



GROUNDS FOR ACTION

By Anne C. Bell & Janet E. Dymont

Promoting Physical Activity through
School Ground Greening in Canada



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The Toyota Evergreen Learning Grounds program brings school communities together to transform barren school grounds into healthy, natural and creative outdoor classrooms. By planting trees, shrubs and vines, and adding shade, seating and heritage vegetable gardens, the learning opportunities come alive. These outdoor classrooms provide students with a healthy and safe place to play, learn and develop a genuine respect for nature and each other.

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Table of Contents

6	Executive Summary
11	Introduction and Context
12	Canadian children and the overweight/obesity crisis
13	Responding to the crisis
14	Schools and school grounds as sites of intervention
16	Green school grounds
17	Research Design
22	Results and Discussion
22	Sites and levels of physical activity
26	Quality of play and physical activity
31	Equitable opportunities for play and physical activity
36	Physical activity within the wider community
39	Food gardens, physical activity and nutritional awareness
42	Limiting and enabling factors: Design and culture
51	Conclusion and Recommendations
55	References

Executive Summary

About This Report

Grounds for Action presents the findings of a national survey that explored the relationship between green school grounds and physical activity at elementary schools across Canada. This is a timely investigation given the growing epidemic of overweight and obesity among Canadian children. Children spend on average about 25% of their school day outdoors on the school ground. This setting thus offers important opportunities for promoting physical activity and health.

Key Findings

Grounds for Action examines the ways that greening initiatives can influence the quality and quantity of active play on school grounds. It analyzes information provided by 105 parents, teachers and administrators at 59 elementary schools in British Columbia, Alberta, Manitoba, Ontario, Quebec and Nova Scotia. The evidence indicates that green school grounds can play a significant role in promoting physical activity – especially moderate and light levels of activity – by increasing the range of enjoyable, non-competitive, open-ended forms of play at school. When asked to compare their school ground before and after greening, almost half of the respondents (49%) reported that their green school ground now promotes more vigorous activity (40% reported no change; 2% reported less activity; 9% were unsure). The majority of respondents (71%) indicated that greening has also resulted in more moderate and/or light physical activity (17% reported no change; 1% reported less activity; 11% were unsure).

Through greening, school grounds diversify the play repertoire, creating opportunities for children of all ages, interests and abilities to jump, climb, dig, lift and generally get moving in ways that nurture all aspects of their health and development. These positive findings emerged consistently across the schools participating in the survey, despite the differences in size, student population and geographic location. The following are the key findings:

- 1. Compared to conventional school grounds, green schools grounds appeal to a wider variety of student interests and support a wider variety of play opportunities that promote more vigorous, moderate and light physical activity.** On green school grounds trees, shrubs, rocks and logs define a variety of places to run, climb, hide and socialize. Moveable, natural materials such as sticks, branches, leaves and stones provide endless opportunities to engage in imaginative play. Food gardens invite children to be more physically active through digging, planting, weeding, raking, watering and other gardening activities.

- 2. On green school grounds, a different pattern of activity emerges: more students are engaged in moderate and light physical activity.** In addition to the vigorous, rule-bound games played on turf and asphalt, children are climbing boulders, chasing butterflies, building shelters, collecting leaves and engaging in other forms of open-ended play. These non-competitive activities invite boys and girls of all ages and abilities to get moving.
- 3. Green school grounds improve the quality of play by encouraging children to be active in ways that promote their physical, social and cognitive well-being.** They promote more active, imaginative and constructive play and more civil behaviour. By involving kids in hands-on food production, they promote greater awareness of and appreciation for healthy foods. And by supporting activities such as gardening, bird feeding, catching and releasing animals (e.g. tadpoles, insects), sketching and exploring nature, green school grounds strengthen the link between play and learning and better integrate physical activity into everyday school life.
- 4. Green school grounds create opportunities for the broader school community to participate in gardening, maintenance and after-school leisure activities.** In so doing, they offer many ways to model healthy, active lifestyles for younger generations, as children work or play alongside teachers, parents, grandparents and neighbours.
- 5. The design and culture of school grounds can limit or enable physical activity.** To stimulate active play, school grounds should be designed to provide adequate space, diversity and interest (e.g., trees, bushes, rocks, logs, as well as playing fields). Safety, comfort and maintenance issues also need to be taken into consideration at the design stage. Children are more active when school ground rules, policies and supervision allow for non-competitive, open-ended play, as well as opportunities to care for the garden or green space.

Green school grounds can play an important role in health promotion. As this study reveals, they can benefit an entire student body and the broader school community by supporting healthier activity on a regular basis. For these and other reasons, they should figure prominently as a pre-emptive measure within comprehensive school-based strategies to address overweight and obesity.

Currently, green school grounds are *not* considered in this light, so their potential remains largely unrealized. To pursue the opportunities they present, we offer the following recommendations:

Recommendations

1. Policy. Public policy is needed across a range of sectors to address the dual problems of inactivity and poor eating habits. High-level political direction (e.g., at the federal, provincial and territorial levels) is key to ensuring that local interventions, such as green school grounds, are adequately resourced and integrated into existing programs. In the United States, for example, federal legislation requires each local educational agency to establish a school wellness policy, including goals for physical activity, nutrition education and other school-based activities to promote student well-being. Under each school wellness policy a plan must be developed to measure implementation of the policy and to ensure the involvement of the local school community.¹

In Canada, several policy options have been proposed to address overweight and obesity in the school setting. These focus on health and physical education requirements, school food policies and safe and active routes to schools (Raine, 2004).

Policy proposals should be expanded to include interventions that address both the design and use of school grounds. These are needed to guide education ministries, school boards and schools in setting their priorities, budgets and school ground design standards so that they support opportunities for physical activity on school grounds.

Recommendations

- Health Canada should allocate resources to establish and support research, policies and programs aimed at developing healthy outdoor environments for children, such as green school grounds.
- Education ministries, school boards and schools should officially recognize, at the policy level, the broad health benefits of green school grounds, including their potential to promote physical activity and better nutrition.
- The policies developed by education ministries and school boards should support and promote school ground greening initiatives through adequate financing and the development of standards for green school ground design.
- Health authorities should develop policies that promote healthy outdoor settings for children, including green school grounds.

2. Intersectoral collaboration. The overweight/obesity crisis cannot be tackled solely by individuals and

¹ See section 204 of the *Child Nutrition and Women Infant Children (WIC) Reauthorization Act of 2004*.

organizations working within the obesity field (Raine, 2004). Integrated and collaborative approaches involving many sectors are needed to share knowledge and experiences, to enhance planning, to identify research and policy priorities and to galvanize public and political support for change. Such integration is already underway with the ***Integrated Pan-Canadian Healthy Living Strategy*** (The Secretariat for the Intersectoral Healthy Living Network et al., 2005). Approved by the federal, provincial and territorial Ministers of Health in 2005, the strategy provides a national framework for addressing health issues. It sets targets for physical activity, healthy eating and healthy weights and calls for a coordinated effort of parents, families, professionals, governments, non-government organizations and the private sector to address the overweight/obesity crisis.

School grounds are an obvious setting where health, education and environmental design issues overlap, and where intersectoral collaboration would be of benefit. To date, however, this has not happened. School-based health-promotion efforts related to overweight and obesity have focused on curriculum (health and physical education), food choices (cafeterias, vending machines) and active modes of transportation to and from school. The potential contribution of green school grounds has gone unrecognized.

Recommendation

- Individuals and organizations within the health, environment and education sectors should work together to exchange information, identify policy and research priorities, galvanize public support and lobby decision-makers (governments, school boards, health agencies) to promote healthy school environments, including green school grounds.

3. Curriculum and Teacher Education. Curriculum is an important component of school-based health promotion. While ***Grounds for Action*** focuses primarily on students' physical activity during their free time, green school grounds can also support physical activity during class time if properly integrated into the curriculum. As this study indicates, for example, food gardens provide an excellent opportunity to teach and learn about nutrition through direct experience. Indeed, implementing, caring for and studying aspects of the green school ground offer many opportunities to deliver the curriculum across a range of subject areas while being physically active. Research clearly indicates that learning experiences are far more powerful when they are hands-on and applied in this way (Dyment, 2005a).

Unfortunately, few curriculum documents in Canada explicitly endorse the use of school grounds as sites for curriculum delivery. It's assumed that the primary purpose of education is to develop children's minds, and priority is given to indoor, text-centered learning.

The situation is compounded by the fact that teachers receive little, if any, training on teaching outdoors. Consequently, they lack the knowledge, confidence and motivation to do so (Dyment, 2005b).

To change this, we need a shift in the culture of schooling. We need to develop curriculum that provides clear direction and examples of how to use school grounds for outdoor, experiential learning. Teachers also need professional development opportunities to build their confidence and competence in teaching outdoors.

Recommendations

- Education ministries should ensure that curriculum policies explicitly state the value of outdoor learning and provide concrete examples of how the curriculum can be delivered on school grounds.
- Faculties of education and school boards should train teachers how to teach outside the classroom.

4. Research. Knowledge development, exchange and application are key components of the *Integrated Pan-Canadian Healthy Living Strategy*. But there is currently little understanding of the environmental interventions that might best support physical activity and better nutrition among children (The Secretariat for the Intersectoral Healthy Living Network et al., 2005). If we are to fully understand and realize the potential of green school grounds to increase the physical activity level of children, continued research on this relationship is crucial.

Grounds for Action relied on parent, teacher and administrator perceptions of student behaviour on school grounds. The next step in the research is direct observation and measurement. This should be designed to include the voices missing from *Grounds for Action*, especially those of the target population: children. Research methods would need to be appropriate for children (e.g., mapping, arts-based research, participant observation, group interviews) and could potentially involve them as co-researchers (see, Fraser, Lewis, Ding, Kellert, & Robinson, 2004).

Recommendations

- Undertake a comparative study to monitor (through direct observation and mapping) and measure (through the use of accelerometers or pedometers) children's physical activity behaviours on school grounds with and without green elements.
- Undertake a longitudinal study, tracking cohorts of children as they move through the school system, to explore the influence of greening initiatives on their physical activity and eating patterns over the long term.

Introduction and Context

Overweight and obesity are epidemic in many countries, including Canada. As health experts and advocates grapple with this global health crisis, they are emphasizing the importance of broad societal strategies to address the root causes of the problem: environments that promote sedentary lifestyles and the over-consumption of high-fat foods. It's widely acknowledged that we need to modify the physical and social environments in which we live, work and play, so they become more conducive to physical activity and better eating habits. Environmental factors related to urban design, such as the negative health impacts of sprawl, the walkability of neighbourhoods, the presence of parks and open space and the degree of access to healthy foods, are under increasing scrutiny.

One environmental factor of particular importance to children's physical activity levels appears to be the presence of parks and open space (Frank & Niece, 2005). And one such open space where children spend a considerable amount of time is the school ground. Thus, school grounds merit consideration as a setting for intervention. When it comes to promoting physical activity, however, not all school grounds are created equal. Their design matters, influencing the patterns, quality and levels of participation in active play. The “culture” of school grounds – the social dynamics among students, the rules that govern play, the role of supervisors – also has a significant impact on physical activity.

