

# Grounds for movement: green school grounds as sites for promoting physical activity

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## Abstract

An environmental factor of particular importance to children's physical activity levels appears to be the presence of parks and open space. Thus, in promoting children's health, school grounds merit consideration as a potential setting for intervention. This paper explores how 'green' school grounds, which contain a greater diversity of landscaping and design features, affect the quantity and quality of physical activity among elementary school children. Teachers, parents and administrators associated with 59 schools across Canada completed questionnaires ( $n = 105$ ). Analysis reveals that 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. Seen in this light,

green school grounds stand to be an important intervention to be included in school health promotion initiatives.

## Introduction and context

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' [1, p. 240]. Seen in this light, schools are an obvious setting for establishing healthy habits and promoting change [2–4]. In fact, many schools 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 programmes [4], 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, in Canada children are spending, on average, ~110 min a day on the school ground [5], amounting to ~25% of their school day. When one considers that children attend school ~200 days per year, there can be little doubt that school grounds represent an environment worthy of attention in school-based health promotion initiatives.

Conventionally designed school grounds consist primarily of open expanses of turf and asphalt,

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features which offer valuable opportunities for active play in rule-bound games like basketball, tag, baseball and four-square. Research indicates, however, that conventional school grounds have their limitations in promoting physical activity because many children are not interested or able to play in such vigorous games [6]. In such cases, these children are 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 [4]. Moderate levels of physical activity, such as those achieved through cycling and walking, can reduce the risk of obesity [7]. Recent studies suggest that various forms of leisure activity, such as dance and art, may also be of benefit [8] and point to the importance of increasing the range of enjoyable, non-competitive physical activities for children [9, 10].

If school grounds are to realize their potential to promote physical activity, 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.

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 school ground 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.

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, this paper takes a critical look at the design of school grounds and the types of play and social interactions that they invite and support. It considers how green school grounds affect the quantity and quality of physical activity among elementary school children (kindergarten to grade eight).

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## Methods

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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 that were covered during this review included healthy schools, health promotion initiatives, physical activity and green school grounds. The literature review uncovered several studies of relevance to the research topic, but little focusing directly on the relationship between school grounds and physical activity.

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 programmes. 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.

A purposeful sampling protocol was used to determine which schools were invited to participate in the survey [11]. Specifically, with the assistance of

the Canadian charitable organization Evergreen, which promotes school ground greening across the country, the research team identified candidate schools that met the following criteria:

- (1) The greened site was sufficiently developed and defined so that a comparison could be made with its prior/ungreened state.
- (2) Children had 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. Generally, we acknowledge that the retrospective nature of the survey may have influenced the results (e.g. untrustworthy recall of activity patterns prior to greening). This is an inherent limitation of retrospective surveys, and yet is justified given the initial, exploratory stage of the research. Follow-up research should include direct observation and measurement of children's physical activity patterns and levels.

A package of three questionnaires was distributed to 145 schools in British Columbia, Alberta,

Manitoba, Ontario, Quebec, Nova Scotia and Newfoundland. At each school, the questionnaires were to be completed by up to three 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 as parent, teacher or administrator. To further tease out a range of responses, the 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.

The questionnaires were analysed 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 and interest), school characteristics (e.g. number of students and geographic location) and greening project characteristics (e.g. number of design elements). Qualitative data from the open-ended questions were reviewed with a view to identifying relevant themes and topics.

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## Results and discussion

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### Response rates and demographics

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 I). 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. Twenty-eight parents, 48 teachers and 29

**Table I.** Background information on schools

Characteristic and variable	Count	% of respondents
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

Total = 59 schools.

administrators completed questionnaires ( $n = 105$ ). These individuals differed in terms of their age, gender and teaching experience, as well as their level of interest in greening initiatives (see Table II).

### Sites and levels of physical activity

To appreciate the relationship between green school grounds and levels and types of physical activity, it is 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 and consistent image of relatively uniform environments that consisted primarily of asphalt, manicured grass and manufactured play equipment with some trees, shrubs and floral gardens.

