings in this study may be useful and apply to schools in a similar context.

### 3.4 Conclusion

This chapter contains a description of methods that are pertinent but not described elsewhere in this thesis. The first section provides background information about scoping reviews and details of the data extraction process that was used in paper 1. The second section discusses the research questions for the study comparing diet quality of students in school meal programs compared to those who bring lunch from home, which is described in paper 2. The third section describes concepts about case study research that are pertinent to paper. 3. Chapters 4, 5, and 6 contain papers 1, 2, and 3, respectively. These studies were done to advance the area of school food and sustainable food systems in schools.

# CHAPTER 4: DETERMINING PROMISING PRACTICES FOR CANADIAN SCHOOL FOOD PROGRAMS- A SCOPING REVIEW

## Prelude to paper 1

The primary purpose of the scoping review was to determine promising practices in Canada for school food programs in elementary and high schools. To be included in this review, articles published after 1970 needed to have an evaluation component and describe school food programs where food was provided to students for nourishment purposes during school hours. Some progams were provided at no cost to the students and some were cost-shared. This topic lends itself to a scoping review because few peer-reviewed evaluations are available in the Canadian context. We included grey literature because health promotion program evaluations are often not peer-reviewed.

This study answers the research questions:

1. What are the current practices in school food programs in Canada that are currently evaluated?
2. How do these programs contribute to third phase of school food programs (incorporate sustainable food system strategies)?

I am the primary author on this paper. Co-authors for this paper are Dr. Rachel Engler-Stringer and Dr. Wanda Martin. They reviewed and provided feedback. Also, I would like to acknowledge the contributions of Jennifer Nghiem for literature searches and article screening; Brynn Mayo for literature searches, article screening, and data extraction; and Catherine Boden for assistance with the search strategy planning and review.

A version of this chapter is currently under review as an article to be published by Taylor & Francis in the Journal of Hunger and Environmental Nutrition. The publication date is currently not available.

## Abstract

In Canada, childhood obesity is increasing while 16% of children are food insecure. Schools provide an opportunity to promote healthy eating, yet, there is no national school food program. The purpose of this scoping review is to determine promising practices for Canadian school food programs. Using peer reviewed and grey literature in English and French published after 1970, we examined 35 publications for evidence of nutritional intake, nutrition education, improved educational attainment, promotion of health equity, and cultural awareness. Interest in school food programs is growing. Programs should address social determinants of health, food systems, and environmental and economic sustainability.

**Keywords:** School food program, breakfast program, lunch program, snack program, gardening, children, health promotion, Canada

## 4.1 Introduction

Healthy eating supports optimal growth, development and learning in children and the food choices that children make while at school can have significant long-term impacts (Roustit, Hamelin, Grillo, Martin, & Chauvin, 2010). Childhood is an important time for establishing eating habits that last a lifetime (Ballard, 2013). Despite the importance of healthy eating, the diet quality of school-aged children while at school is poor, and up to 37% of calories come from minimally nutritious foods (Tugault-Lafleur et al., 2017). Canadian children's diets include a large proportion of ultra-processed foods generally high in salt and sugar. (Tugault-Lafleur et al., 2017), and these foods contribute to environmental degradation. Overweight and obesity have been increasing and affect 26% of 2 to 17 year-olds (Shields, 2006). At the same time, 16% of Canadian children experience some level of food insecurity (Tarasuk et al., 2014). School-aged children spend most of their week-day waking hours at school, which is an ideal environment to promote healthy eating behaviours.

School food availability has been identified as important; however, Canada is lacking national school food standards and remains one of the few industrialized countries without a national school food program despite recent potential developments in that direction (Godin, Patte, & Leatherdale, 2018). Although Canada lacks national standards for foods available in schools; there is a guidance document for provinces and territories to provide recommendations for foods and beverages in school (Food Secure Canada, 2013) and many provinces have school nutrition guidelines (Alberta Government, 2012; British Columbia, n.d.; Ministry of Children and Youth Services, 2016; Ministry of Education, 2010; Nova Scotia Education Health Promotion and Protection, 2013; Saskatchewan Ministry of Education, 2012). Many communities across Canada have identified a need for food programs to support school-aged children and have established milk, snack, vegetable, fruit, breakfast, or lunch programs (Gates, Hanning, Gates, Isogai, et al., 2013; Hanbazaza et al., 2015; He et al., 2012; Naylor & Bridgewater, 2007; Russell et al., 2007; Saksvig et al., 2005; Sangster Bouck et al., 2011; Skinner, Hanning, Metatawabin, Martin, & Tsuji, 2012; Triador, Farmer, Maximova, Willows, & Kootenay, 2015). In some cases, schools may provide food at no cost, particularly in economically-deprived regions or neighbourhoods.

The development of school food programs in high-income countries has followed three phases (Oostindjer et al., 2017). The first phase occurred between 1850 to 1950 and focused on

providing calories, regardless of food quality, to reduce hunger (Oostindjer et al., 2017). Foods were often high in fat and sugar, and low in nutrients. The second phase of school food program development, which started around 1970 in some countries, and more recently in others, shifted from addressing hunger to encouraging healthier, more nutrient-dense, lower-calorie foods in response to concerns about poor dietary quality (Oostindjer et al., 2017). During this phase, some countries initiated school nutrition guidelines, which promoted high-quality food (Oostindjer et al., 2017). The third phase of school food programs, which is in its infancy in most countries, involves integrating health and environmental sustainability concerns more closely into school food programs (Oostindjer et al., 2017). Integrating health not only means addressing the nutritional quality of diets overall but also promoting health through addressing the social and environmental determinants of health. This third phase has represented a shift towards school food programs that incorporate food system and societal issues into meals through curricular integration so the curriculum content teaches about food, culture, and sustainable food production while the school provides healthy sustainable food (Oostindjer et al., 2017). Curriculum integration improves food literacy and provides knowledge and skills so health-supporting decisions can be made. Food literacy includes varying levels of skills, from simple to complex. It includes interpreting food labels, understanding how food choices impact health, having the skills to procure healthy food and includes a critical perspective along with advanced knowledge of the food system to promote action and improvement (Anderson & Falkenberg, 2016; Azevedo Perry et al., 2017; Robertson & Scheidler-Benns, 2016; Truman et al., 2017).

The shift toward the third phase of school food programs around the world includes broadening the scope of school food program components to considerations beyond diet quality. Garret and Feenstra (Garret & Feenstra, nd) developed a framework for achieving sustainability in a community food system that includes three components: Social Equity and Human Health; Environmental Health; and Economic Vitality. This is similar to a framework by Tagtow et al. (2014) that identified the components necessary for sustainable food and water systems: Nutrition and Health; Environmental Stewardship; Economic Vitality; and Social, Cultural and Ethical Capital (Tagtow et al., 2014). These components may not explicitly be identified in school food programs; however, as Canada is shifting into the third phase of programs described above (Oostindjer et al., 2017), these themes are part of this review.

The purpose was to identify the extent to which Canadian school food programs contribute to the third phase of school food programs. This topic lends itself to a scoping review because few peer-reviewed evaluations are available in the Canadian context. We included grey literature because health promotion program evaluations are often not peer-reviewed. Additionally, we anticipated that a wide range of research methods would be used, which would make comparing results challenging. This review can inform the design and testing of curriculum-integrated school food programs that can meet the multiple needs of children while advancing ideals of sustainability in a community food system.

**4.2 Methods**

We followed the Arksey and O'Malley's Methodological Framework for Scoping Reviews (Arksey & O'Malley, 2005) during the design phase and the PRISMA-ScR Checklist for reporting findings from scoping reviews (Tricco et al., 2018). Our searches included both peer-reviewed and grey literature in English and French. Databases searched include OVID Medline (1947 to present), OVID ERIC (1965 to present), PsycINFO (OVID, 1806 to present), and Web of Science (1900 to present). Although the databases had articles available before 1970, the search was for articles after 1970. Table 4.1 includes the search terms that were developed with the assistance of a librarian (CB). The search strategy was adapted to optimize the search in each database. The peer-reviewed literature search was conducted on June 5, 2018, and limited to articles published after 1970 to capture literature in the time span of the third phase of school food programs (Oostindjer et al., 2017). Reference lists of the included articles were reviewed to identify additional relevant references.

*Table 4.1:Ovid Medline Search Strategy*

| |
|---|
| 1. canada.ab,ti. |
| 2. canadian.mp. |
| 3. canada/ or alberta/ or british columbia/ or manitoba/ or new brunswick/ or newfoundland/ or labrador/ or northwest territories/ or nova scotia/ or nunavut/ or ontario/ or prince edward island/ or quebec/ or saskatchewan/ or yukon territory/ |
| 4. 1 or 2 or 3 |
| 5. breakfast/ or lunch/ or snacks/ |
| 6. breakfast*.mp. |
| 7. lunch*.mp. |
| 8. snack*.mp. |
| 9. MEALS/ |
| 10. (Meal* adj2 (plan or plans or program* or intervention*)).mp. |
| 11. (food* adj2 (plan or plans or program* or intervention*)).mp. |
| 12. (nutrition* adj2 (plan or plans or program* or intervention*)).mp. |
| 13. MILK/ |
| 14. (milk* adj2 (plan or plans or program* or intervention*)).mp. |
| 15. fruit*.mp. |
| 16. (fruit* adj2 (plan or plans or program* or intervention*)).mp. |
| 17. (vegetable* adj2 (plan or plans or program* or intervention*)).mp. |
| 18. (garden* adj2 (program* or intervention*)).mp. |
| 19. (cook* adj2 (program* or intervention*)).mp. |
| 20. farm-to-school*.mp. |
| 21. farm-to-fork*.mp. |
| 22. (eat* adj2 (plan or plans or program* or intervention*)).mp. |
| 23. 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 |
| 24. (elementary adj school*).mp. |
| 25. (middle adj2 school*).mp. |
| 26. (high adj2 school*).mp. |
| 27. (primary adj2 school*).mp. |
| 28. (secondary adj2 school*).mp. |
| 29. (grade adj2 (school* or student*)).mp. |
| 30. kindergarten.mp. |
| 31. (kindergarten adj2 student*).mp. |
| 32. ((boarding or private) adj2 (school* or student*)).mp. |
| 33. 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 |
| 34. 4 and 23 and 33 |

We designed a comprehensive grey literature search strategy, outlined in Table 4.2. Search terms for websites were adapted from the peer-reviewed strategy. E-mail messages were sent to sources, as identified in Table 4.2.

*Table 4.2: Grey Literature Search Strategy*

| **Web search** | **Contacted by e-mail** |
|---|---|
| Ministries of Education and Health | Members of the Coalition for Healthy School Food |
| Advanced Google search *<br>Schools<br>Ministries | Food Studies Organizations:<br>Canadian Association for Food Studies listserv |
| Child focused charities:<br>Breakfast for Learning<br>Breakfast Club of Canada<br>Children's Breakfast Club<br>One X One | Professional Networks<br>Messages on List Serves: Dietitians of Canada; Food Security Network; Public Health Network<br>Personal e-mail:<br>Manager of Practice-Based Evidence in Nutrition; Editor, Canadian Journal of Dietetic Practice and Research |
| Public Health Associations:<br>British Colombia<br>Ontario<br>Quebec<br>Alberta | Professional Networks<br>Personal e-mail sent to chair:<br>New Brunswick Dietitians in Action<br>Dietitians of Newfoundland and Labrador |
| Epistimonikus | |
| Trial Registries: clinicaltrails.gov | |

* A thorough advanced google search was done using school terms (domains ending in .edu in Canada), the ministries of health and education in the provinces and territories in Canada (domains ending in .gov)

To be included, an article had to focus on programs that provided food to children for nourishment purposes during school hours, had an evaluation component, and was conducted in Canada. Publications were excluded if they were descriptive only (no evaluation), if they provided food for educational purposes only (cooking classes), included only a literature review, focused on adherence to policy, or discussed foods in cafeterias or vending machines.

The components selected for inclusion that are commonly evaluated in school food programs are educational outcomes; behaviour, including attention and attendance; improved nutritional intake; and improved food insecurity. Additional concepts reflecting the move towards the third phase of school food programs as described by Oostindjer et al. (2017) and supported by the sustainability frameworks as described by Garret and Feenstra (n.d.) and

Tagtow et at. (2014) were incorporated. This included information on the social benefits; increasing environmental knowledge; strengthening food systems, food system knowledge or food literacy; increasing cultural knowledge, attitudes and practices; improving health equity, and addressing the economic feasibility of the program.

A title scan was the first level of screening, followed by an abstract scan. The literature then underwent full-text screening. The screening was conducted using Distiller software by two independently trained research assistants (BM, JN). Excluded peer-reviewed articles and conflicts for grey literature articles were reviewed by a third reviewer (TE). Two independent researchers (BM, TE) extracted data from the 3 included sources to determine program evaluation outcomes. TE then appraised and rectified discrepancies in the extracted data.

### 4.3 Results

Figure 4.1 shows the flow of our screening process. The systematic search of major health and nutrition databases provided 395 publications (288 peer-reviewed and 107 grey literature eports) after removing duplicates.

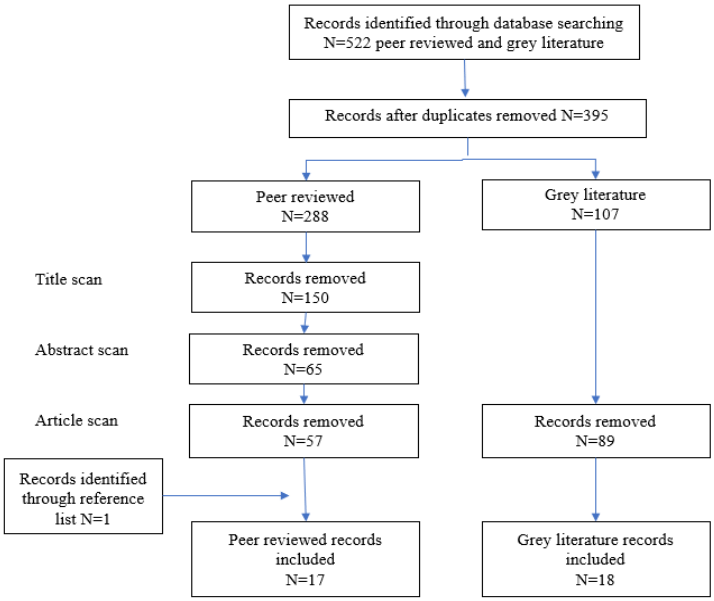



*Figure 4.1: Article Screening Flowchart*

After the full–text review, 16 peer-reviewed and 18 grey literature publications remained. One additional peer-reviewed article was entered after scanning the reference lists of the included peer-reviewed articles. We found a few publications in the grey literature that

summarized other evaluations, and when this occurred, we located as many of the original evaluations as we could find and then put them through our review process.

### 4.3.1 Overall Publication Summary

Twelve of the 17 peer-reviewed publications were focused on six programs in Alberta, Saskatchewan, and Ontario. Seventeen reports come from individual programs spread across all Canadian provinces but do not cover the territories. Of these, only five are peer-reviewed.

There are various types of programs in the review, which include lunch, breakfast, snack, and fruit and vegetable programs. Four publications focus on milk programs and two on garden sites. Six of the peer-review articles and two of the grey literature reports reported on programs in First Nations communities. Some publications reported on existing and ongoing programs and others reported on interventions. Intervention durations varied greatly, with the shortest being one week. The number of participants ranged from 16 to over 23,000. Appendix A.2 and A.3 provide a summary of the program characteristics for the peer-reviewed and grey literature. Table 4.3 provides a summary of the types of programs and the type of publications per program per province.

***Table 4.3: Summary of Programs and Publications per Program***

| Province | Name | Location | Type | Peer Reviewed | Grey Literature |
|---|---|---|---|---|---|
| British Columbia | BC Farm to School Salad Bar | Northern and Interior BC | **Lunch salad bar** | - | Social Research & Demonstration Corporation (2010) |
| | New Westminster breakfast, lunch, snack programs | New Westminster School District | **Breakfast, lunch & snack** | - | Scott et al. (2017) |
| | BC Fruit and Vegetable Snack Program | Not specified Public and First Nations schools Not specified - provincial | **Fruit and vegetable snack** | _ | ActNow BC (2008) * Context (2013) Naylor et al. (2007) |
| Alberta | School Milk Program | Calgary and surrounding area | **Milk** | Ransome et al. (1998) | - |
| | Central Alberta First Nations gardening and snack program | First Nations communities | **Gardening and Snack** | Hanbazaza et al. (2015) * Triador et al. (2015) * | Triador, (2013) * |

| | | | | | |
|---|---|---|---|---|---|
| Saskatchewan | Food For Thought | Saskatoon | **Lunch & snack** | - | Opoku (2016) |
| | Elementary School Milk program | Saskatoon and surrounding rural | **Milk** | Henry et al. (2015)<br>Henry et al. (2016) | - |
| | School meal program samples | Saskatoon | **Breakfast, Lunch, Snack** | Goguen et al. (2011) | Gougeon et al. (2011) |
| Manitoba | Manitoba Nutrition Positive | Throughout Manitoba | **Breakfast, lunch, snack, fruit & vegetable** | - | Prowse (2011) |
| Ontario | Child Nutrition Program | Rural and urban sites | **Breakfast & snack** | Russell et al. (2007) | - |
| | Ontario Northern First Nations Snack Program | Northern First Nations communities | **Snack** | Skinner et al. (2012) | - |
| | Sandy Lake school-based diabetes prevention program | Northern First Nations communities | **Lunch** | Saksvig et al. (2005) * | - |
| | Breakfast for Kids | Peel region | **Breakfast, lunch & snack** | - | Valatis (2009) |
| | Better Beginnings Better Futures | Etobicoke, Cornwall | **Breakfast, lunch, snack & garden** | - | Edward (1998) |
| | Feeding our Future | Toronto district | **Breakfast** | - | Muthuswamy (2012) |
| | First Nations Fruit, Vegetable and Milk Programs | First Nations communities | **Fruit, Vegetable and Milk** | Gates et al. (2013) *<br>Gates et al. (2013) | Gates (2010) * |
| | Northern Fruit and Vegetable Pilot Program | Northern Ontario | **Fruit and Vegetable** | He et al. (2009) *<br>He et al. (2012)<br>Sangster Bouck et al. (2011) | He et al. (2008) * |
| Ontario/Alberta | COMPASS Study | Site location not specified<br><br>Urban and rural | **Breakfast** | Godin et al. (2018) (ON and AB)<br>Leatherdale (2016) (ON) | - |
| Quebec | Social and Health Survey of Children | Remote, rural and urban areas included | **Breakfast, lunch and snack** | Roustit et al. (2010) | - |
| New Brunswick | Healthy Minds Breakfast | Urban and rural | **Breakfast** | - | Policy and Planning Branch (2006) |
| Nova Scotia | Eating Well, Learning Well | Halifax regional municipality | **Fruit & vegetable** | - | Abrey, (2008) * |
| Newfoundland | Kids Eat Smart | Throughout the province | **Breakfast, lunch and snack** | - | Goss Gilroy Inc. (2013) |

| | | | | | |
|---|---|---|---|---|---|
| Prince Edward Island | Fruit and Vegetable Pilot Program | One school from each district (3) | **Fruit & vegetable snack** | - | Taylor (2003) |

An * indicates the program included an educational component

Although our search was looking for publications written since 1970, most of the publications are from the last ten years (2008-2018). This includes fourteen of the 17 the peer-reviewed publications and 14 out of 18 grey literature publications.

### 4.3.2 Peer-Reviewed Publications

The 17 quantitative studies included dietary assessment, food security, food-related behaviour, and educational outcomes measurement. Of the 12 out of 17 studies on nutrition-related outcomes, ten focused on nutrition and changes in intake using a 24-hour recall or food frequency questionnaire (Gates, Hanning, Gates, Isogai, et al., 2013; Gates, Hanning, Gates, McCarthy, & Tsuji, 2013; Gougeon et al., 2011; He, Beynon, Sangster Bouck, St Onge, et al., 2009; Henry, 2015; Henry, Whiting, Finch, Zello, & Vatanparast, 2016; Ransome, Rusk, Yurkiw, & Field, 1998; Saksvig et al., 2005; Skinner et al., 2012). Three studies relied on self-report of food intake through focus groups or surveys (Hanbazaza et al., 2015; He et al., 2012; Triador et al., 2015). Breakfast was evaluated through the frequency of breakfast eating (Leatherdale, Stefanczyk, & Kirkpatrick, 2016) or breakfast program use (Godin et al., 2018). One study included plate waste measurement (Henry et al., 2016), another measured food security and health equity (Roustit et al., 2010), another food-related behaviour (breakfast skipping and program use) (Leatherdale et al., 2016), five included educational components (Gates, Hanning, Gates, Isogai, et al., 2013; Hanbazaza et al., 2015; He, Beynon, Sangster Bouck, St, et al., 2009; Saksvig et al., 2005; Triador et al., 2015) and two included educational outcomes (Hanbazaza et al., 2015; Roustit et al., 2010). One article focused on environmental knowledge (Hanbazaza et al., 2015), one focused on environmental sustainability by measuring food waste (Sangster Bouck et al., 2011), and one discussed economic feasibility (Skinner et al., 2012). Process evaluations in three studies were completed in the form of descriptions of program perceptions, barriers, facilitators, and implementation (He et al., 2012; Russell et al., 2007; Sangster Bouck et al., 2011).

Some reports covered only one type of program, whereas others covered more than one. Single programs that were evaluated included a breakfast program (Godin et al., 2018;

Leatherdale et al., 2016) a milk program (Gates, Hanning, Gates, McCarthy, et al., 2013; Henry, 2015; Henry et al., 2016; Ransome et al., 1998), vegetables and fruit snack program (He, Beynon, Sangster Bouck, St Onge, et al., 2009; He et al., 2012; Sangster Bouck et al., 2011; Skinner et al., 2012) and a lunch program (Saksvig et al., 2005). Evaluations with more than one component included breakfast and snack programs (Gates, Hanning, Gates, Isogai, et al., 2013; Russell et al., 2007), breakfast and lunch programs (Gougeon et al., 2011; Roustit et al., 2010), and garden and vegetable programs (Hanbazaza et al., 2015; Triador et al., 2015).

All but three of the peer-reviewed articles included quantitative findings, and of those, two studies used mixed methods (Gates, Hanning, Gates, McCarthy, et al., 2013; Henry, 2015). The other three included only qualitative methods (He et al., 2012; Russell et al., 2007; Sangster Bouck et al., 2011). The following section discusses the statistically significant findings from the quantitative studies in the peer-reviewed literature.

#### 4.3.2.1 Quantitative Research Findings

The school milk programs studies improved intake of milk and alternatives resulting in higher calcium and vitamin D intakes in grades 6-8, as well as increased knowledge and intention to consume milk and alternatives (Gates, Hanning, Gates, McCarthy, et al., 2013; Ransome et al., 1998). However, children may continue to consume inadequate amounts of milk and alternatives. School milk intake was decreased in the short term when chocolate milk was replaced with low-sugar chocolate milk (Henry et al., 2016) or if chocolate milk was removed entirely (Henry, 2015). A grey literature study with similar results was also included (Gates, 2010).

Snack program participants increased their consumption of vegetables, fruits, milk and alternatives, and decreased their intake of minimally nutritious foods while at school (Skinner et al., 2012). Free fruits and vegetables, along with nutrition education in a snack program, resulted in a significant increase in fruit and vegetable consumption (He, Beynon, Sangster Bouck, St Onge, et al., 2009).

In one study, the lunch program was part of a more complex strategy that included curriculum, environment, family, and peer considerations (Saksvig et al., 2005). This study demonstrated an increase in health and nutrition knowledge (Saksvig et al., 2005). The authors explained that the other intervention components, such as the curriculum, the improvements to

the food environment, the focus on family and peer influences, might have contributed to the changes in scores.

Publications that discussed gardening and taste testing examined knowledge and preference for vegetables and fruit (Hanbazaza et al., 2015; Triador et al., 2015). Hanbazaza et al. (Hanbazaza et al., 2015) assessed knowledge by asking children to name vegetables and fruit and assessed preferences by asking about the likability of different foods comparing these results from before and after their snack program intervention. They found increased knowledge (Hanbazaza et al., 2015) and preferences (Hanbazaza et al., 2015; Triador et al., 2015) for vegetables and fruit.

Gougeon et al. (Gougeon et al., 2011) looked at the nutrient composition of foods offered in breakfast and lunch programs. They took samples of foods offered, conducted a nutrient analysis, compared it to the dietary reference intakes and concluded that the foods that were offered were nutrient-dense, but not sufficiently energy-dense to meet the needs of the child participants.

#### 4.3.2.2 Qualitative Research Findings

There were three peer-reviewed publications studies which included qualitative components. Data was collected through surveys and interviews (Sangster Bouck et al., 2011) and focus groups (He et al., 2012; Russell et al., 2007). Participants in a snack program, for example, reported eating more vegetables and fruit at school, home, or both (He et al., 2012). Snack programs benefitted students by encouraging healthier eating, providing new foods, and giving the students more energy (He et al., 2012). When looking at perceptions of the program, stigma may reduce program use, even in programs that attempt to reduce stigma (Russell et al., 2007). Qualitative data also indicate that community involvement facilitates program delivery (Sangster Bouck et al., 2011).

### 4.3.3 Grey Literature

Of the 18 grey literature publications, five came from British Columbia (Act Now BC, 2008; Context, 2013; Naylor & Bridgewater, 2007; Scott, Wheeler, Francoeur, & Jassar, 2017; Social Research and Demonstration Corporation, 2010), five from Ontario (Edward, 1998; Gates, 2010; He et al., 2008; Muthuswamy, 2012; Valatis, 2009), two from Saskatchewan (Gougeon, 2008; Opoku, 2016), and one each from Alberta (Triador, 2013), Manitoba (Prowse, 2011), Nova Scotia (Abrey, 2008), Newfoundland (Goss Gilroy Inc., 2013), New Brunswick

(Policy and Planning Branch, 2006), and Prince Edward Island (Taylor, Binns, Smith, Gallant, & Crozier, 2003). Five of the 19 studies measured nutrition-related outcomes. Of these, three focused on nutrition and changes in intake using a 24-hour recall or food frequency questionnaire or weighing samples of foods served (Gates, 2010; Gougeon, 2008; Henry et al., 2016). Two studies relied on self-report of food intake through focus groups, surveys, or interviews (Act Now BC, 2008; Naylor & Bridgewater, 2007). Most of the grey literature reports captured more than one component in their evaluation. Some evaluated the program overall (Edward, 1998; Naylor & Bridgewater, 2007; Opoku, 2016; Scott et al., 2017; Social Research and Demonstration Corporation, 2010; Sustainable Societies Consulting Group for Community Garden Council of Waterloo & Region of, 2016), others captured knowledge and attitudes towards trying new foods (Context, 2013; He et al., 2008; Taylor et al., 2003; Triador, 2013), and some focused on behaviour, attendance, and educational outcomes (Goss Gilroy Inc., 2013; Muthuswamy, 2012; Policy and Planning Branch, 2006; Prowse, 2011; Valatis, 2009). Five programs included an educational component (Abrey, 2008; Act Now BC, 2008; Gates, 2010; He et al., 2008; Triador, 2013). Other aspects of school food programs that were studied include local food procurement (Abrey, 2008), economic feasibility (Edward, 1998; Naylor & Bridgewater, 2007; Social Research and Demonstration Corporation, 2010; Valatis, 2009), and health equity (Goss Gilroy Inc., 2013; Muthuswamy, 2012; Prowse, 2011). Several reports included process evaluations comprised of program perceptions, barriers, facilitators, and implementation considerations (Abrey, 2008; Context, 2013; Muthuswamy, 2012; Naylor & Bridgewater, 2007; Policy and Planning Branch, 2006; Social Research and Demonstration Corporation, 2010; Valatis, 2009).

Six of the grey literature articles looked at programs that included a combination of breakfast, lunch, snack, and/or garden programs (Edward, 1998; Goss Gilroy Inc., 2013; Gougeon, 2008; Opoku, 2016; Prowse, 2011; Scott et al., 2017; Valatis, 2009). Six articles focused on snack programs that included fruit and vegetables (Act Now BC, 2008; Context, 2013; He et al., 2008; Naylor & Bridgewater, 2007; Taylor et al., 2003) and milk (Gates, 2010). Other programs included garden and snack programs (Triador, 2013), breakfast programs (Muthuswamy, 2012; Policy and Planning Branch, 2006) and a farm-to-school salad bar (Social Research and Demonstration Corporation, 2010).

Eight of the grey literature reports consisted of qualitative evaluations, two used quantitative methods, (Taylor et al., 2003; Triador, 2013) four used mixed methods (Context, 2013; Gates, 2010; Gougeon, 2008; Social Research and Demonstration Corporation, 2010) and five used qualitative methods along with descriptive quantitative results – descriptions of the data without doing statistical analysis (Muthuswamy, 2012; Naylor & Bridgewater, 2007; Policy and Planning Branch, 2006; Prowse, 2011; Valatis, 2009).

#### 4.3.3.1 Quantitative Findings

Snack programs positively impacted food intake**.** Specifically, snack program**s** increased acceptance and willingness to try new foods and increased the number of vegetables and fruits tried at home and in school (Context, 2013). Vegetable and fruit snack programs increased the willingness to try some vegetables and increased the preference for some fruits and vegetables (Taylor et al., 2003). While garden and snack programs increased preferences for and positive attitudes towards vegetables and fruit, they did not change home consumption (Triador, 2013).

The farm-to-school salad bar was a subsidized lunch program providing local vegetables and fruit. It increased raw vegetable intake and willingness to try new foods (Leatherdale et al., 2016; Social Research and Demonstration Corporation, 2010). Use of the salad bar in high schools was lower than expected (Social Research and Demonstration Corporation, 2010).

A study looking at the nutrient composition of meals provided in meal programs reported the same conclusion as the peer-reviewed publication written by the same author. After taking samples of foods offered in breakfast and lunch programs and conducting a nutrient analysis, both publications concluded that school meals are nutrient-dense but do not meet energy requirements (Gougeon, 2008).