In ***Grounds for Action***, Evergreen presents the findings of a Canada-wide study into the relationship between green school grounds and physical activity. “Green school grounds” is an umbrella term used here to describe a range of changes occurring on school grounds across Canada, including naturalization, habitat restoration, tree planting, food gardening and other efforts to bring nature back to school. This report analyzes information provided by 105 parents, teachers and administrators at 59 elementary schools from Vancouver, British Columbia to Brookfield, Nova Scotia. Through a survey, participants shared their perceptions about:

- the levels and types of physical activity occurring on their school ground
- the conditions and factors affecting levels of active play
- the impact of greening on the quality of play and on active community involvement in school life
- the impact of greening on physical activity across differences in gender, physical competence, age, ability and income.

Participants also commented on the unique role that school food gardens can play in addressing another root cause of overweight and obesity: lack of awareness of and appreciation for healthy foods.

While exploratory in nature, *Grounds for Action* provides a solid base from which to understand the role school ground greening can play in promoting physical activity. The survey results span a diversity of geographic and demographic circumstances, as well as a variety of approaches to greening. Urban, suburban and rural schools are represented, for example, some with fewer than 200 students, and some with over 1,000. The ethnicity of the student population at individual schools varied widely, from almost entirely Caucasian at about half the schools, to largely Aboriginal, Afro-Canadian, Indo-Canadian, Arabic and/or Asian at others. A diversity of design elements characterized the greening projects themselves, including ponds, greenhouses and fitness trails at a few schools, food gardens at about a third of the schools, and trees, wildflower gardens, rocks and seating areas at most of the schools. While most projects were between three and ten years old, some were almost brand new, and a few were much older.

Despite these differences among schools and projects, survey participants consistently reported that their green school ground is having a positive influence on physical activity. All across Canada, green school grounds are supporting a wider variety of play activities, enhancing the quality of active play, inviting greater community use of the school ground and promoting more physical activity generally. To fully understand and appreciate these benefits, however, it's important to situate them within the broader context of the overweight/obesity crisis, the array of interventions being proposed and employed and the school ground greening movement.

Canadian children and the overweight/obesity crisis

Over half of Canadian children and youth aged five to 17 are not active enough for optimal growth and development (Public Health Agency of Canada, no date). One in three children is overweight, and one in ten is obese, numbers that have risen dramatically over the last two decades (Active Healthy Kids Canada, 2005; Canadian Institute for Health Information, 2004; Raine, 2004). This disturbing situation was brought to wide public attention with the

"In 2004, the combined overweight/obesity rate for each sex was about 70 % higher than it had been in 1978/79, and the obesity rate was 2.5 times higher." (Shields, 2004, p. 2)

2005 release of *Dropping the Ball: Canada's Report Card On Physical Activity for Children and Youth* (Active Healthy Kids Canada, 2005), a nation-wide study on physical activity opportunities and behaviours among Canadian children. As suggested by the title, a troubling picture emerged from the study, with an overall grade of "D" assigned, based on a variety of indicators.

The effects of this health crisis are serious, with more and more Canadian children suffering from problems associated with increased childhood obesity, Type 2 Diabetes, and other chronic diseases. In addition, obese children tend to have an increased risk of becoming overweight in adulthood, with higher morbidity and mortality rates (Public Health Agency of Canada, no date). The direct and indirect costs to the Canadian health care system stand to be considerable (Heart and Stroke Foundation of Canada, 2005), with the cost of obesity in Canada estimated at \$1.8 billion in 1997 (Birmingham, Muller, Palepu, Spinelli, & Anis, 1999), and the annual economic burden of physical inactivity estimated at \$5.3 billion (The Secretariat for the Intersectoral Healthy Living Network, F/P/T Healthy Living Task Group, & F/P/T Advisory Committee on Population Health and Health Security, 2005).

While the problems associated with overweight and obesity are serious across all of Canada, certain factors, such as socio-economic status, education, gender, ethnicity and geographic location, are directly linked to obesity in young Canadians (Oliver & Hayes, 2005; Raine, 2004; Shields, 2004; Tremblay & Willms, 2003). In fact, children from families with low incomes are 1.5 times as likely to be obese as their counterparts from higher income families (Canadian Institute for Health Information, 2004). In households where no members have more than a high school diploma, children are more likely to be overweight or obese than in households where members have a post-secondary education (Shields, 2004). Boys and girls have their own unique challenges, with more boys being overweight than girls (31 % compared to 23 %), and yet girls reporting less daily physical activity than boys (10-15 % differential) (Action for Healthy Kids, 2004). Youth of Aboriginal origin (off-reserve) have a higher than average overweight/obesity rate (Shields, 2004). Overweight and obesity rates for young people tend to be highest in the Atlantic provinces (Shields, 2004).

Responding to the crisis

The reasons for the growing number of obese children in Canada are complex, yet readily understood. Stated most simply, children in Canada are sitting more, moving less and eating too much unhealthy food. Numerous environmental and societal factors have been identified as determinants of these unhealthy behaviours. These include:

- insufficient “walkability” and “playability” of neighbourhoods, insofar as they encourage car use and discourage walking, cycling and active forms of leisure
- increased “screen time” (television, computers)
- unequal access to participation in organized and unorganized sport/community programs (function of gender, socio-economic status)

- reduction in daily physical education classes and lack of teachers trained as health and physical education specialists
- lack of access to healthy food choices (function of the built environment, the school environment, the family environment, socio-economic status)
- shifts in food consumption patterns, especially the increase in consumption of snacks, soft drinks and fast foods
- marketing/advertising that promotes the consumption of unhealthy food.

In response to these diverse and pervasive influences, it is generally agreed that health promotion strategies must be integrated and complementary, and must work at the individual, community, environment and policy levels (The Secretariat for the Intersectoral Healthy Living Network et al., 2005). In other words, health experts and advocates have moved beyond the historical focus on individual behaviours, recognizing that interventions must influence the environments within which choices about nutrition and physical activity are made (Raine, 2004). Accordingly, a range of environment-based strategies is recommended, involving sectors and settings not directly linked to the health promotion field. Schools are one such setting.

**“Prevention [of overweight and obesity] is not just the responsibility of individuals but also requires structural changes in societies.”
(World Health Organization, 1998, p. 240)**

Schools and school grounds as sites of intervention

As the World Health Organization suggests, the prevention of overweight and obesity “should begin early in life, and should involve the development and maintenance of lifelong healthy eating and physical activity patterns” (World Health Organization, 1998, p. 240). Seen in this light, schools are an obvious setting for establishing healthy habits and promoting change (Active Healthy Kids Canada, 2005; Canadian Institute for Health Information, 2006; Ronson & MacDougall, no date). In fact, many schools in Canada have taken up the overweight/obesity challenge with strategies that typically include increasing the amount of physical education offered, providing healthier food choices in the cafeteria and encouraging walking and cycling to and from school.

While a healthy school environment is a recognized component of coordinated school health programs (Canadian Institute for Health Information, 2006), school grounds are seldom directly mentioned within strategies intended to influence children's eating or activity behaviours. This

is despite the significant amount of time that children spend there on a daily basis. Indeed, at the schools participating in this study, children are spending, on average, about 110 minutes a day on the school ground. This amounts to about 25% of their school day and includes:

- 15 minutes before school (range: 1-45 minutes)
- 17 minutes during morning recess (range: 5-25 minutes)
- 37 minutes during lunch (range: 5-90 minutes)
- 17 minutes during afternoon recess (range: 5-45 minutes)
- 23 minutes after school (range: 1-120 minutes)

When one considers that children attend school about 200 days per year, there can be little doubt that school grounds represent an environment worthy of attention in school-based health-promotion initiatives.

Most school grounds consist of open expanses of turf and asphalt, features which offer valuable opportunities for active play in rule-bound games like basketball, tag, baseball and four-square. But many children are not interested or able to play in such vigorous, rule-bound activities (Dyment, 2005), and are therefore relegated to the sidelines.

Moreover, the vigorous level of activity provided by competitive, rule-bound games is not in itself adequate to respond to the overweight/obesity crisis. *Canada's Physical Activity Guide for Youth* recommends, for example, an increase in moderate activity as well as vigorous activity (Canadian Institute for Health Information, 2006). Moderate levels of physical activity, such as those achieved through cycling and walking, can reduce the risk of obesity (Frank & Niece, 2005). Recent studies suggest that various forms of leisure activity, such as dance and art, may also be of benefit (Tremblay & Willms, 2003) and point to the importance of increasing the range of enjoyable, non-competitive physical activities for children (Kumanyika, Jeffrey, Morabia, Ritenbaugh, & Antipatas, 2002).

If school grounds are to realize their potential to address overweight and obesity, they must offer opportunities for forms of active play that appeal more broadly to children of varying interests and abilities. This is where green school grounds stand to make an important contribution. By their very design they create new opportunities for more children to engage in active play.

**"Schools remain the best environment to consistently engage nearly all of Canadian kids."
(Active Healthy Kids Canada, 2005, p.16)**

Green school grounds

School ground greening is a growing international movement that focuses primarily on the design, use and culture of school grounds, with a view to improving the quality of children's play and learning experiences. Schools around the world have embraced the notion of greening and are transforming hard, barren expanses of turf and asphalt into places that include a diversity of natural and built elements, such as shelters, rock amphitheatres, trees, shrubs, wildflower meadows, ponds, grassy berms and food gardens. School ground greening is particularly prominent in Canada, Australia, the United Kingdom, the United States, Scandinavia, New Zealand and South Africa.

Researchers across a range of disciplines (e.g., education, psychology, sociology, architecture) have noted the impacts of these spaces (Bell, 2001; Cheskey, 1994; Dymont, 2005a; Malone & Tranter, 2003b; R.C. Moore & Wong, 1997; Titman, 1994). Some have discussed health benefits, especially the immediate physical ones such as protection from ultraviolet radiation (Evergreen, 2006; Greenwood, Soulos, & Thomas, 1998; Queensland Health, 2002). Other recognized health issues on school grounds revolve around the elimination of pesticides (Daniel, 1991) and the potential of food gardens in helping students to understand food production and healthy food choices (Canaris, 1995; Dillon, Rickinson, Sanders, Teamey, & Benefield, 2003; Morris, Briggs, & Zidenberg-Cherr, 2002). The social, mental and physical dimensions of health have also been alluded to by researchers investigating the relationship between the type, quality and diversity of play spaces and the type, quality, and diversity of play behaviours (Barbour, 1999; Kirkby, 1989; Malone & Tranter, 2003b).

While the intersection of green school grounds and health has received some attention, few studies have directly explored the implications of greening for physical activity. To this end, ***Grounds for Action*** takes a critical look at the design of school grounds, the rules that govern them, their role in school and community life and the types of play and social interactions that they invite and support. Although exploratory in nature, this study lays the groundwork for future research and suggests opportunities for change.

The remainder of this report is divided into the following major sections. In the **Research Design** section, the research approach is explained, including the process of reviewing the literature, the design and pilot-testing of the survey, the selection of schools and study participants and the data analysis. The major findings are presented and discussed in the **Results and Discussion** section, which is organized around the six research questions (RQ). The **Conclusion and Recommendations** section proposes several ways that health advocates can move forward with the findings emerging from this study and highlights future research priorities.

Research Design

This study began with an extensive literature review to determine what was known about the relationship between school grounds and physical activity and to situate that issue within on-going discussions about the overweight/obesity crisis. Major thematic areas covered included healthy schools, health promotion initiatives, physical activity and green school grounds. The literature review revealed several studies of relevance to the research topic, but little focusing directly on the relationship between school grounds and physical activity. Thus it pointed to the need for broad-based, exploratory research of the sort well suited to a national survey.