**Table II.** 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
>20	56	53
Number of years involved with school ground greening projects		
0–5	81	77
6–10	19	18
11–20	4	4
>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

Total = 105 study participants.

Survey participants portrayed a very different picture of their school grounds 'after' greening. They 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%).

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 gave a strong indication that green school grounds were providing more opportunities for physical activity.

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.

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).

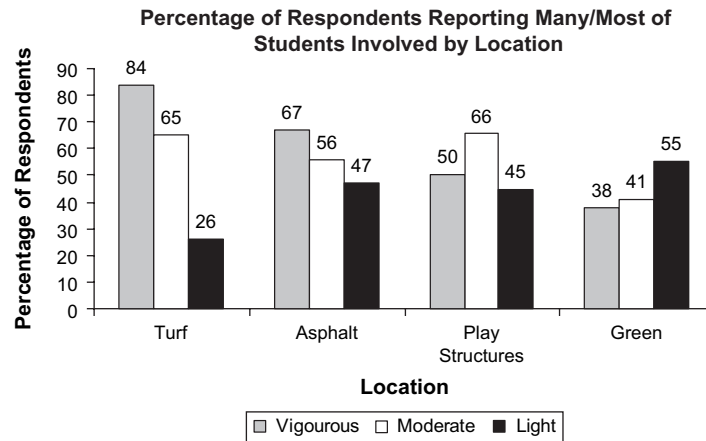
**Light physical activity:** does not affect breathing or heart rate; equivalent to slow walking (e.g. moving light objects like toys, stones or sand, acting out roles and situations, hide and seek, picking fruit or vegetables, games like hopscotch or bouncing balls).

Generally, participants reported that all parts of the school ground are being used to promote all levels of physical activity. As illustrated in Fig. 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.

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, in addition to the conventional activities supported by turf, asphalt and play structures.

In fact, green school grounds profiled in this study 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 added advantage of school grounds as a setting for promoting a variety of levels of physical activity lies, of course, in accessibility: children



**Fig. 1.** Percentage of respondents reporting many/most of students involved by location.

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 types of vigorous, competitive activities commonly occurring on turf and asphalt [12, 13], and in such cases, green school grounds can offer inviting alternatives. Indeed, comparing their school ground before and after greening, survey participants indicated that their green school ground appeals to a wider variety of student interests (90% of respondents) and supports a wider variety of play activities (85%) (While outside the scope of this study, an issue to explore in future research would be the impact of seasonal changes on children's activity patterns, especially as this relates to school ground design. What opportunities do green school grounds offer, for example, when play areas are covered in ice and snow?).

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 from Sweden indicates, for example, that the physical qualities of outdoor preschool environments (their size, the presence of trees and shrubs, the proximity of play structures to vegetation) are an important trigger of physical activity. Using pedometry to measure and

compare children's movement at 11 different pre-schools, the researchers found that children were taking a significantly higher number of steps in spacious play environments with trees, shrubbery and broken ground [14]. Another 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 [15]. 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 [16].

### Quality of play and physical activity

In addressing overweight and obesity, it is important to provide children with enjoyable, non-competitive play opportunities as well as opportunities to integrate physical activity into their daily lives [3, 9, 10]. Green school grounds profiled in this study are doing just that, thereby enriching the quality of children's play in many ways (see Table III). 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 thus 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.

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 to a child walking along logs, across posts or through a labyrinth—all activities described by survey respondents. While the measurement of heart rate—one quantitative measurement of the level of physical activity—may be similar between these play activities, there is little comparison to be made with respect to the quality of the experience.

Children desire natural, complex, challenging and exciting play environments that provide options and choice for play [13, 17]. In light of this desire, it is not surprising 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%). Indeed, many

researchers have documented the changes in children's play behaviours as a result of greening, noting in particular an increase in the diversity of play behaviours [18, 19]. 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 [20, 21].