#### 4.3.3.2 Qualitative and Descriptive Findings

Qualitative findings of the programs identified many of the same benefits, including health, academic, behavioural, and social. Health benefits included improved awareness of healthy eating, improved nutrition, including outside of school (Goss Gilroy Inc., 2013; Opoku, 2016), a willingness to try new foods (Edward, 1998; Opoku, 2016), and skill development including cooking skills (Valatis, 2009). Academic and behavioural benefits included improved academic effort, performance, and attendance (Goss Gilroy Inc., 2013; Prowse, 2011; Valatis, 2009), literacy scores (Prowse, 2011), and behaviour demonstrated through a decrease in disciplinary action and suspension of students (Prowse, 2011). School food programs contributed

to socialization, social contact, and peer connectedness from eating together, learning to be responsible, working with adults, and developing a community network (Edward, 1998; Goss Gilroy Inc., 2013; Opoku, 2016; Valatis, 2009). School meal programs provided teaching (Edward, 1998) and volunteer opportunities (Valatis, 2009), and overall increased knowledge while promoting positive attitudes and practices (Prowse, 2011).

Evaluations that reported on vegetable and fruit programs identified similar benefits as those that reported on multiple programs. These included increasing vegetable and fruit consumption, trying new vegetables and fruit, increasing knowledge about vegetables and fruit (Act Now BC, 2008; He et al., 2008; Naylor & Bridgewater, 2007), and asking parents to buy more at home (Act Now BC, 2008). Some programs reported increased awareness about eating healthy and local foods (Naylor & Bridgewater, 2007) or strengthening the local food system (Abrey, 2008).

Addressing hunger and food insecurity through school food programs was important (Roustit et al., 2010). Students in focus groups reported that up to 50% of students have insufficient food (Scott et al., 2017). The authors concluded it is difficult to know who these students are and if they know about the food program (Scott et al., 2017). Despite uncertainty around the needs of school food program beneficiaries, such programs were seen as a way to address hunger (Edward, 1998).

There was one publication that provided details on the benefits of breakfast programs in middle and secondary schools (Muthuswamy, 2012). Participants did better on independent work, problem-solving, and class participation, and had more initiative than those who did not regularly participate. The findings were listed in percentages, but no statistical analyses were conducted. Regular participants in the breakfast programs were described as having higher scores in science, reading, and math, and as more likely to be on track to graduate on time. Students reported that well-being and health improved and that they were less likely to be suspended. Teachers reported that students showed less tardiness, improved ability to stay on task, and fewer behaviour problems (Muthuswamy, 2012).

#### 4.3.4 Study Designs

Authors used a combination of methods for study designs. There was one randomized, control trial with three study arms, including a control group (He, Beynon, Sangster Bouck, St Onge, et al., 2009). The remaining publications did not have a control group, which is a

limitation for determining promising practices. Some studies measured pre-post intervention changes; however, some of the intervention times were short. For instance, Gates, Hanning, Gates, Isogai et al. (Gates, Hanning, Gates, McCarthy, et al., 2013) provided a 1-week intervention and then measured changes in milk intake. Abrey (Abrey, 2008) provided one fruit and vegetable serving per day for one week and conducted a case study evaluation of the process. Henry et al. (Henry, 2015; Henry et al., 2016) conducted a cross-over design with the total duration being 12 weeks and six weeks, respectively. It is difficult to draw conclusions from short interventions as they have limitations in influencing long-term intake.

## 4.4 Discussion

In this scoping review, we provided a synopsis of the literature reflecting current practices from a health promotion perspective and reported on the extent that the components to support economic and environmental sustainability as per Garret and Feenstra (Garret & Feenstra, nd) and Tagtow et al. (Tagtow et al., 2014) were included. Below, we comment on the state of the evidence and then discuss the findings according to how they reflect three main categories: the social determinants of health, the food system and environment, and economic sustainability. We then compare our findings to recent recommendations for components to include in a national school program for Canada (Hernandez, Engler-Stringer, Kirk, Wittman, & McNicholl, 2018).

### 4.4.1 State of the Evidence

Although there were publications from across Canada, the breadth and depth of data in the area of school food programs in Canada is lacking. For instance, there were no articles from the territories, which would have unique food access challenges as well as important cultural considerations. A systematic review of peer-reviewed literature done from 1990-2017 did not reveal any further studies that fit our criteria (Colley, Myer, Seabrook, & Gilliland, 2019). Given the complexity of the school environment and the diversity of possible programs, current research is not sufficient to determine best practice, and so we have decided to focus on promising practices.

Some of the nutrition interventions were of short duration (Abrey, 2008; Gates, Hanning, Gates, Isogai, et al., 2013; Henry et al., 2016; Park, White, & Julia, 2015). Drawing conclusions from short study durations fails to recognize the complexity of food choices and the length of time required to elicit behaviour change. This was demonstrated in Gates et al. (Gates, Hanning,

Gates, McCarthy, et al., 2013), where they measured changes after one week, which were not maintained one year later. Longitudinal design studies are lacking, which would demonstrate if measured benefits persist over time.

### 4.4.2 Social Determinants of Health

Important components to address the Social Determinants of Health include improving nutritional intake, contributing to food literacy through nutrition education, supporting educational attainment, promoting health equity, addressing stigma related to program use, and including culturally appropriate food while increasing cultural knowledge through food programs. There were no programs that included all of these components. All programs shared the aim to improve students' nutritional intake, and programs that focused on measuring changes in nutrition status found some benefits. Programs that included nutrition education found that dietary improvements were more significant when pairing food provision with nutrition education (He, Beynon, Sangster Bouck, St Onge, et al., 2009; Sangster Bouck et al., 2011). This finding aligns with the recommendation for multi-component programs that was published after the scoping review was conducted (Hernandez et al., 2018). Some programs were specifically designed for students who were food insecure, but it was challenging to determine who the food insecure students were. Stigma can result from targeting food insecure students (Russell et al., 2007). Universal programs that provide food to all students in a non-stigmatizing way benefit all students (Hernandez et al., 2018).

Hamm and Bellows (Hamm & Bellows, 2003) define community food security as "... a situation in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice" (p. 37). Most of the programs in this review focused on nutritionally adequate diets, and some addressed the sustainability of the food system, but few focused on culture. Some programs identified the importance of cultural appropriateness of the foods included in school programs, but few used food programs to teach about other cultures, and no programs evaluated the cultural appropriateness of the food in their program. Respectful school food programs consider the local conditions and involve input from stakeholders to ensure they are culturally appropriate (Hernandez et al., 2018). Food security and education are key elements of the social determinants of health, along with healthy child development and culture (Public Health Agency of Canada Canadian Best Practices Portal, 2016). A school food program that can

address the social determinants of health could promote health equity and help to build a strong society.

### 4.4.3 Food Systems and Environment

Oostindjer et al. (2017) discussed the three phases of school food programs and indicated that the second phase, which started in 1970, focused on encouraging healthier and more nutrient-dense choices. The focus of most of the publications reviewed indicated that, for the most part, Canada is still in this second phase of school food programs. The third phase includes integrating health and environmental sustainability concerns in the meal program along with curriculum integration. There is some evidence that programs are moving in this direction as there was some discussion about food systems and environmental considerations in the grey literature primarily (Abrey, 2008; Naylor & Bridgewater, 2007).

School food programs are well-positioned to consider the systems in which the school operates: the local food and environmental systems. Local foods were intentionally incorporated in some programs (Abrey, 2008; Context, 2013; Naylor & Bridgewater, 2007; Social Research and Demonstration Corporation, 2010) and one program specifically chose re-useable plates due to environmental considerations (Social Research and Demonstration Corporation, 2010). Being involved with gardening from planting to harvesting to preparing and sharing builds a sense of connection with the natural environment, communities, and ecosystems. Being connected to local communities provides opportunities to support local producers and to benefit from community support (Hernandez et al., 2018). Gardening can be integrated into the curriculum to provide experiential learning opportunities that incorporate many topics, including food webs, ecology, microorganisms, decomposition, and botany.

With up to one-third of human food being wasted (Food and Agriculture Organization of the United Nations, 2018), addressing food waste in schools is an opportunity to influence future consumers' sustainable practices. Strategies to reduce food waste can be part of the school culture and incorporated into the curriculum. The Northern Fruit and Vegetable Pilot Program was the only program to identify food waste as a concern (He et al., 2012). Reducing food waste in the school setting is an untapped opportunity to address the ecological impact of food production.

### 4.4.4 Economic Sustainability

Economic sustainability is a concern identified in many programs (Edward, 1998; Gates, 2010; Opoku, 2016; Scott et al., 2017; Valatis, 2009). Funding sources of programs vary and include government, non-government organizations, parents, and donations. Some programs require volunteers to operate, and this can leave a program vulnerable because insufficient volunteers can lead to decreasing program frequency (Edward, 1998). Program success is enhanced when the program is institutionalized, and this happens with program consistency over many years (Skinner et al., 2012). Financial constraints can make it difficult for schools to procure local food (Social Research and Demonstration Corporation, 2010), which works against the move towards the third phase of school food programs. Economic sustainability includes having sufficient resources to procure food, to staff the program, to build capacity, and to monitor and evaluate the program (Hernandez et al., 2018).

While some programs in our review included some components described in the third phase of school food programs most of the programs were firmly rooted in the second phase of school food programs, (Oostindjer et al., 2017). Yet, some in Canada recognize the importance of including sustainable food system strategies such as gardening and preparing food; composting and recycling; providing healthy, sustainable food; and integrating food and nutrition into the curriculum (Black et al., 2015; Stephens, Black, Chapman, Velazquez, & Rojas, 2016). The Nova Scotia Food and Nutrition Policy for Public Schools, for example, recommends reducing food packaging, providing local foods, reducing waste, compost, recycling and including nutrition education in classes (Nova Scotia Education Health Promotion and Protection, 2013).

### 4.4.5 Recommendations for School Food Programs

Given that schools were inconsistent in applying curriculum-integrated, sustainable food system strategies in their food programs, we have developed a framework to guide schools of components to consider for the school food programs. Similar to Garret and Feenstra's (Garret & Feenstra, nd) framework for sustainable food systems, we consider three components important for school food programs: Social Equity and Human Health, which is similar to what we called Social Determinants of Health; Environmental Health, like our category of Systems and Sustainability; and Economic Vitality, similar to our Economic Sustainability. Recommendations for promising practices for school food programs should consider these three components.

Tagtow et al. (Tagtow et al., 2014) identified the components necessary for sustainable food and water systems: nutrition and health; environmental stewardship; economic vitality; and social, cultural and ethical capital. The first three categories reflect what we found. The fourth category promotes cultural diversity, which we recognized as important but did not see reflected in the literature, along with promoting social responsibility and ethical treatment of people and animals.

We developed a framework (Figure 4.2) adapted from Garret and Feenstra (Garret & Feenstra, nd) and Tagtow et al.(Tagtow et al., 2014), informed by our findings in this review, and from the recommendations for best practices in a national school food program in Canada drawing on international literature (Hernandez et al., 2018). Improving the nutritional quality of children's diets is the foundational reason for school food programs. Program benefits can be maximized by incorporating these concepts into curriculum, policy, and practice (Chapman et al., n.d.). This includes improving food literacy by integrating nutrition education into the curriculum, creating a supportive school environment by having appropriate health policies, and providing universal access to food programs to reduce stigma. Providing universal access can address the issue of under nutrition in those that are food insecure and over nutrition in those that have good access but rely on packaged ultra-processed foods. Including children in growing, cooking, preparing, and preserving food will provide important life skills influencing their lifetime food intake. Additionally, food in schools should be culturally appropriate, and be used as a medium to create cultural awareness and acceptance. Addressing all relevant components of school food programs in one figure can be a challenge, especially given the complexity of school food environments. Future research is required to further refine and develop a more robust theory that can be more inclusive and define each area in more detail.

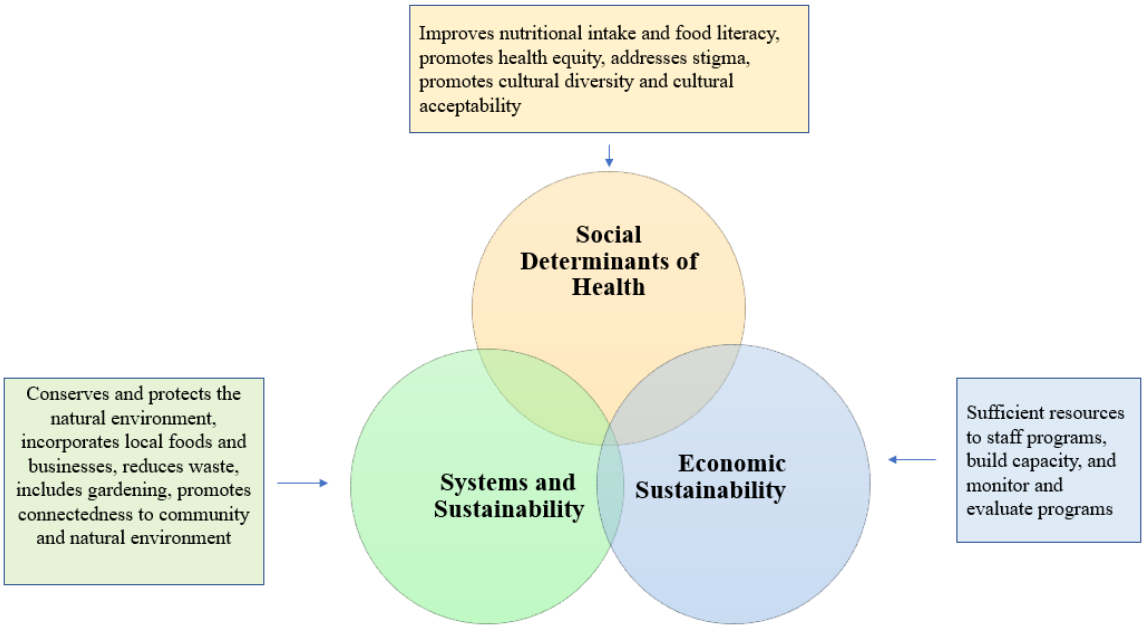



*Figure 4.2: Considerations for School Food Programs in Canada*

### 4.5 Implications for Practice

Consideration of food systems and environmental impact when planning school food programs is needed. First, where possible, schools should grow food, both for their own use and for learning purposes. Gardens provide experiential learning opportunities to enhance classroom learning. Building connections through local producers, either through farm tours or through local purchasing helps to create community connections supporting local producers, along with reducing the environmental impact of food production by decreasing food miles.

Economic sustainability of a school food program allows staff to focus on delivering a high-quality program, rather than recruiting and training volunteers, and searching and applying for funding or seeking donations. Options of how to make programs sustainable may include a national, universal, curriculum-integrated program funded by various levels of government. Cost-sharing options may also be explored; however, consideration is necessary for lower socio-economic areas where parents may be challenged by cost-sharing. It is important to maintain respect and dignity to reduce stigma, which can be a barrier to program use. Food programs may provide opportunities for students to develop leadership skills if they are involved in program organization and dissemination.

The depth and breadth of school food research in Canada is lacking. Important missing components in Canadian programs, which we have identified as a promising practice, include universality, cultural adaptation, and being multi-component. In order to be consistent with the third phase of school food programs around the world, Canadian programs should consider food systems and environmental sustainability, address the social determinants of health, and be economically sustainable.

# CHAPTER 5: COMPARING DIET QUALITY OF SCHOOL MEALS VERSUS FOOD BROUGHT FROM HOME

## Prelude to paper 2

The primary purpose of this research project was to determine the nutritional quality of the lunches of elementary students in grades 4-8. We compared lunches from students in meal programs to those not in meal programs, in both urban and rural contexts. The goal of this research was to determine if the students participating in meal programs had healthier lunches.

This research project answered the following questions:

1. What is the food group composition of MPS, NMPS, and NMP-RS students' lunches?
2. What are the differences in food composition of MPS, NMPS, and NMP-RS students' lunches?
3. How does the food group composition of MPS, NMPS, and NMP-RS students' lunches follow the recommendations of Eating Well with Canada's Food Guide (2007)? The 2019 version Canada's Food Guide had not yet been released when this study was conducted.
4. What is the quality of MPS, NMPS, and NMP-RS students' lunches?
5. In the lunches of MPS, NMPS and NMP-RS students, what percentage of calories make up processed and convenience foods?

I am the primary author on this paper. Co-authors for this paper are Dr. Rachel Engler-Stringer, Dr. Wanda Martin and Dr. Hassanali Vatanparast. They reviewed and provided feedback. I would also like to acknowledge the contributions of the research assistants that helped collect data: Aiya Amery, Joel Heitmar, Joanna Jakubczyk, Christine Nisbet, Caitlin Olauson, Sylvana Tu, and the University of Saskatchewan Nutritional Epidemiology Department who helped convert data into nutrition values.

A version of this chapter is currently under review as an article to be published by the Canadian Journal of Dietetic Practice and Research.

**Abstract**

**Purpose:**

Consuming nutritious food is essential to learning. The purpose of this research was to determine the diet quality of elementary school lunches, both those in meal programs and those bringing food from home, in urban and rural locations in Saskatchewan.

**Methods:**

Using a School Food Checklist and digital photography we compared food group servings and diet quality in three school types: urban schools with a meal program, and urban and rural schools without a meal program. The total sample was 773 students.

**Results:**

Only 55% of all students brought the minimum number of servings for grain products and meat and alternatives, with even fewer bringing the minimum for vegetables and fruit (25.6%-34.9%), whole grains (24.1%), and milk and alternatives (14.1%). Students bringing food from home had significantly more calories in their lunches from minimally nutritious foods. Students in meal programs had the highest diet quality scores using the school-adapted Healthy Eating Index.

**Conclusions:**

Overall, the diet quality of elementary students needs improvement. Although elementary school children benefit from meal programs, current meal programs may be insufficiently resourced to ensure participants receive one-third of the minimum number of food group servings per day. Interventions targeting what children eat at school should focus on increasing the number of students meeting the minimum recommendations in all food groups while decreasing minimally nutritious foods (MNFs) brought to school.

**Keywords**: elementary school diet, school day, Canada

## 5.1 Introduction

Recent research shows that the diet quality of Canadian children during school hours is sub-optimal (Tugault-Lafleur et al., 2017), yet there are significant health impacts related to food availability and food choices made at school. Healthy eating among school-aged children supports optimal growth and development, can maximize academic achievement (Faught et al., 2017), establishes lifelong healthy eating patterns (Ballard, 2013), and mitigates long-term chronic disease risk including overweight/obesity (Shields, 2006), diabetes, cancer, and heart disease (World Health Organization, 2003). Despite the importance of healthy eating for children, in 2004 only 43.6% of Canadian children 12 to 19 years old consumed five or more servings of vegetables and fruit daily (Statistics Canada, 2016). In addition, between 22-25% of calories consumed by 9 to 18-year-olds in Canada comes from foods that nutritional professionals recommend to be limited (Office of Nutrition Policy and Promotion, 2007).

School-aged children consume approximately one-third of their calories at school (Tugault-Lafleur et al., 2017; Woodruff, Hanning, & McGoldrick, 2010). Canada lacks national standards for foods available in schools, yet many provinces have school nutrition guidelines (Alberta Government, 2012; British Columbia, n.d.; Ministry of Children and Youth Services, 2016; Ministry of Education, 2010; Nova Scotia Education Health Promotion and Protection, 2013; Saskatchewan Ministry of Education, 2012). Providing nutrition guidelines, however, does not ensure that foods brought from home or provided by the school are healthy (McIsaac, Shearer, Veugelers, & Kirk, 2015). Canadian school food research includes the relationship between lunch location and meal quality (Tugault-Lafleur, Black, & Barr, 2018; Woodruff et al., 2010) and quality of food purchased at school versus foods brought from home suggesting diet quality is sub-optimal (Taylor et al., 2012). Studies from other countries have shown that foods from home are less healthy than school food programs (Caruso & Cullen, 2015; Evans, Cleghorn, et al., 2010; Hubbard et al., 2014; Hur et al., 2011; Johnston et al., 2012; Stevens & Nelson, 2011). A national school food program can ensure that calories consumed at school contribute to optimal diet quality, yet Canada is one of the few high-income countries that does not have a national school food program (Koç & Bas, 2012)

Along with food that students bring, available foods may include a milk or snack program, food for purchase, or a meal program of breakfast and/or lunch. In the latter case, foods

are generally provided at no cost to children in schools located in economically deprived areas (Saskatchewan Association for Community Education, n.d.). In Saskatoon, there are no public schools with meal programs that feed all children a daily meal at school. Typically, Saskatoon school staff in schools with meal programs have identified adequate, nutritious food intake as a concern and seek resources to fill this need (Saskatchewan Population Health and Evaluation Research Unit, 2014).

The school environment could contribute to improved diet quality among Canadian children, specifically over-nutrition that leads to overweight and chronic diseases, and under-nutrition that can lead to nutrient deficiencies. The purpose of this cross-sectional observational study was to compare the diet quality of food and beverages provided by schools with food and beverages brought from home in elementary school children in and around Saskatoon. Results will inform school food interventions and future research in an effort to improve children's nutritional intake.

### 5.2 Methods

In a cross-sectional observational study, we characterized foods and beverages children brought to school or accessed in the school meal program using digital photography and an SFC (Appendix A.4). Digital photographic methods (Figure 5.1) used for capturing information on foods in schools has been assessed (Mitchell et al., 2010; Swanson, 2008; Williamson et al., 2003) and found to have acceptable accuracy and reliability (Tugault-Lafleur et al., 2017). The SFC is a one-page form with a list of foods, beverages, and portion sizes of foods commonly eaten and is an efficient and accurate method of obtaining dietary information in schools (Hubbard et al., 2014; Kremer et al., 2006; Mitchell et al., 2010). Both inter-rater and intra-rater reliability of the SFC has shown strong agreement (Mitchell et al., 2010), and inter-rater reliability is improved when this method is combined with digital photography (Tugault-Lafleur et al., 2017).

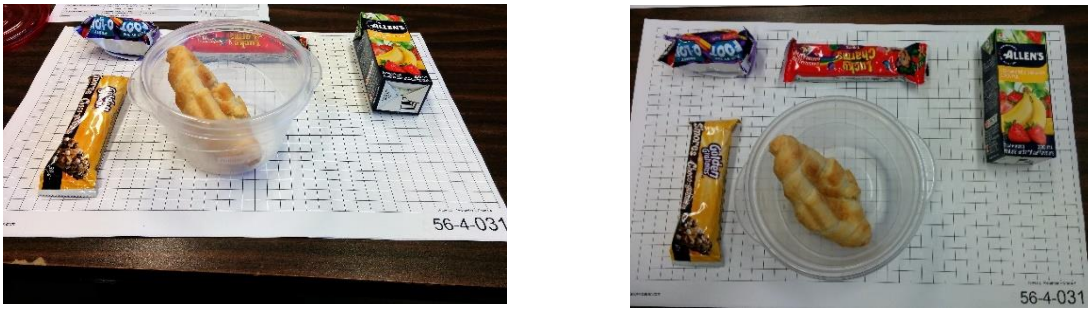



*Figure 5.1: Digital Photography of School Lunches*

This study took place in and around Saskatoon, and included elementary school children in grades 4-8 in three school types: urban meal program schools (MPS), urban non-meal program schools (NMPS), and non-meal program rural schools (NMP-RS) located within an hour driving distance from Saskatoon. Rural schools do not typically have lunchtime meal programs. There were three schools in each category. Schools in the Saskatoon Public School Division with more than 50 students were randomly sampled through a random number generator. Students in MPS who did not participate in the meal program were included with the students in NMPS.

Ethics approval was obtained through the University of Saskatchewan Behaviour Research Ethics committee (BEH 16-290). School principals in each school requested an assent process be used whereby parents were notified of the study in writing and were asked to inform the research team if they did not want their child to participate. Children were also given the choice to opt out the day of the study.

A team of trained research assistants (RA) visited each school from October to December 2016, gathering data before lunch. Children and their families were not aware when data collection would happen. We sent fruit to classes that we did not visit before the morning break to encourage the students to eat the fruit and not their packed lunch so that we could obtain accurate records. Children spread their lunch on a 1 cm grid placemat with their ID number. The grid helped determine portion sizes from photographs. RAs took photographs at 45$^{o}$ and 90$^{o}$ angles as shown in Figure 5.1. Students were excluded if they were going home for lunch, did not have a lunch, or if the student or the parent did not consent.

The SFC included demographic data with the home address or postal code of the student. We used census data to categorize the neighbourhood of the home address as low, middle, or high income as a proxy for socioeconomic status (SES). There is no way to determine the income level of rural addresses or those in very new neighbourhoods.

Data consisted of what students brought in their lunch, not what they ate. Data was collected before lunch for two of the MPS. Students who usually participate in the meal program had both meal program foods and foods brought from home included in their data. In the third MPS, data collection occurred while the students were being served.

Trained RAs working in the Nutrition Epidemiology lab at the University of Saskatchewan converted the SFC and photos into detailed nutrition information, using the Food Processor Nutrition and Fitness Software version SQL 10.5 (Esha Research, Salem, USA) with the Canadian Nutrient File (Health Canada). Food group categories were determined using Eating Well with Canada's Food Guide (CFG) (Health Canada, 2007). The nutrition information was reviewed by the lab manager to ensure accuracy and consistency. Questions about the responses on the SFC were verified by reviewing the digital photos. The use of photos minimized potential recall bias. Any errors in the data had the potential to be equal for all groups.

Data analysis was conducted in SPSS Version 24 (IBM). Data on continuous variables is reported as a mean ±SD. G power software determined that for 80% power, using a p-value of 0.05, assing 300 student lunches was necessary.

Diet quality was assessed by calculating the school-adapted Healthy Eating Index (S-HEI). HEI was developed in the United States to align with the USDA Food Guide Pyramid (Kennedy et al., 1995), and adapted for Canadian recommendations (Dubois et al., 2000; Garriguet, 2009). The Canadian HEI was adapted to assess school-time food intake (Tugault-Lafleur et al., 2017) and uses one-third of recommended daily intake (Garriguet, 2007; Taylor et al., 2012). A S-HEI score less than 50 indicates poor diet quality, 50-80 indicates that the diet needs improvement, and greater than 80 signifies a healthy diet (Garriguet, 2009).

Data did not pass normality tests, and neither a log nor square root transformation normalized distributions. The Kruskal Wallis H test was used to compare continuous variables to

determine differences in S-HEI scores, the number of food group servings, calories, sodium, and minimally nutritious foods (MNFs) for all participant groups. Distributions of these variables were not similar for all groups, as assessed by visual inspection of box plots and histograms. When necessary, a post hoc analysis was conducted to test pairwise comparisons using Dunn's procedure with a Bonferroni correction to correct for the increased probability of a Type 1 error of multiple comparisons.

### 5.3 Results

There were 1162 students in the grades 4-8 of sampled schools, with 224 students in MPS, 495 in NMPS, and 443 in NMP-RS. Demographic information is in Table 5.1. Of these, assent forms were not sent home to two classrooms (one NMP-RS and one NMPS), excluding these students. Other reasons for exclusion were parent refusal, student absence, or students declining to participate on the day of the study. Some additional participants were removed from the sample because they did not have a lunch and were planning on 1) going home, purchasing food, or going without lunch (n=98); 2) indicating they sometimes participated in the meal program (n=41); or 3) missing information was on their data sheets (n=22). Missing information included not indicating the extent of participation in the meal program, or having a lunch that was being delivered later in the day. The final sample was 773.

*Table 5.1: Demographic Information*

| Demographic | N (%) |
|---|---|
| Males | 374 (48.4) |
| Females | 395 (51.) |
| Sex data missing | 4 (0.5) |
| Grade 4 | 196 (25.3) |
| Grade 5 | 161 (20.8) |
| Grade 6 | 163 (21.2) |
| Grade 7 | 138 (17.9) |
| Grade 8 | 115 (14.9) |
| Meal Program | 147 (19.0) |
| No Meal Program | 291 (37.6) |
| Rural | 335 (43.4) |
| NMPS students in mid or high-income neighbourhoods | 564 (73%) |
| MPS students in low-income neighbourhoods | 641 (82.9%) |

Total N=773

*Table 5.2: Participants by School Type*

| School Type | Total | Going home N (%) | Sometimes N (%) | Missing info N (%) | N (%) |
|---|---|---|---|---|---|
| MPS | 224 | 20 (8.9) | 41 (18.3) | 16 (7.1) | 147 (66.6) * |
| NMPS | 352 | 57 (16.2) | N/A (0.0) | 4 (1.1) | 291 (82.6) |
| NMP-RS | 358 | 21 (5.9) | N/A (0.0) | 2 (0.6) | 335 (93.5) |
| Overall | 934 | 98 (10.5) | 41 (4.3) | 22 (2.4) | 773 (82.7) |

*This is the total number of students in schools with meal programs. Of these, 47 were MPS students and 100 were NMPS students. Students from meal program schools but considered NMP students comprise 26% of NMP-S students.

The participation rate, as shown in Table 5.2, was lowest for the MPS at 66.6%. Students in MPS were asked if and how frequently they used the meal program. Students who indicated "sometimes" were removed from the sample because it was not possible to determine if they were planning on using it that day. Of the students in MPS (n=224), 47 indicated they always or almost always used the program. The participation rate for NMPS was 82.6%. Students from MPS but considered NMPS students comprise 26% of NMPS participants. The participation rate

for urban students (MPS and NMPS) was 76% and NMP-RS students was 93.5%, with an overall rate of 82.7%.

Males and females were evenly split overall, and in each school type category, with 48.4% of the overall sample being male, 51.1% being female and 0.5% were missing this data. Males brought more servings of meat and alternatives than females (p=0.044). There were no other statistically significant differences in the food group intake between males and females.

Participation by grade was not evenly distributed. Table 5.3 shows a downward trend in the number of students participating in the study with increasing grade. This decrease occurred for a few reasons. First, two classes in older grades did not receive the assent form, so their data was omitted. Second, in one rural school, the elementary school (Kindergarten to grade 6) agreed to participate, but the high school (grades 7-12) did not, so grades 7 and 8 were not included. Also, while collecting data, we observed older students were more likely than younger students to opt out the day of the study. In a small number of cases, this then caused a few students in a row to decline.