Research questions

The literature review shaped the development of the central research question and six focused sub-questions:

Central Research Question: How do green school grounds affect the quantity and quality of physical activity among elementary school children (kindergarten to grade eight)?

Secondary Research Questions (RQ):

RQ 1. What is the relationship between school ground design features and the levels and types of physical activity on the school ground?

RQ 2. How do green school grounds influence the quality of play and physical activity?

RQ 3. Do green school grounds encourage physical activity across a range of student populations (e.g., across differences of gender, age, physical/social/intellectual ability/socio-economic status)?

RQ 4. Do green school grounds influence physical activity among the wider school community?

RQ 5. How do food gardens promote physical activity and nutritional awareness?

RQ 6. What factors or conditions limit or enable physical activity on green school grounds?

Questionnaire development

A questionnaire was designed to gather results from and understand trends across a large number of Canadian schools, thus ensuring adequate geographical representation and statistical relevance to the study. Although consisting primarily of closed questions, it also included open-ended questions to elicit additional comments, insights and explanations.

Prior to distribution, the content validity of the questionnaire was judged by a panel of six experts who evaluated the pertinence of the items relative to the research questions. The panel consisted of academics and practitioners with expertise in health and physical education, physical education pedagogy and

health-promoting school programs. The survey received very high overall ratings and demonstrated sufficient content validity evidence from the expert judges to proceed. It was then revised in light of the reviewers' comments, pilot tested and further revised.

Selection of schools

A purposeful sampling protocol was used to determine which schools were invited to participate in the survey (de Vaus, 1996). Specifically, the research team worked with Evergreen's² network of associates and colleagues to identify candidate schools that met the following criteria:

1. the greened site is sufficiently developed and defined so that a comparison can be made with its prior/ungreened state
2. children have access to the greened site during their free time (before and after school, at recess)
3. diversity of socio-economic status of schools (schools from a wide variety of neighbourhoods)
4. diversity of grade levels (kindergarten to grade eight)
5. diversity of urban, suburban, small town and rural schools across Canada.

The first criterion was intended to ensure that survey participants would be able to respond to questions tracking change with respect to physical activity levels and patterns – something that would be impossible if projects were only partially completed or simply too small. The second criterion was intended to exclude schools where children were not allowed to use the greened areas of the school ground during their free time. These two criteria no doubt shaped the results in important ways, selecting only for schools where there was a **possibility** for greening projects to have had an impact on physical activity and for survey participants to have noticed and been able to comment on change, if it had occurred. The final three criteria were intended to ensure that a broad range of schools was represented.

Survey

A package of three questionnaires was distributed to 145 schools in British Columbia, Alberta, Manitoba, Ontario, Quebec, Nova Scotia and Newfoundland (total of 435 questionnaires). At each school, the questionnaires were to be completed by individuals involved in the greening project, including, if possible, a parent, a teacher and an administrator.

It was anticipated that participants would have varying levels of experience in greening efforts and would offer a variety of perspectives, depending on their position. To further tease out a range of responses, the

²Evergreen is a charitable organization whose mission is to bring communities and nature together for the benefit of both. It supports school ground greening initiatives across Canada.

questionnaires provided participants with opportunities to indicate if and how their greening initiative influenced the physical activity of students in both positive and negative ways.

Out of the 145 schools invited to participate, 59 returned at least one questionnaire (41% response rate at the school level). As expected, given the range of schools originally contacted, the schools from which responses were received were very diverse. They included 27 urban, 21 suburban and 11 rural schools, located across Canada, with small to large staff and student populations (see Table 1). The ethnicity of the student population at individual schools varied widely, from almost entirely Caucasian at about half the schools, to largely Aboriginal, Afro-Canadian, Indo-Canadian, Arabic and/or Asian at others. The greening projects at the schools were also varied, having been in place for between 1 and 26 years.

In terms of individual questionnaires, 105 out of a possible 435 questionnaires were returned (24% response rate at the questionnaire level). Twenty-seven parents, 45 teachers and 29 administrators completed questionnaires. These individuals differed in terms of their age, gender and teaching experience, as well as their level of interest in greening initiatives (see Table 2).

Data analysis

The questionnaires were analyzed using a statistical analysis program (Statistics Program for the Social Sciences, SPSS Version 12) to understand basic trends in participants' responses and to explore if and how responses differed as a function of individual characteristics (e.g., age, gender, interest), school characteristics (e.g., number of students, geographic location) and greening project characteristics (e.g., number of design elements).

Qualitative data from the open-ended questions were reviewed to identify potential themes and topics relevant to the research questions.

Table 1***Background Information on Schools***

Characteristic and Variable		Count	% of school
Location			
	Urban	27	46
	Suburban	21	35
	Rural	11	19
Length of school ground greening project (years)			
	<2	9	15
	2-5	27	45
	6-10	18	31
	>11	5	9
Number of students			
	<200	12	21
	200-500	32	53
	501-1000	14	24
	>1000	1	2
Number of staff			
	<20	29	49
	20-40	27	47
	41-60	1	1
	>60	2	3
Provinces			
	British Columbia	5	8
	Alberta	7	12
	Manitoba	10	17
	Ontario	26	45
	Quebec	5	8
	Nova Scotia	6	10

Note. Total = 59 schools.

Table 2***Background Information on Respondents***

Characteristic and Variable		Count	% of Respondents
Role			
	Principal	29	28
	Involved teacher	48	45
	Parent	28	27
Gender			
	Male	83	79
	Female	22	21
Age			
	20-29	2	2
	30-39	27	26
	40-49	41	39
	50-65	35	33
Highest level of education completed			
	College diploma	21	20
	Undergraduate	45	43
	Masters	31	29
	Doctorate	1	1
	Other	7	7
Years working in public/private education system			
	0-5	5	5
	6-10	14	13
	11-20	30	29
	More than 20	56	53
Number of years involved with school ground greening projects			
	0-5	81	77
	6-10	19	18
	11-20	4	4
	More than 20	1	1
Level of interest with school ground greening projects			
	Not interested	0	0
	Somewhat interested	4	4
	Interested	20	19
	Very interested	81	77

Note. Total = 105 study participants.

Results and Discussion



Sites and levels of physical activity

RQ 1. What is the relationship between school ground design features and the levels and types of physical activity on the school ground?

To appreciate this relationship, it's important first to consider how greening has transformed the school landscape. According to survey participants, the change has been dramatic. When asked to indicate which features were present prior to greening, they painted a clear image of relatively uniform environments that consisted of asphalt (90% of respondents), play structures (80%), trees (80%), lawn and turf playing fields (75%) and ornamental shrubs and flowers (58%). When asked to list other features, participants mentioned sand areas, picnic tables, gardens (memorial, peace, winter and herb gardens), baseball diamonds and a basketball court. Whether on the East coast or West coast, whether urban, suburban or rural, whether large or small, school grounds in Canada that have not been greened tend to conform to a conventional, homogeneous design template.

Survey participants portrayed a very different picture of their school grounds after greening. The green school grounds feature more trees (96% of respondents) and more shrubs (87%) as well as rocks/boulders (66%), wildflower gardens (65%), floral gardens (49%), butterfly gardens (41%), sand (38%), logs (38%), berms (31%), water features (7%) and food gardens (27%). Some emphasize ecological systems, including elements such as woodland habitat (35%), grassland habitat (20%), wetland habitat (10%), bird feeders (31%) and nesting structures for birds (27%). Many are enhanced with art (25%) and most provide gathering/seating areas (81%) to augment the aesthetic and social value of the space. Others with a strong environmental education focus feature elements such as nature trails (22%), composting stations (42%), vermicomposters (10%) and greenhouses (6%). Some explicitly emphasize physical activity through the development of fitness trails (12%). When asked to list other design elements that had not been itemized in the questionnaire, participants mentioned an ethnobotanical garden (focus on plants used for cultural or medicinal purposes), an arboretum, a sundial, a shade structure, a skating rink, stepping stones and signage.



Sites of active play

Clearly, green school grounds stand out from conventional school grounds in terms of landscape diversity and a multi-purpose design focus. But do their diverse design elements create inviting places for children to engage in active play? Survey participants say yes.

When asked to estimate the percentage of students engaged in physical activity on various parts of the school ground on a typical day, survey participants indicated that the majority of students are using all parts of the school ground to engage in physical activity. Specifically, 'many' or 'most' of the students are using the turf playing field (87% of respondents), the asphalt (83%), manufactured play structures (75%) and greened areas of the school ground (66%) for active play. Greened areas are thus an important location for promoting physical activity, adding to the more traditional opportunities provided by turf, asphalt and play structures.

Levels of active play

Survey participants were asked to indicate the levels of physical activity (vigorous, moderate, light) that were occurring on different parts of the school ground (turf, asphalt, play structures, greened areas). The following explanations of levels of active play were provided in the questionnaire:

Vigorous physical activity: makes people breathe hard; equivalent to jogging (e.g., skipping rope, running, rule-bound competitive sports like soccer or basketball)

Moderate physical activity: causes a slight but noticeable increase in breathing and heart rate; equivalent to brisk walking (e.g., building forts or shelters, exploring nature, digging, climbing)

Light physical activity: does not affect breathing or heart rate; equivalent to slow walking (e.g., moving light objects like toys, stones or sand, acting out roles and situations, hide and seek, picking fruit or vegetables, games like hopscotch or bouncing balls)

Generally, participants reported that all parts of the school ground are being used to promote all levels of physical activity. As illustrated in Figure 1, turf and asphalt support more vigorous and moderate levels of activity than light levels of activity. So do play structures, though the emphasis shifts from vigorous to moderate levels of activity. A different pattern of activity emerges on greened areas of school grounds: these tend to support more moderate and light activity than vigorous activity.