### Exploring the natural world

Within the field of health promotion generally, the value of regular contact with the natural world is increasingly recognized [22]. Unfortunately, however, the relatively barren design of conventional school grounds works against the likelihood of such 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 'clea-

**Table III.** *Quality of play and physical activity*

Compared with your school ground prior to greening, your green school ground now	Percentage of respondents reporting		
	Strongly disagree/disagree	Agree/strongly agree	Not sure
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
Promotes more imaginative/pretend social play	3	83	14
Promotes more active play	4	82	14
Strengthens the link between play and learning/cognitive development	1	82	17
Promotes more civil behaviour among students	2	81	17
Promotes better integration of physical activity into school life generally	8	77	15
Promotes more constructive play	14	59	27

Total = 96 study participants.

ning'—all physical activities which tangibly and meaningfully engage them in their environment.

The natural environment has long been an important site for play and physical activity for many children. A strong body of evidence-based research indicates that children, when given the choice, prefer to play in natural settings [20]. 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) [20, 21]. 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 23, 24] [It should be noted that fears about child safety also have an impact on the design and use of school grounds. In this study, 36% of participants indicated that safety concerns (about water features, sight lines, climbing, etc.) limited physical activity on their school ground after greening [5]. Clearly, safety is an issue that can and needs to be addressed during the design stage. It should also be noted, however, that in many ways, greening can enhance the safety of school grounds by calming student traffic, by softening play surfaces, by promoting more civil and cooperative behaviour and by inviting greater community involvement and sense of ownership in the school ground [6]. In the United States, greening has had a positive impact on levels of crime and aggression in urban residential areas [25, 26]]. Thus, insofar as 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, then their interest in play and physical activity will undoubtedly increase. Conversely, if a play space is hostile, exclusive or overly chal-

lenging, then children will be less inclined to actively participate [13, 27].

As noted above, green school grounds in this study 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 researchers who have likewise documented the positive influence of exposure to green spaces on social behaviour [19, 28, 29].

The relationship between the design of school grounds and student behaviour seems clear: play-grounds become much more peaceful and harmonious when play spaces are diversified [30]. Given that boredom is a factor that 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 [13, 30]. Improvements can be even more dramatic if students are involved in the process of greening (i.e. planning, design, fund-raising, implementation, maintenance) [31, 32]. It is notable that the increase in civil and cooperative behaviours on green school grounds in this study stands in stark contrast to the increase in aggressive behaviour and bullying at schools described in a growing body of literature [30, 33]. These findings underline the potential of greening initiatives to foster positive social interactions, and in turn, promote more physical activity at schools.

### **Cognitive development**

When children play they are informally engaged in learning [34]. This inherent link between play and cognitive development is strengthened on the green school ground, according to the large majority of survey participants (82%). Participants listed numerous physical activities occurring on their green school ground that have fairly obvious links to either formal or informal learning. These include gardening activities, observing and feeding birds, hatching and releasing butterflies, capturing and releasing animals (e.g. tadpoles, bugs), building shel-



ters, sketching and art and generally studying and exploring nature.

The link between green school grounds and learning is supported by a number of studies [13, 34, 35]. A mounting body of evidence likewise indicates that green settings generally may help to promote increased concentration [36], attentional functioning [37, 38] and self-discipline [39]. 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) [40]. It has been shown, for example, that children with ADD have fewer attention deficit symptoms after spending leisure time in natural settings [37, 41].

The positive relationship between physical activity and academic success has been repeatedly demonstrated [42–44]. A meta-analysis of >200 studies of the effectiveness of exercise on cognitive functioning found that regular physical activity supports better learning [43]. When young people's bodies are engaged, moving and busy, their minds are also active. This positive relationship stands to be even stronger when children are physically active in green school environments [45].

### Conclusion and recommendations

This exploratory study clearly suggests that green school grounds can play a significant role in promoting physical activity. Through greening, school grounds diversify the play repertoire. Complementing the competitive games supported by asphalt and turf playing fields, green school grounds invite children to 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. While these initial findings must be verified through future studies involving direct observation

and measurement, their consistency is revealing, given the diversity of the schools, survey participants and green school grounds profiled. 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 may have wide application.

For these and other reasons, they should be investigated 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.

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### Conflict of interest statement

None declared.

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