A comparison was done to determine if there was a difference in what was brought to school between grades 4-6 (younger) and grades 7-8 (older) students. Mann-Whitney U results indicate there was no difference in vegetables and fruit servings (p=0.911), grain product servings (p=0.561), and meat and alternatives (p=0.735) brought to school. Younger students brought more servings of milk and alternatives than older students (p=0.017)

***Table 5.3: Participation by Grade Based on School Type***

| Grade | NMPS Total (%) | MPS Total (%) | NMP-RS Total (%) | Overall Total (%) |
|---|---|---|---|---|
| Grade 4 | 84 (21.5) | 14 (29.8) | 98 (29.3) | 196 (25.3) |
| Grade 5 | 80 (20.5) | 5 (10.6) | 76 (22.7) | 161 (20.8) |
| Grade 6 | 83 (21.2) | 9 (19.1) | 71 (21.2) | 163 (21.2) |
| Grade 7 | 84 (21.5) | 6 (12.8) | 48 (143) | 138 (17.9) |
| Grade 8 | 60 (15.3) | 13 (27.7) | 42 (12.5) | 115 (14.9) |

The socioeconomic status (SES) of students was extrapolated from the SES of their reported home neighbourhood. However, the SES of very new neighbourhoods and rural residents could not be determined. The majority of students in NMPS (73%) live in mid or high-

income neighbourhoods. The majority of students in MPS (82.9%) live in low-income neighbourhoods.

The food offered in meal programs in Saskatoon varies by school and by meal and depends on the food available to the meal program. Some foods provided are acquired through donations, not necessarily fitting nutrition guidelines. Table 5.4 contains the minimum number of recommended servings of each food group for school time intake for ages 9-13 (Health Canada, 2007; Tugault-Lafleur et al., 2017), along with the contributions of the meal program servings on the day of data collection. Students participating in the meal program choose what foods they want and may also bring food from home. All three meal programs included sandwiches, two included a small serving of vegetables and fruit, one included milk. School 3 contains a low calorie amount because only sandwiches were served. No minimally nutritious foods were served.

***Table 5.6: Comparison of Food Group Offerings by School with Meal Programs***

| | **Vegetables and Fruit** | **Grain Products** | **Whole Grain** | **Meat and Alt** | **Milk and Alt** | **Calories** |
|---|---|---|---|---|---|---|
| **Min. Recommended (1/3 day intake)** | 2 | 2 | 1 | 0.3 | 1 | 530-750 (1/3 day requirement, low active) (Government of Canada) |
| **School 1** | 0.1 | 2 | 2 | 2.3 | 0.5 | 622 |
| **School 2** | 1.76 | 1.3 | 1 | 1.1 | 0 | 488 |
| **School 3** | 0.3 | 2 | 1 | 0.8 | 0 | 331 |

Overall, many students do not meet the minimum number of servings from the four food groups. Only 55% of all students brought the minimum number of servings for grain products and meat and alternatives, with an even smaller proportion bringing the minimum for vegetables and fruit (25.6%-34.9%), whole grains (24.1%), and milk and alternatives (14.1%). Table 5.6 shows the mean and standard deviation of the number of servings of each food group, total calories, calories coming from MNF, and sodium. Foods classified as “MNF” include sugar-sweetened beverages, salty snacks, and foods not classified in any of the food groups in Eating Well with Canada’s Food Guide. The p-values of the pairwise comparisons of the mean rank values are also in Table 5.6.

Meal program participants had significantly higher amounts of meat and alternatives (p=0.000) and fewer calories from MNF (p=0.000). Students in NMP-RS schools had statistically significantly higher servings of grain products compared to NMPS students (p=0.014) but not MPS students (p=1.00). NMP-RS students brought statistically significantly more milk products in their lunches (p=0.000). There was a statistically significant difference between all three groups for whole grains (p=0.000), with the MPS students having the highest amount, and for total calories, with the MPS students having the lowest amount (p=0.000). Analyses indicated no statistically significant differences between the groups for vegetable and fruits (p=0.051) and sodium (p=0.163). S-HEI scores were statistically significantly different between the three student groups, with MPS students having the highest scores, (p=0.000) followed by NMP-RS and NMPS students.

*Table 5.7: Servings from Each Food Group, Calories, MNF, and Sodium*

| **Food Groups** | **NMPS[a]** | **MPS[b]** | **NMP-RS[c]** | **p-value** | ***Mean rank p-value for pairwise comparisons, adjusted for Bonferroni Correction.** |
|---|---|---|---|---|---|
| | Mean(SD) | Mean (SD) | Mean (SD) | | |
| Vegetables and Fruit | 1.6 (1.38) | 1.55 (1.01) | 1.88 (1.53) | p=0.051 | - |
| Grain Products | 1.71 (1.17) | 2.13 (1.42) | 2.02 (1.26) | p=0.013 | a-c **p=0.014**<br>a-b p=0.469<br>b-c p=1.00 |
| Whole Grains | 0.27 (0.68) | 1.36 (0.85) | 0.53 (0.91) | p=0.000 | a-c **p=0.000**<br>a-b **p=0.000**<br>b-c **p=0.000** |
| Milk and Alternatives | 0.35 (0.56) | 0.22 (0.32) | 0.53 (0.60) | p=0.000 | a-c **p=0.000**<br>a-b p=0.899<br>b-c **p=0.002** |
| Meat and Alternatives | 0.42 (0.47) | 0.97 (0.92) | 0.40 (0.55) | p=0.000 | a-c p=0.654<br>a-b **p=0.000**<br>b-c **p=0.000** |
| **Calories, Sodium, and S-HEI** | | | | | |
| | **NMPS** | **MPS** | **NMP-RS** | **p-value** | ***Mean rank p-value for pairwise comparisons, adjusted for Bonferroni Correction.** |
| Total Calories | 653.69 (258.83) | 536.34 (345.54) | 702.33 (267.92) | p=0.000 | a-c **p=0.042**<br>a-b **p=0.001**<br>b-c **p=0.000** |
| MNF Calories | 241.20 (205.41) | 90.78 (126.14) | 217.29 (192.52) | p=0.000 | a-b **p=0.000**<br>a-c p=0.313<br>b-c **p=0.000** |
| Sodium (mg) | 1024.52 (610.59) | 1438.66 (1174.35) | 1070.16 (553.75) | p=0.163 | - |
| HEI | 47.68 (13.13) | 62.01 (10.73) | 51.64 (13.67) | P=0.000 | a-c **p=0.000**<br>a-b **p=0.000**<br>b-c **p=0.000** |

*Kruskal-Wallis H test

Note: MNFs, minimally nutritious foods; (a)NMPS, no meal program school; (b)MPS, meal program school; (c)NMP-RS, no meal program rural school, S-HEI, Healthy Eating Index adapted for schools

Significant p value <0.05

Values are mean (SD)

N=773

Diet quality is described by the S-HEI scores, which are listed in Table 5.7. Overall, 49% of diets are classified as poor, 50% need improvement, and less than 1% were classified as healthy. The average diet quality score for all groups combined was 50.3 (SD=13.7)

***Table 5.7: HEI Category Comparison***

| Score | NMP | MP | NMP-r | Total |
|---|---|---|---|---|
| Below 49.9 (poor) | 227 (58.1%) | 5 (10.6%) | 149 (44.5%) | 381 (49.3%) |
| 50-80 (needs improvement) | 163 (41.7%) | 40 (85.1%) | 184 (54.9%) | 387 (50.1%) |
| 80.01 and above (healthy) | 1 (0.3%) | 2 (4.3%) | 2 (0.6%) | 5 (0.6%) |

Note: NMPS, no meal program school; MPS, meal program school; NMP-RS, no meal program rural school, HEI, Healthy Eating Index adapted for schools
Total number (%)
The differences between the score categories are statistically significant, p=0.000
N=773

**5.4 Discussion**

Schools are an ideal site to promote healthy eating, and meal programs can play a significant role in improving diet quality. Findings revealed that the food available to elementary school children while at school in and around Saskatoon generally does not meet recommendations. Overall, just over half of the children had sufficient grain products and meat and alternatives, while just over a quarter met minimum vegetable and fruit recommendations and less than one-sixth met milk and alternatives recommendations. High reliance on packaged and processed foods was demonstrated through high sodium levels in all groups. Children not participating in meal programs had over a third of calories coming from MNFs, which was reflected in poor S-HEI scores. S-HEI scores indicated that 49% of children's diet quality was classified as poor and 50% as needs improvement. Although the food provided in the meal programs did not achieve the minimum recommended servings of each food group, the overall diet quality was greater with MP students having a statistically significant higher S-HEI score. Meal programs are currently under-resourced to consistently provide the recommended number of servings of food groups to children. When the programs are adequate, they can help improve diet quality by including nutritionally dense foods while minimizing MNFs.

Participants' lunches at school did not meet minimum recommendations for the number of servings from each food group. Overall, 55% of children had sufficient grain products and

meat and alternatives, while just over 25% met minimum vegetable and fruit recommendations. Eating Well with Canada's Food Guide recommends that half of all grain products be whole grain. In this study, a quarter of the students met whole grain recommendations. Just under 15% of the children in this study met milk and alternatives recommendations, although this amount is likely under-reported. Some schools have a milk program so the students can purchase milk. This study did not capture if students participated in the milk program on the day lunches were assessed.

This study used the 2007 version of Eating Well with Canada's Food Guide and the S-HEI that was developed based on this version. The latest version of Canada's Food Guide was released in 2019 and includes recommendations on specific foods and nutrients, and associated health risks (Health Canada, 2016). Guiding principles for the new food guide include recommending healthy staples such as vegetables and fruit, whole grains, plant-based protein-rich foods, and drinking water (Government of Canada, 2017). Foods high in sodium, sugar, or saturated fat should be limited, and sugar-sweetened beverage should be avoided (Government of Canada, 2017). With the new guidelines, it is likely that we would find a decrease in diet quality scores upon data re-analysis.

Findings in this study conducted in 2016 were similar to those reported by Tugault-LeFleur et al. (2017), who looked at 2004 Canadian Community Health Survey data to determine school time food intake of children 6-17 years. Tugault-LaFleur et al. (2017) found that in Canada, on average, grain product intake while at school was 2.5 servings, vegetable and fruit intake was 1.5 servings, and milk and alternatives intake and meat and alternatives intake were 0.6 servings each. Both Tugault-LeFleur et al. (2017) and our study compared intake to one-third of the recommended number of servings. Average school S-HEI scores were also similar, with the Canadian average being 53.4 points (Tugault-Lafleur et al., 2017) It appears little has changed in 12 years. Optimal nutrition in schools remains a local and national concern.

It is important to examine the inclusion of processed, packaged, and MNFs in children's diets. Such foods make up a significant part of the school day calories for NMPS participants (37%) and NMP-RS students (31%) in this study, which was similar to the 37% reported in the national survey (Tugault-Lafleur et al., 2017) and less than reported in the 2004 Canadian Community Health Survey (Office of Nutrition Policy and Promotion, 2007). This appears to be

a problem across SES and is perhaps a greater problem among students who come from mid and higher-income neighbourhoods, given we found that students in meal programs consumed significantly fewer calories from MNFs, at 17%.

The degree of packaged and processed foods is also demonstrated through our finding of high sodium levels. All school types exceeded sodium recommendations. The Tolerable Upper Level (UL) of sodium for children aged 9-13 is 2200 mg (Institute of Medicine, 2006). There was no difference between the sodium levels in the foods of the three school types. Sodium levels varied greatly, but the average ranged from 1000-1400mg/day among the school types. In some cases, this was more than 50% of the UL. Appel, Lichtenstein, Callahan, Sinaiko, Van Horn, and Whitsel (2015) report that the average child in the United States consumes more than 3,100 mg of sodium per day. High blood pressure and other chronic diseases get a start in childhood, a time when children are establishing eating patterns (Appel et al., 2015). Given the high prevalence of high blood pressure, recommending lower sodium intakes in children is prudent to prevent elevated blood pressure, cardiovascular disease, and stroke (Appel et al., 2015).

Meal programs can contribute to increasing healthy food intake. MPS participants were closer to meeting nutrition recommendations, especially whole grains and meat and alternatives, and fewer calories from MNFs. The meal programs currently being offered in Saskatoon struggle with finding resources to operate and sometimes depend on food donations that range in quality (Everitt, Engler-Stringer, Martin, & Miller, n.d.). Meal programs target students that are at high risk of being food insecure, with over 80% of the participants living in lower-income neighbourhoods. Most food group servings provided by schools fell short of requirements for children 9-12 years old. It may be possible to improve diets by ensuring availability of the minimum number of recommended servings. At the calorie levels currently served, bringing food from home would be necessary for most students to reach minimal daily requirements.

Most of the schools did not have food available for sale and students were not allowed to leave school premises except to go home to eat. Students would likely not have purchased foods that were not captured in our study. Some schools offered milk for a cost, and some offered snacks in class, neither of which were recorded. Any errors in the data collection or analysis would have been similar for all groups and would not impact the overall findings.

Schools were aware of the day of the assessment, but this did not likely affect food program offerings given that foods provided in the meal program are dependent on what is available. Some programs rely on donations, so school staff have little control over what food is served. One school was transitioning to a new cook, and this did impact the food served because the new cook had less experience. The meal that was served was a soup and sandwich meal instead of an entrée or caserole, which would typically have been served under the more experienced cook according to what teaching staff indicated to us during data collection.

Factors such as sex and age may impact food choices for those aged 12 and older (Garriguet, 2009). Females, for example, tend to have healthier diets (Garriguet, 2009). In our sample, males were found to bring more servings of meat and alternatives, but there were no other significant differences between males and females in the number of food group servings brought to school so our finding did not support this claim. As children get older, diet quality often deteriorates, especially in early adolescence (Garriguet, 2009). Our study found that younger children brought more milk and alternative servings with no differences in the number of other food group servings between the younger (grades 4-6) and older (grades 7-8) students.

Not all children in MPS schools participated in meal programs. These students were included with and comprised 26% of the NMPS students. Schools with meal programs were located in lower-income neighbourhoods, so when the non-participating students from MPS students were included with NMPS students; this may have increased the number of low-income students in the NMPS category. The number of low-income students in the NMPS group was 17% compared to 85% in the MPS group. Although adding the students from MPS to the NMPS group may have increased the number of lower-income students in the sample, 73% of the NMPS participants came from mid to high-income neighbourhoods.

There were several strengths to our study. We compared three groups of students: MPS students NMPS students and NMP-RS students. Data gathering did not require recollection because we used digital photography and an SFC of actual foods brought to school. Our initial sample size for 80% power was calculated to be 300 students. However, we exceeded our target and had 773 participants. In addition, we had a high response rate. National nutrition surveys, such as the Canadian Community Health Survey had a response rate of 76% in 2004 and 61.6%

in 2015 (Health Canada, 2018). Our overall response rate of 82.8% gives us confidence that our data is representative of the population we studied.

Limitations to the study include being a cross-sectional design and therefore, does not imply causality. The study focused on what children brought to school, not what they ate. The students had access to healthy and MNFs, however, it is not known which foods they ate. The reported food group servings indicate the best-case scenario – students ate all of the healthy foods. School food waste is complex and is affected by several extraneous factors, including food preferences, the availability of favourite foods (Marlette, Templeton, & Panemangalore, 2005), and the age of students (Niaki, Moore, Chen, & Weber Cullen, 2017).

Most of the schools that were selected did not have foods available for sale in the school (and students were not allowed to leave school premises except to go home to eat). Students would likely not have purchased foods that were not captured. A limitation, however, was that some schools offered milk for a cost and some offered snacks in class, neither of which were captured in our study. Any errors in the data collection or analysis would have been equal for all groups and would not impact the overall findings.

Schools were randomly sampled by school type without consideration to the number of students that participated in the meal programs. A limitation to this study is that two of the three schools had small meal programs which impacted the number of MPS students. In addition, students who did not participate in the meal program every day were removed from the study.

### 5.5 Conclusion

This study demonstrated that meal program school lunches, which were mainly provided to students who lived in lower-income neighbourhoods, contained significantly more meat and alternatives and whole grain products, as well as fewer MNFs compared to the lunches of children who did not participate in a meal program. This contributed to a significantly higher diet quality for students who participated in the meal program.

To support optimal childhood growth and development, prevent chronic disease, and maximize academic achievement for children, the quality of school-time dietary intake overall needs improvement. Many children in elementary schools are eating an insufficient quantity of all four food groups, and many are exceeding recommendations for sodium and MNFs. The

school environment is the optimal setting for improved diet quality for children, as they form what are likely lifelong dietary patterns. Interventions targeting what children eat at school need to focus on increasing the number of students meeting the minimum recommendation in all food groups, while decreasing MNFs, to see future improvements in health. These enhancements to children's diets can help to ensure nutritional adequacy, support optimal growth and development, and contribute to greater academic achievement while establishing healthy eating habits.

# CHAPTER 6: SUSTAINABLE FOOD SYSTEMS AND FOOD PROGRAMS IN ELEMENTARY SCHOOLS

## Prelude to paper 3

The primary purpose of this case study research was to identify barriers, facilitators, and opportunities to adopting sustainable food systems and food programs in schools. It is important to identify how to incorporate sustainable food system strategies in schools so Canada can move towards the third phase of school food programs, which includes consideration for environmental sustainability (Oostindjer et al., 2017). The case study took place in two Saskatoon Community Schools. Community Schools have this designation to better address poverty and community needs in neighbourhoods with large Indigenous populations (Saskatchewan Association for Community Education, n.d.). These schools have Community School Coordinators and Teacher Associates to support community education and a school nutrition program (Saskatchewan Association for Community Education, n.d.). Over time, and with changes in government, funding has eroded, so remaining staff had to try to do more with less. The plan of the case-study research was to do a cross-case analysis to determine similarities and differences in the two schools; however, during analysis, I found that the schools were very similar – they are both located in low-income neighbourhoods, they are both community schools, so they have a similar philosophy and support staff to provide community services.

This study answers the research questions:

1. What are the current practices around sustainable food systems and school food programs in schools?
2. What would school staff like to do in relation to sustainable food system strategies?
3. What are the barriers, facilitators, and opportunities for adopting curriculum integrated sustainable food systems and food programs in elementary schools?
4. What supports are required to help schools incorporate sustainable food systems strategies and food programs into their practices?

I am the primary author of this paper. Dr. Rachel Engler-Stringer, Dr. Wanda Martin, and Dr. Dianne Miller are co-authors for this paper, and they reviewed and provided feedback. The school staff and principals were integral to this project. They were available for the interviews and observations. This paper is not currently under review but will be revised and submitted to the Journal of School Health.

## Abstract

### Background

Healthy eating supports optimal growth, development, and academic achievement. Yet, the diet quality of school-aged children is poor. Food insecurity and overweight and obesity is a concern, and the ability to produce food is compromised due to unsustainable agricultural practices. Sustainable food systems have a low environmental impact. Strategies in schools can address both dietary and sustainability concerns.

### Methods

This multi-case study was conducted in two Community Schools in a mid-size Canadian city. Data was collected through interviews with teachers and nutrition workers, observations, document review of curriculum and policy, and by using the School Food Environment Assessment Tool Checklist.

### Results

There were components of sustainable food systems reported both in the curriculum documents and by teachers. Teachers were cooking and gardening with students, and both schools were doing some recycling. There are no specific food policies at the schools. Infrastructure challenges vary by school. Insufficient funding and curriculum resources were seen as barriers to implementing sustainable food systems. Staff characteristics and relationships were seen as facilitators.

### Conclusions

Community Schools are in a strong position to be leaders in the area of school food. Schools can achieve this by prioritizing food literacy and sustainable food system strategies and developing supportive policies, including community members and students in programming, and including experiential food production opportunities for all students.



**Keywords**: sustainable food system, school food, school meal program, food literacy, lunch program, snack program, milk program

## 6.1 Introduction

Healthy eating is important for optimal growth, development, and academic achievement (Faught, Vander Ploeg, Chu, Storey, & Veugelers, 2016; Roustit et al., 2010); yet the diet quality of school-aged children during the school day is poor (Tugault-Lafleur et al., 2017). Fewer than half of Canadian children aged 12-19 years consume five or more servings of vegetables and fruit daily (Statistics Canada, 2016) and almost a quarter of calories in diets of 9-18 year-olds come from minimally nutritious foods (Office of Nutrition Policy and Promotion, 2007). The typical Canadian diet eaten by children aged 2-18 years contains 55% of calories from minimally nutritious, ultra-processed foods, (Moubarac, Batal, Louzada, Martinez Steele, & Monteiro, 2017; Moubarac et al., 2014) that are usually high in salt, sugar and fats. Food processing (Schmidt Rivera, Espinoza Orias, & Azapagic, 2014) and food packaging (Reisch, Eberle, & Lorek, 2013) contribute to environmental degradation. Overweight and obesity have been increasing and affect 26% of 2 to 17 year-olds in Canada. (Shields, 2006). At the same time, 16% of Canadian children experience food insecurity (Tarasuk et al., 2014).

School-aged children spend most of their weekday waking hours at school, and therefore this is an ideal site to promote healthy eating behaviours and food sustainability education (Anonymous, 1997; Rojas et al., 2011). Food habits learned in childhood can have significant long-term health impacts (Roustit et al., 2010) and is a critical time for establishing lifelong healthy eating patterns (Ballard, 2013). School food availability is important. However, in Canada, there are no national school food standards to guide the availability or quality of food consumed in schools. Many communities across Canada have identified a need for food programs to support school-aged children and have established milk, snack, vegetable, fruit, breakfast, lunch and gardening programs (Gates, Hanning, Gates, Isogai, et al., 2013; Hanbazaza et al., 2015; He et al., 2012; Naylor & Bridgewater, 2007; Russell et al., 2007; Saksvig et al., 2005; Sangster Bouck et al., 2011; Skinner et al., 2012; Triador et al., 2015). In some cases, schools may provide food at no cost to the children, particularly in economically depressed regions or neighbourhoods.

A sustainable food system recognizes that the health of humans depends on healthy ecosystems (Loring et al., 2016). Sustainable food systems have a low environmental impact and protect and respect biodiversity while ensuring nutritional adequacy and food security (FAO, 2012). Food should be accessible, affordable, culturally acceptable, and economically fair and

produced in a way that considers both present and future generations (FAO, 2012). Sustainable food system strategies can increase the efficiency of our current food systems, improve health, decrease food system environmental impact, and mitigate impacts of the food system on climate change while supporting the local economy (Rojas et al., 2011).

The school environment is an opportunity to address healthy food availability, food literacy, food security, and food system sustainability through curriculum, policy, and practice (Rojas et al., 2011). Schools can integrate sustainable food system strategies in many ways such as including cooking, gardening, and composting in the curriculum, having a recycling program, minimizing waste and packaging, procuring local foods, and respecting cultural diversity (Black et al., 2015; Rauzon, 2010; Rojas et al., 2016). Food programs in schools provide an opportunity to apply sustainable food system strategies. Food programs should be economically sustainable and have enough resources to staff, monitor, evaluate, and build capacity while implementing sustainable food system strategies (Everitt, n.d.).

Addressing food and sustainability literacy in the school setting improves both health and educational outcomes in school-aged children and is necessary to drive social change towards food system sustainability while addressing food security (Rojas et al., 2011). A list of possible strategies to incorporate sustainable food systems in schools can be found in Appendix A.5. Incorporating sustainable food system strategies into schools moves schools into the third phase of school food programs, which is in its infancy in most countries (Oostindjer et al., 2017). This phase addresses hunger and nutritional quality of foods being offered and integrates health and environmental sustainability (Oostindjer et al., 2017).

In Canada, provinces determine education standards and curriculum for kindergarten through to grade 12. In Saskatchewan, the Ministry of Education is responsible for the development of curriculum and determines the outcomes for each grade (Ministry of Education, n.d.). In 1980, the Department of Education in Saskatchewan designated some schools in core neighbourhoods as Community Schools to better address poverty and community needs in neighbourhoods with large Indigenous populations (Saskatchewan Association for Community Education, n.d.). Community School Coordinators and Teacher Associates were hired to support community education and a school nutrition program (Saskatchewan Association for Community Education, n.d.). Over time, more schools, including rural schools, have been designated as

Community Schools. Staff continue to work with communities to promote lifelong learning and leadership development to a broad number of community residents (Saskatchewan Association for Community Education, n.d.). The work that Community Schools do was seen as so valuable that it was recommended that the Community School Philosophy be adopted by all public schools in Saskatchewan; however, the funding was not ever allocated to support this (Saskatchewan Instructional Development & Researach Unit, 2001).

Some community schools follow a specific framework. Comprehensive School Community Health is a framework to assist in planning integrated, holistic health promotion strategies (Government of Saskatchewan, n.d.) and is recognized in the health curriculum (Ministry of Education, n.d.) This framework has four components: family and engaging the community, high-quality teaching and learning, effective policy, and healthy physical and social environments (Government of Saskatchewan, n.d.). Schools following this philosophy support the well-being of, students, their families, staff, and the community (Government of Saskatchewan, n.d.). Information is available to support the schools in the Comprehensive School Community Health philosophy; however, compliance to the recommendations is voluntary.

Similar to the Comprehensive School Community Health framework, many provinces have developed nutrition guidelines such as the Saskatchewan guidelines "Nourishing Minds: Eat Well, Learn Well, Live Well" (Saskatchewan Ministry of Education, 2012). Providing nutrition guidelines, however, does not ensure that they will be followed or that foods brought from home will be healthy. In fact, while there is little research on the food brought from home to school in Canada (Taylor et al., 2012), studies from several countries have shown that lunches provided in schools are healthier than foods brought from home (Caruso & Cullen, 2013; Evans, Greenwood, et al., 2010; Hubbard et al., 2014; Hur et al., 2011; Johnston et al., 2012; Stevens & Nelson, 2011). Existing frameworks and guidelines are provincially determined and are therefore not consistent in the Canadian school system, as there is no national policy or strategy.

Preadolescent years are a time of significant physiological and psycho-social change. Habits formed during these years can affect behaviour throughout the lifespan (Mikkila, Rasanen, Raitakari, Pietinen, & Viikari, 2004). The focus of this case study research is the school environment for children ages 8-13 years, covering grades 3-8, because the children of this age

are becoming more independent and are beginning to make their own food choices, but they are still dependent on caregivers for meals.

The purpose of this study is to understand the capacity of local elementary schools (covering ages 8-13) to implement sustainable food systems strategies in curriculum, policy, and practice. This case study is exploratory and seeks to determine current practices, barriers, facilitators, and opportunities for adopting curriculum integrated sustainable food systems strategies. The findings will be used to inform future intervention research in schools.

## 6.2 Methods

### 6.2.1 Participants and Instrumentation

The school division determined the eligibility criteria and selected two out of a possible eight schools. Eligible schools for this study had meal programs in place that fed 25-40% of children and therefore, had in-house cooking infrastructure to prepare food. The justification used by the school division for selecting these two particular schools was they believed they would be good candidates for future school food interventions.

This case study used multiple data sources to triangulate findings: interviews, curriculum review, policy review, observations, and completion of the School Food Environment Assessment Tool (SFEAT) checklist. Interview participants consisted of a principal, teachers, and nutrition support staff. Nutrition support staff included both the Nutrition Workers who helped to prepare meals and snacks and the Educational Assistant who works in the classrooms, with students and families, and are a liaison to the community. The School Food Environment Assessment Tool (SFEAT), adapted from Black et al. (2015), and shown in Appendix A.6, was used to record current practices around food gardens, composting systems, recycling, and waste reduction strategies, food preparation activities, food-related teaching and learning activities, and availability of healthy food. Observations were used to provide more detail on the components assessed in the SFEAT. Potential or existing gardens, composting programs, food preparation, and school layout were assessed to determine how current infrastructure acts as a barrier or facilitator to developing sustainable food system strategies and food programs in schools.

There were 11 interview participants, including a principal, vice-principal/teacher-librarian, teachers, nutrition workers, and support staff. Some teachers in these schools cover

split classrooms- teaching more than one grade in the same room at the same time. In order to capture educators for 8-year-old students, a grade 2/3 teacher was interviewed. During the initial meeting, the principal and staff members chose to have teachers interviewed for all grades except grade 6 in both schools. Grade 6 was omitted because neither school identified a teacher informant from this grade. Teachers teaching grades 2/3, 4, 4/5, and 7/8 were interviewed.

In school Mariella (pseudonym), interview participants were two teachers, the Nutrition Worker, the Community Educational Assistant, and the Community School Coordinator. Relevant interview participants in school Barton (pseudonym) were two teachers, the Nutrition Coordinator, and the Community School Coordinator. The principal and the vice-principal/teacher-librarian were interviewed together. There were ten female and one male respondent. To maintain confidentiality, in the writing of this report, the Nutrition Worker, Educational Assistant, and Community Coordinator are all referred to as Nutrition Worker while the teacher and principals are referred to as teachers.

Curriculum and policy documents were searched and reviewed. The Saskatchewan curriculum is available online (Ministry of Education, n.d.). Each subject of each grade from grades 2-8 was reviewed to determine if there were any outcomes related to environmentally sustainable food systems or food literacy. A Policy search was conducted to determine if there were policies that supported sustainable food systems or school food programs.

### 6.2.2 Procedure

Principals acted as the main school contact. The principal and staff members that principals had identified as likely to be involved with the study discussed the purpose and components of the study with the first author at an initial meeting. The staff that the principal identified were either teachers that incorporate sustainable food systems strategies in their classrooms or were knowledgeable about how this happened in the school or were Nutrition Workers or Educational Assistants who assist with the meal programs and have regular contact with students and families. The first author met with staff in each of the two schools separately.

Participants were interviewed individually, except in one school where the principal and vice-principal/teacher-librarian requested to be interviewed together. Consent forms were reviewed and signed before starting the interview. The interview time was scheduled at a time that was convenient for the participant, in a quiet room with the door closed. Before starting, the interviewer described the concepts included in sustainable food systems, and participants were

given this list and the interview questions found in Appendix A.5. Interviews were audio-recorded and transcribed.

The SFEAT was filled out with the assistance of school staff. In school Mariella, the SFEAT was filled out during the initial meeting with the help of attending participants. In school Barton, the SFEAT was filled out with the assistance of an interview participant. In both schools, the curriculum components were obtained from the teachers during the interviews. Responses to the SFEAT were summarized and typed up and sent to the principals for review and to verify accuracy.

Ethics approval for this case study was obtained through the University of Saskatchewan Behaviour Research Ethics committee (BEH 509), and the Saskatoon Public School Division approved the study. Participants signed consent forms and were able to withdraw all or part of their comments at any time.