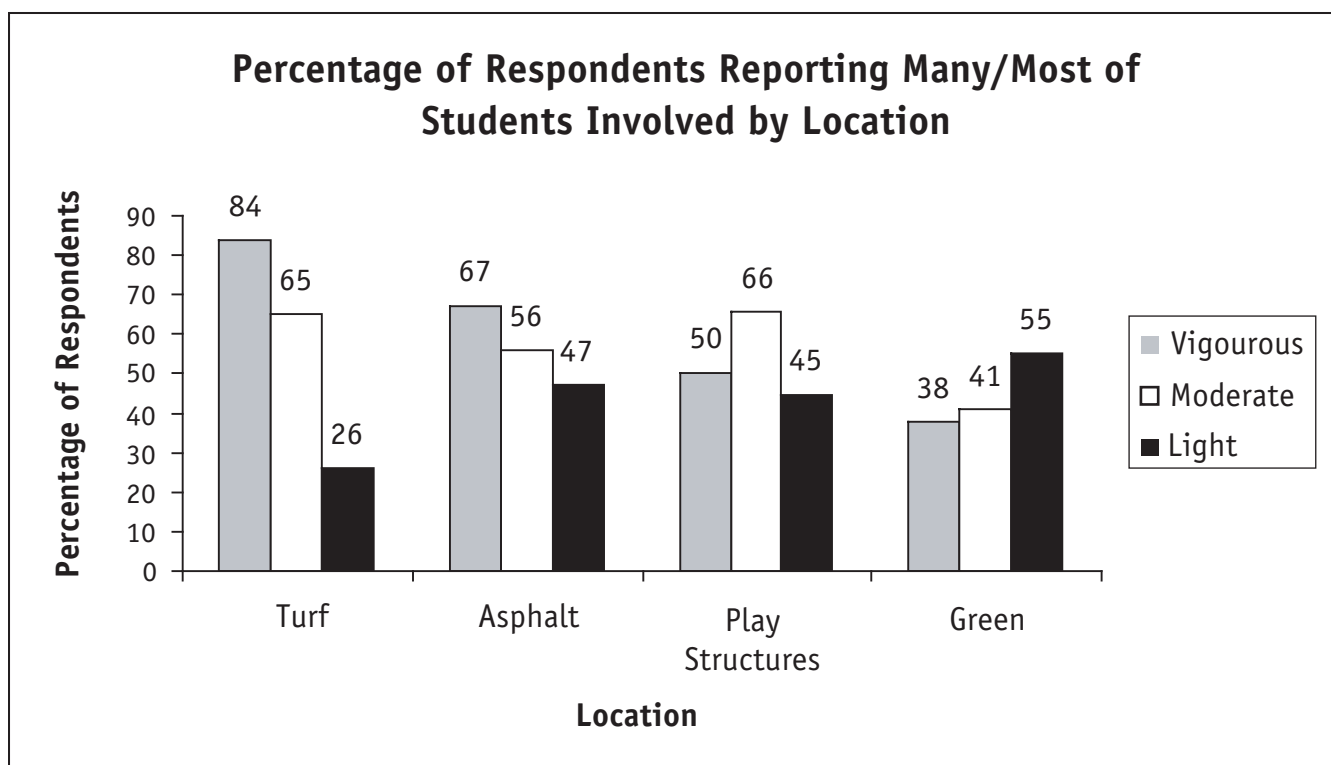


Figure 1: Percentage of Respondents Reporting Many/Most of sStudents Involved by Location.

While 38% of participants indicated that many or most students engage in vigorous physical activity on the greened areas of the school ground, these areas are more important for moderate (41%) and light (55%) levels of activity. These results reflect the unique role that green school grounds can assume in providing spaces for alternative forms of active play (see next section 'Quality of play and physical activity'), in addition to the conventional activities supported by turf, asphalt and play structures.

In fact, green school grounds across Canada are encouraging children to get moving. When asked to compare their school ground before and after greening, almost half of the respondents (49%) reported that their green school ground now promotes more vigorous activity (40% reported no change; 2% reported less activity; 9% were unsure). The majority of respondents (71%) indicated that greening has also resulted in more moderate and/or light physical activity (17% reported no change; 1% reported less activity; 11% were unsure).

This finding is significant given the important roles of moderate and light levels of activity in addressing overweight and obesity. The vigorous level of activity provided by active, rule-bound games (best supported by turf and asphalt play surfaces) is not in itself adequate to respond to the overweight/obesity crisis. Canada's *Physical Activity Guide*

for Youth recommends an increase in moderate activity as well as vigorous activity (Canadian Institute for Health Information, 2006). Moderate physical activity, such as that achieved through cycling and walking, can reduce the risk of obesity (Frank & Niece, 2005). Recent studies also suggest that leisure activities, such as dance and art, may be of benefit, too (Tremblay & Willms, 2003), and point to the importance of increasing the range of enjoyable, non-competitive physical activities for children (Kumanyika et al., 2002; Raine, 2004).

The added advantage of school grounds as a setting for physical activity is their accessibility: children play there on a daily basis for most of the year. The challenge is to ensure that that time is well spent. Many children are simply not interested or able to participate in the vigorous play that often occurs on turf and asphalt (Barbour, 1999; Dymont, 2005a; R.C. Moore & Wong, 1997). For them, green school grounds offer inviting alternatives. When survey participants compared their school ground before and after greening, they said the green school ground appeals to a wider variety of student interests (90% of respondents) and supports a wider variety of play activities (85%).

These findings take on added significance when considered in light of an emerging body of literature on the health implications of physical activity in diverse environments. A recent study by a Norwegian researcher measured the influence of natural playscapes on motor development in children. The study found that when children were provided with a natural landscape for play, there was a statistically significant increase in motor fitness, balance and coordination compared with a control group of children playing in a conventional playground (Fjortoft, 2004). A British study investigating the health implications of “green exercise” found that exposure to pleasant urban and rural nature scenes while engaging in physical activity significantly heightened the psychological health benefits (Pretty, Peacock, Sellens, & Griffin, 2005).

What is the relationship between school ground design features and the levels and types of physical activity on the school ground?

Green school grounds are more diverse environments that:

- **appeal to a wider variety of student interests**
- **support a wider variety of play activities**
- **promote more physical activity at all levels: vigorous, moderate and light**
- **afford unique alternative opportunities for moderate and light physical activity.**

Quality of play and physical activity

RQ 2. How do green school grounds influence the quality of play and physical activity?

There are dramatic and important differences between the play opportunities afforded by conventional and green school grounds. Put most simply, all physical activity is not equal. Compare, for example, a child simply walking the pavement with a child walking along logs, across posts or through a labyrinth – all activities described by survey respondents. While heart rates may be similar in these play activities, there is little comparison in the quality of the experience.

Green school grounds across Canada are enriching the quality of children's play in many ways (see Table 3). They are promoting more active (82% of participants), more imaginative (83%) and more constructive play (59%), more civil behaviour (81%) and a better integration of physical activity into school life generally (77%). They are also strengthening the link between play and learning (82%). In enhancing the quality of play, green school grounds represent a promising means of getting more children moving – moving in ways that promote physical, social and cognitive health at one and the same time.

Children desire natural, complex, challenging and exciting play environments that provide options and choice for play (R.C. Moore & Wong, 1997; Rivkin, 1995, 2000; Stine, 1997). It's not surprising then that green school grounds in Canada appeal to a wider variety of student interests (90% of participants) and support a wider variety of play activities (85%). On green school grounds trees, shrubs, rocks and logs define a variety of places to jump, climb, run, hide and socialize. Moveable, natural materials such as sticks, branches, leaves and stones provide endless opportunities to engage in imaginative play, such as building shelters and huts an appealing and almost universal experience of childhood (Cobb, 1977; Kylin, 2003; Sobel, 1993).

"The children like to play tag and hide and seek around the big boulders. They love being involved in digging, planting and maintaining what they have done." (Parent, Breslau, Ontario)

Exploring the natural world

Health experts recognize the value of contact with the natural world (Frumkin, 2001; Stilgoe, 2001; Ulrich, 1999), yet the standard barren school ground works against that contact. In contrast, the majority of survey participants (84%) report that since greening, their school ground encourages exploration of the natural world. They describe, for example, how children are involved in chasing butterflies, exploring for rocks and insects, looking at plants, bug

watching and animal catching and releasing. Through their gardening efforts, children are also digging, watering, weeding, planting, mulching, harvesting, pruning, raking, composting, lifting and cleaning.

The natural environment has long been an important site for play and physical activity for many children. A strong body of research indicates that when given the choice, children prefer to play in natural settings (Cunningham & Jones, 1996; R.C. Moore, 1986a; Sobel, 1993; Titman, 1994). While contact with nature is important during all stages of development, some researchers and theorists stress that it is especially important during middle childhood (ages 9-12) (Cobb, 1977; Hart, 1987; Hutchison, 1998; Kellert, 2002; Nabhan & Trimble, 1994; Sheppard, 1982; Sobel, 1993). In contemporary industrial societies, however, factors such as increased urbanization and increased fears about child safety mean that young people have less access to outdoor natural spaces (see Cunningham & Jones, 1996; Herrington & Studtmann, 1998; Malone, 2001; Rivkin, 1995; Tranter & Malone, 2004; Tranter & Pawson, 2001). Since green school grounds facilitate more regular contact with the natural world, they stand to make an important contribution to children's well-being.

Social health

From a holistic health-promotion perspective, addressing the social dimensions of health goes hand in hand with addressing the physical dimensions. If the social environment is fun, peaceful and welcoming, and children are feeling emotionally safe, their interest in play and physical activity will undoubtedly increase. Conversely, if a play space is hostile, exclusive or too challenging, children will be less inclined to actively participate (R.C. Moore & Wong, 1997).

Green school grounds across Canada are encouraging positive changes in student play behaviour, with the large majority of survey participants reporting that their green school ground promotes more cooperative play and more civil behaviour. These findings are supported by other researchers who have documented the positive influence of exposure to green spaces on social behaviour (Alexander, Wales North, & Hendren, 1995; Cheskey, 2001; Faber-Taylor et al., 1998; Huttenmoser, 1995; Wells & Evans, 2003).

The relationship between the design of school grounds and student behaviour seems clear: playgrounds become much more peaceful and harmonious when play spaces are diversified (Evans, 2001; R.C. Moore, 1986b; Rivkin, 1995; Titman, 1994). Given that boredom can lead to increased aggression on school grounds, it may be that the decrease in aggression is related to

more diverse and interesting play spaces (Evans, 2001; R.C. Moore & Wong, 1997). Improvements can be even more dramatic if students are involved in the process of greening (Hart, 1997; Mannion, 2003; Titman, 1994). The increase in civil and cooperative behaviours on green school grounds across Canada stands in stark contrast to the increase in aggressive behaviour and bullying at schools described in a growing body of literature (Borg, 1999; Craig, Pepler, & Atlas, 2000; Evans, 1998, 2001). These findings underline the potential of greening initiatives to foster positive social interactions, and in turn, promote more physical activity at schools.

Citing a study of over 4,000 children in 21 Brisbane (Australia) primary schools, Evans notes: "the most active playgrounds with the happiest children were those containing the greatest variety of play areas." (Evans, 1998, p. 15)

Cognitive development

Children learn through play (Adams, 1990; Malone & Tranter, 2003b; Titman, 1994), and this link between play and cognitive development is strengthened on the green school ground, according to the large majority of survey participants (82%). They listed numerous physical activities that have links to either formal or informal learning: gardening activities, observing and feeding birds, hatching and releasing butterflies, capturing and releasing animals (e.g., tadpoles, bugs), building shelters, sketching and art, and generally studying and exploring nature.

The link between green school grounds and learning is supported by a number of studies (Malone & Tranter, 2003a, 2003b; R.C. Moore & Wong, 1997). A mounting body of evidence likewise indicates that green settings generally may help to promote increased concentration (Grahm, Martensson, Lindblad, Nilsson, & Ekman, 1997), attentional functioning (Faber-Taylor, Kuo, & Sullivan, 2001; Wells, 2000) and self-discipline (Faber-Taylor, Kuo, & Sullivan, 2002). Green environments can play a particularly important role for young people who have difficulty learning in the formal school environment, who are reluctant learners, who have difficulty concentrating, or who suffer from Attention Deficit Disorder (ADD) (Dymont, 2005a; Pentz & Strauss, 1998). It has been shown that children with ADD have fewer attention deficit symptoms after spending leisure time in natural settings (Faber-Taylor et al., 2001; Kuo & Taylor, 2004).

A meta-analysis of over 200 studies of the effectiveness of exercise on cognitive functioning found that regular physical activity supports better learning. When young people's bodies are engaged, moving and busy, their minds are also active. (Etnier et al., 1997)

The positive relationship between physical activity and academic success has been repeatedly demonstrated (Action for Healthy Kids, 2004; Etnier et al., 1997; Symons, Cinelli, James, & Groff, 1997). This relationship stands to be even stronger when children are physically active in green school environments (Lieberman & Hoody, 1998; Simone, 2002).

