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# Biodiverse or Barren School Grounds: Their Effects on Children

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## Abstract

*This child-centered study compares the effects on children of two Canadian public school grounds chosen for maximum variability of vegetation, one (Strawberry Vale Elementary) richly biodiverse, the other (Glanford Elementary) relatively barren. A total of 349 students (grades 1 to 7, aged 6 to 13) participated by 1) indicating their use of the school ground through drawings, 2) stating their preferences for various school ground elements through a survey, and 3) sharing their perceptions of each school ground through group brainstorming sessions and individual "walkabout" interviews on the grounds. Results of the analyses indicated that on the biodiversified school ground the quality of the children's outdoor experience was richer, the children's stated preferences more diverse and more oriented toward nature, and the use of their outdoor environment more complex. This was especially true for primary children (grades 1 to 3, aged 6 to 9) and intermediate girls, but less so for the intermediate boys (intermediate: grades 4 to 7, aged 10 to 13). The biodiverse school ground afforded children more opportunities for functional, constructive and symbolic play. It also offered children more places for reflection and conversation. This research has implications for curricular integration of environmental education and the healthy development of children.*

**Keywords:** children, nature, school grounds, children's perspectives, dens, affordances, learning through play, biodiverse, landscape ecology, environmental attitudes

## Background

Increasingly, children spend their free time either indoors or in barren outdoor play spaces with little natural diversity (Louv 2005). Children's freedom to explore complex natural environments has been severely constrained in the space of a single generation. This trend is escalating worldwide (Louv 2005; Goodall 2010).

The benefits of play in natural landscapes are widely recognized (Chatterjee 2005; Chawla 2007; Fjørtoft 2004; Titman 1994). The negative effects on children deprived of contact with nature during their formative middle childhood years are also well-documented (Carson 1956; Hart 1979; Moore and Wong 1997). Some of the benefits for children in nature include more creative and elaborate symbolic or make-believe play (Kirkby 1989; Samborski 2000); stress reduction and greater ability to cope with upsetting events (Wells and Evans 2003); greater gains in agility and balance (Fjørtoft 2001); and better concentration by inner-city children and those diagnosed with attention deficits (Faber Taylor and Kuo 2008; Faber Taylor et al. 2002; 2001). Berman, Jonides and Kaplan (2008) demonstrated that people learn better after walking in nature.

Children who spend significant time in nature also show a greater commitment to protecting the natural world during their adult years (Chawla 1999; 2007; Wells and Lekies 2006). Nature study helps students acquire knowledge, values and a concern for the environment, as well as the motivation and commitment to participate in environmental stewardship (Engleson and Yockers 1994; Harvey 1990). School grounds that include natural diversity may help to meet these objectives of environmental education.

To benefit children and meet their needs for environmental understanding and exploration, a landscape must be child-friendly: it should have enough complexity to be interesting and it should capture the imagination through an element of mystery, as a path does by disappearing around a corner (Kaplan and Kaplan 1989). It should also provide small vegetative rooms or dens for symbolic play (Titman 1994; Stanley 2010) and for the "4$^{th}$ R": reflection (Siegel 2007; Goleman and Lucas 2010). Such a landscape offers opportunities for environmental and social learning through repeated use and care. It also allows children to express themselves freely in creating and controlling their special places, and protects the secrets and activities in these places from adult interference (Chatterjee 2005). A child-friendly landscape is likely to meet children's developmental needs for power, freedom, fun and belonging (Glasser 1990).

The diversity of a natural, child-friendly landscape provides more affordances[1] for functional play (running, climbing rocks, sliding down slopes), constructive play (building huts and shelters, manipulating loose parts) and symbolic play (playing

[1] An affordance is defined here as a quality of an object or an environment that allows an individual to perform an action. *Potential* affordances (action possibilities) are properties of the environment; *actualized* affordances are individual relationships with the environment (Gibson 1977; Heft 1989 in Chatterjee 2005; Stanley 2010).

house, pirates, or kings and queens) (Fjørtoft 2004; Samborski 2000). The imagination needs deep absorption (Tornyai 1999). Symbolic play and socio-drama, which usually take place in concealed or semi-concealed places, lift a child to the highest level of functioning (Nabhan and Trimble 1994; Vygotsky 1979).

Nature is disappearing from many neighborhoods, while parents' fears and work schedules limit their children's freedom to explore. Organized activities and electronic media vie for children's playtime, leaving them little access to the outside world. For many children, the only available outdoor environment is their school ground, so it is imperative that schoolyards become more biodiverse and child-friendly.