### 6.2.3 Data Analysis

Participants reviewed the interview transcripts for accuracy and had the opportunity to take out any comments that they did not want to be included in the study. Only one participant removed details from the transcript. The details that were removed were tangential to the purpose of the study and were not likely to impact findings. NVIVO 12 (QSR International) was used to analyze and code the data. Transcripts were coded inductively using open coding and constant comparative analysis following grounded theory practices as discussed previously in chapters 2 and 3 (Glaser & Strauss, 1967). The first round of analysis broke data up into broad categories. Subsequent coding rounds in each category further articulated themes. Decisions about coding were accompanied by memo-writing to help develop and compare ideas (Charmaz, 2006). Principals were contacted if further clarification was required during the analysis process. The result of the analysis is not a full grounded theory but provides a robust description of the cases using a grounded theory analytical approach. The purpose of the exploratory case study is to get a better understanding of the context. As such, theories can be considered prior to starting the research. The theory that informs this study is that there are system barriers that challenge implementing sustainable food programs in schools (Jones, Mitchell, & Bailey, 2015; Powell & Wittman, 2018). This case study can help to refine and further develop the theory and explore how to overcome challenges.

### 6.2.4 Member checking

Member checking is a process where the person interviewed reviews the data that was gathered to ensure it is accurate (Stake, 1995). Data was collected in each school and compiled together to determine the findings. In order to ensure the findings were relevant to each school, they were reviewed and approved by each principal in an in-person meeting. Components that were clarified at this meeting were included in the final report. Most changes were additions and expansions to what was reported and not deletions. Once the changes were incorporated, the final written draft was sent to each principal to review and approve.

## 6.3 Results

### 6.3.1 SFEAT and Observations

School Mariella is in an old building that opened in the early 1920s. According to census data, median household income in the neighbourhood is currently between $30,000 and $35,000 before tax, with a household size of 2.3. The Low Income Measures cut-off for a 2-person household in 2017 (most current data) is $33,252 (Statistics Canada, 2019) which makes this a low-income neighbourhood. In the school, there are 210 students in pre-kindergarten through grade 8. Respondents indicated that the school population includes a large proportion of Indigenous students.

The SFEAT was used to determine current practices. In school Mariella, the cooking facilities are used by school staff to provide healthy foods in the breakfast, lunch, milk, snack programs, and for special food days. There has recently been an increase in vegetables and healthier meal items, but no change in less healthy items offered. Many of the food items are acquired through donations, and staff do not have control over nutritional quality. Respondents indicated that it is difficult to provide environmentally sustainable (minimally processed, locally grown, organic, seasonal, vegetarian) options because many of the foods are donated or are ordered through another organization. Some local food is procured through grants and donations. Some students help with the meal program: the student leadership team (grades 7 and 8), the health promotion student team (grade 6) and a few other students who help with breakfast to help them transition from home to the school environment. There have been some cooking activities with the students in the past. The Little Chef program has taught students cooking skills, but not in the last year. Recycling in classrooms is limited to beverage containers as there are no sinks in classrooms to rinse recyclables. However, in the kitchen, they can recycle beverage containers,

cans, certain plastics, and paper products. The grade 7/8 class, with the help of parents, have been involved with gardening activities. The school currently has eight 4x8 garden beds, an Indigenous circle garden bed, and they are in the process of developing an outdoor classroom. They currently use the gardens to teach about food, gardening, and eating healthy. There is currently no composting.

As observed, this school has three levels with the kitchen in the basement, accessible only by stairs from the main level. The kitchen is a large room with two ovens, a commercial dishwasher, a three-compartment sink, a handwashing sink, and carts that can be used to transport food. The kitchen has two upright coolers in the main kitchen area and a chest freezer that has awkward access because it is in a hallway. The doors on the upright freezer result in needing to walk by it to open it. The hallway provides just enough room to walk by it; however, this would be challenging and inefficient if working with a large amount of food. There are no counters nearby to place items. There are other pieces of equipment in the kitchen; however, the kitchen facilities are shared with the daycare located in the school. The equipment listed here describe what is available to the school. There are several covered dry storage shelves, counter space, and tables that are used for food preparation. The kitchen is not large enough for all students to have lunch in the space.

Other facilities are important for supporting sustainable food systems and food programs. Hand washing stations are limited to the sinks found in the student bathrooms in the basement. There is a single stall bathroom on the main level for pre-kindergarten and kindergarten. There are no student bathrooms on the upper level. There is a sink on the top level and one on the main level in a classroom. Drinking water is limited to one water fountain on each level of the school. School gardens are available and located at the back (rectangular beds) and the front (circle garden) of the school. Some classrooms have large windows with ledges that are broad enough to hold plant containers.

School Barton is a single level school that opened in in the early 1960s. According to census data, median household income before taxes in the neighbourhood is between $25,000-30,000 with an average household size of 2.8. The Low-Income Measures cut-off for a 3-person household in Canada in 2017 (most current data) is $40,726 (Statistics Canada, 2019) which makes this a low-income neighbourhood. There are approximately 325 students from kindergarten to grade 8. Respondents indicated that the school population consists of both a large

Indigenous and newcomer population. Serving culturally appropriate foods such as halal foods was identified as an issue in this school.

According to data collected from the SFEAT at school Barton, there are cooking facilities available and primarily used by school staff to provide breakfast, lunch, milk, and snack programs. Food preparation is only taught to a few students, mainly those who need additional supports or learning opportunities outside of the classroom. The resource teacher also works with 4-5 students who do cooking as a social activity. Sometimes classes are involved with a kitchen project, such as one teacher who made mini pizzas as a celebration and learning opportunity. Grade 8 students sometimes help with kitchen clean-up activities and transporting food into the school. Healthy food is available through breakfast, lunch, snack, milk programs, special food days, and special community events. Food fundraisers include a hot lunch once a month, and other events. There are some unhealthy foods available – both served to children and used for fundraisers, such as bake sales and concession items. Some minimally processed, locally grown, organic options are available; however, this is dependent on what donors supply and on seasonal availability of local and organic products. Some local, organic vegetables are available when the Nutrition Worker orders from CHEP Good Food Inc., but school staff are not informed when the foods are local or organic. Additionally, in the fall, the school sometimes receives donations of garden produce.

There is a well-established recycling program, which includes beverage containers, paper, and plastic products. There are some school gardening activities with some classes, but the school staff and students are not currently composting.

As observed, there is a large main floor kitchen for food preparation, open shelving units with dry goods neatly organized, closed cupboards, a stand up and chest freezer, two upright coolers, a household-sized fridge, and two sinks. One sink is a two-compartment stainless steel kitchen sink, and the other is a handwashing sink. Staff report sometimes using the oven, fridge, and household dishwasher in the staff room if more equipment is needed. The kitchen is not a large enough space for all students to have lunch. Almost all classrooms have a sink, and there are two water bottle filling stations – one in each wing – and water fountains throughout the school. Several carts can be used to transport items throughout the school, which is on a single level. The second sink in the kitchen is used to rinse recyclable materials, so this does not disrupt

kitchen activities. School gardens are available and are located at the side of the school in an area that has low visibility from the street.

### 6.3.2 Curriculum and Teaching Practice

The Saskatchewan curriculum is available online (Ministry of Education, n.d.). For each outcome, there are several indicators identified - strategies that teachers can use to meet the educational outcomes. Outcomes from each subject of each grade from grades 2-8 were reviewed to determine if they related to environmental sustainability or food literacy. The curriculum outcome summary for grades 2-8 is in Appendix A.7. The outcomes were then compared in the discussion below to what was reported in practice by the teachers during their interviews. Between the two schools, teachers from grades 2-8 were interviewed, except for grade 6.

Teachers are guided by the curriculum outcomes but can meet these in different ways. There is an opportunity to teach about sustainable food systems and improve food literacy; however, the teacher's interest will determine the degree to which this happens. As one teacher stated, "if the teacher decides that that's the important aspect to bring out, then the teacher will pull it out. So that's gonna really vary depending on what the teacher's perspective is."

In addition to the learning outcomes, the curriculum document provides the philosophies of three broad areas of learning: lifelong learning; a sense of self, community, and place; and the importance of developing engaged citizens (Ministry of Education, n.d.). It contains cross-curricular competencies, including developing thinking, developing identity and interdependence, developing literacies, and developing social responsibilities (Ministry of Education, n.d.). The document may also include curriculum integration: how the content connects with other subjects. The curriculum document for health includes a description of the principles of Comprehensive School Health (Ministry of Education, n.d.).

There were components of sustainable food systems reported both in the curriculum documents and by teachers in each of the grades. Some teachers have split classrooms where there are two grades in the same class. In this case, sometimes the teacher covers the same content in both grades. The focus of this study is on students aged 8-13 (grades 3-8). However, the grade 2 curriculum was reviewed because it is taught as a part of a split classroom; grade 2/3.

The grade 2 Health curriculum outcomes include healthy routines. If the teacher chooses, this could be covered by discussing eating healthy meals, as suggested in the indicators. The resources available to teach this include a web link to the latest version of Canada's Food Guide (2019), resources developed by the Public Health Nutritionists of Saskatchewan Working Group to support the curriculum, and videos that the teachers would be required to purchase. The Grade 2 Health curriculum also covers recycling. The curriculum integration section suggests that students could collect data about snack choices in Math. The Science curriculum covers life cycles and interdependence. The grade 2 Science curriculum was released in 2011. It does not refer to the concept of sustainability, but rather refers to interdependence, which seems to be a related concept in the sense that the focus is on the diverse nature and interconnection of people and animals in natural and built environments.

Grade 3 Arts Education includes perspectives on the community and natural environment and could be integrated with science by expressing life cycles of humans or animals through art. Health addresses the role of healthy food choices, and Science investigates plant growth and the importance of soil. In practice, the grade 2/3 teacher in one school uses the support of the Little Green Thumbs program (Agriculture in the Classroom, 2019) to grow, harvest, prepare, and eat food and has worms in her classroom for vermicomposting.

The grade 4 curriculum outcomes in Health include assessing healthy eating in Health Education. The resources available to teach this include a web link to the latest version of Canada's Food Guide (2019) and resources developed by the Public Health Nutritionists of Saskatchewan Working Group. Grade 4 Science outcomes include exploring the interdependence of plants and animals. Grade 5 Health curriculum assesses challenges and finding solutions to lifestyle choices. The indicators suggest including healthy eating practices to achieve this outcome. The Social Studies curriculum investigates the role of agriculture and sustainable management.

To cover the curriculum outcomes, in one school, the Grade 4 teacher discusses historical agricultural practices, includes a gardening component, and she then covers healthy eating in Health. In the other school, a grade 4/5 teacher brings gardening into her science class while following the grade 4 curriculum guide and resources.

The grade 6 Science curriculum covers outcomes on diversity, ecosystems, characteristics of vertebrates, invertebrates, and microorganisms. Neither school identified a grade 6 teacher to be an informant.

The grade 7 Art curriculum explores the importance of place, including the relationship to land. The Health curriculum discusses the importance of harmonious relationships, including with the environment. The Social Studies curriculum outcomes include evaluating the human impact on the natural environment. The Health curriculum includes a component on assessing personal food choices and includes a section on personal action plans. Physical Education includes a component on nutrition and fluid habits to support physical activity. Science contains information about Indigenous knowledge in understanding ecosystems while investigating the human impact of natural ecosystems. Grade 8 Arts Education includes a component on expressing perspectives on social issues, and this may include sustainability; however, the curriculum document does not articulate what type of sustainability this refers to. Health includes action plans for sustainability but does not articulate the meaning of sustainability. Grade 8 Health includes a section on Indigenous knowledge and sustainability and specifically discusses the implications for water resources. The specifics regarding the learning outcomes of the home economics curriculum is not available on the website; however, the topics covered in middle school include kitchen basics, kitchen and food safety, baking basics, and snacks (Saskatchewan Learning, 2006).

To incorporate the curriculum, the grade 7/8 teacher talked about the importance of creative planning, both in teaching two grades at once and in integrating curriculum components. This teacher planned on doing some cooking and possibly some gardening but was not sure as she was new to teaching these classes; she believes that project-based learning is best. Grade 8 students choose between Home Economics or Industrial arts and, if they choose Home Economics, they get bussed to another school that has the necessary facilities.

### 6.3.3 Current practice

Current practice refers to practices in the school that staff know to do, but there is no written policy guiding the practice. Current practice that respondents identified were broken down into five themes: program availability, food choices served, the importance of being an economical planner, sending food home, and what to do when students bring unhealthy foods to

school. The first category discussed program availability. Some components of the meal program were universally accessible, and other components were "needs-based." There were no eligibility requirements; however, so all students were able to access the needs-based programs. According to a principal, most of the food program funding comes from donors and community partners and is based on the population of the school. The school division provides funding that covers staff time and some program resources. The amount allocated is determined by the average number of students that use the programs. School staff determine how this funding is spent, for example, the Nutrition Workers decide what food to buy. The funding of needs-based programs, however, is based on need as determined by the number that participated the previous year, so the amount of funding received does not increase if more students participate on a given day. As a result, the lunch program is not heavily advertised. In one school, the Nutrition Worker found that if students liked the choice, they may opt for the meal program and throw out the lunches they brought that day. The Nutrition Worker in the other school found the same thing: "if they have a lunch, if they do come with a lunch, then they come downstairs, and they see what's for lunch, and they won't eat what's actually in their lunch-kit, they'll take my food instead, kind of thing." This led to greater food waste, made it difficult to predict food quantities needed and made it difficult to accommodate allergies and food preferences. The staff do their best to reduce meal program stigma by being respectful of what children bring and encouraging them to participate in the meal program to supplement the foods brought from home when they do not bring enough food to meet their needs. Children who teachers identify as not having enough food to eat are sent to get something from the meal program. In one school, a teacher stated that she may notice students do not have much for lunch when they are eating in the classroom or may not have healthy options. She sends them to the lunch program to supplement what they have. Nutrition Workers accommodates children who are late and have not had breakfast by giving them food items they can carry in and eat in the classroom. The staff report trying to support hungry children. One respondent indicated:

> *Yeah, a lot of kids come at the end of the day looking for snacks to take home. And it's never, no. We'll take them to the lunchroom, "Here's one for your pocket- and a couple for your little siblings at home."*

The second component of current practice was the food choices served. Nutrition Workers reported doing their best to include healthy foods and to make the unhealthier

donations, such as sausage or bear paws, better by serving them alongside healthier choices. Staff were not able to identify the written policies to guide practice; however, they identified the importance of including "the basic food groups" and stated that "the policy is understood." One Nutrition Worker further articulated this by saying that breakfast should "include three; and snack, at least two food groups." Another respondent reported, "as long as there's a protein and a vegetable or fruit throughout the day." Vegetables and fruit are regularly served and encouraged, along with milk and yogurt. Due to insufficient time, the Nutrition Worker in one school serves sandwiches because she does not have enough time to serve a hot meal every day. The other school tries to serve a hot meal every day, "Because I know I have students in my building that the only hot meal they sometimes get is in our school. Sometimes the *only* meal or food that they get is when they walk into our building."

The third component of current practices that was disclosed was the importance of careful managing of finances and making the most from the foods available. Nutrition Workers do this by discouraging food waste, reusing leftovers, finding creative ways to use donations, purchasing foods on sale when possible, and trying to make the best use of the food they have.

In regard to sending food home with students, half of the respondents reported that they have sent food home. One respondent justified this:

> *So that's why they get apprehensive on a Friday, because there's a weekend where they have no food on the weekends. That's why they get apprehensive before a long break from school. So we just came off a break. We had heightened behaviour, Wednesday, Thursday, Friday because the kids knew that they were gonna be without for the week, right? So you see it within the students.*

A Nutrition Worker respondent indicated, *"*...there's a lot of, I don't wanna say anxiety either, but I'm not really sure what else to say. And we've got kids on Friday, they know they're going home and the fridge is empty."

Although several respondents have sent food home with hungry students, not all are sure it is acceptable to do this, as a teacher indicated:

> *…a parent came in and said, "Oh you're having that, do you mind if I just take a little bit home" I really didn't know what to say, and I was like, "sure go ahead." I probably wasn't supposed to do that but. I don't know. The kid was sick. My kid- my student, was sick. I think she wanted to take it home. …I allowed them to.*

There were no policies identified indicating whether children can bring unhealthy foods to school, and this is being managed in different ways. If pop is discovered, it is often taken away until the end of the day. If children bring unhealthy choices in their lunch, they may be encouraged to get healthy foods from the food program. Sometimes, parents drop off a fast food meal, *"*and then our whole classroom smells like McDonald's. Whereas these kids are trying to eat their healthy- and they look over, and it's really hard." This type of thing can undermine the school's efforts to encourage healthy choices.

### 6.3.4 Written policy

A policy search revealed that there are no specific food policies at the schools. There are, however, provincial documents stating that Boards of Education are responsible for developing school policy (Saskatchewan Ministry of Education, 2019) and are encouraged to use supporting documents, such as the Comprehensive School Community Health Approach (Government of Saskatchewan, n.d.) and Healthy Foods for my School (Public Health Nutritionists of Saskatchewan, 2014). The latter document provides specific guidelines on how to classify foods according to the best choices ("choose most often" and "choose sometimes" choices). No specific food policies have been identified that cover these schools.

### 6.3.5 Barriers, Facilitators, and Opportunities

There were several barriers, facilitators, and opportunities recognized**.** Appendix A.8 breaks program aspects into specific areas and identifies barriers, facilitators, or opportunities that were reported for each. Funding was the largest barrier and impacted many areas including program access, food variety, food options, and in one school, limits in staff time which lead to lunches being sandwiches instead of a hot meal. The snack programs in the schools were universally accessible; however, the lunch programs were based on need. Parents were told about the lunch program when their child enrolled in the school, and hot lunch options were not advertised in case students preferred the hot school lunch over what they brought from home. At the same time, teachers noticed that some students brought many unhealthy foods in their lunches. In one school, the lunch program was encouraged to supplement lunches brought from home. Respondents indicated that the school provides an opportunity for students to have hot meals and an increase in the variety of foods that they might not have at home. Yet, the Nutrition Worker in one school indicated that food variety was limited to those that were economical to

purchase and those provided by donation. Also, a Nutrition Worker voiced her concern about shrinking budgets and increasing demand. Schools could provide an opportunity to develop social skills around meal-times by having a sit-down meal; however, teachers take their lunch break, so there are not enough teachers in every classroom to supervise. In one school, the teachers turn on the television to help manage behaviour.

Funding impacts the infrastructure of the school and, as a result, the ease with which programs can be delivered. Renovations, for example, cannot be undertaken until funding is approved. In one school, stairs provide a challenge for moving both the raw food used for cooking down the stairs and prepared foods up the stairs. The latter is a serious challenge since there is not enough space for students to eat their lunch near the kitchen. Carts to move food are available; however, this does not address the challenge that stairs pose. Access to adequate handwashing sinks and drinking fountains is available in one school but not the other. Infrastructure challenges vary by school.

Sustainable food system strategies such as gardening, composting, and reusable dishes are hindered by insufficient funding. This would include insufficient tools, indoor and outdoor gardening space and infrastructure, and a management plan. In some cases, disposable dishes are being used because the staff do not have sufficient staff time and alternative options, such as including students in washing dishes, have not been explored.

Curriculum resources act as a barrier when they are not available and a facilitator when they are available. Funding cuts to education resulted in a disbanding of the central resource centre for the school division. Teachers in both schools report that curriculum resources are important to support teaching, especially when it is an area with which they are less familiar. According to one respondent, up-to-date, relevant resources are now sought, paid for, and housed at the school instead of centrally-located and shared with other schools in the division. The same respondent indicated that this happened at the same time as cuts to librarian time. On the other hand, teachers report that when the appropriate curriculum supports are in place, they act as a facilitator.

School staff characteristics act as a facilitator to implementing sustainable food system strategies. One teacher identified the need to be creative to teach content to a split classroom and reported that, “creative planning comes in.” A Nutrition Worker identified the importance of

being creative, “I’m a budget-shopper, [I’ve brought] more creative ways to use donations that are coming in.” Staff work hard to complete the work they are assigned. A teacher described a Nutrition Worker, “the woman we have working in there, honestly, is like a tornado. She hustles, and she’s got it all set out.” Staff report caring about the work they do. Some staff work extra hours to get their job done. One respondent indicated, “it’s a paycheck of the heart” and “it has to be a bit of a passion.”

Relationships with funders, Health Promoting School staff, Nursing students, CHEP Good Food, Inc., and community members, were seen as facilitators. Organizations that provide grants, food, and equipment donations provide essential resources for the food programs to run. Health Promoting School staff and Nursing students help prepare food and support community events. Community members help support garden projects, including over the summer.

There are many activities supportive of sustainable food systems in schools; however, these initiatives are not consistent, leaving an opportunity to foster consistency in practice. Nutrition Workers and teachers report that the nutritional quality of food served to students is a priority; however, they report that less healthy choices are also available due to foods being received by donation. Teachers report that food fundraisers are used to raise funds to support physical activities; however, they report that they raise funds by selling unhealthy foods because healthy foods do not make money. The philosophy of Community Schools and Comprehensive School Community Health support healthy and effective policy; however, there are no food policies that guide food availability in schools. Some teachers and Nutrition Workers report that they give food to students to take home; yet another teacher is uncertain that this is acceptable practice. Several respondents recognized the importance of healthy food choices, yet many respondents reported that addressing hunger was more important than addressing nutritional quality. Nutrition Workers and teachers report that they do not think students should drink pop in schools; yet another respondent indicated that staff drink pop. There were composting programs in place in one school, for example, but participants report that this was not continued due to the loss of knowledge when the teacher who was running the program left the school, and due to vandalism, damaging the composter. There are many examples of activities that support sustainable food systems. The opportunity lies in sustaining these practices from year to year when staff and other circumstances change and having a way to address challenges and to plan

through change. A summary of the barriers, facilitators, opportunities, and priorities can be seen in Table 6.1.

***Table 6.1: Barriers, Facilitators, Opportunities, Priorities for School Food Programs***

| **Barriers** | **Facilitators** | **Opportunities** | **Priorities** |
|---|---|---|---|
| Funding<br>• Program Access<br>• Food variety<br>• Food options<br>• Staff time<br>• Infrastructure<br>• Gardening space and equipment<br>• Composting- safety<br>• Reusable dishes – time<br><br>Curriculum resources<br>• Disbanding of the central resource centre<br><br>Noon hour supervision | School Staff Characteristics<br>• Creative<br>• Resourceful<br>• Budget-shoppers<br>• Work hard<br>• Staff care<br>• Work extra hours<br><br>Relationships<br>• Funders<br>• Health Promoting Staff<br>• Nursing students<br>• CHEP Good Food, Inc.<br>• Community members | Foster consistency in practice<br>• Support healthy food choices- policy<br>o Donations<br>o Fundraisers<br>o Sending food home with students<br>o Response to pop in school<br>o Quality of food brought from home<br>o Staff modelling<br>o<br>• Knowledge/practices when staff leave<br>• Vandalism | Address hunger<br><br>Nutritional quality<br><br>Gardening<br>• Indoor<br>• Outdoor<br>• Composting<br>• Reducing waste<br><br>Increase food access and variety<br><br>Increase food skills<br><br>Policy |

### 6.3.6 Priorities

Many respondents indicated that the top priority was to address hunger. As one respondent indicated, "Priorities, making sure students have food in their bellies so that they can learn." Another identified the relationship between hunger and behaviour:

> *And also the fact that a student in the classroom if they're starving, can't focus on learning, on their education. So we were having a lot of trouble first thing in the morning with behaviours; unregulated students within the classroom. Because they're hungry and they're acting out negatively, because that's the only way they know how to get what they need, right?*

A close second to addressing hunger was ensuring the food was healthy, "and making sure that obviously that, it's as nutritional as I can get it."

Other priorities that were identified include gardening, indoor gardening, composting, and reducing waste. As stated by one participant, "It would be amazing if classrooms could take their kids outside to learn in the garden." In order to address time constraints and competing priorities, one participant suggested:

> *… there's not enough minutes in the school day to do everything that needs to be done so somebody else decides what needs to be done and gardening isn't it. Right so if there was a way to do it outside of the school dictated times, that would be awesome.*

This participant also suggested recruiting community members to help with gardening activities.

Increasing accessibility and variety were identified as priorities: increasing variety in food choices, including more culturally acceptable and diverse options, and providing new foods and more hot meals. One respondent indicated:

> *I think that it's something we can address, especially within our school here, is the diversity of cultures. And I think it would be fantastic to be able to highlight different foods, provided they met certain nutritional values. And I think that that is just an educational thing that I think we need to be exposing our children to that.*

Students' food skills were seen as lacking, yet this was identified as an essential life skill. Increasing variety was also seen as supporting the priority of increasing nutrition education, especially if students are involved with cooking and developing food skills:

> *I think just educating what healthy meals look like and if students aren't seeing this at home, this helps them to see what this looks like. . . . It's good for students to see how to actually prep these lunches and breakfasts.*

One respondent summarized the ultimate goal as "what matters about all this, is really for them to be life-long healthy eaters."

Ensuring that nutrition policies are known, supported and implemented at all levels was seen as a priority. As one respondent indicated, ". . . we need to integrate food and nutrition and health into everything else we're doing." Participants felt that creating a culture of healthy eating, where children feel comfortable asking for food when they are hungry also helps to build relationships in the school.

### 6.4 Discussion

The school food environment is an opportunity to address sustainable food system strategies and the nutritional quality of students' diets while addressing food insecurity. Important components to consider include curriculum, policy, and practice as well as facilities and staffing levels, having program continuity plans, and building relationships. Barriers and facilitators to implementing aspects of sustainable food systems into elementary schools were identified. Barriers to implementing sustainable food systems in schools include funding

constraints, which impact many factors. Curriculum resources are seen as a facilitator when they are available. Staff characteristics such as being hardworking, resourceful, creative, and passionate are facilitators in supporting sustainable food system strategies. Relationships to donors, funders, Health Promoting School staff, Nursing students, and community members have facilitated program delivery. It is important to have continuity in program availability and in curriculum components that deal with sustainable food systems because changes in staff are a regular part of the school environment. Barriers can be categorized according to the Socio-ecological Framework (Townsend & Foster, 2013) and will need to be addressed for Canada to move into the third phase of school food programs, so food system sustainability is part of the consideration for school food (Oostindjer et al., 2017).

Curriculum, policy, and practices are important components of sustainable food systems in schools (Chapman et al., n.d.). In this study, for example, the curriculum for students in grades 3-8 has several supportive, required educational outcomes. The curriculum is an important guiding document for teachers; however, the way a topic is addressed depends on teacher interest and knowledge levels. Teachers who were passionate and knowledgeable about an area, such as gardening or composting, felt comfortable including it in the curriculum and used several innovative and experiential strategies. Curriculum support resources are no longer available at the school division level making it more challenging for teachers to access resources supportive of teaching about food sustainability.

Although policies are important for schools to support sustainable food systems, this study found that beyond the Community School philosophy, there were no formal policies supporting nutrition guidelines or sustainable food system strategies. Developing policies is an opportunity to move forward in developing sustainable food systems in schools. Issues that came up in this study where policies would be helpful include the nutritional quality of food brought from home, nutrition guidelines for food choices served, class incentives, fundraisers, and a plan to communicate these policies. Policies related to food safety may impact access to local foods so should be considered intentionally. Reaching a consensus on what these policies should entail was beyond the scope of this study. Participants' responses in this study were consistent regarding current practices; however, discussing and writing formal policies would provide

support and ensure consistency. Policies can enable success; however, it is important they are not so restrictive that they act as barriers (Rojas et al., 2016).

There were many sustainable food system practices identified by these schools. Some initiatives were undertaken previously but had been discontinued. For example, composting was discontinued due to a lack of knowledge and vandalism of equipment. Prioritizing initiatives and providing the necessary supports for program continuation would help ensure program sustainability and that efforts to start programs are not lost. The concern about initiatives being lost over time due to a lack of supportive policies has been noted elsewhere (Rojas et al., 2016).

Only considering curriculum, policy, and practices for sustainable food systems in schools overlooks important factors. Other considerations such as facilities and staffing levels, having program continuity plans, and building relationships are also significant components. These six factors are shown in Figure 6.1 as a Model for Sustainable Food Systems in Schools. Adequate and essential facilities include an operational kitchen with storage space, the equipment to transport food safely, and the ability to keep food safe. This can be a challenge in schools that may not have the infrastructure, and so creative solutions may need to be found such as sharing or using community spaces such as community churches or gardens (Rojas et al., 2016). Infrastructure challenges vary by school. When challenges exist, adequate resources are required to mitigate these challenges.

**Curriculum**

- Experiential learning opportunities
- Resources for Curriculum

**Policy**

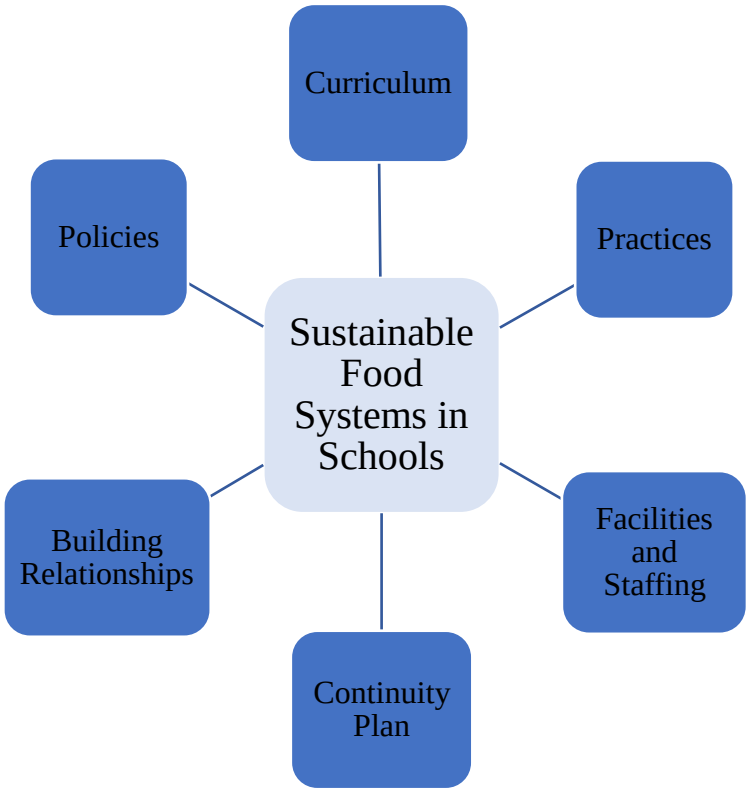
- Nutrition Guidelines
- Fundraisers
- Food brought from home
- Treats and incentives
- Staff modeling
- Continuity of programs – plan and resources
- Communication plan

**Practices**

- Composting and vermicomposting
- Gardening
- Mealtime management and family-style meals
- Recycling
- Reducing packaging and waste
- Using reusable dishes
- Meal and snack programs
- Food access
    - Addressing stigma
    - Culturally appropriate
    - Nutritious and adequate

**Continuity Plan**

- When plants do not grow
- Vandalism
- Things go missing




**Facilities and Staffing**

- Kitchen equipment and storage space
- Food safety, temperature controls, water access
- Dining space, garden space, tool shed, water source
- Access to professional development
- Adequate staff time
- Safe work environment

**Relationships**

- Community members and parents
- Volunteers and charities
- Local businesses
- Within school

*Figure 6.1: Model for Sustainable Food Systems in School*

Adequate staffing levels are necessary to ensure there is relief coverage and time for personal and program development, and program evaluation. Continuity plans are important, so when problems arise, the program is not derailed. Resources and supports should be available to address school-specific challenges. Also, incorporating gardens and composting systems into maintenance plans would help support and ensure their success. Providing enough staff time to clean dishes or to organize students or volunteers would reduce waste created from disposable dishes.