How do green school grounds influence the quality of play and physical activity?

Compared to conventional school grounds, green school grounds can enhance the quality of play and physical activity by:

- promoting more active, more imaginative and more constructive play
- promoting more civil behaviour
- supporting a wider variety of play activities
- appealing to a wider variety of student interests
- encouraging exploration of the natural world
- better integrating physical activity into school life generally
- strengthening the link between play and learning.

Table 3***Quality of Play and Physical Activity***

Compared to your school ground prior to greening, your green school ground now:	Percentage of respondents reporting		
	Disagree/strongly disagree	Agree/strongly agree	Not sure
Promotes more active play	4	82	14
Promotes more imaginative/pretend social play	3	83	14
Promotes more constructive play	14	59	27
Promotes more civil behaviour among students	2	81	17
Promotes better integration of physical activity into school life generally	8	77	15
Strengthens the link between play and learning/cognitive development	1	82	17
Appeals to a wider variety of student interests	0	90	10
Supports a wider variety of play activities	1	85	14
Encourages exploration of the natural world	4	84	12

Note. Total = 96 study participants

Equitable opportunities for play and physical activity

RQ 3. Do green school grounds encourage physical activity across a range of student populations?

Green school grounds across Canada are helping to create environments that promote physical activity across a range of student populations (see Table 4 on p. 35). This inclusiveness manifests itself in many different ways, with approximately half of all study participants reporting that green school grounds promote “more” or “much more” moderate and light physical activity among individuals who are typically disadvantaged on conventional school grounds, such as girls (62% of respondents), less physically competent children (64%), younger children (65%), children with intellectual and physical challenges (42% and 34 % respectively), and children from lower-income families (46%).

This is an encouraging finding considering conventional school grounds cater to only a portion of the student population – primarily boys (Cunningham & Jones, 1996; Dymont, 2005b), older students, students with high physical competence (Barbour, 1999), and students from wealthier communities (Dymont, 2005c). These are the students who tend to dominate large open areas and play equipment (Evans, 1998).

The findings emerging from this study suggest that, in contrast, green school grounds can open up the playing field to those who are commonly relegated to the sidelines – a benefit that has obvious psychosocial as well as physical health implications. It is particularly important to target these student populations, as research has repeatedly shown that they are 'higher risk' with respect to health issues, including overweight and obesity (Active Healthy Kids Canada, 2005; Heart and Stroke Foundation of Canada, 2005).

Gender

Comparing their school ground before and after greening, survey participants indicate that the green school ground now promotes more active play among both boys and girls. In terms of activity levels, 43% of participants report more vigorous physical activity for both genders. More than half of participants also report an increase in moderate and/or light physical activity, both for boys (66%) and for girls (62%). Even though a slightly larger percentage notes the benefit for boys, this finding is particularly encouraging with respect to girls, since girls are often marginalized in their play activities on conventional school grounds (R.C. Moore, 1986b). They also tend to be less active than boys: only 38% of Canadian girls are considered to be active enough, compared to 48% of boys (Public Health Agency of Canada, no date).

Several researchers have noted the different play behaviours of boys and girls throughout a number of developmental stages, and many have argued that play spaces need to be designed with their respective needs in mind (Cunningham & Jones, 1996; Hart, 1987; R.C. Moore, 1986b; Nabhan & Trimble, 1994). While it is important not to reinforce simplistic gender stereotypes (there are, of course, girls who want to run and play competitive games and boys who want to engage in quieter activities), the findings from this study highlight the value of spaces that accommodate a range of active and quiet, competitive and cooperative, rule-bound and open-ended play activities. All students stand to benefit from this diversity (Dyment, 2005a).

"There used to be competition for limited space. Younger children and girls were cut out. But not anymore. There is a more relaxed dynamic and more variety." (Teacher, Toronto, Ontario)

Physical competence and age

Instead of being faced with the limited choice of soccer, baseball or tag on conventional school grounds, children playing on green school grounds can engage in different kinds of play that draw on their physical strengths and personal interests. For example, they can build a shelter, climb boulders, chase butterflies, dig gardens – all activities that promote movement and physical activity (Dyment, 2005a).

Comparing their school ground before and after greening, survey participants report that their green school ground promotes more vigorous physical activity (47%) and more moderate/light physical activity (64%) among less physically competent students. An American study sheds light on this relationship. Barbour (1999) compared play behaviours between two school grounds, one that provided opportunities primarily for physical play and another that provided for a diversity of play options. At the first school, social hierarchies were established according to physical ability, and children with low physical competence (or desires) were often socially excluded. Conversely, at the second school where more play opportunities were afforded, the less physically competent students could participate in a type of play that corresponded with their abilities/interests and they were included in the social hierarchy.

Much like physical competence, the age of students can influence their level of involvement in physical activities on the school ground. When they are young, and thus small and less experienced, children can easily feel intimidated and shy away from competitive, physically demanding forms of play. By catering to a wider variety of needs and interests, green school grounds help to ensure that even young children will be able to claim a space for play. According

to survey participants, green school grounds promote more vigorous (46%) and more moderate/light (65%) physical activity among younger students.

Intellectual and physical disabilities

Study participants note that their green school ground is providing opportunities for children with a range of intellectual and physical abilities to engage in more vigorous and more moderate/light physical activity. Regarding moderate/light physical activity, this benefit was noted by just under half (42%) of the survey participants with respect to intellectual disabilities and by about a third (34%) of participants with respect to physical disabilities.

This finding is supported by a study of school ground greening in the Toronto District School Board where participants reported that green school grounds provided safer and more suitable play spaces for children with intellectual disabilities (Dyment, 2005). The Toronto study also noted, however, that green school grounds could and should be much more inclusive than is currently the case. Specific design ideas such as accessible signage, wider pathways, inclusive toys and raised planting beds have not yet been widely incorporated into green school grounds in Toronto, despite ample literature describing how this would better accommodate physical and intellectual disabilities (Farnham & Mutrie, 1997; Nabors, Willoughby, Leff, & McMenamin, 2001; Schleifer, 1990).

Socio-economic status

Recent evidence suggests that children in low-income, multi-ethnic, urban Canadian neighbourhoods are at particular risk for obesity, due to a range of factors, including limited access both to low-cost nutritious food and to inexpensive venues for engaging in physical activity (Oliver & Hayes, 2005; Raine, 2004). From this perspective, green school grounds stand to be an important environmental intervention. Participants in this study agreed, with almost half (46%) reporting that their green school ground provided opportunities for children from families with lower incomes to engage in physical activity.

Research indicates that children from communities of lower socio-economic status rely more on and have more familiarity with their local neighbourhoods than wealthier children (Faber-Taylor et al., 1998; Heerwagen & Orians, 2002). For many of these young people a green school ground may be one of the only easily accessible outdoor spaces to be active, to play freely and to experience nature (Thomson & Philo, 2004).

The importance of green school grounds for disadvantaged children was revealed in the Toronto District School Board study mentioned above. Study participants from schools located in communities of lower socio-economic status consistently gave a higher ranking to the importance of green elements on their school ground than did participants from other schools. Disturbingly, however, they also gave a consistently lower ranking to the adequacy of their school grounds than did their counterparts. In other words, while greening was perceived to matter more at these schools, it was also perceived to have been less successful. One explanation for this discrepancy is that at schools located in communities of lower socio-economic status, parents tend to be less involved in greening and fundraising tends to be more difficult. Thus, in the absence of adequate public funding, it appears that green school grounds in Canada do not yet represent level playing fields (Dyment, 2005c).

Do green school grounds encourage physical activity across a range of student populations?

Yes, green school grounds:

- **provide a diversity of play opportunities that appeal to girls as well as boys**
- **better accommodate the needs and desires of young children and less physically competent children**
- **encourage more physical activity among students with intellectual disabilities**
- **provide an easily accessible outdoor play space for economically disadvantaged children.**

Table 4

Equity of Play

Compared to your school ground prior to greening, your green school ground now promotes:	Percentage of respondents reporting			
	Much less/less	Unchanged	More/Much more	Not sure
Vigorous physical activity	2	40	49	9
Moderate and/or light physical activity	1	17	71	11
Vigorous physical activity among <i>girls</i>	1	40	43	16
Moderate and/or light physical activity among <i>girls</i>	2	22	62	14
Vigorous physical activity among <i>boys</i>	1	43	43	13
Moderate and/or light physical activity among <i>boys</i>	2	19	66	13
Vigorous physical activity among <i>less athletic/less physically competent students</i>	1	34	47	18
Moderate and/or light physical activity among <i>less athletic/less physically competent students</i>	1	18	64	17
Vigorous physical activity among <i>younger students</i>	1	41	46	12
Moderate and/or light physical activity among <i>younger students</i>	2	21	65	12
Vigorous physical activity among students with <i>intellectual abilities</i>	0	37	42	21
Moderate and/or light physical activity among students with <i>intellectual abilities</i>	1	22	56	21
Vigorous physical activity among students with <i>physical disabilities</i>	1	44	28	27
Moderate and/or light physical activity among students with <i>physical disabilities</i>	1	37	34	28
Opportunities for children from <i>lower-income</i> families to engage in physical activities	1	30	46	23

Note. Total = 96 study participants

Physical activity within the wider community

RQ 4. Do green school grounds influence physical activity among the wider school community?

The majority of survey participants (68%) reported that local community members are actively involved

in gardening and maintenance activities on the green school ground and are making more use of this space for play and recreation as a result of the greening project. And while community members made good use of conventional school ground features prior to greening (e.g., turf, asphalt, manufactured play structures), they

According to survey respondents, community members are participating in a wide variety of physical activities as a result of the greening project. These include the physical work typically associated with gardening and landscaping (e.g., making pathways, constructing fences, preparing soil, planting, weeding, watering, mulching, pruning and harvesting) as well as active play (e.g., ball games, kite flying, sand play, climbing rocks, playing on benches and collecting bugs).

are now taking advantage of the trees, rocks, logs, gardens and other green elements to expand their repertoire of outdoor activities.

Most of these activities take place outside school hours. For example, parents, grandparents, siblings, children in daycare, youth groups (e.g., Scouts, Brownies), gardening clubs and other volunteers are actively involved in spring and autumn cleanups, summer maintenance programs, work days, harvest festivals and other events that occur after school, on weekends or during holidays. According to the majority of survey participants (71%), greening projects have led to greater community involvement in school life.

"We have grandparents and parents who help plant, prune, weed and water, especially in the summertime when the children are out of school. The naturalization committee has done a fantastic job for the school. They have put a lot of time and effort in making a wonderful addition to the school ground." (Parent, Breslau, Ontario)

Meaningful work and a welcoming environment

How do greening projects encourage community involvement? Research suggests that community gardening and ecological restoration efforts provide important opportunities for meaningful engagement around common goals and priorities (Glover, 2004; Lewis, 1992; Shapiro, 1995). Participants enjoy a sense of accomplishment, as well as personal and community renewal. The same holds true for school ground greening. Given the hands-on, physical nature of the work, it can also transcend language barriers, inviting involvement, for example, from new Canadians (Dyment, 2005a).