Yet, too often school ground management succumbs to adult priorities for neatness, simplicity of maintenance, litigation concerns, the demands of team sports, and the surveillance and behavior management of children (Cheskey 1996). School grounds that are shaped by these adult priorities are generally devoid of natural diversity and do not adequately meet children's developmental and environmental needs. Understanding the benefits of natural play environments can boost political and professional motivation to establish and maintain biodiverse playgrounds in the face of these pressures.

## Objectives

I hypothesized that if exposure to nature influences children to prefer natural elements and enriches their experience, then children who regularly play on a more biodiverse school ground should show a significantly higher preference for natural elements and use landscape elements in a more complex manner.

To address this hypothesis, I compared children's experiences on two contrasting school grounds, one barren (Glanford Elementary) and the other biodiverse (Strawberry Vale Elementary).[2] The study documents and discusses how the children used each school ground, what they felt was important on a school ground, and how they perceived their own school ground. This study is part of a larger investigation of the design and maintenance of sustainably biodiverse public school grounds through collaborative school ground management.

## Setting: Two Contrasting School Grounds, 1999 to the Present

In Canada since 1989, approximately 2,000 school communities have been involved in school ground naturalization projects, inspired and partially funded by the Habitat 2000 initiative of the Canadian Wildlife Federation (now WILD Schools). The Habitat 2000 project aimed to involve school children in creating outdoor classrooms by planting native vegetation on their school grounds, attracting urban wildlife and enhancing nature awareness.

In order to evaluate the effect on children of natural elements in school grounds, I studied two neighboring schools, similar but with contrasting school grounds, in

[2] Children have been given pseudonyms to protect confidentiality, but the school names have not been changed.

Victoria, British Columbia. Strawberry Vale Elementary is one of Canada's best examples of a biodiverse Habitat 2000[3] school ground maintained for over 20 years with the children's participation[4] (Photo A).

**Photo A. Red-flowering currant blooming in the Strawberry Vale School Native Forest**

The second school ground in the study, Glanford Elementary, is a typical example of a barren landscape (Photo B). Many adults recall using a barren playground such as this during recess and lunch breaks, and then after school running off to the woods, streams or vacant lots for "real" play. However, millions of children no longer have the opportunity to range freely in nature; the school ground is their only safe, accessible outdoor environment for personal restoration and imaginative play.

[3] Though some Habitat 2000 projects across Canada have survived and continued to thrive like Strawberry Vale's, others were abandoned with few trees left growing, some stripped of their bark by weed-eaters, mowed over or dried out during arid summers. Projects also failed because a leader moved away or ceased coordinating and protecting the project. Without strong advocates, biodiverse school grounds usually revert to sterile landscapes.
[4] Strawberry Vale School's website is http://www.sd61.bc.ca/school/strawberryvale/ Click on "Earth School" to view children's projects, including "Our Pond Restoration Project" and "Green Team Slideshow."

**Photo B. Glanford school ground—"The typical barren school ground is a desert in the middle of an oasis." —a teacher**

The two schools, carefully selected to minimize confounding variables, were similar in population size and socio-demographics, and in the spacious (approximately ten acre) outdoor areas available. In the opinion of several teachers, Glanford had a slightly higher number of "blue collar" families with traditional values, and children for whom English was a second language. Strawberry Vale had a somewhat broader socioeconomic mix of families and a higher number of "blended families" from parental remarriages. Each school had a warm, welcoming social climate with teachers, administrators, playground supervisors and parents being very supportive of this research. Classrooms at both schools were divided into primary level (grades 1 to 3, ages 6 to 9) and intermediate level (grades 4 to 7, ages 10 to 13). Both schools had kindergarten classes that were not involved in this study.

Situated on either side of Colquitz Creek, the two school populations had similar access to wetlands for field trips. When this study began in 1999, Strawberry Vale had a more highly developed environmental education program than Glanford, though both schools were involved in environmental studies. For example, at each school the children raised salmon from fertilized eggs and released them into the creek in special spring celebrations. However, at Strawberry Vale, the children's involvement in school ground biodiversification provided their teachers many more opportunities for fulfilling the environmental education mandate of the British Columbia Education Curriculum. The curriculum's guiding principles included: nature awareness and appreciation, knowledge, action, and recognition or celebration. At every grade level, Strawberry Vale teachers took advantage of opportunities for outdoor classroom time, bringing science, math, gym and art

classes into the inviting outdoor space (Photo C). In contrast, outdoor class times at Glanford were usually limited to physical education.

**Photo C. Jeremy and Monty found this sphinx moth freshly emerged from its pupa case in the warm spring soil under a shrub in the Strawberry Vale School Native Forest**

The most striking physical contrast between the two study sites was their degree of botanical diversity, making them virtually ecologically antithetical to one another. Glanford's school ground was a typical monoculture of lawn grass (Photo B, above), except for a few trees at the entrance and a single cluster of non-native shrubs (Photo K below). Strawberry Vale had a native plant garden, a seasonal stream of fresh rainwater, a pond, and an adjacent oak meadow park (Photo D).