Food programs provide an opportunity, not only to provide healthy foods and meals but also to model healthy foods and eating practices. This could be done by providing new foods for students to try that may not be accessible at home. Enjoying hot meals in a social environment without other distractions would benefit students. To do this, adequate funding support is required to organize community volunteers to provide appropriate supervision. These eating experiences may not be available to some students in their home environment. The opportunity to participate in family-style hot meals in school supports both healthy growth and development, social development, and healthy eating practices (Oostindjer et al., 2017).

Building relationship**s** in the community and forming partnerships is an important component of sustainable food system strategies (Rojas et al., 2016). Community building may occur at many levels: within the school; with the local community members and parents; with volunteers and charities; and with local businesses. Respondents indicated that the school would benefit from the support of community members and volunteers but can also act to bring people together through school family meals and events, and gardening.

Schools operate in complex contexts with many factors impacting the capacity to integrate sustainable food systems strategies. In addition, the context varies by school. Using a framework, such as the Socio-ecological Framework can help identify how and whether environmental factors act across multiple levels (Onwuegbuzie et al., 2013). The Framework can assist in generating insight into appropriate interventions at various levels equally, as opposed to solely focusing on individual behaviour change (Story et al., 2008). Appendix A.9 shows the barriers identified in this case study, charted at the level they influence in the Socio-ecological Framework. Appendix A.10 identifies the facilitators at the various levels. Charting

these factors from a Socio-ecological perspective can assist in determining appropriate actions to move towards supporting sustainable food systems in schools.

Some challenges and facilitators work at multiple levels. Competing priorities, for example, acts at the individual level when there are more tasks for a person to do than time available. Competing priorities manifest at the school level (Microsystem) when staff want to support optimal nutrition, but the food donations they receive do not support this (Exosystem). Staff value nutritional quality; however, addressing hunger was seen as more important.

Community Schools, such as those in this study, value supporting children's health; however, there are no food policies to guide practice and to support a healthy food environment. Healthy foods are offered in the school; however, there are no restrictions on what staff and students can bring from home. Also, unhealthy food is sometimes used for fundraising for outdoor extra-curricular activities. Although the school philosophy supports a healthy school food environment, policies are not in place, and practice is not consistent with philosophy. This demonstrates a lack of continuity throughout the socio-ecological levels.

Decisions at one level can impact another. For example, due to funding cuts, the central resource center, which would be in the Mesosystem, was disbanded. Resources were distributed from the central repository to schools, based on the amount of storage space they had. Since this change, resources are no longer kept up to date. This responsibility moved to the school level (Microsystem) without the resources to follow. As such, new initiatives are more challenging to accommodate because resource support has been discontinued.

An activity might occur in the school and seem to be within the school's control but be impacted by decisions made at other levels. For example, noon hour supervision happens within the school environment with the school staff; however, staff breaks are regulated by union contracts, so noon supervisory activities are voluntary. Because there is insufficient supervision over lunch, sometimes the television is turned on to manage behaviour. This detracts from creating a healthy eating environment where food is shared as a social activity amongst the students and adults.

Understanding the level a factor plays may also help to determine if it can effectively be addressed in the school environment. For example, the broader food environment in which the

school is located does not provide healthy options for teachers to pick up during their short lunch breaks. As a result, teachers sometimes bring in fast food for their own lunches. This would be a Macrosystem issue so the school will have little control beyond advocating for improved food environments around schools.

### 6.5 Limitations and Conclusions

Findings from this study may not apply to schools in other contexts. The context of two Community Schools in Saskatoon, Saskatchewan situated in lower-income areas, with large Indigenous and newcomer populations following a specific philosophy of Community Schools may not be found in other schools. Community School funding provides staff to support student challenges. Furthermore, the infrastructure in these schools may not reflect what is available in other elementary schools. This study took place in elementary schools, and so does not cover the whole student experience of food and sustainability literacy. As children get older, they would be more able to participate in food preparation and other activities to support a school food or sustainability program. In addition, the specifics of the Home Economics curriculum was not available online. This is a concern because this may reflect the perceived importance of Home Economics and students can develop a negative attitude towards healthy eating and school food programs when Home Economics is seen to have a low level of importance (Oostindjer et al., 2017).

Figure 6.1 was developed from the data that was collected in this study. Components may be missing or may not pertain to other contexts. There is an opportunity to further refine this model by looking at other contexts. In addition, consideration should be given to how the factors identified (Curriculum, Policy, Practice, Building Relationships, Continuity Plans, Facilities and Staffing) relate to each other. Further developing this model will help to ensure that it is applicable in a wider variety of schools.

Steps are being taken to address food literacy and food system sustainability through some curriculum components and some practices. Although there is some reference to interdependence in the curriculum, it is up to the teacher to bring out how this relates to environmental sustainability. Most of the curriculum was developed between 2009-2011. Updating the curriculum to ensure sustainability was more prominent could help to ensure

continuity in practice in what is being taught and to ensure that students develop food literacy and sustainability skills.

Policy documentation and support are lacking so although staff are motivated to address both environmental and nutrition issues, they are not able to consistently optimize their efforts because of competing priorities and lack of prioritization, policy, and financial support. The food programs at Community Schools are driven by the need to address student hunger and when resources are tight, food quantity is valued over food quality. Undernutrition is important and needs to be addressed to support optimal academic achievement; however, overnutrition also needs to be addressed to support long term health outcomes. School food programs in the U.S., for instance, have been found to be associated with a greater prevalence of overweight and obesity (Peterson, 2014). Healthy school nutrition policies help to promote a healthier BMI (Taber, Chriqui, Powell, & Chaloupka, 2013). Adequate support and training are needed to ensure policy adherence (McIsaac et al., 2015). Schools should provide a healthy food environment for students through policy, support, and making healthy food environments a priority to develop a healthy food culture within the school.

Components essential to adopting sustainable food system strategies include adequate facilities and staffing levels. Also, facilities should generate continuity plans and have supportive resources to ensure program continuation. Building relationships at the school, community, and in the larger context will help support program priorities. Creative solutions to solve school challenges while engaging community members and students may help find solutions to resource constraints. In Italy, for example, children aged 3-13 follow nutrition standards and help prepare food for their canteen (Benvenuti, De Santis, Santesarti, & Tocca, 2016). Considering at what levels in the Socio-ecological Framework barriers act will help in developing strategies to overcome them.

The philosophy of Community Schools with the support of the Comprehensive Community School Health Framework puts the schools in this case study in a strong position to be leaders in the area of school food. Staff are motivated, work hard, and care about the students' short- and long-term goals. Prioritizing sustainable food system strategies and school food programs, so they are foundational to school culture, will support providing optimal nutrition and learning experiences with food that students may not otherwise have. Supportive policies and

including community members and students in programming would help support these priorities. Also, developing partnership with local producers, both for local food procurement and for student engagement through farm visits or work projects would provide learning opportunities for students to understand where their food comes from.

# CHAPTER 7: DISCUSSION AND CONCLUSION

In this chapter, I consider the findings that were discussed in the previous three chapters in the context of the current situation around school food in Canada. I discuss concepts to consider when developing a National School Food Program such as including sustainable food system strategies and addressing stigma. I discuss how the Socio-ecological Framework can be used to better understand the factors that impact food choice in the school environment. The section on food sovereignty includes the importance of critically looking at the consequences of current food provisioning practices. After discussing these considerations, I present components to include in a National School Food Program. This includes discussing the importance of including strategies to improve food literacy, increase diet variety, along with incorporating school gardening and farm-to-school programs. This section concludes with recommendations for School Food Programs, limitations to the research presented in this thesis, and suggestions future research.

## 7.1. Food Insecurity and the Nutritional Quality of School Food

It may be surprising that food insecurity at the household level is a problem in an affluent, food-producing country like Canada. In 2012, *Household Food Insecurity in Canada* reported that 4 million people in Canada, including 1.15 million children (16% of all children under 18 years) experienced some level of food insecurity (Tarasuk et al., 2014). In the study in Chapter 5, which compares diet quality of school meals versus foods brought from home, 83% of the students who regularly participate in meal programs live in low SES neighbourhoods. Respondents in the case study indicated that addressing hunger was their highest priority because they witness how hunger impacts behaviour and students' ability to concentrate in school. The research done in this thesis demonstrates that food insecurity in children during the school day is a concern in Saskatoon.

Poor nutritional quality is not limited to children living in low-income neighbourhoods. In the study comparing school meals to foods brought from home, the diet quality of all children, including those that live in higher SES neighbourhoods, was a concern. Many lunches, especially those in mid and high SES neighbourhoods, contain processed, packaged, minimally nutritious foods, which is both a concern nutritionally and environmentally. Food programs typically only address food insecurity and do not address the poor diet quality of children in mid and high SES

neighbourhoods. When school food initiatives are minimally resourced, it makes it difficult for staff to consider consequences of food programs on the environment, and consequently more difficult for Canada to move into the third stage of food programs, which includes both student health and environmental concerns (Oostindjer et al., 2017). Food programs should be repositioned to support high diet quality in all children, not just those that are perceived to be food insecure, and be designed to consider and minimize their environmental impact.

The type of foods seen in school lunches reflects our current food system. The high number of MNFs, as found in chapter 5, is a reflection of the neoliberal, globalized food system and the degree to which these types of foods have been promoted (Weiler et al., 2015). Our current food system focuses on the interests of multinational corporations, often at the expense of health. Schools could consider their role in advocating for and working towards a healthier food system for all people. Healthier food environments overall would better support students, both those coming from low SES areas and those coming from higher economic means.

Food programs, as they are currently structured, provide limited impact in reducing school day food insecurity in children. Schools that receive support for school food programs are given limited resources to address food insecurity; the demand for food programs exceeds the resources provided. As a result, not all foods that are served are of high nutritional quality because the schools receive some foods by donation and staff have little control over what they receive. Food programs help to address hunger and support academic achievement, but they do not fully optimize the potential to address inequities caused by being born in low-income households. For school meal programs to address this, priorities need to shift to support the nutritional quality of foods served to all children, to develop food literacy skills, and to incorporate strategies that move towards food system sustainability. Addressing food insecurity by only providing food to those that are food insecure does not address the power imbalance which determines what foods are produced and consumed, and how food is distributed (Wiebe & Wipf, 2011). In order for system changes to make the food system more equitable, citizens need to be informed and involved in the decision-making process (Wiebe & Wipf, 2011). Schools can be active participants in engaging citizens about food and driving food system change (Rojas et al., 2016; Rojas et al., 2011).

### 7.2 School Food in Canada

There is no national school food program in Canada, and in response to student need, many programs across the country have been initiated to address the nutritional health of school-aged children. The scoping review identified that there were a variety of programs in many contexts but that there was wide variation in terms of evaluation and program delivery. The programs are most often initiated due to concerns about food insecurity and poor diet quality. The study discussed in chapter 5 indicated that the diet quality of all school-aged children is poor, not just those that are food insecure. The nutritional concerns of school lunches is a national problem (Taylor et al., 2012; Tugault-Lafleur et al., 2017; Tugault-Lafleur, Barr, & Black, 2019), yet there is no national strategy or standards to address this problem (although 2019 has marked the first time the federal government has publicly stated its willingness to consider developing a national strategy or program).

Without a nationally-funded or guided school food program, schools rely primarily on local or regional charities to provide food to children. It is difficult to plan meals and follow nutrition guidelines when relying on donations. The school is well-positioned to address diet quality and sustainable food system strategies to support the nutritional health of children and the environment. Since these health concerns are national in scope, a National strategy would address these issues across the country. Food Secure Canada is a national organization working towards eliminating hunger while ensuring healthy and safe food through sustainable food systems (Food Secure Canada, 2017). The Coalition for Healthy School Food, a group of Food Secure Canada, has been advocating for a Universal Healthy School Food Program so students would be able to access healthy meals every day (Food Secure Canada, 2017). The government announcement for a Food Policy for Canada and their intention to consult with the provinces and territories to develop a National School Food Program in 2019 (Agriculture and Agri-Food Canada, 2019) suggests that politicians are beginning to see the importance of supporting the nutritional health of school aged-children. It is unclear what this program will encompass because details have not yet been released (Government of Canada, 2019). The research in this thesis is well-positioned to inform factors to consider for the National School Food Program. The Food Policy for Canada and the National School Food program have the potential to help Canada integrate health and environmental sustainability (Oostindjer et al., 2017). A universal, health-promoting, multi-component, sustainable food program in Canada that respects cultural

diversity would address this national concern (Hernandez et al., 2018). It must be noted, however, that a federal election is slated to occur in 2019 so funding to these programs may change, depending on election results.

## 7.3 Considerations for a National School Food Program

There are a number of high-level factors to consider in constructing a National School Food program that are a result of the studies described in this thesis. These factors include sustainable food systems and food programs; stigma; using the Socio- ecological Framework to understand the school context, and addressing food sovereignty.

### 7.3.1 Sustainable Food Systems and Food Programs

The motivation behind many nutrition interventions and school food programs in children fall into two categories: addressing overweight and obesity or addressing food insecurity. The connection between children's health and the health of the planet has been identified in some school nutrition programs; however, this is not the dominant discourse. Canada continues to be predominantly in the second phase of school food programs and only considering nutritional quality and not environmental sustainability (Oostindjer et al., 2017). Canada will need to be intentional to move towards food system sustainability, because, although there is interest in the school, sufficient supports are not in place.

Respondents in the case study were interested and motivated to incorporate sustainable food system strategies. Teachers incorporated some cooking and gardening into classes, and there was vermicomposting in one classroom. In many cases, school staff were not able to incorporate sustainable food system strategies. One school uses disposable dishes for breakfast, the other for one weekly lunch due to insufficient staff time to do dishes. In one school, recycling was limited due to a lack of sinks to rinse recyclables. Composting programs had never been established in one school and had been discontinued in the other. Staff were not able to specifically procure local foods because food choices were based on cost and donation, and were sometimes ordered through another organization (CHEP Good Food, Inc.). Although school staff are interested in incorporating sustainable food system strategies, they are not always able to start or continue initiatives due to a lack of support.

Experiential learning opportunities and interaction with the environment through gardening help to connect people to where their food comes from. Respondents in the case study

valued the learning opportunities gardening provided to students. People who develop a greater understanding and appreciation for the natural world as children may develop pro-environmental behaviours as adults (Gifford & Nilsson, 2014). Students who garden were found to a have a sense of responsibility towards the environment (Skelly & Bradley, 2007) and these gardening experiences may impact their attitudes about the environment when they are adults (Blair, 2009). Being involved in the process of producing food from planting to harvesting to preparing and sharing builds a sense of connection, including with the natural environment, communities, and ecosystems (Rojas et al., 2016).

Is learning about where food comes from enough to enact food system change? Learning about gardening may inform students about where food comes from; however, by itself, it may not invoke a critical reflection of the impacts of current food provisioning practices. In order to influence system change, gardening and other food programs need to include a critical component which challenges the ideology of the dominant food system (Meek & Tarlau, 2015). Some of the teachers in the case study teach in split classrooms and already have to be creative to cover the curriculum. Given the time constraints that teachers have, it would be challenging for them to incorporate this critical component. In addition, they would have to understand the critical component themselves, which is not the dominant discourse in this country. To incorporate a critical perspective, it would be helpful for teachers to be connected to those that understand the environmental and health consequences of our current dominant food system. For meaningful system change, school food programs need to be connected with a group that is working towards food system transformation (Meek & Tarlau, 2015).

Individual behaviours can have an impact and can influence change; however, the right kind of knowledge needs to be obtained to support this. Transformational change requires information in different knowledge domains: learning about declarative or factual knowledge, procedural or "how to" knowledge, effectiveness or understanding the impact, and understanding social trends and expectations (Redman & Redman, 2014). Often school programs include declarative or factual knowledge, and this alone does not significantly impact a change towards environmentally responsible behaviours (Redman & Redman, 2014). The Saskatchewan curriculum is based on Bloom's taxonomy (Ministry of Education, n.d.). Declarative and factual knowledge would fit in various levels in blooms taxonomy, depening on how the learning was

constructed (Krathwohl, 2002). For learning to be transformative, there needs to be a shift towards including procedural, effectiveness, and social knowledge (Redman & Redman, 2014). These may be more challenging to incorporate in an elementary school as they represent higher order thinking on Bloom's taxonomy (Krathwohl, 2002). Social knowledge includes what is considered "normal" and "expected," and can be used to promote desirable behaviour and then be reinforced by modeling sustainable practices in schools (Redman & Redman, 2014). The social knowledge domain is not reflected in Bloom's taxonomy (Krathwohl, 2002); however, schools may be able to incoporate this component through practices. The schools in the case study, for example, were able to do this to some degree, such as through vermicomposting and recycling programs, and through the healthy foods provided for school lunches. There is an opportunity to further develop the social knowledge and modeling in schools.

The menu and foods provided is another way to demonstrate sustainable strategies. In the case study schools, many plant-based proteins are used on the menu because this is an affordable way to feed students. This has environmental benefits because meat consumption has a significant environmental impact (De Laurentiis, Hunt, & Rogers, 2017). The study in Chapter 5 comparing school meals from foods brought from home used the 2007 version of Canada's Food Guide. Since then, the new food guide was released and the 2019 version promotes plant-based proteins to promote human and environmental health (Health Canada, 2019).

Financial constraints work against healthy menu options. Insufficiently resourced food programs that need to have low labour costs and schools that lack cooking infrastructure may feel pressured to use food companies that provide processed heat and serve foods (Gaddis & Coplen, 2018). This is both a nutritional and environmental concern. The case study schools do the best they can with the resources available, and staff are motivated and want to support sustainable food systems. If they did not personally see the value in healthy, sustainable options, they may chose more convenient, less-nutritious, less sustainable options. Without policy support, there is no guarantee sustainable choices will continue, especially given the transient nature of school staff. Policy support and resources are needed to maintain and increase healthy, sustainable food choices in the school.

### 7.3.2 Stigma

Framing school food programs to reduce stigma is an important consideration. Stigma can occur at many levels: with students, caregivers of participating students, caregivers of non-participating parents, and community members (Russell et al., 2007). Stigma was a common theme noticed in the scoping review, even though we were not specifically looking for it. Respondents in the case study also discussed stigma during the interviews. As much as schools do their best to address stigma by keeping the program open to all students, and report there is no stigma in the school, they do not have control over the attitudes and beliefs of all students (McIsaac et al., 2018) and community members (Russell et al., 2007).

One method to address food program stigma is universal access (McIsaac et al., 2018; Russell et al., 2007). In the case study research, many participants indicated that program stigma was not an issue, and staff consistently reported that food was available to all students, not just those that may be considered in need. This, however, was contradictory because although both schools indicated that the lunch program was universal, neither advertised what was being served because they did not want more students participating than necessary. Lunch program funding is depenent on the previous year's participation rates which does not allow the school to meet demands day-to-day. Philosophically both schools were universal (participation is not contingent on need); however, in practice, they do not want an influx of participants as this would overwhelm their financial resources. When asked if there was stigma in the community; however, one respondent indicated that it was an issue. As much as staff try to minimize stigma at the school level, it is important to be aware that community members, especially those not involved with the program, may view the program negatively. Negative comments about school food programs or about participants or their families can adversely impact program use by those who need it the most (Russell et al., 2007).

Some parents feel more comfortable with their child participating if they can support the food programs through donations (Russell et al., 2007). Cost-sharing of programs can be done in a confidential and non-stigmatizing way so those that can afford to pay can contribute and those that cannot afford to pay can be subsidized (Hernandez et al., 2018). Cost-sharing, including giving extra to support a child in need, and having parents volunteer to assist in program delivery should be explored to move towards a community school food program rather than a food program for children in need.

School food programs that focus on the nutritional quality of the diets of all students and involve community members and parents may be well-accepted by parents (Russell et al., 2007). Parents involved in food program delivery have a better understanding of the purpose, which helps reduce stigma (Russell et al., 2007). Parents that are not involved with school food programs may have negative comments and attitudes about the program. School food programs provide an opportunity to build community through parent involvement.

School food programs address many food challenges. For example, parents have many challenges in packing lunches, including schedule and time constraints (Russell et al., 2007), peer pressure, lack of lunch option ideas, limited time for children to eat (Bathgate & Begley, 2011), school allergy policies, food safety concerns, cost, child preferences and picky eating (Hawthorne et al., 2018). Parents will often compromise food quality to manage these challenges (Bathgate & Begley, 2011). The positive benefits of meal programs can be used to market the program to improve acceptance.

### 7.3.3 Understanding School Food From a Socio-ecological Perspective

A school's current capacity to incorporate sustainable food systems and food programs to improve the diet quality of all students varies greatly. The schools in the case study, for example, are in low SES neighbourhoods and have been designated as Community Schools. They already provide some form of meal programs, and therefore have more of the infrastructure to both prepare food and include cooking in classroom teaching. They have support staff to assist with programs that other schools do not. Resource allocation when implementing new programs should reflect current capacity and infrastructure.

The Socio-ecological Framework can be used to understand the environmental influences impacting health-related choices. Factors can impact food choices at many levels: the individual level, Microsystem, Mesosystem, Exosystem, and Macrosystem. A description of the Socio-ecological Framework and its application was discussed previously in section 2.4.4, and the adapted framework can be seen in Figure 2.1. Chapter 6 included barriers, facilitators and opportunities to implementing sustainable food systems and food programs and Appendix 9 and 10 chart this from a Socio-ecological perspective. This section examines how the Socio-ecological Framework can be used to understand school food and sustainable food systems in school within the context of this thesis. What I have reported here is not comprehensive; however, presenting findings from this perspective provides examples and demonstrates the

utility of this framework. There are many other aspects that would be relevant and could be charted on this framework to enhance understanding. My intention is not to repeat what I have said in previous sections but rather to discuss important factors that came up. Figure 7.1 provides a diagram of the factors noted below.

#### 7.3.3.1 Microsystem

Peer influence falls under the Microsystem in the Socio-ecological Framework and includes face-to-face interactions. Case study participants did not identify this as a barrier or facilitator for school food programs; however, it can impact food choice both positively and negatively (Bathgate & Begley, 2011; Russell et al., 2007). Peer-led interventions may improve food choice in the school context (Yip, Gates, Gates, & Hanning, 2016). The larger context and socio-ecological levels in which the school operates influences the true impact of these interventions (Lake et al., 2012). An example of peer-influence in the case-study research was that in one school, the grade 4 students were responsible for recycling for the school. Students valued this position, and students from other grades asking to volunteer demonstrates this. Future research in sustainable food systems in schools and school food programs should include peer-led interventions because adding a peer-led component can result in greater program impact (Yip et al., 2016).

Sustainable food systems connect people to the community (Tagtow et al., 2014). Mealtimes provide an opportunity for community building, social interaction, and social skill development. This includes students interacting with other students and adults. The mealtime environment falls under the Microsystem or face-to-face interaction on the Socio-ecological Framework. Findings in the case study indicate that schools do not always optimize mealtime opportunities. During lunchtime, teachers are required to take breaks as per their union contracts. This leaves insufficient staff to support eating environments that promote socialization. In one school in the case study, teachers would play a movie during lunch to help manage behaviour. Playing a movie does not create an environment that supports socialization, nor does it encourage mindful eating as promoted by Canada's Food Guide (Health Canada, 2019). Eating mindfully requires minimizing distraction so attention can be focused on the enjoyment of eating and to feelings of fullness (Health Canada, 2019). Creating a social environment would consist of students focusing on eating their lunch while taking with other children and adults and

learning social norms and meal-time manners (Oostindjer et al., 2017). In France and Japan, socialization is an important part of school lunches (Moffat & Thrasher, 2016), and meals can be used to teach nutrition education (Oostindjer et al., 2017). Also, mealtimes can promote a relaxed environment where the students have time to eat generates less plate waste (Derqui, Fernandez, & Fayos, 2018; Oostindjer et al., 2017).

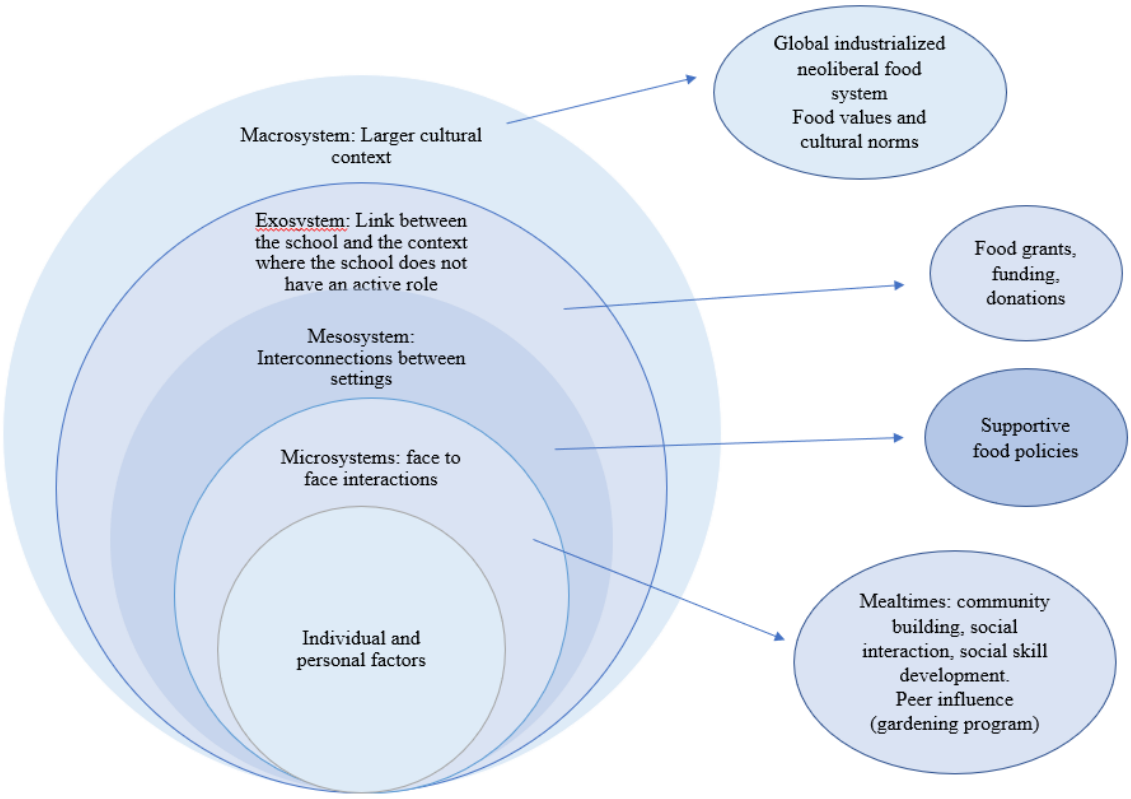



***Figure 7.1: Socio-ecological Framework School Context Examples***

#### 7.3.3.2 Mesosystem

Factors in the Mesosytem impact many of the foods available in school. These include the (lack of) food policies. The case-study research identified that there are no nutrition policies in place for foods available in the schools. There were several places where supportive food policies would be beneficial: food donations, fundraisers, sending food home with food-insecure students, and the nutritional quality of foods brought from home. For example, it is important to promote healthy food environments beyond what is available in the meal program, including using food for rewards, foods available during celebrations, fundraising options, and creating a

social eating environment (Dietitians of Canada, 2017; McKenna, 2010). Further research could explore how some of these concepts could be developed and framed in policy to be accepted and effective. Fundraising options, for example, such as using healthy, local food options or non-food items needs to be explored. Ideally, school meal programs would be adequately funded and not rely on donations so schools could have more choice in the foods provided and not need to fundraise. Adequate funding would make it easier for schools to adhere to healthy school food policies. Universal meal programs that provide healthy school meals to all children would be in a stronger position to have policies around what types of foods children can bring from home. All school staff would then have policy support and know how to respond when children bring unhealthy choices to school. School philosophy can support the importance of healthy eating practices; however, supportive policies are needed to support this philosophy. Once policies are enacted, adequate support and training are needed to ensure policy adherence (McIsaac et al., 2015). Schools should provide a healthy food environment for students through policy, support, and making healthy food environments a priority to develop a healthy food culture.

The scoping review determined that most schools in Canada are in the second phase of school food programs, and only a few are incorporating sustainable food system strategies (Oostindjer et al., 2017). The case study identified no formal policies supporting sustainable food system strategies. When schools move towards developing policies, they should consider including sustainable food system concepts. Policies can enable success; however, it is important they are not so restrictive that they act as barriers (Rojas et al., 2016).

#### 7.3.3.3 Exosystem and Macrosystem

The food environment and cultural norms around food is an example of the influences in the Exosystem and Macrosystem in the Socio-ecological Framework. Elementary schools are preferred for nutrition interventions in school-aged children because the food environment is easier to control than in high schools. Students are often not able to leave the school grounds without permission and are therefore not able to access unhealthy food off school property. There are often fewer competitive foods (unhealthy foods for purchase) in elementary schools. The schools in the case study, for example, did not have competitive foods. Consideration of the food environment in and around middle and high schools is important. Supports are necessary to help students transition to these schools. This is especially true for schools in low SES areas as

these schools are often in closer proximity to unhealthy food sources off of school property (Engler-Stringer, Shah, Bell, & Muhajarine, 2014). Further research is important on ways to support and prepare students as they transition to middle and high schools. Improving the food environment around the school can be more difficult for the school to influence.