"Our community has been involved in our project. All students got to plant and therefore have a sense of ownership." (Teacher, Calgary, Alberta)

By providing shade and seating areas, green school grounds create more appealing places to gather and socialize. Survey participants indicated that green school grounds are more “peaceful,” “quiet,” “relaxing” and “comfortable.” They provide an attractive setting for casual encounters among caregivers as they watch over children, and a meeting place for pizza parties, garden parties, picnics and other get-togethers. They thus tend to draw people outdoors, creating a social environment more amenable to walking, strolling and unorganized play.

Significance for lower-income communities

Creating easily accessible public green space may be a health intervention of particular benefit to people with lower incomes (Raine, 2004). When asked to indicate whether school ground greening led to more opportunities for children from families with lower-incomes to engage in physical activities, almost half of the survey respondents (46%) indicated that this was the case.

The benefits of public green space for low-income communities have been noted in other studies. Research conducted in inner-city neighbourhoods of Chicago indicate, for example, that greener common spaces attract people outdoors and foster stronger neighbourhood social ties (Kuo, Bacaicoa, & Sullivan, 1998). Children in these neighbourhoods also engage in significantly more play when the setting is greener (Faber-Taylor et al., 1998).

A study of 45 schools in the Toronto District School Board similarly noted that children in lower-income neighbourhoods particularly benefit from accessible public green space. Study participants suggested that green school grounds assumed an important role for students who lived in dense housing units and lacked access to back yards or parks (Dyment, 2005a). Given the link between low socio-economic status and higher rates of obesity, school ground greening merits investigation as a community-based intervention to promote physical activity in low-income neighbourhoods.

The health of individuals is influenced by social and family relationships, and as Canadians tackle the growing crisis of physical inactivity and obesity, community involvement and community interventions will be critical (Heart and Stroke Foundation of Canada, 2005). Because green school grounds lead to increased community activity outdoors, they offer a promising opportunity to model healthy, active lifestyles for children.

“Families use the school grounds on weekends. They're more pleasurable grounds. Parents garden, while children ride bikes, skateboard, play and fly kites. The grounds are well used.” (Teacher, Peterborough, Ontario)

Do green school grounds influence physical activity among the wider school community?

Yes, green school grounds:

- involve community members in gardening and maintenance activities
- are used by community members during non-school times
- are especially important for individuals from lower-income communities who have limited access to public green space for play and physical activity.

Food gardens, physical activity and nutritional awareness

RQ 5. How do food gardens promote physical activity and nutritional awareness?

Food gardens on school grounds are providing important opportunities for moderate physical activity and are promoting greater awareness and appreciation of nutritional food among children. Featured in about 30% of the school ground projects registered with Evergreen (Hayes, 2006), food gardens represent an increasingly popular approach to exploring and addressing health and environmental issues. In this study, about one-third of the respondents (35 out of 105 individuals) from just over a third of the schools (23 out of 59 schools) completed the food garden section of the survey. The discussion and numbers that follow are based on their responses (see Table 5).

The vast majority of participants (89%) indicated that food gardens at their schools are providing important opportunities for moderate physical activity. Preparing soil, planting, raking, weeding, watering and harvesting occur on a regular basis, throughout the growing season and from one year to the next, providing ongoing opportunities for light and moderate physical activity. Although not tested through the survey, it is reasonable to speculate that such sustained involvement may potentially lead to the development of lasting skills and interests that will encourage people to garden and thus to be more physically active throughout their lives.

The special allure of food gardening seems to lie in the possibility of eating what one grows. The large majority of participants (85%) reported that edible berries, vegetables and plants encourage activity in the food garden. Interestingly, over half of the participants (60%) felt that their food garden encourages physical activity among students who tend to be less physically inclined.

Food gardens and the nutrition factor

The value of food gardens as an intervention to address overweight and obesity also lies in their potential to heighten awareness and appreciation of nutritious foods. The large majority of participants (80%) indicated that the food garden at their school was a deliberate strategy used to promote nutritional awareness among students.

Recent Canadian statistics indicate that children who eat fruit and vegetables five or more times a day are substantially less likely to be overweight and obese than those who do not (Shields, 2004). This relationship between healthy weights and healthy dietary behaviours is well recognized by health experts who are calling upon schools to support healthy eating choices (Action for Healthy Kids, 2004). In Canada, attention is currently focused on providing nutrition

education as well as healthy food choices in vending machines and school cafeterias. In the United States and the United Kingdom, however, food gardens are also recognized as an important means of supporting school-based nutrition programs.

Again, the power of food gardens seems to lie in the tangible, sensory involvement of children in the food production cycle. The vast majority of survey respondents (91%) reported that opportunities to harvest and taste food from the garden foster student awareness and appreciation of nutritional food. This result is supported by other studies of school-based food gardens. One American study found improved nutritional awareness among 40 children (grades 1 – 4) participating in hands-on, garden-based programs (Canaris, 1995). Another study that evaluated the effect of a garden-based nutrition program on 200 grade four students found significant improvement in both nutrition knowledge and vegetable preferences (Morris et al., 2002; Morris, Neustadter, & Zidenberg-Cherr, 2001; Morris & Zidenberg-Cherr, 2002).

Through school-based food gardens, children can experience nutritional foods that they might not otherwise be exposed to. By planting, tending, harvesting and eating a variety of vegetables and fruits, they also gain hands-on knowledge about food production (Gottlieb & Azuma, no date). Such opportunities may be particularly important for children from families with low incomes. Lower-income communities often lack access to healthy food environments, a problem that is often compounded by a lack of access to open green space for physical activity (Gottlieb & Azuma, no date). Lower socio-economic status also tends to be associated with obesity (Shields, 2004). In light of these factors, school-based food gardens represent a potentially important health intervention, achieved through better design and use of school grounds.

How do food gardens promote physical activity and nutritional awareness?

Green school grounds:

- **provide opportunities for moderate physical activity**
- **represent a unique and powerful drawing card, as they provide opportunities to pick and taste nutritional food**
- **can support school-based nutrition programs through meaningful, hands-on involvement in food production.**

Table 5

Food Gardens

	Percentage of respondents reporting		
	Disagree/strongly disagree	Agree/strongly agree	Not sure
Digging, raking, water carrying and other gardening activities in the food garden provide important opportunities for moderate physical activity	2	89	9
Edible berries, vegetables and plants at our school encourage activity in the food garden	3	85	12
At our school the food garden encourages increased levels of physical activity among students who tend to be less physically active	16	60	24
We use our food garden to promote nutritional awareness among students	9	80	11
Opportunities to pick/harvest and taste food from the garden foster student awareness of nutritional food	3	91	6
Opportunities to pick/harvest and taste food from the garden foster student appreciation of nutritional food	3	91	6

Note. Total = 35 study participants, representing 23 schools.

Limiting and enabling factors: Design and culture

RQ 6. What factors or conditions limit or enable physical activity on green school grounds?

The degree to which a green school ground can promote physical activity and better nutrition depends on a number of factors related to both its design and “culture” (e.g., the rules that govern play, the role of supervisors, the social dynamics among students).

In order to examine these factors more closely, the questionnaire included lists of conditions that could potentially enable or limit the number of children engaging in physical activity on green school grounds. Survey participants were asked to evaluate the extent to which each of these factors was at play on their school ground and to add any additional factors not listed. They were then asked to rank the top three enabling and limiting factors at their school.

In order of prevalence, the factors that participants identified as enabling physical activity were:

1. opportunities for non-competitive, open-ended play (85% of participants felt that this factor enabled physical activity at their school)
2. diversity of play opportunities (83%)
3. social dynamics between students and adults (e.g., cooperation and civility) (78%)
4. space is well-defined (e.g., by vegetation, seating, play areas, etc.) (78%)
5. opportunities to explore nature (77%)
6. project has fostered a culture of participation (76%)
7. opportunities to care for the garden or green space (74%)
8. social dynamics among students (e.g., cooperation, collaboration, participation) (74%)
9. diversity of landscape features (71%)
10. project has fostered a culture of stewardship (71%)
11. shaded areas for play (63%)
12. opportunities to observe wildlife (61%)
13. moveable parts (e.g., sand, sand toys, sticks, stones, dirt, tools, etc.) (50%)
14. sheltered areas for play (41%)
15. award programs for participation (32%)

Note the mix of design and culture factors listed by the majority of participants. Clearly, school grounds can be designed with the explicit goal of promoting active play, but there are many strong social influences that need to be considered at the same time, if the goal is to be realized. For example, through design elements such as logs, boulders, gardens, wildlife feeding stations and nature trails, spaces can be

defined in a way that promotes non-competitive, open-ended play; such forms of play are more likely to occur, however, if they are well suited to the social dynamics defining relationships among students and between adults and students.

Culture and design factors are similarly intertwined in the list of limiting factors identified by participants. In order of prevalence, the factors that participants identified as limiting for physical activity were:

1. maintenance concerns (48% of participants felt that this factor limited physical activity at their school)
2. lack of shade (46%)
3. social dynamics among students (40%)
4. lack of moveable parts (e.g., sand, sand toys, sticks, stones, dirt, tools, etc.) (38%)
5. safety concerns (e.g., about water features, sight lines, climbing, etc.) (36%)
6. lack of play equipment (e.g., toys, balls, etc.) (32%)
7. lack of adequate space (32%)
8. inability to supervise students in green spaces (30%)
9. lack of diverse landscape features (e.g., trees, hills, gardens, seating areas, etc.) (29%)
10. bullying (27%)
11. green spaces do not meet student needs (27%)
12. school rules that prohibit active play (26%)
13. lack of physical education classes (24%)
14. green spaces are off limits to students during their free time (24%)
15. lack of manufactured play structures (22%)
16. play ground supervisors do not encourage active play (20%)
17. space is poorly defined (e.g., by vegetation, seating, play areas, etc.) (18%)
18. lack of school policy promoting active play (16%)
19. playground supervisors discourage active play (16%).

Not surprisingly, what is considered a factor that enables physical activity at one school can prove to be a limiting factor at another (or even the same school). For example, the social dynamics among students are seen as an enabling factor by 74% of participants, but a limiting factor by 40%. Similarly, the provision of shade is a frequently noted enabling factor (63%), while the lack of shade is the second most commonly cited limiting factor (46%).

It is interesting to note that a much larger percentage of participants reported enabling factors than limiting factors on their green school grounds. The top 12 enabling factors were noted by the majority of participants, whereas none of the limiting factors was reported by even half of participants. While this discrepancy suggests a certain level of satisfaction with the impact that green school grounds are having, there are nevertheless obvious challenges that need to be addressed in order to maximize the health benefits of green school grounds.

Ranking of enabling and limiting factors

Working from the lists of enabling and limiting factors (see above), study participants ranked the top three factors that enabled or limited physical activity on their green school ground. In these rankings, participants mentioned design factors about twice as often as culture factors, suggesting that design factors are perceived to be the more important determinant of physical activity on school grounds.

In the discussion that follows, the lists of enabling and limiting factors are explicitly divided along the lines of design and culture. Admittedly, this division is somewhat arbitrary, since several factors are related to both design and culture. The division is useful, however, in characterizing and analyzing the types of opportunities and challenges that are at play.

The pie charts that follow (see Figures 2, 3, 4 and 5) represent the ranking of enabling and limiting factors, according to participants. Note that in some cases there is a high level of consistency between the prevalence of a particular factor (i.e., how often it is identified as a factor by survey participants) and its ranking at individual schools. In other cases, however, the relative importance of enabling and limiting factors shifts as a consequence of the ranking process. In such cases, a factor may be less widespread than others (i.e., identified by fewer participants), and yet may be highly significant at individual schools.