The food system in which the school operates is another macrosystem influence. The United States has a National School Lunch Program (NSLP) that was established in 1946 to support the health of children through providing food while supporting farmers by using the commodities they produced (US Department of Agriculture, 2014). From the perspective of the Socio-ecological Framework, the NSLP operates in the macrosystem of the global, industrialized food system and is subject to these influences. Large multi-national companies have gained power through partnerships with the public sector and have established agreements that serve corporate interests (Busch & Bain, 2004). This has resulted in a move towards processed and convenience foods in the NSLP. Thus, due to the influence of the globalized, industrialized food system, NSLPs have shifted away from supporting the health of children and have compromised food quality in favour of serving the interests of multi-national corporations (Gaddis & Coplen, 2018). This example demonstrates why food sovereignty is important and why citizens need to have a say in their food system. An unintentional negative consequence of the NSLP is that school food programs in the United States are associated with a greater prevalence of overweight and obesity (Peterson, 2014). As Canada moves forward in the area of school food, it is important that we learn from the negative example provided by the United States and instead prioritize the health of our children.

### 7.3.4 Food Sovereignty

As the Socio-ecological framework as delineated in section 2.4.4 suggests, schools are situated within larger environments and are impacted by cultural norms and values found in the Macrosystem of the framework. Such factors include the neoliberal environment in which the schools operate. Addressing poor diet quality and food insecurity without addressing the underlying factors that caused these problems, namely who holds power and has access to goods, will limit our ability to improve health inequities (Weiler et al., 2015). Neoliberalism encourages open global markets which distance the consumer from the producer (Wittman et al., 2010). Responsibility is offloaded from the government and industry and is placed on the individual and

under-resourced community groups (Mansfield & Mendes, 2013). People are responsible for making good food choices. However, with the nature of the food system, the information required to make good choices is often not available (Jaffe & Gertler, 2006). The schools in the case study have taken on the responsibility to provide food to students with the support of a community organization, CHEP Good Food Inc., yet they are so under-resourced, they cannot even decide what foods are going to be served because the programs are reliant on donations.

The case study demonstrates that there is support for food programs; the resources that come with being a Community School allow the staff to support students in areas beyond academics. At the same time, the school system further entrenches neoliberalism by not providing enough support to engage and empower the community to have more control of the foods the schools offer their students. A community food security perspective includes developing self-reliance and social justice (Hamm & Bellows, 2003). When students graduate from these schools, they and their families may be no closer to having control of the food they eat, or the capacity to grow, harvest, prepare, compost or reduce waste than when they entered the school. Engaging students, parents, and community members in all aspects of the food system including planting, growing, harvesting, preparing, eating, and composting helps to connect people with the environment, can improve health by transforming food habits while addressing food insecurity, food sovereignty, and sustainability (Levkoe, 2006; Rojas et al., 2011). Only offering food to address food insecurity does not address the root social, political, and economic structures that created the problem in the first place (Health Canada, 2019; Wittman et al., 2010)

In addition to school food procurement strategies further entrenching neo-liberalism by not providing supports for active community engagement, many school food programs further entrench the status quo by using traditional procurement methods. The case study demonstrates that school staff are at the mercy of outside organizations to provide food donations to hep thee program operate. Neither parents nor staff members choose some of the foods available. Innovative solutions, which seek to support local producers while feeding children, could improve nutritional intake by procuring local, healthy, unprocessed foods while being more environmentally sustainable. Saskatchewan has a strong agricultural industry and food is produced locally; however, the schools in the case study had no connection to producers, except for, in one school, receiving donated garden produce in the fall. School food programs in Japan

and Brazil, for example, support local producers who grow for the domestic market (Otsuki, 2011; Wittman & Blesh, 2017). Institutional support of local producers can strengthen local producers' position (Ashe & Sonnino, 2013; Wittman & Blesh, 2017). Collectively, food programs use a lot of food. Transitioning to sustainable and local food procurement practices would have a significant impact on the food system, improve food security, and lead to structural changes which support food sovereignty (Ashe & Sonnino, 2013; Wittman & Blesh, 2017).

The food system contributes significantly to environmental degradation, greenhouse gas emissions, and climate change through degrading soils, deforesting, polluting water, and reducing biodiversity (Wiebe & Wipf, 2011; Wittman et al., 2010). Addressing this from a food sovereignty approach invites citizens to be informed and involved in remodeling food production and distribution practices to reduce environmental impact (Wittman et al., 2010). Programs, such as those described in the case study, can help to inform students about where their food comes from and the consequences of their food choices on the environment.

## 7.4 Strategies

The following section describes strategies that could be incorporated into school food programs to improve diet quality and address environmental sustainability. These strategies include improving food literacy, using school food programs to encourage diet variety, integrating school gardens, and incorporating farm-to-school programs.

### 7.4.1 Food Literacy

Supporting students' nourishment so they can achieve the educational attainment to enhance the opportunity for adequate income when they are adults addresses the social determinants of health. However, their health status may still be compromised if they do not have the food literacy skills necessary to eat healthily. Ironically, nutrition workers in schools are expected to have the knowledge and skills to provide nutritious but affordable foods, yet this knowledge is not being passed to students. The Saskatchewan elementary school curriculum includes learning outcomes so students can learn about healthy eating (Ministry of Education, n.d.), and some teachers in the case study cook with their students. Yet, respondents in the case study indicated that children's food skills were lacking. A lack of student food skills was also found in a Manitoba study (Slater, 2013). Although the case study demonstrated that some cooking skills are worked into the curriculum, not all students are involved with food preparation

in the school and few assists with the meal and snack programs. Since the case study was conducted, home economics in grade 8 has been cut, further limiting access to cooking and food literacy skills for grade 8 students (Young, 2019). Food literacy skills are essential for students to navigate complex food landscapes, and without these skills, students are more likely to rely on convenience and processed foods (Slater, 2013). The 2019 version of Canada's Food Guide recognizes the importance and encourages the development of food literacy skills along with understanding the impact of food choices on the environment (Health Canada, 2019). Involving children in cooking and preparing foods can be used for skill development, to encourage them to try new foods, and to foster healthy eating habits (Health Canada, 2019).

In secondary school, food skills commonly are taught through Home Economics classes, which are often optional. Principals, teachers, and some parents see Home Economics as less important as other classes, such as math and science and so students may decide not to take it (Oostindjer et al., 2017; Slater, 2013). Because it is seen as a lower priority class, it is not kept up-to-date, and the material neither reflects current nutrition information nor addresses societal trends (Slater, 2013). The Home Economics curriculum should be revitalized to incorporate practical strategies to navigate current food and lifestyle situations and to address the trends of overweight and obesity and reliance on processed and convenience foods (Lichtenstein & Ludwig, 2010). While doing this, the stereotypical roles of who is involved with food preparation can also be addressed (Lichtenstein & Ludwig, 2010). All students should have access to food literacy skills, not just women through Home Economics classes or by having to choose this over other classes. Having all children learn about food and cooking would address gender stereotypes about women being responsible for food provisioning (Slater, Sevenhuysen, Edginton, & O'Neil, 2012). The attitude towards cooking and food literacy needs to shift, so it is recognized as an essential life skill for all students.

### 7.4.2 Diet Variety

Diet variety of low-income children is often limited because parents cannot afford the cost of food waste, as it often takes 8-15 times to try a new food before it is accepted (Daniel, 2016). Students coming from homes with food insecurity may not have the opportunity to try new and healthy foods because the family does not have the financial resources to cover when children do not eat foods they have not yet acquired a taste for (Daniel, 2016). Limited access to

novel foods can impact a child's food preferences because they do not develop a taste for new foods and may instead rely on calorie-dense, nutrient-poor foods (Daniel, 2016). School food programs are well-positioned to introduce new foods to children. This ability is compromised, however, when programs do not have sufficient resources. This issue was identified in the case study. The Nutrition Worker who purchases food would like to provide novel foods for students to try; however, finds this challenging when these foods cost more. This is exacerbated by the short growing season and having foods that travel long distances to provide access in the winter.

Children will often eat foods in school food programs that they will not eat at home (Russell et al., 2007). Acceptance of unfamiliar foods can be improved by trying new foods at school and student involvement in cooking programs (Zahr & Sibeko, 2017). Parents are more likely to buy new foods if they know their child will eat them because they tried these foods at school (Daniel, 2016). If school food programs focused on the long-term outcome of establishing healthy eating patterns, sufficient resources would be allocated to include novel, healthy foods, and be tolerant of food waste while students became accustomed to new flavours. This approach supports establishing lifelong healthy eating patterns and better addresses the health inequities caused by being born in low-income families.

### 7.4.3 School Gardens

School gardens can provide experiential learning opportunities about food production and bring healthy foods into schools and classrooms (Powell & Wittman, 2018). Both schools in the case study incorporated gardening into classroom learning. Due to the size of the gardens, the classroom gardening did not contribute much to school food; however, classrooms were able to eat the food they produced and were sometimes able to share with other classes in the school. Several articles in the scoping review identified gardening programs. Gardens can promote both healthy eating and sustainable food systems. A study in California, for example, found that school gardening improved nutrition knowledge, improved attitudes towards food and the environment, and increased vegetable and fruit intake both in and out of school (Rauzon, 2010). Gardens can promote school and community connectedness (Powell & Wittman, 2018), which is an important component of sustainable food systems (Tagtow, 2009). School gardens can contribute to the development of food literacy skills through teaching about growing and preparing food and learning about food systems (Powell & Wittman, 2018). Garden and snack

programs were identified in the scoping review, which demonstrates that this is a viable strategy in the Canadian context. In addition, gardens may provide a move towards food sovereignty by shifting the focus from individual consumer concerns of individual healthy choices to systems-related concerns such as improving food literacy, engaging citizens, supporting local producers, and improving the quality of food in schools (Powell & Wittman, 2018).

### 7.4.4 Farm-to-School

Farm-to-school programs are an example of how schools can incorporate sustainable food system and food program strategies. Farm-to-school programs connect local producers to schools to provide healthy foods, provide educational opportunities to students while supporting local producers (Joshi, Azuma, & Feenstra, 2008). The farm-to-school salad bar program in British Columbia that was included in the scoping review, for example, provides subsidized, curriculum-integrated, local, environmentally friendly vegetables and fruits through a salad bar twice a week to improve nutritional intake (Social Research and Demonstration Corporation, 2010). Farm-to-school programs can move food sovereignty forward by promoting the procurement of local and sustainable foods through non-traditional supply chains (Powell & Wittman, 2018). These programs cut out the middle-men, support local producers, and decrease the distance between producers and the school community members (Powell & Wittman, 2018). Farm-to-school programs can be instrumental in supporting food literacy through classroom learning, tasting new foods, field trips, and eating local foods in meal and snack programs (Joshi et al., 2008). In British Columbia, farm-to-school programs are promoted as a way to improve food literacy, and they can be incorporated to foster community engagement (Powell & Wittman, 2018). When engaging local farmers, creative solutions should be considered to ensure the relationship is mutually beneficial so they are not over-burdened.

## 7.5 Recommendations

The recently announced Food Policy for Canada includes promoting Canadian food and supporting local food production initiatives. This, along with the announcement of the intention to work with the provinces and territories to develop a National School Food Program positions Canada to begin to move into the third phase of school food programs (Oostindjer et al., 2017) and address the nutritional quality of children's diets and environmental sustainability. Incorporating healthy, local food into the curriculum and having supportive food policies and practices would help to create a healthy food culture in the school.

A National School Food Program provides both the opportunity to improve diet quality and food literacy in school-aged children while promoting environmental sustainability. School food programs that address concerns beyond overnutrition and undernutrition and include informing students about the food system and its environmental impact along with strengthening food literacy skills will put students in a stronger position to make food choices that are healthy and have less of an environmental impact.

Multiple ways of incorporating food into the school environment and curriculum have been demonstrated through the scoping review articles and could be considered, including gardening, preserving, preparing, composting, and recycling. These initiatives can be incorporated into classroom teachings to give experiential learning opportunities. Involving students in food production within the schools would provide them with the skills to make food at home, both while they are attending school and once they graduate. Understanding how food is produced and where it comes from could form the basis of critically analyzing the consequences of the mainstream globalized food systems. Alternative market streams options such as sourcing food directly from local producers could be explored and supported, not only in the school but also potentially in the home environment if community members and caregivers are involved.

Mealtimes offer an opportunity to develop social skills and build community both within the school environment and into the surrounding community. Adequate time for meals would allow time for socialization and eating mindfully. Adequate staff time would support mealtime social development. Limited staff resources can make school programs challenging; however, innovative solutions could be explored, such as including students and community members in food production or for meal-time behaviour management.

Adequate resources to support the procurement of a variety of local and healthy foods would not only support local producers but also provide students opportunities to try new foods. Sourcing foods from local producers provides the opportunity to build relationships between local producers, the school, students, and community members. Opportunities for students to learn about local food production practices directly from producers could provide the students with meaningful learning experiences. Considering local food available and seasonal availability helps food to be more affordable and taste better. Including plant-based proteins instead of meat

aligns with the 2019 version of Canada's Food Guide (Health Canada, 2019). If schools foster a culture of eating healthy for all students, it will be easier for students to make healthy food choices. Adequate funding for school food programs would allow the school staff, parents, or students to have control over the food provided. Funding for school food programs that considered the community the school is situated in would ensure sufficient financial resources were transferred to the school to support the program. Sliding-scale cost-sharing programs could be considered if appropriate, so parents could confidentially contribute what they could afford.

Canada is a diverse country, and school contexts vary widely. A National School Food Program that provided an overarching framework of the objectives to the program and not be too prescriptive would allow the provinces and schools to determine the best way to meet these objectives in their context. Sufficient resources would ensure food programs are adequately staffed evaluated.

### 7.6 Limitations

The discussion in Chapter 7 is based on the studies that were presented in Chapters 4, 5 and 6. Limitations to the research in these chapters beyond what was discussed previously is discussed below.

A scoping review is a type of literature review that helps give an idea of the amount and type of research that has been done in a particular area (Arksey & O'Malley, 2005). Scoping reveiws tend to focus on broader topics, may include a variety of study designs, are less likely to assess the quality of the studies, and may include published and unpublished literature (Arksey & O'Malley, 2005). A limitation of the scoping review in Chapter 4 is that it included both peer-reviewed and grey literature and we did not assess the quality of the included studies. Study designs in this review varied greatly. For example, both qualitative and quantitative methods were used to assess changes in food intake, and not all measurement methods have been validated. Some of the grey literature reports included in the scoping review may have been completed to justify funding. This could provide a potential bias for reporting positive results of the program. The scoping review provided an idea of the amount and type of work that has been done to evaluate school food programs in Canada; however, the quality of results found in each study were not assessed.

The purpose of conducting the scoping review on school food programs was to develop promising practices for school food programs in Canada. This type of review provides information from the Canadian context. A limitation to only looking at Canadian literature, however, is it does not consider effective, innovative, successful strategies that may be in place in other countries.

The study in Chapter 5 comparing school lunches from foods brought from home used the 2007 version of Eating Well with Canada's Food Guide (Health Canada, 2007). This version provided recommendations on serving sizes and the number of servings to have from each food group each day. The Healthy Eating Index was developed based on these recommendations. The 2019 version of Canada's Food Guide (Health Canada, 2019), however, does not include serving size or number of serving recommendations. It includes a picture of a plate depicting what meals should look like: encourages vegetables, fruits, plant proteins, and whole grains; recommends water, discourages fruit juice; and does not depict dairy products in the picture (Health Canada, 2019). Recommendations on serving size and number of servings is not yet available but will be released at some point for health professionals and policymakers (Webster, 2019). Updates in assessment methods, either through changes in the recommended number of servings or through the adjustments to the HEI, will make it difficult to compare findings before and after the food guide was updated.

Another limitation to the study in Chapter 5 was that the study focused on what children brought to school, not what they ate. The students had access to healthy and MNFs; however, it is not known which foods they ate. The reported food group servings indicate the best-case scenario – students ate all of the healthy foods. It is not known whether they threw foods out or took them back home.

The purpose of the case study was to develop a better understanding of the context of school food programs in Saskatoon. Findings from this study may not apply to schools in other contexts. The context of two Community Schools in Saskatoon, Saskatchewan situated in lower-income areas, with large Indigenous and newcomer populations following a specific philosophy of Community Schools may not be found in other schools.

The case study described in Chapter 6 conducted interviews and did site observations of infrastructure; however, it did not observe the types of foods served. Respondents may have

reported, for example, that the food served is healthier than it actually is due to a desirability bias. Although findings were triangulated between data collection sources, they were not verified by an objective observer.

### 7.7 Future Research

Diet quality of school-aged children is a concern and interventions at schools are strategic because students are captive, and they spend much of their time there. The concerns for school-aged children include diet quality, overweight, and food insecurity. It is not known what the best intervention is to address these similar, but diverse concerns. It will be important to determine that interventions that help some students do not cause unintentional negative consequences to other students. For example, in addressing food insecurity and providing food at schools, does this increase food intake overall in other children and predispose them to overweight or obesity?

School food interventions assume that children having access to healthy food at schools will improve intake. This assumption, however, does not identify the mechanism of how this works. The Socio-ecological Framework can be used to identify that factors that impact food choices influence at several levels from individual choice to personal interaction, to cultural norms, to the food system. Providing healthy food at school is only one of the potential factors that impact food choice and intake. Future research should be done to further clarify the factors that support and impede healthy food choices in school-aged children so that school food programs can be optimized.

School environments and contexts vary greatly across Saskatoon, and across the country. The case study research in this thesis provides details of the schools in a similar context but does not represent all school situations. Further research should be done to develop an understanding of schools in different contexts, so school food interventions can be tailored for maximum benefit.

Canadian schools are in their infancy for incorporating sustainable food system practices. The main focus of providing food at school has been to address food insecurity. As such, there is limited knowledge of how best to incorporate sustainable food system strategies in different contexts. The scoping review provided promising practice recommendations for school food programs and recommended to include addressing social determinants of health, systems and

sustainability, and economic sustainability. Further research should be done to determine how these strategies can be implemented, documented, and evaluated.

The scoping review identified that there are various school food program initiatives across the country, but the method of evaluation varies greatly. Further research to develop consistent evaluation strategies would make it possible to compare programs and changes over time.

Sustainable food system strategies can be incorporated into schools while maintaining the dominant food system. To affect system changes, school food programs need to be designed intentionally to increase awareness of the consequences of current provisioning practices and to engage and support citizens to action to support non-traditional market streams and food procurement practices. Future research that determines the best and most effective way to engage and activate citizens in diverse contexts would help to inform school food interventions so they can support food sovereignty and influence changes to the food system.

### 7.8 Conclusions

The announcement by the federal government about developing a Food Policy for Canada and the intention to work with the provinces and territories to work towards developing a National School Food Program places Canada at an opportune time to move forward in the area of school food. This announcement along with the recent changes in Canada's Food Guide has made school food an area of rapid change. The research presented in this thesis is well-timed to inform the development of a National School Food Program. There are several important considerations when developing school food programs such as promoting nutrition recommendations, minimizing environmental impact, reducing stigma, and being sufficiently resourced. Food production, preparation, and waste management can be incorporated into curriculum, policy, and practice to increase food system knowledge and food literacy. A critical look at the globalized neoliberal food system to increase awareness of the consequences of current provisioning practices and engaging and supporting citizens to action could facilitate changes to make the food system more environmentally friendly. Future research in this area could be done to determine appropriate context-specific interventions and to ensure that interventions are effective while minimizing unintentional negative consequences.

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# APPENDICES

**Appendix A.1: HEI for a School Environment**

| Food Component | Points | Modified for children aged 9-13 | Servings modified for school context (1/3 of recommended) |
|---|---|---|---|
| **Adequacy** | 0-60 points | | |
| **Total vegetables and fruit** | 0 -10 points | Min: 0<br>Max: 6 | Min 0<br>Max 2 |
| **Whole fruit** | 0-5 points | 21% of recommended for total vegs and fruit<br>Min: 0<br>Max: 1.3 | Min: 0<br>Mid: 0.2<br>Max: 0.4 |
| **Dark green and orange vegetables** | 0-5 points | 21% of recommended for total vegs and fruit<br>Min: 0<br>Max: 1.3 | Min: 0<br>Mid: 0.2<br>Max: 0.4 |
| **Total grain products** | 0-5 points | Min: 0<br>Max 6 | Min: 0<br>Max: 2 |
| **Whole grains** | 0-5 points | Min: 0<br>Max: 3 | Min: 0<br>Mid: 0.5<br>Max: 1 |
| **Milk and alternatives** | 0-10 points | Min: 0<br>Max: 3- 4 | Min: 0<br>Max: 1.3 |
| **Meat and alternatives** | 0-10 points | Min: 0<br>Max: 1- 2 | Min: 0<br>Max: .7 |
| **Unsaturated fats** | 0-10 points | Min: 0<br>Max 30 g | Min: 0<br>Mid: 5 g<br>Max: 10 g |
| **Moderation** | 0-40 points | | |
| **Saturated fats** | 0-10 points | Min: 7-10% of total energy – 8-10<br>Max: 10-15% total energy – 0-8 | same |
| **Sodium** | 0-10 points | AI-UL (1500-2200mg: 8-10<br>Greater than UL (2200mg) | 500-730mg<br>730 -1460mg<br>>1460mg |
| **Other foods** | 0-20 points | Min: <5% total energy intake<br>Max: > 40% total energy intake | same |

**Appendix A.2: Peer-Reviewed Literature**

| Author | Location, Program Duration | Grades/ Ages, # participants | Intervention | Evaluation method | Evaluation criteria | Method and Conclusions |
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| Hanbazaza et al. (2015) * | Alberta, Alexander First Nation Sept. 2010-June 2011, Sept. 2011-June 2012 | Grades 1-6 n=116 total n=66 data collected at all 3 occasions | Vegetable garden: growing and taste testing, curriculum integration through gardening, daily fruit and vegetable snack program | Survey: write down 5 fruit and vegetables they know, adapted questionnaire for preference and home consumption | Educational: Knowledge of vegetables, fruit, and the environment. Nutrition: Vegetable and fruit preferences, and consumption. Food literacy: Vegetable and fruit knowledge | Quantitative. Children listed a greater number of vegetables and fruit demonstrating knowledge ($p<0.05$) and greater fruit preferences at 18 months ($p<0.05$). There was no increase in home intake. |
| Triador et al. (2015) * | Alberta, Alexander First Nation 7-month gardening, 4-month snack program | Grades 1-6 n=116 total n=76 all occasions | One free vegetable or fruit a week, taste testing. Gardening. Reading themed books about gardening/ vegetables. | Survey: Pre and post vegetable preference survey | Nutrition: Impact on reported home consumption and preference towards vegetables and fruit | Quantitative. Preference towards vegetables and fruit increased over 7-month study period ($p<0.017$). There was no increase in home intake. |
| Ransome et al. (1998) | Alberta, School Milk Program, Calgary and | Ages 6-12 n=783 | Milk | Food Frequency Questionnaire: Questionnaire filled out by | Nutrition: Calcium containing foods. | Quantitative. There were higher calcium and vitamin D intakes ($p<0.05$) and milk and alternatives consumption |

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| | Surrounding area, ongoing program | | | parents for full day intake. | | ($p<0.05$) in students whose school had a milk program. Females aged 10-12 may benefit most from the program as this age group is at highest risk of not meeting requirements ($p<0.05$). |
| Russell et al. (2007) | Ontario, Child Nutrition Program Evaluation Project 10 sites in Ontario, cities of 10,00-2.4 million and rural communities of 10,000 or fewer. Students and parents that have participated for at least 1 year | Grades 2-4 Children n= 46 that have participated for at least 1 year, participating parents at least 1 year n=19, non-participating parents n=22, volunteers n=4, program coordinators n=8, Educators n=8 | Breakfast, snack | Focus group: children, parents, volunteers, coordinators, educators. Interview. | Perceptions of the program | Qualitative report. Children and community members report some stigma. Some parents and children are uncomfortable identified as program users. Older children, starting with grade 6, may be more secretive with program use. Some non-participating parents blamed others for sending their children. Some children did not participate because parents felt the program was for children who did not have a healthy breakfast at home. Volunteers indicated that children participated because there was no food at home or due to parents' work schedules. Educators viewed the programs as universal and identified social benefits to participation. |
| Godin et al. (2018) | Ontario and Alberta | Grades 9-12 | Breakfast | Survey: COMPASS | Student’s use of the program. | Quantitative. Student’s use of the program is low (16%). |

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| | COMPASS study Students participating in year 3 of the COMASS study (2014-2015) | n=30,771 in 87 schools Alberta schools = 8, Ontario Schools = 78 | | student questionnaire | | Logistic regression indicated that program use was associated with being non-white ($p<0.01$), using public transit to get to school ($p<0.001$), being a bullying victim ($p<0.001$), and having a high school connectedness score ($p<0.001$). Providing breakfast at school may not ensure students eat breakfast. |
| Leatherdale et al. (2016) | Ontario, COMPASS study Students participating in year 1 and 2 of the COMASS study (2012-2014) | Grades 9-12 43 schools N= 23,921 students in year 1 and n=23,424 in year 2 | Breakfast | Survey: COMPASS student survey, the frequency of breakfast eating and breakfast program use | Program use and breakfast skipping. | Quantitative. Breakfast program use was 12.3-13.6% and the prevalence of breakfast skipping was 54.5%-54.9% measured over 2 years in 5 intervention schools. School breakfast programs may not currently be effective for reducing breakfast skipping among most youth. Despite the availability of free school breakfast programs, the majority of students skipped breakfast at least once a week. Use of the program remains low. |
| Gates, Hanning, Gates, Isogai, et al. (2013) * | Ontario, First Nations school in Fort Albany Pre and post 5 week education program | Grades 6-8 n=16 for paired analysis | Fruit, vegetable, and milk snack program. Only | Web-Q 24 hr recall, Food Frequency Questionnaire, Survey: Pre-post questionnaire- | Nutrition: pre-post changes in intake, food literacy | Quantitative. Knowledge ($p<0.05$) and intention ($p<0.01$) improved but remained poor. Most (87%) failed to meet milk and alternative recommendations |

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| | | | evaluated milk. | knowledge, self-efficacy, and intention | | before and intakes remained inadequate after the program. Food environments beyond the school need to be addressed. |
| Gates, Hanning, Gates, McCarthy, and Tsuji (2013) | Ontario, Kashechewan and Attawapiskat First Nations Assessed pre and 1 week post program and 1 year follow-up | Grades 6-8 Kashechewan n=37 pre to 1 week post program, n=24 in 1 week post to 1 year post, Attawapiskat: n= 48 pre to 1 week post | Fruit, vegetable, and milk snack program. Only evaluated milk. | Web-Q 24 hr recall: pre-post. Focus group: Students. Interview: Informal | Nutrition: Milk and alternative, calcium, and vitamin D intake | Mixed methods. Assessed 1-week post intervention. Calcium intake improved after 1 week ($p<0.044$) but was not sustained at 1 year. Qualitative: Students said the snack program helped them eat healthier because they were hungry when they got to school. Snack programs can be successful at addressing low milk and alternative intake but funding, staff, facilities, and resources need to be addressed. |
| Meizi He et al. (2012) | Ontario, Northern, Ongoing program | Grades 5-8 18 focus groups in 18 schools with students, n=139 | Fruit, vegetable: 1 fruit or 1 veg offered 3 times/week | Focus group: 18 focus groups | Nutrition: self-report. Qualitative assessment of barriers and facilitators from the perspective of program participants. | Qualitative. Self-report eating more vegetables and fruit either at school, home, or both. Report eating healthier, having more energy, and trying new foods. Peers influenced behaviour. Changed parents' food purchasing behaviours. Concerns included poor food quality, lack of variety and waste. Suggested trying more new foods and having twice a day. |

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| Meizi He et al. (2009) * | Ontario, Northern Fruit and Vegetable Pilot Program, 26 elementary schools in Northern Ontario, 21 week program | Grades 5-8 N=1277 | Snack: Fruit and vegetable. Experimental design: Fruit and vegetable and enhanced nutrition education, fruit and vegetable alone or no intervention. | 24 hr recall, Survey: Pro-Children Questionnaire | Nutrition: Fruit and vegetable intake, attitudes, willingness to try, preferences and self-efficacy. Food literacy: Fruit and vegetable knowledge. | Quantitative. Free fruit and vegetable along with nutrition education consumed more F&V than free fruit and vegetable and control group ($p<0.05$). The free fruit and vegetable group ate more F&V than the control group (not statistically significant) and had some changes in preferences. A combined strategy works best. An unintended adverse consequence was being exposed to produce of low quality. |
| Sangster Bouck et al. (2011) | Ontario, Northern. Fruit and Vegetable Pilot Program, Ongoing program | Whole school: Process evaluation of staff perspective n =26 | Fruit or vegetable snack 3 times/week | Survey: Teachers assess the implementation of the nutrition education component. Interview: Identify program facilitators and challenges. Wastage. | Educational: There was a curriculum component, but outcomes were not evaluated because it was not well implemented. | Qualitative. Facilitators identified include funding and the school community's participation. Challenges: Product delivery, quality, variety, wastage. The snack program along with nutrition education improved intake. |

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| Skinner et al. (2012) | Ontario, Northern First Nations communities Ongoing program. Data collected in Nov. 2004 and Dec. 2007 | Grades 6-10 n=63, n=50 | Snack | Web Q Food Frequency Questionnaire, survey: Participation, preferences, and impressions of the snack program. Economic feasibility. | Economic feasibility. Nutrition: Improved nutrition. Compared the intake of participants to non-participants. | Quantitative. Participants in 2004 had higher vegetables and fruit and other nutrients ($p<0.05$) than non-participants. In 2007, participants had a higher intake of milk and alternatives ($p<0.01$) and lower intakes of other foods ($p<0.049$). Economically feasible: the snack program in Fort Albany has become institutionalized in the community and the school and has gradually improved over many years. The snack program lead to improved food and nutrient intake but did not improve home intake. |
| Saksvig et al. (2005) * | Ontario, Sandy Lake school-based diabetes prevention program Study conducted during the 1998-99 school year | 3-5 n=122 | Lunch. Intervention components - curriculum, family, peer, environment, and school meal | 24 hr recall, survey: pre-post intervention | Health, knowledge, and behaviour questionnaire, parent questionnaire. Nutrition, food literacy, anthropometric measures. | Quantitative. Increased health knowledge, dietary intention, preference, knowledge about the nutritional content of food, and increased self-efficacy between baseline and follow-up ($p<0.001$). |

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| Roustit et al. (2010) | Quebec, Social and Health Survey of Children and Adolescents (1999) | Ages 13 and 16<br>n=2346 | Breakfast, lunch, snack | Survey: principal, student, parents | Educational, health equity, food security | Quantitative. Data is reported as changes in Odds Ratios. The statistical differences in children in schools without supplementation versus with supplementation for the various factors range from p= 0.18-0.84. Limitations: They were not able to assess the effects of food assistance programs on academic performance. However, the authors conclude that targeted school meal programs can improve academic performance in those that are food insecure. |
| Henry et al. (2016) | Saskatchewan Saskatoon: 8 elementary schools in Saskatoon, Saskatchewan 6 week cross-over design | Grades 1-8<br>n=2124 | Milk | Plate waste | Nutrition: milk intake changes when regular chocolate milk is switched to reduced sugar chocolate milk | Quantitative. Milk intake decreased in the short term when schools switched to low sugar chocolate milk ($p<0.001$). |
| Henry et al. (2015) | Saskatchewan, Saskatoon: 6 Catholic schools,<br>12 week cross-over design | Grades 1-8<br>n=1205<br>Eleven focus groups, n=72 | Milk | Food Frequency Questionnaire; Beverage frequency questionnaire. Focus group: identified factors that influenced | Nutrition: waste, milk intake | Mixed methods. Quantitative: Milk intake decreased by 12.3 % after chocolate milk was removed ($p<0.001$). Qualitative: Focus groups revealed that taste, cost, convenience, and variety impact milk intake. Chocolate |

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| | | | | milk intake, wastage | | milk is more convenient than other milk alternatives. |
| Gougeon et al. (2011) | Saskatchewan, Saskatoon, (1997-2007) | Different ages n=159 lunches and 90 breakfasts | Breakfast, lunch | Weighed/measured food, conducted nutrition analysis and compared to DRIs. | Nutrition: compared nutrients in meals to requirements | Quantitative. Foods are nutrient dense, not energy dense, provide significant nutrition, especially for those of lower income. Many nutrients in the samples are adequate but energy is insufficient ($p<0.05$). |

An * indicates the program included an educational component.

**Appendix A.3: Grey Literature**

| Author | Location, Program, Duration | Grades/ Ages, # participants | Intervention | Evaluation method | Evaluation criteria | Conclusions |
|---|---|---|---|---|---|---|
| Triador (2013)* | Alberta, First Nations Cree community, Earthbox Kids study, 7 month gardening and 4 month snack program | Ages 10-21 n=76 | 7 month gardening, 4 month healthy snack, receiving 1-2 servings per week | Survey: Pre-post, Vegetable and Fruit Knowledge and Attitudes. Survey: caregivers' perceptions of eating habits | Attitude towards and acceptability of vegetables and fruits. | Quantitative: Increase in self-reported positive attitudes towards vegetable and fruit ($p<0.0)5$ in both normal weight and overweight children. Increase in self-reported likeability score ($p<0.05$) from baseline to follow-up in normal weight children. There was no change in home consumption. |
| ActNow BC (2008)* | BC, ActNow BC: BC Fruit and Vegetable Snack Program, Location not specified, Ongoing program | Elementary school, 10 pilot schools n=3300 | Fruit and vegetable snacks were given 2 times/week | Interview: teachers, administrators, coordinators, others: self-report | Nutrition. Receive information on produce grown in BC. | Qualitative: Increase in vegetable and fruit consumption, feel healthier, try more vegetables and fruit, increase in knowledge, ask their parents to buy more vegetables and fruit. |
| Context (2013) | BC, BC School Fruit and Vegetable Nutritional Program, Evaluation 2012-2013 | K-12 N=956 students for paired analysis, n=832 survey of teachers and coordinators, n=82 First | Snack: fruit and vegetable provided every other week for 13 weeks | Survey: students, teachers, coordinators. Observation: program impact. Interview: administrators, | Acceptance and willingness to try new vegetables and fruits. Food system knowledge, attitudes, and practices. Nutrition: availability of vegetables and fruit. Importance of | Mixed methods-quantitative: Self-reported. Increased acceptance ($p<0.05$) and willingness to try new foods ($p<0.001$) in elementary children and in First Nations students ($p<0.05$). Perception scores (perception of whether classmates liked vegetables and fruits) in secondary |

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| | | Nations communities | | produce partners | the relationship between administrator, schools, and produce partners. | students improved (P<0.05). Self-reported intake of fruits and vegetables tried increased (P<0.05) and vegetables and fruit tried at home increased in elementary students (p<0.001). Influenced by peer attitude; younger children are more influenced to try new foods. Did not increase awareness of local foods in students but it did in teachers and coordinators. Nutrition: increased availability of vegetables and fruit. Qualitative data provides detail on the process evaluation, which is included in the report. |
| Social Research and Demonstration Corporation (2010) | BC, Farm to School Salad Bar, Northern and Interior BC | Grades K-12 Eleven schools (4 secondary, 7 elementary) Grades 4 and up n= 427 for pre-survey and n=351 for post-survey Interviews and focus group | Provide a salad bar lunch twice a week for 26 weeks | Survey: grade 4 and up. Interview: principal, coordinator, food service staff, volunteers, producers | Economically feasible. Nutrition. Vegetable and fruit intake. Eco-friendly practices - reusable plates and cutlery. Food literacy. Strengthen local food systems. Evaluation of program planning and implementation. | Mixed methods - quantitative: Self-reported increased raw salad intake (p<0.05), and increased willingness to try new fruits (p-0.016). Qualitative data captured program process evaluation: Economic feasibility is more challenging in low-income areas. Fundraising and other efforts were often needed. Ongoing funding is needed for operational expenses. Use in high schools was lower than expected. Food literacy: It |

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| | | description not provided | | | | may take longer than a year to include the food skills component. Strengthen local food systems, local procurement - it takes time to develop relationships. Cost and availability make consistently sourcing local a challenge. Knowledge about food, nutrition and health improved. Requires adequate planning and support. More details about process evaluation are in the report. |
| Scott et al. (2017) | BC, New West Minster Schools | K-12, multiple schools Family surveys n=1304 Staff surveys n=165 Student focus groups = 5, 18 students, Environment al scan | Breakfast, lunch, snack | Survey: administrators, teachers, staff, parent, external review. Focus group: secondary and middle school students. Interview: school - to determine what services are provided. Food insecurity statistics, program use. | Food security. Understanding, attitudes, knowledge, and behaviour of staff, parents, and students. | Qualitative: Students estimated up to 50% of students do not have sufficient food, some are not comfortable accessing food or do not know programs are available. It is difficult to identify hungry students resulting in subsidizing students not in need. |

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| Naylor & Bridgewater (2007) | BC, School Fruit and Vegetable Snack Program, Roll-out evaluation 2006-2007 | 3 high schools, one middle school, and 47 elementary schools, n= 51 schools interview participants teachers n=7, administrators n=8, suppliers n=7, parent committees n=8, focus groups | Snack, fruit and vegetable: twice a week along with educational support material | Survey: program satisfaction. Focus group: teachers, some parental advisory committee members, and administrators. Interview: teachers, administrators, suppliers, distributors, parent advisory council members. Delivery logs: receipt of produce, quality, returned from the classroom | Economic feasibility Strengthening of local food systems. Process implementation: satisfaction and fidelity. Food literacy: exposure to new foods | Qualitative and quantitative descriptive. Increased vegetable and fruit intake. Funding, resources (storage) are key, as is educational material for classrooms. Challenges: finding volunteers, storage space, coordinating for delivery. Many benefits were identified including improving eating, trying new foods, increasing awareness about eating healthy, and local foods. Knowledge of BC apples increased. Process evaluation and program fidelity addressed in the report. |
| Prowse (2011) | Manitoba, Nutrition Positive, Fall 2008-Spring 2010 | Grades K-12 Piloted 26 sites involving 3500 students | Breakfast, lunch, snack, fruit, vegetable | Focus group, observation, site visit, interview | Educational. Behaviour. Social aspects: improved attendance, Health Equity: universal. Nutrition: tasting new foods, increasing vegetables and fruit | Qualitative and quantitative descriptive: Benefits: Improved literacy, behaviour, and attendance. Classroom literacy scores increased 5% from the previous year. Discipline decreased from 25% to 1%. Decrease in suspensions. Increase |

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| | | | | | | knowledge and promotes positive attitudes and practices. Challenges included fundraising, staff/volunteers, time, and suitable facilities. |
| Policy and Planning Branch (2006) | New Brunswick, Healthy Minds Breakfast Pilot Program, Oct. 1999-Mar. 2000 | Grades K-5, urban and rural context, information not provided | Breakfast | Survey: program perceptions. One survey on the set-up of the program and the other on long term concerns. Interview: principles - satisfaction and sustainability of the program. Program use statistics | Behaviour | Qualitative and quantitative descriptive. Participation rate of 17.5%, with higher use during the colder months. Stigmatization was a barrier to program use. Principals reported that the program improved behaviour and attendance. Includes a discussion of factors that influenced participation, operational issues, and challenges. |
| Goss Gilroy Inc. (2013) | Newfoundland, Kids Eat Smart, evaluation of ongoing program, conducted in 2013 | Elementary, primary, junior and high school, 6 case study schools, student participants n=91, student non-participants n=29, key | Breakfast, lunch, snack | Focus groups: students - what they liked/did not like, why they participate, benefits, why they felt others did not participate. Interview: students who | Educational: attendance and academic performance. Behaviour. Health equity. | Qualitative case study: Perceived positive impacts on academic performance, thought that the most vulnerable were participating. Benefits include improved awareness of healthy eating, improved school attendance, improved academic effort. Contributes to socialization and improves school climate and links to the community. |

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| | | informants n=12, provincial-level key-informants n=4 | | did not participate - why they did not participate. Principal, program coordinator, teachers and volunteers. Government representatives: policy context and achievement of objectives. | | Improves nutrition and contributes to healthy choices outside of school. Contributes to health and wellness. The report discusses success strategies. |
| Abrey (2008)* | Nova Scotia, Eating Well, Learning Well: Fruit and Vegetable Pilot Project Program, one week pilot | Elementary schools, interviews n=8 | Fruit and vegetable: 1 serving per day, one week pilot | Interview: government and industry stakeholders; case study: document review, field notes. | Strengthen local food systems: supportive environment for promoting local in schools, identify the strengths of the collaboration | Qualitative case study: Sites were satisfied with delivery, had adequate product and storage space, and would participate in the program again if it was offered. There are benefits to business and students in offering local foods. Evaluation of process included in the report. |
| Edward (1998) | Ontario, Etobicoke, Cornwall, Better Beginnings, Better Futures Initiative, initiated in 1993 and 1992 | Etobicoke: Elementary, Cornwall, ages 4-8, group interviews n=69 | Breakfast, lunch, snack, garden. Etobicoke: Snacks 3x/week before and after school | Interview: group interview: parents, teachers, staff, children | Behaviour: attention, concentration, behaviour, mental well-being, and social interaction: social contact. Economic | Qualitative: Benefits included addressing hunger, social contact, nutritious food, introducing new food, teaching opportunities, and developing a community network. Older siblings may not be in the |

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| | | | and lunch to those in need. Cornwall: breakfast program, garden. | | feasibility: changes made to the program due to insufficient finances. Nutrition: behaviours, introduction to new foods. Developing a community network, decreased tension between children and their parents. | program potentially promoting disparities in families. |
| Muthuswamy (2012) | Ontario, Toronto District School Board, Feeding Our Future, Evaluation of first and second years (2009, 2010) | Middle and secondary schools, 7 sites First year: interviews n=52, 3 focus groups, Second year surveys n=4050 | Breakfast | Survey: student-participation, eating habits, quality and quantity of food. Focus group: student. Observation: site visits. Interview: school administrators, teachers, school and program staff. Document review: program records to | Educational: Surveys-attendance, suspension, achievement. Behaviour. Health Equity: students coming from low SES neighbourhoods. | Qualitative with descriptive quantitative. The report was done in the second year using surveys. Data was described as percentages; however, findings were not statistically analyzed. Grade 7 and 8 students who participated most days did better on independent work, initiative, problem solving, and class participation than those who did not regularly participate. Students who participated regularly had higher scores in science, reading, and math, and were more likely to be on track to graduate on time. Students reported better well- being and their health improved, and they |

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| | | | | determine participation rates and implementation communication. | | were less likely to be suspended. Grade 7 and 8 students who ate in the morning achieved better in school, came to school regularly and were less likely to be suspended. Qualitative: Teachers reported improved behaviour, tardiness, ability to stay on task, and fewer behaviour problems. The majority of students participated. Participation rates were highest for grade 6 and then declined up to grade 12. Qualitative data was collected in the first year to describe the implementation evaluation and recommendations. |
| Gates (2010)* | Ontario, Kashechewan, Attawapiskat First Nations Schools, data collected between Nov. 2003-June 2010 | Grades 6-8, n= 443 | Snack, one serving of vegetables and fruit and 1 serving of milk. Assessed pre and after 1 week and 1 year | Web-Q 24 hr recall, Web-Q, Food Frequency Questionnaire. Student, teacher, and principal impressions of snack program. Assessed pre and after 1 week and 1 year | Nutrition: intake improved a week after the program | Mixed methods. Quantitative: After 1 week of the intervention, calcium (p=0.044), and vitamin D (p=0.022) intakes improved, increased milk and alternatives (p=0.034). Knowledge (p=0.05) and intentions (p=0.010) to eat milk and alternatives increased. Improvements were not sustained a year later. Qualitative: Students, teachers, and parents valued the |

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| | | | | | | program. Comprehensive programs improve knowledge and intentions to eat healthy. |
| He et al. (2008)* | Ontario, Northern Fruit and Vegetable Program, Phase II | Grades 5-8, not specified | Snack: fruit and vegetable | Focus group: student perspective | Nutrition: willingness to try new foods, vegetable, and fruit intake. | Qualitative: self-reported. Increased willingness to try new foods, increased vegetable, and fruit intake, felt healthier, had more energy. |
| Valatis (2009) | Ontario, Peel Region Breakfast for Kids | Elementary, middle, high, alternative Survey n=62, interviews n=22 | Breakfast, lunch, snack | Survey: Adapted from: Ontario Child Nutrition Program Evaluation Project, sent to Peel Region programs that had been running for at least a year - program descriptions. Interview: Program coordinators. | Educational, behaviour, mental well-being, social interaction. Economic feasibility, food literacy. | Qualitative and quantitative descriptive: Strengths included open access to students, little stigma when universal, reach a large number of people, provides social opportunities. Benefits to students: academic, social, behavioural, volunteer opportunities, skill development including social, cooking, learning to be responsible, and working with adults. The report includes a process evaluation. |

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| | | | | SWOT analysis. | | |
| Taylor (2003) | Prince Edward Island, Fruit and Vegetable Pilot Program, 6 week intervention | Grades 1-6 N=479 | Snack: fruit and vegetable snack tray once a week for 6 weeks. | Survey: pre-post, food preferences and willingness to try, 3 point schematic faces | Nutrition. Food literacy. | Quantitative: Increased in self-reported willingness to try cauliflower and turnip sticks ($p<0.01$) and no change for other fruit and vegetables. Increased self-reported liking of cantaloupe, cauliflower and turnip sticks ($p<0.0001$), broccoli, carrots, cucumber ($p<0.001$) and grapes ($p<0.05$). |
| Opoku (2016) | Saskatchewan, Food for Thought | Elementary Group interview n= 22 students from grades 4-8 | Lunch, snack | Survey: Principals, community school coordinators. Observation: School food. Interview: Group interviews with students in grades 4-8 were conducted to determine their perceptions and experiences with school lunches. | Social aspects. Food Security: Some programs are targeted. Nutrition: Promote vegetables and fruit, and healthy meals. | Qualitative: Peer connectedness, promoted healthy eating practices at school and at home and increased self-reported willingness to try new foods. Some schools have a universal snack program, some provide snacks based on perceived need. Some teachers integrate food into the curriculum: English, Arts, Science, Math, and Social Sciences. |

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| Gougeon (2008) | Saskatchewan, Saskatoon, CHEP Good Food Inc. (1997-2008) | Elementary schools n=159 lunches and 90 breakfasts | Breakfast, lunch, snack | Focus group: nutrition coordinators to determine training and nutrition guidelines. Observation: foods consumed, plate waste. Interview: nutrition coordinators to determine knowledge about nutrition. guidelines. Weigh food (meals and snacks provided), comparing to 1/3 DRI for lunch and 1/4 DRI for breakfast and snacks. | Nutrition: weighing food to determine nutritional adequacy of meals | Mixed methods. Quantitative: breakfast calories met the requirement for younger children but not older children ($p<0.05$). Protein and fat were adequate ($p<0.05$). Fibre was inadequate in older children ($p<0.05$). Breakfast met most vitamin requirements and exceeded almost all mineral requirements ($p<0.05$). Lunch-protein and carbohydrate were adequate ($p<0.05$). Energy and fibre were inadequate ($p<0.05$). Nearly all vitamins and minerals were adequate ($p<0.05$). Snacks fell short on many requirements ($p<0.05$). Plate waste was low. Meals are nutrient dense and low in calories. Data analyzed according to food groups indicated servings for meat and alternatives was not met. Qualitative: menus are not planned to ensure adequate energy and fibre, rather, they are planned to follow CFGHE. |

## Appendix A.4: School Food Checklist

**School Food Checklist**

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|---|---|---|---|
| School: | Grade: | Child ID: | Recorder: |
| Date: | Sex: Age: | Code Sticker Goes Here | Going home for lunch today? Y / N |
| DOB: | | | Participated in vegetable gardening? Y / N |
| Home Address: | | Ate anything from lunch? Y / N<br>What was eaten: | Participate in school meal program? Y / N<br>☐ a) Every day, or almost every day<br>☐ b) Sometimes or once in a while<br>☐ c) Never<br>More than one serving? Y / N |
| | | Who packed lunch: | |

| Food Category | Description | 1 serving equals | Number of servings 1 | 2 | 3 | 4 | ml/g | Comments |
|---|---|---|---|---|---|---|---|---|
| Bread/Roll | ____White ____Brown | 1 slice, 1/2 Kaiser, 1/2 flatbread | | | | | | |
| Filling | meat/seafood/egg | 1 slice/layer = 30g | | | | | | |
| Cheese (slice) | | 1 slice/layer = 20g | | | | | | |
| Vegetable/Salad | 2 different veg/salad | 1 cup | | | | | | |
| Peanut/pea/seed butter | | 1 Tbsp | | | | | | |
| Sweet spreads | honey, jam, Nutella | 1 tsp | | | | | | |
| Extra | mayo, mustard, sauces, pickles, vegetables | 1 tsp | | | | | | |
| Butter/margarine | | 1 tsp per slice of bread | | | | | | |
| Fast food | hot dog, hamburger, pizza, chicken nuggets, pizza pop, fries | 1 each, 7 chicken nuggets, 1 containe | | | | | | |
| Leftovers/mixed dishes | pasta noodles (incl pkg), rice, meat or mixed dishes | 1 cup | | | | | | |
| Noodles | Instant noodles - dry | 1 pkg | | | | | | |
| Packaged snacks<br>Brand: | potato chips, granola bars, fruit pieces/bars corn chips, pretzels | 1 package | | | | | | |

| Food Category | Description | 1 serving equals | Number of servings 1 | 2 | 3 | 4 | ml/g | Comments |
|---|---|---|---|---|---|---|---|---|
| Cookies, crackers<br>Brand: | sweet, savory or chocolate cookies, rice cakes or other crackers | 1 cookie, 1 rice cake, 7 crackers | | | | | | |
| Candy, chocolate<br>Brand: | | 1 regular size chocolate bar | | | | | | Type, grams |
| Cheese, eggs, dried fruit, nuts, meat stick/jerky | eggs, cheese, raisins, dried fruit, peanuts | 1 egg, 1 inch cubed cheese, ¼ cup dried fruit or nuts | | | | | | |
| Cakes, muffins, buns, scones | cakes, buns, scone, muffin, donuts, tarts | 1 piece of cake, 1 muffin, 1 bun, 1 scone, 1 donut, 1 tart | | | | | | |
| Pastries | Danish, croissant | 1 piece | | | | | | |
| Desserts | ice cream, dairy dessert, jello, pudding | 1 piece or container | | | | | | |
| Yogurt<br>Brand: | regular<br>reduced fat <2% | 1 container/tube | | | | | | |
| Fruit | apple, pear, banana, orange, stone fruit, canned fruit | 1 piece apple, pear, banana, navel orange, peach<br>2 pieces mandarin, plum<br>1 container | | | | | | |
| Vegetables | carrot sticks, celery sticks, broccoli | ½ cup | | | | | | |
| Milk | Plain, flavoured<br>reduced fat <2% | 250 ml/1 cup | | | | | | |
| Soft drinks<br>Brand: | Diet: Y / N | 1 can, 375 ml | | | | | | |
| Fruit juice, kool-aid, etc.<br>Brand: | | 1 package = 250 ml | | | | | | |
| Water | bottled, mineral | | | | | | | |

Notes:

Adapted from Kremer et al. (2006)

**Appendix A.5: Components of interest when looking at Sustainable Food Systems and Food Programs in elementary schools**

We are interested in knowing if your school is involved in any of the following:

1. Nutrition and Health Related Initiatives
    - Improving nutritional intake
    - Increasing food knowledge
    - Helping those that may not have enough to eat
    - Reducing food program stigma
    - Including culturally diverse foods
    - Incorporating food into the curriculum
    - Having healthy foods available (milk program, farm-to-school, breakfast, lunch, food fundraisers, special school days)

2. Environmental Sustainability
    - Making food-related choices that protect the natural environment
    - Incorporating local foods
    - Reducing waste
    - Gardening
    - Promoting connectedness to food or the natural environment
    - Composting
    - Including environmentally sustainable foods (minimally processed, locally grown, organic, seasonal, vegetarian)
    - Having sustainable food purchasing policies (minimally processed, locally sourced, less packaging, and single-serve packages, condiments in bulk, reusable dishes)
    - Recycling
    - Having events on environmental sustainability
    - Reducing greenhouse gas emission and negative environmental impact
    - Having a food garden maintenance and management plan

3. Economic Sustainability
    - Having sufficient resources to staff programs
    - Building capacity
    - Monitoring and evaluating programs

**Interview Questions**

1. What are the current practices around sustainable food systems and school food programs in schools?
2. What would school staff like to do in relation to sustainable food system strategies?

3. What are the barriers, facilitators, and opportunities for adopting curriculum integrated sustainable food systems and food programs in elementary schools?
4. What supports are required to help schools incorporate sustainable food systems strategies and food programs into their practices

## Appendix A.6: School Food Environment Assessment Tool

| SFEAT Indicator | Score | Interpretation of Qualitative Score |
|---|---|---|
| **Food gardens**<br>• Do you have a school garden?<br>• What year was it established?<br>• Which activities use the garden? (teaching about food preparation, teaching about healthy eating, teaching about gardening, teaching about science or other subjects, using food grown for students' consumption, donate to the community, food fundraisers, other) | **0** | No garden available/food grown at school |
| | **1** | School has just started growing some food or the existing garden is not well maintained |
| | **2** | Garden is up and running well, but is not used regularly for multiple activities. |
| | **3** | Garden is used regularly for several different activities |
| | **4** | Garden is well-developed and is a significant part of the school community |
| **Composting systems**<br>• Do you have a composting program?<br>• What year was it established?<br>• Which of the following types of food waste are composted? (waste from the kitchen, waste from cooking classes, waste from students' meals or snacks in lunch room, waste from students' meals or snacks in the classroom, waste from meals or snacks I staff room, school garden or yard waste?) | **0** | No composting at school |
| | **1** | School has just started a composting program or has program that is rarely used |
| | **2** | Composting program is up and running but is not widely available or used throughout the school |
| | **3** | Composting program is widely available and used throughout the school |
| | **4** | Composting program is well developed and is a significant part of the school community |
| **Food Preparation Activities**<br>• Are any school facilities or kitchens used for student food skill education or clubs/after/school programs that prepare food or work on cooking skills?<br>• How are the school facilities or kitchens used? By whom and how often?<br>• Are school gardens used to teach about food preparation? If so, how well used are they?<br>• Are there courses that teach about food prep? | **0** | No food preparation activities |
| | **1** | Occasional food prep activities are available for some students |
| | **2** | Regular food prep activities are integrated into the curriculum or after-school activities for some grades, but are not available widely or used by most students. |
| | **3** | Food prep activities are well integrated into school courses and activities. Most students can prepare food in multiple contexts. |
| | **4** | Food prep activities are highly integrated, using healthy, local products, culturally diverse supported by parent advisory councils, use products grown at school or with community partners. |
| **Food Related Teaching and Learning Activities**<br>• How does the school integrate food and nutrition in the classroom?<br>• Are any school facilities or kitchens used for student education about food preparation or cooking? How are facilities used? By whom and how often? | **0** | No food or sustainable food systems-related activities used for teaching |
| | **1** | Some food or SFS activities initiated by infrequently. |
| | **2** | Food or SFS topics and activities are incorporated in multiple grades and classes, 50% or fewer grades are exposed |

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| • Are any school facilities used for teaching about food prep or managing food/composting?<br>• In what ways is food integrated into the school curricula or teaching activities? | **3** | Integration of teaching and learning in within food programs, gardens etc. is well-developed, more than 50% of grades exposed |
| | **4** | Well-developed integration of the entire food cycle into teaching and learning activities for all classes and grades. |

| **SFEAT Indicator** | **Score** | **Interpretation of Qualitative Score** |
|---|---|---|
| **Availability of Healthy Food** | **0** | Foods provided or sold offer almost no healthy options and are almost always unhealthy foods. |
| • Which food programs are available? (milk program, farm to school, breakfast, lunch, food fundraisers, special food days)<br>• How frequently are food fundraisers or special food days held? When they are held, what type of food is offered?<br>• Has the school recently increased availability of healthier items?<br>• Has the school recently stopped the availability of less healthy items?<br>• Have events that encourage healthy food choices been held? what ones?<br>• Are healthy food items available? How often?<br>• Are unhealthy food items available? How often?<br>• Are foods/beverages sold in vending machines, school stores and fundraisers in compliance with school nutrition guidelines? | **1** | School tries to make some healthy options available and tries to limit unhealthy foods. |
| | **2** | Healthy options are frequently, but not always available and unhealthy foods are rarely available. |
| | **3** | Healthy options are always available and unhealthy foods are rarely available. |
| | **4** | Providing healthy foods is fully supported and implemented by the school community. |

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| **Availability of environmentally sustainable foods**<br>• How often are the following foods available: minimally processed, locally grown, organic, seasonal or vegetarian options?<br>• Do food purchasing policies support environmentally choices (minimally processes, locally sourced, less packaging, reduced use of single serve packages, condiments in bulk, reusable dishware?)<br>• Have environmentally sustainable activities/programmes been held (waste free lunches, sustainability fairs). Which ones and how often?<br>• How important is environmental sustainability when making school meal planning or purchasing decisions? | **0** | Foods provided or sold offer almost no environmentally sustainable options |
| | **1** | School tries to some environmentally sustainable options available. |
| | **2** | Environmentally sustainable options are regularly available. |
| | **3** | Environmentally sustainable options are always available. |
| | **4** | Ensuring availability of environmentally sustainable food is fully supported and implemented by the school community. |

| SFEAT Indicator | Score | Interpretation of Qualitative Score |
|---|---|---|
| **Recycling**<br>• Do you have a recycling program?<br>• What year was it established?<br>• Which of the following types of items are recycled? (beverage containers, paper products, other) | **0** | No recycling at school |
| | **1** | School has just started a recycling program or has program that is rarely used |
| | **2** | Recycling program is up and running but is not widely available or used throughout the school |
| | **3** | Recycling program is widely available and used throughout the school |
| | **4** | Recycling program is well developed and is a significant part of the school community |

Adapted from Black et al., 2015

**Appendix A.7: Curriculum outcomes related to sustainability and food literacy – grades 2-8**

**Grade 2**

| Subject | Outcome |
|---|---|
| **Arts Education (2011)** | CP2.1 Create and connect dance phrases using ideas about community as stimuli (e.g., our school, community events, farm life, city life, cultural heritage)<br>CP2.3 Adopt roles and collaborate with others in role within dramatic contexts, using community as inspiration (e.g., contexts inspired by local stories and songs, photographs of local people and places, or events from real or fictional communities).<br>CP2.7 Create visual artworks that draw on observations and express ideas about own communities. |
| **Health (2010)** | USC2.1 Demonstrate a basic understanding of how thoughts, feelings, and actions influence health and wellbeing.<br>Examine daily habits/routines that are healthy/unhealthy (e.g., eating breakfast/skipping breakfast, recycling/littering).<br>USC2.2 Determine how healthy snacking practices influence personal health.<br>USC2.4 Examine social and personal meanings of "respect" and establish ways to show respect for self, persons, living things, possessions, and the environment. |
| **Science (2011)** | AN2.1 Analyze the growth and development of familiar animals, including birds, fish, insects, reptiles, amphibians, and mammals, during their life cycles.<br>AN2.3 Assess the interdependence of humans and animals in natural and constructed environment<br><br>Curriculum integration with<br>• Arts Education -<br>o Creating sketches, drawings, and other appropriate representations of the life cycles of humans and familiar animals.<br>o Examining ways in which others have represented their scientific understanding of the importance of air and water for the survival of living things through visual art, drama, dance, and music.<br>• Health Education<br>o Discussing the importance of ways in which traditional and contemporary food choices contribute to personal growth and development.<br>o Demonstrating respect for animals and the environment when investigating animal growth and development and air and water in the environment. |

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| | • Math<br>  ○ Examining repeating patterns in the growth and development of humans and familiar animals.<br>• Physical Education<br>  ○ Discussing the importance of nutrition, clean air, and water for personal health and development.<br>• Social Studies<br>  ○ Examining how the absence or presence of water in the natural environment influences community development. •<br>  ○ Investigating the importance of air and water in traditional First Nations worldviews. |

**Grade 3**

| Subject | Outcome |
|---|---|
| **Arts Education (2011)** | CP3.1 Generate a variety of alternatives and solutions in movement explorations (improvisation) using the environment (e.g., natural, constructed, imagined) as stimuli<br>CP3.3 Sustain roles in dramatic situations and accept/respond to others in role, using the environment (e.g., natural, constructed, imagined) as inspiration.<br>CP3.5 Demonstrate basic skills in use of voice and a variety of sound objects and instruments (traditional and/or homemade) using the environment (e.g., natural, constructed, imagined) as inspiration.<br>CP3.7 Create visual art works that express ideas about the natural, constructed, and imagined environments.<br>CR3.2 Respond to arts expressions that use the environment (natural, constructed, imagined) as inspiration. |
| **English Language Arts (2010)** | Curriculum integration with<br>• Other subject areas |
| **Health (2010)** | AP3.1 Use the understandings, skills, and confidences related to healthy foods and physical activity, one's "inner self," helpful and harmful substances, healthy family and home, safety at home, and impact of violence. |
| **Science (2011)** | PL3.1 Investigate the growth and development of plants, including the conditions necessary for germination.<br>PL3.2 Analyze the interdependence among plants, individuals, society, and the environment.<br>ES3.1 Investigate the characteristics, including soil composition and ability to absorb water, of different types of soils in their environment.<br>ES3.2 Analyze the interdependence between soil and living things, including the importance of soil for individuals, society, and all components of the environment.<br><br>Curriculum integration with |