School ground design

Figure 2 and Figure 3 represent the rankings of design factors that enable or limit physical activity on green school grounds. They signal the importance of designing school grounds to provide adequate space, diversity and interest to stimulate active play. They also underline the need to address issues of safety and comfort as well as maintenance, since these factors influence the number of children who are being physically active.

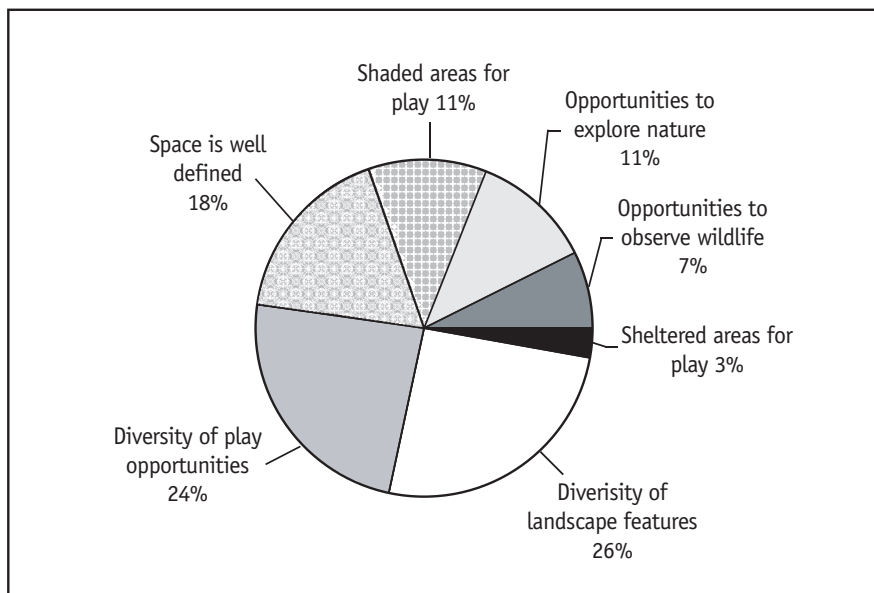


Figure 2: Enabling design factors (148 responses).

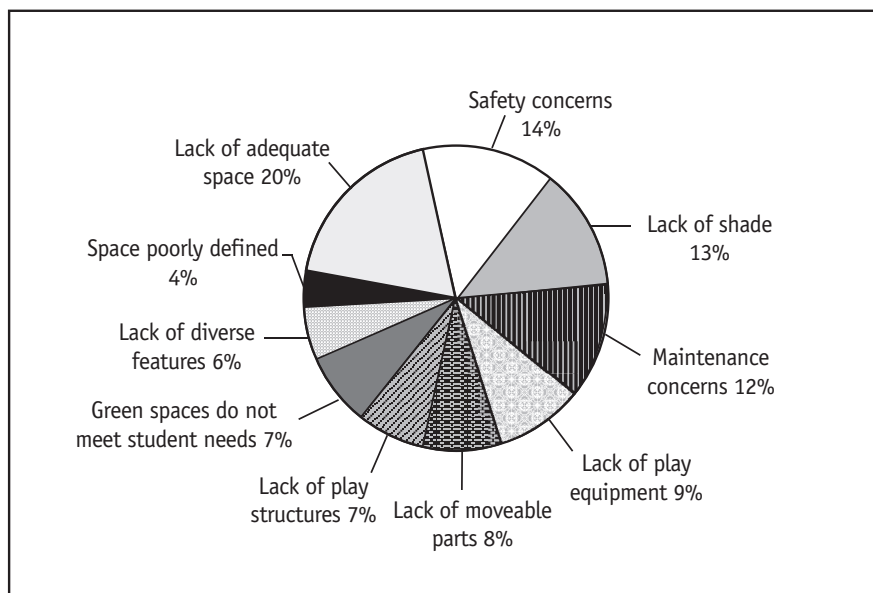


Figure 3: Limiting design factors (107 responses).

Clearly, diversity of both landscape features and play opportunities stands out as the primary design factor influencing physical activity. This finding is supported by a number of studies. Diverse outdoor play environments have been shown to improve motor fitness (Fjortoft, 2004; Fjortoft & Sageie, 2000; Iltus & Steinhagen, 2003), stimulate movement such as rolling, crawling, sliding, balancing, jumping and climbing (R.C. Moore, 1996), and nurture all aspects of children's development – social, emotional, cognitive and physical (Heerwagen & Orians, 2002; Herrington & Studtmann, 1998; R. C. Moore, 1989). Simple design elements such as stepping stones and vegetation, for instance, help to define and diversify a play space and can dramatically shape the way that children move and interact with each other (Herrington, 1999; Herrington & Studtmann, 1998; R. C. Moore, 1989).

To diversify the school ground, natural elements are of critical importance. Survey participants indicated that opportunities to explore nature, observe wildlife and care for the green space or garden all help to encourage physical activity on the school ground. Thus there is a strong synergy between this health benefit and the more traditional purposes of school ground greening, such as restoring wildlife habitat and bringing nature back into children's everyday experiences.

"... opportunities to be immersed in earth, water, and growing things and to make, destroy, and remake – mud pies, sand castles, rock piles, and such – are an important part of children's play outdoors." (Chawla, 2002, p. 215)

The developmental benefits of including natural design features in children's play spaces are well documented. Alive and ever-changing, natural elements such as trees, bushes, flowers and insects have a very high play value. Stones, sand, earth and branches further enhance the complexity and plasticity of these play environments, inviting manipulation and movement. They stimulate the imagination, encouraging children to participate in "world-shaping," "meaning-making" and problem-solving activities (Chawla, 2002; Cobb, 1977; Kellert, 2002; Malone & Tranter, 2003a; R.C. Moore, 1986a; R. C. Moore, 1989; R.C. Moore & Wong, 1997; Sobel, 1993).

As survey participants indicated, however, these benefits can be undermined if other design factors are not taken into consideration. The top limiting design factor, according to the ranking, was the lack of adequate space. This finding is open to different interpretations, including the most obvious, which is that some school grounds are simply too small to allow adequate opportunities for physical activity. Although options for addressing this barrier at existing

schools may be limited, where new schools are being built, it is a factor that could and should be addressed through policy governing school ground design and development.

Another interpretation of the adequate space issue is that, in many cases, greened areas on school grounds are off limits during children's free time. This may be as a result of safety concerns (e.g., where water features are involved), maintenance concerns (e.g., where features are vulnerable to trampling or erosion) or supervision issues (e.g., where shrubs or trees impair sight-lines; where greened areas are located at the front of schools). All of these conditions received a high ranking by survey participants as factors limiting physical activity and should be taken into account in the design process.

Despite these potential limitations, however, greening can also improve the adequacy of space available on the school ground for active play. Often, through greening, under-used areas of the school ground become more desirable as play spaces, and consequently help to spread the student population throughout the yard. Whether an area is adequately shaded, for example, is a strong determinant of whether it will be used for active play, according to survey participants. Shade provides protection from the sun, increasing the safety and comfort of the school ground, two important design considerations. One way that greening could further enhance the adequacy of available space at many schools would be to better accommodate the needs of users with physical disabilities, for example by including raised flowerbeds or pathways suitable for people using wheelchairs or walkers.

"Seating and benches have been effective in drawing in community members and parents to watch the children while they play on the school grounds. I particularly have been impressed with more shade trees as well, because the school grounds are much more inviting for all to enjoy on those warm sunny days." (Teacher, Burnaby, British Columbia)

School ground culture

Figure 4 and Figure 5 below represent the rankings of culture factors that enable or limit physical activity on green school grounds. They signal the importance of a school ground culture that fosters positive social dynamics and provides opportunities for non-competitive, open-ended play and stewardship. They also point to the need for rules, policies and approaches to supervision that explicitly support active play on the school ground.

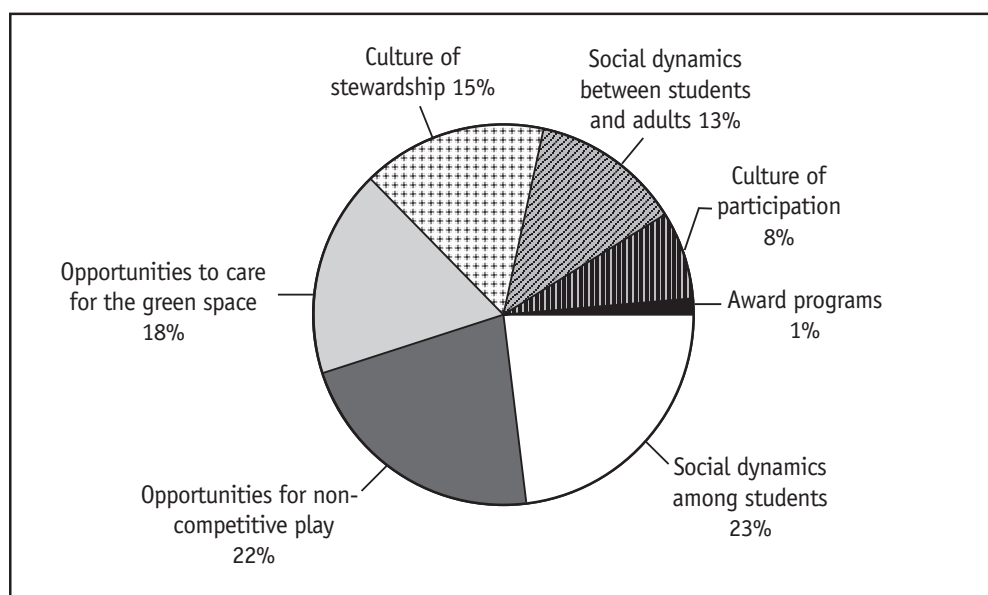


Figure 4: Enabling culture factors (78 responses).

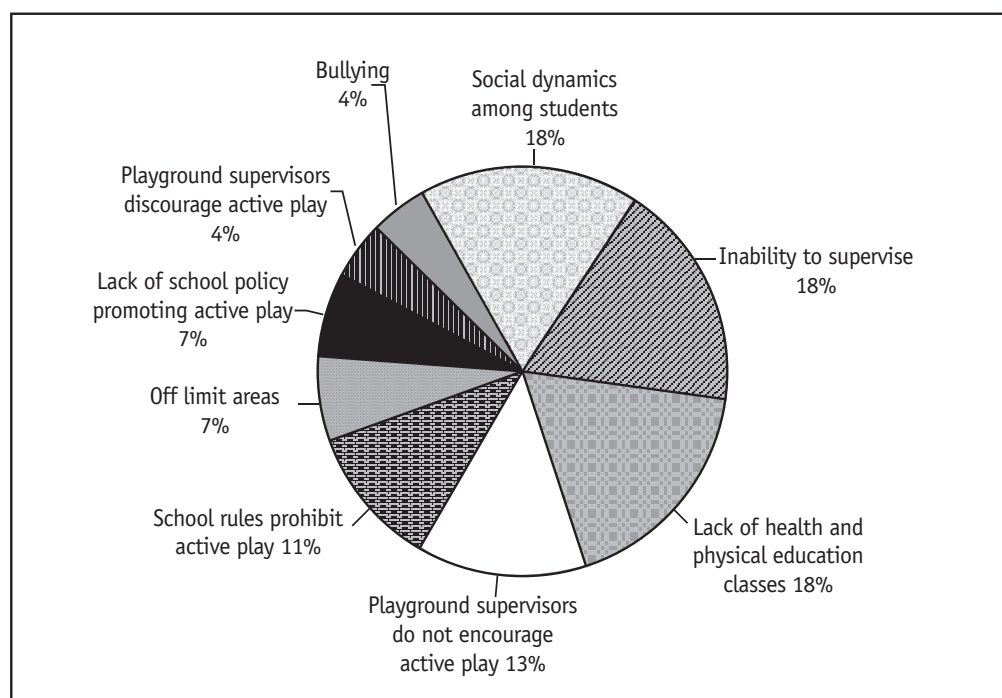


Figure 5: Limiting culture factors (45 responses).

Social dynamics on the school ground stand out as the number one culture factor influencing physical activity. This is especially true of relationships among students, and to a lesser degree of the relationships between students and adults. It is helpful to interpret this finding in light of studies exploring the dominant cultural beliefs and values that shape the design and culture of school grounds.

One such belief is the “surplus energy theory,” according to which school grounds serve primarily as places for children to “let off steam” (Evans & Pellegrini, 1997). Conventional school ground design embodies this belief, with its emphasis on wide-open expanses of turf and asphalt that favour vigorous, rule-bound, competitive play. Closely related to the surplus energy theory are the “military” and “factory” models of school ground design and culture (Stine, 1997). The military model values containment, control and surveillance. Children must be in sight and under control at all times – hence the chain-link fencing, flat play surfaces and absence of hiding places, reminiscent of the military drill yard. The factory model emphasizes efficiency and production: children move on predictable schedules and engage in physical activity during breaks to improve intellectual production; turf and asphalt are preferred as the lowest-cost design option.

This set of beliefs and values, at play to varying degrees on school grounds across Canada, implicitly supports a hierarchical social dynamic of exclusion and dominance: there are those who can compete and/or command the playing field and those who cannot (or will not). It is also very much in line with the view that behavioural problems on the school ground should be addressed by strengthening control and enforcement – for instance, by increasing the number of supervisors on duty, enforcing stricter rules, having segregated playgrounds, enforcing anti-bullying policies, reducing the length of recess, and even totally eliminating recess (Evans, 1997, 2001). Some of these strategies clearly work against the hope of increasing physical activity, since they reduce the amount of time spent outdoors. Others reinforce the power of school ground supervisors, a move unlikely to alleviate social tensions that might exist between students and adults.

“Safety and ease of supervision have come to dominate our thinking about playgrounds and in the process has turned them into fairly barren and uninviting places to play.” (Evans, 2001, p. 50)

Conversely, rather than building on the social dynamics of control and dominance, greening has the potential to temper them, by diversifying play opportunities, providing opportunities for

non-competitive, open-ended play and fostering more civil and cooperative behaviour. In so doing, greening can help to create a more welcoming environment, inviting more children to participate in physical activity.

Using design interventions to deliberately and positively influence the social dynamics among children on the school ground makes sense, given the findings from this study. In addition, school rules and policy are needed to ensure that the culture of the school ground is explicitly targeted as a means of promoting physical activity. The importance of encouraging diverse play activities, of raising awareness about the benefit of moderate and light levels of physical activity, and of maintaining or increasing the amount of time that children spend outdoors (both free time and class time) should be acknowledged and supported through school rules and policy.

A related issue identified by participants and frequently discussed in the literature is the insufficiency of health and physical education classes. Many Canadian children have limited health and physical education classes (Active Healthy Kids Canada, 2005), a fact that highlights a serious weakness in the dominant culture of schooling: children are expected to be seated and still while learning; physical education, and indeed physical modes of education are often seen as an 'add on' to the core academic subjects. This division of the cerebral and the physical is unfortunate, given the positive relationship that has been unequivocally demonstrated between students' health and their academic performance (Symons et al., 1997). Green school grounds represent a promising opportunity to reunite mind and body at school.

What factors or conditions limit or enable physical activity on green school grounds?

Results reveal that:

- **key enabling design factors are the diversity of landscape features, diversity of play opportunities and good space definition**
- **key limiting design factors are lack of space, safety concerns and lack of shade**
- **key enabling culture factors are social dynamics among students, opportunities for non-competitive play and opportunities to care for the garden or green space**
- **key limiting culture factors are social dynamics among students, the inability to supervise students and the lack of health and physical education classes.**

Conclusion and Recommendations

Grounds for Action presents strong evidence that green school grounds can play a significant role in promoting physical activity. Through greening, school grounds diversify the play repertoire, creating opportunities for boys and girls of all ages, interests and abilities to be more physically active. Complementing the rule-bound, competitive games supported by asphalt and turf playing fields, green school grounds invite children to jump, climb, dig, lift, rake, build, role-play and generally get moving in ways that nurture all aspects of their health and development. Of particular significance is the potential to encourage moderate and light levels of physical activity by increasing the range of enjoyable, non-competitive, open-ended forms of play at school.

These positive findings emerged consistently across the 59 schools participating in this study. This consistency is revealing, given the diversity of the schools, survey participants and green school grounds profiled in the study. The schools differed in terms of their geographic location, their size and their ethnic composition; the study respondents represented a variety of roles, education levels, ages and involvement levels; and finally, the school grounds were varied, with a range of sizes, ages and design elements. In light of this diversity, the consistency of results suggests that the benefits of green school grounds have wide application.

Grounds for Action clearly indicates that green school grounds can benefit an entire student body as well as the broader school community by supporting healthier play and activity on a regular and on-going basis. For these and other reasons, they should figure prominently as a pre-emptive and protective measure within comprehensive school-based strategies to address overweight and obesity. Currently, however, green school grounds rarely if ever figure among these strategies. Their potential thus remains largely unrecognized and unrealized. To better meet the challenges and pursue the opportunities that green school grounds present, the following recommendations are offered for consideration:

1. Policy. Public policy is needed across a range of sectors to address the dual problems of inactivity and poor eating habits. High-level political direction (e.g., at the federal, provincial and territorial levels) is key to ensuring that local interventions, such as green school grounds, are adequately resourced and integrated into existing programs. In the United States, for example, federal legislation requires each local educational agency to establish a school wellness policy, including goals for physical activity, nutrition education and other school-based activities to promote student well-being. Under each school wellness policy a plan must be developed to measure implementation of the policy and to ensure the involvement of the local school community.³

³ See section 204 of the *Child Nutrition and Women Infant Children (WIC) Reauthorization Act of 2004*.

In Canada, several policy options have been proposed to address overweight and obesity in the school setting. These focus on health and physical education requirements, school food policies and safe and active routes to schools (Raine, 2004).

Policy proposals should be expanded to include interventions that address both the design and use of school grounds. These are needed to guide education ministries, school boards and schools in setting their priorities, budgets and school ground design standards so that they support opportunities for physical activity on school grounds.

Recommendations

- Health Canada should allocate resources to establish and support research, policies and programs aimed at developing healthy outdoor environments for children, such as green school grounds.
- Education ministries, school boards and schools should officially recognize, at the policy level, the broad health benefits of green school grounds, including their potential to promote physical activity and better nutrition.
- The policies developed by education ministries and school boards should support and promote school ground greening initiatives through adequate financing and the development of standards for green school ground design.
- Health authorities should develop policies that promote healthy outdoor settings for children, including green school grounds.

2. Intersectoral collaboration. The overweight/obesity crisis cannot be tackled solely by individuals and organizations working within the obesity field (Raine, 2004). Integrated and collaborative approaches involving many sectors are needed to share knowledge and experiences, to enhance planning, to identify research and policy priorities and to galvanize public and political support for change. Such integration is already underway with the ***Integrated Pan-Canadian Healthy Living Strategy*** (The Secretariat for the Intersectoral Healthy Living Network et al., 2005). Approved by the federal, provincial and territorial Ministers of Health in 2005, the strategy provides a national framework for addressing health issues. It sets targets for physical activity, healthy eating and healthy weights and calls for a coordinated effort of parents, families, professionals, governments, non-government organizations and the private sector to address the overweight/obesity crisis.

School grounds are an obvious setting where health, education and environmental design issues overlap, and where intersectoral collaboration would be of benefit. To date, however, this has not happened. School-based health-promotion efforts related to overweight and obesity have focused on curriculum (health and physical education), food choices (cafeterias, vending machines) and active modes of transportation to and from school. The potential contribution of green school grounds has gone unrecognized.

Recommendation

- Individuals and organizations within the health, environment and education sectors should work together to exchange information, identify policy and research priorities, galvanize public support and lobby decision-makers (governments, school boards, health agencies) to promote healthy school environments, including green school grounds.

3. **Curriculum and Teacher Education.** Curriculum is an important component of school-based health promotion. While *Grounds for Action* focuses primarily on students' physical activity during their free time, green school grounds can also support physical activity during class time if properly integrated into the curriculum. As this study indicates, for example, food gardens provide an excellent opportunity to teach and learn about nutrition through direct experience. Indeed, implementing, caring for and studying aspects of the green school ground offer many opportunities to deliver the curriculum across a range of subject areas while being physically active. Research clearly indicates that learning experiences are far more powerful when they are hands-on and applied in this way (Dyment, 2005a).

Unfortunately, few curriculum documents in Canada explicitly endorse the use of school grounds as sites for curriculum delivery. It's assumed that the primary purpose of education is to develop children's minds, and priority is given to indoor, text-centered learning.

The situation is compounded by the fact that teachers receive little, if any, training on teaching outdoors. Consequently, they lack the knowledge, confidence and motivation to do so (Dyment, 2005b).

To change this, we need a shift in the culture of schooling. We need to develop curriculum that provides clear direction and examples of how to use school grounds for outdoor, experiential learning. Teachers also need professional development opportunities to build their confidence and competence in teaching outdoors.

Recommendations

- Education ministries should ensure that curriculum policies explicitly state the value of outdoor, experiential learning and provide concrete examples of how the curriculum can be delivered on school grounds.
- Faculties of education and school boards should train teachers how to teach outside the classroom.

4. Research. Knowledge development, exchange and application are key components of the *Integrated Pan-Canadian Healthy Living Strategy*. But there is currently little understanding of the environmental interventions that might best support physical activity and better nutrition among children (The Secretariat for the Intersectoral Healthy Living Network et al., 2005). If we are to fully understand and realize the potential of green school grounds to increase the physical activity level of children, continued research on this relationship is crucial.

Grounds for Action relied on parent, teacher and administrator perceptions of student behaviour on school grounds. The next step in the research is direct observation and measurement. This should be designed to include the voices missing from *Grounds for Action*, especially those of the target population: children. Research methods would need to be appropriate for children (e.g., mapping, arts-based research, participant observation, group interviews) and could potentially involve them as co-researchers (see, Fraser, Lewis, Ding, Kellert, & Robinson, 2004). In addition, longitudinal studies would help determine how green school grounds contribute to increased physical activity and better nutrition over the long term.

Recommendations

- Undertake a comparative study to monitor (through direct observation and mapping) and measure (through the use of accelerometers or pedometers) children's physical activity behaviours on school grounds with and without green elements. The study should include the voices of children using age-appropriate research methods.
- Undertake a longitudinal study, tracking cohorts of children as they move through the school system, to explore the influence of greening initiatives.

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