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| | • Arts Education<br>  ○ Creating dance phrases or dramatic representations which demonstrate the variety of ways that individuals and communities value and use soil.<br>• Health Education<br>  ○ Comparing how harmful substances affect the health of people and plants<br>• Science<br>  ○ Using charts, lists, bar graphs, and tables to record, organize, and represent first-hand data related to plant growth, structures, and soil absorption.<br>  ○ Examining how plants, soil, and structures change over time<br>• Social Studies<br>  ○ Exploring the influence of individual and communal beliefs, past and present, on land-use practices. |
| **Social Studies (2010)** | IN 3.3 Illustrate examples of interdependence of communities.<br>DR 3.2 Assess the degree to which the geography and related environmental and climatic factors influence ways of living on and with the land.<br>DR 3.3 Compare the beliefs of various communities around the world regarding living on and with the land.<br>RW 3.1 Appraise the ways communities meet their members' needs and wants.<br>RW 3.2 Analyze the creation and distribution of wealth in communities studied.<br>RW 3.3 Evaluate the ways in which technologies have impacted daily life. |

**Grade 4**

| **Subject** | **Outcome** |
|---|---|
| **English Language Arts (2010)** | CR 4.1 Comprehend and respond to a variety of grade-level texts (including contemporary, and traditional visual, oral, written, and multimedia texts that<br>address: Identity (e.g., Expressing myself), community (e.g. Building community), social responsibility (e.g. Preserving a habitat) and support response with evidence from text and own experiences<br><br>Curriculum integration with<br>• Other subject areas |
| **Health Education (2010)** | USC 4.1 (Understanding, skills, and confidences) Assess what healthy eating and physical activity mean for pre-adolescence.<br>Dm 4.1 (Decision Making) Investigate the importance of personal responsibility and communication in making informed decisions related to healthy eating and physical activity, prevention/management of health |

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| | challenges, negotiating disagreements, safety and protection, personal identity, and stressors.<br>AP 4.1 (Action Planning)<br>Design and apply, with guidance, two four-day action plans that require communication related to healthy eating and physical activity, prevention/ management of health challenges, negotiating disagreements, safety and protection, personal identity, and stressors.<br>Curriculum Integration with math: caloric intake, serving sizes based on CFG, whole numbers, meaning of fractions |
| **Science (2011)** | HC 4.1 (Habitats and Communities) Investigate the interdependence of plants and animals, including humans, within habitats and communities.<br>HC 4.2 Analyze the structures and behaviours of plants and animals that enable them to exist in various habitats.<br>HC 4.3 Assess the effects of natural and human activities on habitats and communities, and propose actions to maintain or restore habitats<br><br>Curriculum integration with<br>• Arts Education<br>o Conducting a simulation, role play, dance composition, or dramatic representation to demonstrate how plants, animals, and landscapes interact with each other in the local community.<br>o Gathering observations of local habitats, communities, and landscapes using sketches, drawings, photographs, and/or video recordings.<br>• Math<br>o Analyze patterns found in habitats and populations of plants and animals mathematically and represent data graphically<br>• Health<br>o Comparing how healthy and unhealthy eating practices influence humans and animals<br>• Social Studies<br>o Identifying characteristics of Saskatchewan landscapes which influence and have influenced migration patterns of animals and settlement patterns of humans.<br>o Examining the impact of traditional and contemporary lifestyles on plant and animal habitats and communities in Saskatchewan.<br>o Investigating relationships between increased agricultural knowledge and current and traditional farming and farm stewardship practices. |
| **Social Studies (2010)** | RW 4.2 (Resources and Wealth) Investigate the importance of agriculture to the economy and culture of Saskatchewan. |

**Grade 5**

| Subject | Outcome |
|---|---|
| **English Language Arts (2010)** | Curriculum integration with<br>• Other subject areas |
| **Health (2010)** | USC 5.1 (Understanding, skills, and confidences) Analyze personal eating practices.<br>DM 5.1 (Decision making) Analyze possible obstacles and envision solutions to addressing health challenges related to personal eating practices, changes of puberty, impact of illness/disease, identity and well-being, violence, peer pressure, and self-regulation.<br>AP 5.1 (Action Planning) Design and implement, with guidance, two five-day action plans that embrace health opportunities or address health challenges related to personal eating practices, changes of puberty, impact of illness/disease, identity and well-being, violence, peer pressure, and self-regulation.<br>Curriculum integration with math: analyze personal eating practices, looking at food labels and food guides. Use bar graphs. Use personal and researched data regarding eating practices of themselves and family members or friends. |
| **Social Studies (2010)** | RW 5.1 (Resources and wealth) Explain the importance of sustainable management of the environment to Canada's future. |

**Grade 6**

| Subject | Outcome |
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| **Science (2009)** | DL 6.1 (Life Science: Diversity of Living Things) Recognize, describe, and appreciate the diversity of living things in local and other ecosystems, and explore related careers. (CP, SI)<br>DL 6.2 Examine how humans organize understanding of the diversity of living things. (CP, SI)<br>DL 6.3 Analyze the characteristics and behaviours of vertebrates (i.e., mammals, birds, reptiles, amphibians, and fish) and invertebrates. (SI)<br>DL 6.4 Examine and describe structures and behaviours that help:<br>• individual living organisms survive in their environments in the short term<br>• species of living organisms adapt to their environments in the long term. (CP, DM, SI)<br>D 6.5 Assess effects of micro-organisms on past and present society, and contributions of science and technology to human understanding of micro-organisms. (CP, DM, SI) |

**Grade 7**

| Subject | Outcome |
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| **Arts Education (2009)** | CP 7.1 (Creative Productive) Create dance compositions that express ideas about the importance of place (e.g., relationships to the land, local geology, region, urban/rural environments).<br>CP 7.6 Express ideas about the importance of place (e.g., relationships to the land, local geology, region, urban/rural environments) in drama and/or collective creation.<br>CP 7.10 Create visual artworks that express ideas about the importance of place (e.g., relationship to the land, local geology, region, urban/rural landscapes, and environment)<br>CH 7.2 (Cultural/Historical) Investigate how Indigenous artists from around the world reflect the importance of place (e.g., relationship to the land, geology, region, urban/rural environments).<br><br>Curriculum Integration:<br>Health Education:<br>• USC7.4 Demonstrate ... understanding of the importance of nurturing harmony in relationships (with self, others, and the environment)...<br>Social Studies<br>• DR7.2 Appraise the impact of human habitation on the natural environment [place] in Canada |
| **English Language Arts (2008)** | CR 7.1 (Comprehend and Respond) View, listen to, read, comprehend, and respond to a variety of texts that address identity (e.g., Thinking for Oneself), social responsibility (e.g., Participating and Giving Our Personal Best), and efficacy (e.g., Doing Our Part for Planet Earth). |
| **Health Education (2009)** | USC 7.5 (Understanding, skills, and confidence) Evaluate personal food choices and needs by applying accurate and current nutritional knowledge (e.g., content labels).<br>USC 7.7 Investigate and express an understanding of possible discrepancies in morals (e.g., beliefs, ethics, virtues, understanding of right/wrong) that may determine and/or affect the commitment to the well-being of self, family, community, and the environment.<br>DM 7.8 (Decision Making) Examine and demonstrate personal commitment to making health decisions related to blood-borne pathogen information, safety practices, harmonious relationships, food choices, interpersonal skills, and morality.<br>DM 7.9 Examine health opportunities and challenges to establish personal commitment goal statements related to blood-borne pathogen information, safety practices, harmonious relationships, food choices, interpersonal skills, and morality.<br>AP 7.10 (Action Planning) Design, implement, and evaluate three six-day action plans that demonstrate a personal commitment to responsible health action related to blood-borne pathogen information, safety |

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| | practices, harmonious relationships, food choices, interpersonal skills, and morality. |
| **Physical Education (2009)** | PE 7.2 Examine personal daily nutritional habits and fluid intake practices that support healthy participation in various types of movement activities and the attainment or maintenance of healthy body weight and body composition. |
| **Science (2009)** | IE 7.1 (Interactions with ecosystems) Relate key aspects of Indigenous knowledge to their understanding of ecosystems. (CP)<br>IE 7.2 Observe, illustrate, and analyze living organisms within local ecosystems as part of interconnected food webs, populations, and communities. (SI)<br>IE 7.3 Evaluate biogeochemical cycles (water, carbon, and nitrogen) as representations of energy flow and the cycling of matter through ecosystems. (CP, SI)<br>IE 7.4 Analyze how ecosystems change in response to natural and human influences, and propose actions to reduce the impact of human behaviour on a specific ecosystem. (DM, CP)<br>HT 7.1 (Heat and Temperature) Assess the impact of past and current heating and cooling technologies related to food, clothing, and shelter on self, society, and the environment. (TPS, DM, CP)<br>HT 7.2 Explain how understanding differences between states of matter and the effect of heat on changes in state provide evidence for the particle theory. (SI)<br>HT 7.3 Investigate principles and applications of heat transfer via the processes of conduction, convection, and radiation. (SI)<br><br>Curriculum Integration with<br>• Arts Education<br>o Create arts expressions using FN stories and Indigenous Knowledge of ecosystems as inspiration of work<br>o Create visual artworks using student observations of living organisms within local ecosystems (egthe sketches and photographs)<br>o Create instrumental and/or vocal soundscapes to represent the changing patterns and interconnected cycles observed in ecosystems.<br>o Analyze how traditional arts, world music instruments, and dance often have deep connections to the local environments and interconnected ecosystems (e.g., Auz digeridoos, Inuit throat singing, beads, FN drums, and flutes)<br>• Health Education<br>o Analyze how ecosystems change in response to natural and human influences, and proposing actions to reduce the impact of human behaviour on a specific ecosystem makes students understand the importance of nurturing |

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| | harmonious relationships between humans and their environment<br>• Physical Education<br>o Student investigations into the problems and issues regarding land use can contribute to an understanding of the influences that may affect options for active living in a community<br>o When students propose actions to reduce the impact of human behaviour on a specific ecosystem in science, they can consider how participation in alternate environment movement activities might influence and be influenced by these actions.<br>• Social studies<br>o Connection between the environment and all living things<br>o Explore the relationship between ecosystems students study and the location and distribution of human populations and communities<br>o Examine the impact of the natural environment on human habitation and the impact of human habitation on natural environments<br>o Draw conclusions about the relationship between natural resources and the lifestyles of populations |
| **Social Studies (2009)** | DR 7.2 (Dynamic relationships) Appraise the impact of human habitation on the natural environment in Canada, and in a selection of Pacific Rim and northern circumpolar countries.<br>RW 7.3 (Resources and Wealth) Assess the ecological stewardship of economies of Canada and the circumpolar and Pacific Rim countries. |

**Grade 8**

| Subject | Outcome |
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| **Arts Education (2009)** | CP 8.1 (Creative Productive) Create dance compositions that express ideas and student perspectives on social issues (e.g., poverty, racism, homophobia, sustainability, gangs).<br>CP 8.6 Express student perspectives on social issues (e.g., poverty, racism, homophobia, sustainability, gangs) in drama and/or collective creation<br>CP 8.9 Compose sound compositions in response to social issues (e.g., poverty, racism, homophobia, sustainability, gangs).<br>CP 8.10 Create visual artworks that express student perspectives on social issues (e.g., poverty, racism, homophobia, sustainability). |
| **Health Education (2009)** | USC 8.6 (Understanding, skills, confidences) Examine and assess the concept of sustainability from many perspectives and develop an understanding of its implications for the well-being of self, others, and the environment.<br>DM 8.9 (Decision making) Analyze the health opportunities and challenges and establish "support others" personal goal statements, related |

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| | to family roles and responsibilities, non-curable infections/diseases, violence and abuse, body image, sustainability, and sexual health.<br>AP 8.10 (Action Planning) Design, implement, and evaluate three seven-day action plans that establish multiple supports for responsible health action related to family roles and responsibilities, non-curable infections/diseases, violence and abuse, body image, sustainability, and sexual health. |
| **Science (2009)** | Acknowledges traditional and local knowledge, indigenous knowledge, sustainability and stewardship, and safety.<br>WS 8.1 (Water systems on earth) Analyze the impact of natural and human-induced changes to the characteristics and distribution of water in local, regional, and national ecosystems.<br>Curriculum Integration:<br>• Health<br>  ○ Analyzing the impact of natural and human changes to the distribution and characteristics of water in local and regional ecosystems will include the examination of human practices and activities that pose a threat to the environment and to the health of people. |
| **Social Studies (2009)** | RW 8.3 (Resources and Wealth) Critique the approaches of Canada and Canadians to environmental stewardship and sustainability. |

The curriculum components are from the Saskatchewan Curriculum found on the website (Ministry of Education, nd) The dates vary by subject and are indicated on the above table.

**Appendix A.8: Barriers, Facilitators and Opportunities**

The following chart depicts barriers, facilitators, and opportunities of different components of sustainable food systems and food programs that were derived from interviews in two elementary schools.

| Program Aspect | Barriers | Facilitators | Opportunities |
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| Access | • Food program is not widely promoted<br>• Some families are too proud to have their kids participate<br>• Not always able to offer halal or options are limited<br>• When kids find out what is for lunch, if it is something they like, more will participate – which makes it difficult for planning and allergies | | • Have fruit bowls in classrooms<br>• Universal program |
| Composting | • Transfer of knowledge when the person responsible leaves<br>• Do not know how to compost in winter<br>• Vandalism<br>• Infrastructure | • Training – not currently composting | • Find out when green bins run<br>• Division-wide composting |
| Vermi composting | • Need buy-in, space, safe space for the worms, optics of having rotting foods in the school, vandalism | | • People vandalize when they don't understand-include students so they will look out for the worms |
| Cooking - kids | • Kids' hygiene, managing the whole class in the kitchen, prep time, time | • Facilities, expertise | • Teach kids cooking skills |
| Curriculum-resources | • Dismantling of the central resource center<br>• Having to create or keep resources up to date; i.e., CFG changes, not getting a warning of the need for resource updates | • Teaching a class more than once | • Resources |

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| | • Not having resources, not having space for resources, lending resources out and not getting everything back, funding to put kits together at the school level<br>• Cut of teacher/librarian time,<br>• Challenging to find local content, time<br>• Competing priorities (citizenship) | | |
| Curriculum and pedagogy | • It takes a couple of months to do an inquiry project. There are challenges with some students in doing a project like this (literacy)<br>• Teaching to cover the curriculum in this context, split classes | • Kitchen space<br>• Teachers are creative<br>• Nursing students work with teachers to collaborate on health-based curriculum outcomes<br>• Online curriculum resources<br>• A nutrition program that supports the curriculum (healthy food provided)<br>• Other organizations provide help for special events<br>• There's overlap between health and social studies | • Document and curriculum support and resources<br>• Farm tours, grocery store tours, farmer's market tour<br>• You can relate gardening to almost all of the core subjects |
| Facilities | • Insufficient storage space to get food delivered – need to order $1000 at a time, delivery fees<br>• Share kitchen with daycare – arranged by the school division<br>• workspace limited (counter/tables)<br>• Two fridges, two freezers, and some cupboard space – great but limited, | • Industrial dishwasher, two sinks in the kitchen,<br>• Fridges, freezers, cupboards, and workspace<br>• Organized | • Way of transporting food up and downstairs |

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| | two stoves- residential-style equipment<br>• An obscene number of stairs and kitchen is in the basement<br>• Not enough space for all students to eat in the basement<br>• If food is not served upstairs, kids are carrying hot food up 90 stairs<br>• need more serving equipment and composting, prep table<br>• Handwashing sinks and water fountains are limited | • Classrooms have sinks | |

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| Food program | • Insufficient funding and time<br>• Food prep takes a lot of time<br>• Allergies, halal, food preferences are challenging to accommodate<br>• Have to plan around donations (what is received) which are inconsistent<br>• Food donations are not always healthy<br>• Participation rate varies (makes it challenging to predict the amount of food needed)<br>• Maybe they don't want sandwiches; more participate when hot meals are served<br>• More students will participate if they know what is being served and they like it<br>• Not enough time to prep for hot meals<br>• Students sometimes throw out the lunch they bring<br>• During clinic days, other people have access to the kitchen and what is on the shelves; food goes missing<br>• Weather causes students to be late and miss the breakfast cart but still need to eat<br>• Budget is fixed regardless of need and has to last for ten months<br>• Diminishing budgets with increasing demand<br>• Food programs used to be better supported, but then some were taken away – what are they supposed to do when the kids say they are hungry?<br>• Where does it leave families if the program is discontinued?<br>• Maintaining relationships when programs change | • Sustainable funding, grants, donations, milk grant to get milk, cheese, yogurt<br>• Carts<br>• Skilled, resourceful staff<br>• Easier to budget better when purchasing herself- as donations fluctuate, have to plan around that, strategic planning<br>• The bus comes early enough for kids to participate in breakfast<br>• Kids help with meal prep and clean up | • Cooking classes, teach the kids food skills, so it won't be so difficult for them when they get older<br>• Provide hot meals at lunch because the kids might not be getting this at home.<br>• Explore how parents feel about having food responsibilities taken away<br>• Commitment to ongoing, sufficient funding, more staffing |
| | There isn't enough capacity for all children to participate in programs, human resources, funding | • Program is accessible to all | |

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| Foods offered | • Staff not always able to choose what foods are available<br>• Food choice and variety is limited by funding, time and human resources, unable to increase variety due to costs<br>• Some kids are picky<br>• Not everyone understands what halal is – need the support (educational) to provide appropriate food<br>• Discussing healthy food options in the Canadian context to immigrant families<br>• Eating what is not familiar is challenging | • Supports from Health Promoting schools – more hands to do the work so different items can be offered<br>• Food skills of the staff | • Getting students' opinion of what they like<br>• Educate about halal |
| Fundraising | • Healthy food fundraisers lose money<br>• Pita pit, not all healthy choices (chips and a cookie) | | • Have funding available, so students do not have to fundraise with unhealthy foods |
| Gardening | • When things don't grow well, and harvest is less than expected, limited capacity to grow a lot of food or and limited space if each classroom has space<br>• No continuity in maintenance, weeds<br>• Growing season, someone to look after it over the summer, school is out when the garden is most productive<br>• Lack of equipment<br>• Programs follow teachers; they don't stay with the school/classroom<br>• Given limited time<br>• Gardening might not be chosen as the priority<br>• Lacking a gardening instruction manual<br>• Lack of funding or time and energy to cobble together grants. | • Garden space<br>• Parent volunteers<br>• Elementary curriculum supports<br>• Teacher interest and experience<br>• Vegetables are accepted by all cultures – not like animal products<br>• Nurse funded by the health region that supports health promotion (cooking garden food),<br>• Senior students built garden boxes<br>• Little Green Thumbs – get | • Inform and include parents to get more community involvement<br>• Education for the adults, kids, community members – cultivate appreciation, so there is less vandalism<br>• Fence<br>• More garden space, tools<br>• Document and curriculum |

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| | | supplies (soil, seeds, fertilizer), garden boxes, lamp, journals for the kids, do not have to apply every year, training<br>• A number of start-up grants available from various organizations | resources to support<br>• Contacts of people who have done it before<br>• Kid mentoring<br>• Division-wide program<br>• After-school programming |
| | • Vandalism | • Fence video camera **– don't currently have** | • Build community to prevent vandalism, put gardens in front where they are more visible |
| Indoor gardening | • Regrow romaine, but people touch it<br>• Space, money, | | |
| General programming | | • Health assessment tool – had school-specific data on schools. This was done before but **no longer**<br>• Kitchen facilities | • Assessment data so that programming could be targeted.<br>• Track vegetable and fruit intake |
| | • Limited time – teachers having to do things on their own time to get it done | • Willingness of teachers<br>• Empower kids to mentor kids | • Recruit volunteers, |
| | • Educate and balance what is happening at home (unhealthy food)<br>• Consequence of kids speaking up at home (advocating for healthy choices) as these comments might not always be welcome, role of influencing what happens at home<br>• Complex issues – challenging and tiring to try to fix. Issues reach into | • Kids sometimes spend time and help out in the kitchen, and this helps to address behavioural issues because they have a job to do | |

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| | the home- where the school doesn't have jurisdiction | | |
| | • Need to be respectful that people are doing their best – referring to when unhealthy foods are packed in lunches. Kids are more concerned with having food than its nutritional quality. | • School food programs allow the school to help children and provide foods they might not otherwise have access to | |
| | • Energy spent on dental and eye appointments, but little is allocated to prevention | • Nursing students do a dental blitz | |
| | • Children then get MacDonald's brought to them at school – works against a supportive environment for the other children | | |
| | • Professional development is focused on curriculum, not health or food security | | |
| Mealtimes/ social environment | • Limited supervision, kids watch TV while they eat lunch<br>• Having kids in the classroom can be challenging at times behaviourally<br>• Some kids eat slow and don't finish before having to go out for recess | • Community members can get paid to supervise, but sometimes they don't have the skills or the relationships with the kids | |
| Nutrition worker | • Not enough time, no relief coverage, challenging to attend professional development events | • Dip into supervisor budget to cover more time, skilled worker<br>• Professional development has been available | • Increase time to allow for professional development<br>• share skills with students by having kids cook and clean up |
| Policies and practices | • Good programs come into place, but when the staff are no longer funded or the priorities changes, the program does not continue. The nutrition policies and support were more | • Clear policy, support from the top that this is a priority, they need to be written, and | • Administrative support and a champion for the cause, |

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| | prominent a few years ago. Nutrition Positive has been watered down. There are many competing priorities.<br>• Keeping it at the forefront when there are competing priorities<br>• Staff cuts have made it difficult to continue to run programs; some staff work on their own time to get their work done<br>• When teachers leave or change roles, its challenging to maintain the program<br>• Difficult to get a yearly commitment for programs to run<br>• Other programs or incentives do not support healthy eating initiative i.e. class treats | staff need to be trained. Nutrition has been supported since the 1980s, and they did a good job.<br>• People that are willing to work for a "paycheque of the heart." | other external supports<br>• Make it part of the school culture<br>• Education so everyone knows what is going on re: meal program and food policies<br>• Adequate funding so food policies can be followed – do not need to use unhealthy food for incentives or fundraising<br>• Other people (nutritionist) or organizations (CHEP) that can support the cause, community school philosophy |
| | • Not consistent with policies, people don't know what the policies are<br>• Teachers take away pop but then drink pop in front of the kids<br>• Challenge having the policy filter through all levels, staff bring in fast food or unhealthy foods | | |
| Recycling | • When the champion leaves the school, program may not continue | • Initiative champion (recycling) | |

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| | | • Classrooms that take responsibility for the initiative, students are rewarded when they get the bottle deposits back, students having pride in their job, shed | |
| Reduce packaging | • Donations come in single-serve containers<br>• Single-serve items save time | | |
| Reusable dishes | • Clinic days– not enough time to do dishes<br>• Staff cuts – not able to do dishes<br>• Utensils go missing<br>• Not enough human resources to wash dishes | • Industrial dishwasher | |
| Relationships | • Volunteers – people not always available when you need them: sick, mental health issues, addictions | • Essential in this setting- both with families and the students<br>• Have events where food is provided to families, and a variety of choices are offered (interviews),<br>• Nursing students help | Recruit volunteers |
| Waste reduction | • Need breakfast to go, so use Styrofoam cups and plastic spoons so kids could take breakfast to the classroom<br>• Kids throw out food | • Teachers and staff bring food waste up with the kids when they see it is an issue | |
| Food environment outside of school | • The external school environment – whether it is community, built, or family, works against, i.e. food swamp (few healthy food options and many unhealthy foods) | | |

**Appendix A.9: Socio-ecological Framework - Barriers and Facilitators**

Note: **Macrosystem, Larger cultural context:** Food norms, eating patterns, food marketing, food system, food assistance programs were not included as participants did not identify factors from this level.

**Barriers**

| **Barriers** | **Individual and personal factors:** Attitude, preferences, knowledge, age, sex, skill, lifestyle | **Microsystem, Face to interactions:** Teachers, health nurse, nursing students, practices, curriculum, role modeling, social norms (what is taught), students | **Mesosystem, Interconnections between settings:** Community, school division, Ministry of Education (policies and curriculum, Health Promoting School, Nutrition Positive), CHEP | **Exosystem, Link between school and context where school does not have an active role:** Volunteer organizations, donors, businesses, built environment |
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| Competing priorities | • Limited time and many tasks | • Feeding children: healthy food versus alleviating hunger<br>• Supporting medical appointments versus prevention initiatives<br>• Two programs need the same space at the same time<br>• Using unhealthy foods to fundraise for activities<br>• Staff model unhealthy food | • Policy and curriculum – new priorities identified, support for former priorities may wane<br>• Professional development is for literacy and math, not health | • Food donations are not always healthy |
| Education and Communication | • Need skills: composting<br>• Need knowledge: eating healthy, waste reduction, composting | • Need knowledge: halal options- parents and school on same page, aiding versus enabling | | |

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| | options, worms, food skills, halal options, school programs (all staff on same page), peer pressure, importance of nutritional quality<br>• Food safe and hygiene | | | |
| Food Preferences and Allergies | • Allergies, nuts, halal, vegetarian, food habits/preferences<br>• Some students were throwing out their lunches to participate in lunch program<br>• Throwing food out<br>• How parents feel about school providing food | | | |
| Lunch hour management | | • Supervision is voluntary, behavioural issues in children<br>• Turn TV on over lunch to manage behaviour<br>• 25 minutes to eat lunch<br>• Some children eat slow | Union rules | |
| Home influences | | • Food brought from home is unhealthy<br>• Some families are too proud to have their children participate | | |

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| | | • Food and budgeting skills in the home<br>• Receptiveness to new ideas in the home | | |
| No continuity | | • Meal demands fluctuate<br>• Resources damaged due to vandalism, so programs cannot continue<br>• Teachers may leave the school and take the programs and expertise with them<br>• Difficult to get yearly commitment for projects | | |
| Resources | | • Without centrally located resources to support curriculum, the teachers need to search for and procure and keep resources updated themselves. Librarian can assist however, budget is not sufficient to develop kits and space is not available to store. Priorities may be directed by the Division/Ministry.<br>• Lack of curriculum support resources | | |
| Policies and support | | • Food treats in the classroom are not always healthy<br>• Need stronger policies, a champion, and support from senior management to weather competing priorities and change in staffing, need to make part of the culture.<br>• Most staff are unable to identify the written policies | • Food policy used to be clearer and more in the forefront<br>• Need stronger policies, a champion, and support from senior management to weather competing | |

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| | | • There are not policies around what children can bring for lunch ie. McDonald's<br>• Sometimes staff bring McDonald's – there is nothing else available in the neighbourhood<br>• Policies not consistently filtering through all levels | priorities and change in staffing<br>• Need consistent training and support from the division – it is not currently supported by professional development | |
| Vandalism and missing items | | • Gardens and composters have been vandalized<br>• Cutlery goes missing so started using plastic<br>• Food goes missing<br>• Need a way to keep worms safe<br>• Concern with touching garden vegetables due to poor hygiene | | |
| Manpower, funding, time, and facility | | • Insufficient resources leave programs relying on donations. Menu selections determined by time available and food donations received.<br>• Food variety is limited due to insufficient funding<br>• Budget allocated needs to last for the year regardless of demand<br>• Over time, funding has decreased and demand has increased.<br>• Concern over losing donors or the food programs<br>• Insufficient time allocated to get the work done | • Staff cuts cause changes in how programs are run<br>• Sharing facility with other groups compromises the safety of resources and decreases equipment availability | |

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| | | • Could look for volunteers, however, community members have other issues they are struggling with<br>• Professional development for nutrition worker is scheduled when she is working<br>• No relief coverage causes other staff to struggle to get their own work done<br>• Many classrooms are split classrooms<br>• Not enough time and support to teach cooking to the kids<br>• Disposable dishes used because not enough time to do dishes<br>• Need time, space, funding, tools and summer care for gardening<br>• Insufficient time to develop and update resources<br>• Lunchroom is limited in size, storage, prep area and equipment is limited<br>• Building construction and insufficient storage space makes food delivery to school challenging<br>• Single serve packages are more convenient, and often what is received for donations, but create more waste<br>• Timing of garden production – most productive and needs management when school is out | | |

**Appendix A.10: Socio-ecological Framework - Facilitators and Supports**

| **Facilitators** | **Individual and personal factors:** Attitude, preferences, knowledge, age, sex, skill, lifestyle | 1. **Level 1 Face to interactions:** Teachers, health nurse, nursing students, practices, curriculum, role modeling, social norms (what is taught) | **Level 2 Interconnections between settings:** Community, school division, Ministry of Education (policies and curriculum, Health Promoting School, Nutrition Positive), CHEP | **Level 3 Link between school and context where the school does not have an active role:** Volunteer organizations, donors, businesses, the built environment |
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| Funding, partnerships, community support | | • Nursing students and others support school events such as community meals during interviews, curriculum activities<br>• Students supporting the program (built garden boxes, help prepare food, help clean up, run the recycling program)<br>• Organizations that come in and do presentations, Health Promoting Schools | • Community volunteers | • Food donations, grants, some funding |
| Staff, champions | | • Staff work for a "paycheque of the heart" – they care<br>• Student champions- recycling program<br>• Staff are creative and resourceful, proficient, organized, skilled, supportive, and passionate | | |
| Infrastructure | | • Garden space, commercial dishwasher, space, carts, sinks, garden shed, freezers, fridge, and cooler space, organized | | |

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| Policy and support | | • Previously had community-specific data so programming could be targeted<br>• Community school philosophy and funding<br>• Healthy snacks and lunches<br>• Healthy foods in a nutrition program to support curricular concepts<br>• The bus comes early enough students can participate in breakfast | • Educate parents and community about gardening to prevent vandalism | |
| Resources | | • Curriculum resources<br>• Little Green Thumbs – training, growing equipment, ongoing support | | |