**Photo D. Children by the Strawberry Vale School pond**

Strawberry Vale School was situated just below Rosedale Park, an inviting rocky outcrop (Photo J below) with wildflower meadows growing under ancient, twisted Garry oaks (*Quercus garryana*). The children were allowed to play in a section of the park. Each spring they took care to fence and protect the wildflowers with the help of their teachers. The old Strawberry Vale school building had been replaced and the new building was designed, with input from children, staff and parents, in the shape of a whale. The new school building was also a model watershed: during a rainfall the children were able to watch the water cascade from the roof of the school and from the rocky outcrops.[5] The rainwater emerged from drains below the school, becoming a small creek that flowed to the pond below (Photos D and L, below). In 1997, every child in the school was involved in creating the Native Plant Garden beside the creek and at the new pond site (Photo E).[6] Together, the school community planted 30 species of hardy, child-friendly native trees and shrubs, for a total of over 350 plants. The children became the gardeners and protectors of this area and the co-creators of their own playscape.

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[5] With unusual insight, the landscape designer, Moura Quayle, had insisted that these outcrops be kept, along with the shrubs growing from the crevices in the rocks rather than blasted away and leveled as would often occur when constructing a new building.

[6] The Native Plant Garden was planted under the leadership of environmental educator Lenny Ross with advice and support from landscape designer Moura Quayle and grounds foreman Al Hood.

**Photo E. Raylene and Stanley planting a native red-flowering currant (*Ribes sanguineum*) at Strawberry Vale School**

Both schools have changed over the past decade. At Strawberry Vale, the Garry oak meadow and rocky outcrops above the school look as inviting as they did in 1999, with the children still protecting the wildflower areas each spring. Below the school, the Native Plant Garden has become a small forest, a much-loved child-friendly area with dozens of places for semi-concealed play (see Figure 7). The young biodiverse forest has become an ever-changing place of dens, castles and giant houses, elf hideouts and branches that invite children to explore, balance, bounce and swing. Strawberry Vale educators continue to mentor other teachers and share good environmental education practice. The school recently celebrated its Earth School status with 1,000 environmental projects completed. The older children (grades 6 and 7) now go to middle school, leaving only grades K through 5 (ages 5 to 11) at Strawberry Vale.

Glanford School has experienced a different kind of transformation: from an elementary (grades K through 7, ages 5 to 13) to a middle school (grades 6 through 8, ages 12 to 14). A dozen large trees have been planted over the past decade and a wetland area is being developed for nature study on the grounds. The school has also increased the scope of its environmental education program. Each year, sixth- and seventh-grade teachers dedicate time to ecosystem study

with field trips around the community.[7] Glanford classes are involved in community tree planting and wetland restoration projects. As well, Glanford students now present their ecological knowledge to neighboring elementary and middle school students. Many Strawberry Vale children now go on to Glanford School, bringing their well-developed environmental ethos and skills with them. Twelve-year-old Katelyn, who had been in fifth grade at Strawberry Vale, told me that she and her friends were looking forward to planting trees at her new school, Glanford—as long as they could plant another tree at Strawberry Vale as well.

## Study Design and Methods

The pilot project for this study took place from September 1997 to April 1999. During this period I upgraded my studies in ecological restoration, ethnobotany and education; conducted preliminary interviews with children and adults on various school grounds; and designed this study to minimize shortcomings. The interviews with adult stakeholders—environmental educators, administrators, advocates for green grounds, school ground supervisors, parents, grounds foremen and crew—and detailed recommendations for grounds management are not included in this paper.

For consistency, I conducted all fieldwork for this study during warm, sunny days in May and June of 1999. In 2006, I returned to Victoria and continued informal observations of the grounds' development and use up to the present. Approximately half of the student populations of the two schools—a total of 349 children—contributed to the study. In all aspects of the study involving children, I kept the role of researcher (observing, inquiring and reflecting) distinct from that of the teacher (Bronfenbrenner 1979; Wong 1995). Therefore, whenever I worked with children in the classroom I asked the regular classroom teacher to be present.

It was important to listen and learn from the children themselves and to understand and respect the social climate of the schools. In order to reflect the multidimensionality of human-environment interactions (Kaplan and Kaplan 1989; Ziegler and Andrews 1987), I employed multiple analytic procedures to examine from several angles the effects of school ground biodiversity on children. By using both quantitative and qualitative methods in a transactive study (Eisner 1998), my objective was to achieve structural corroboration.[8] This multi-faceted structure was necessary in order to capture the children's feelings and insights and as closely as possible—to see school grounds through the children's eyes.

This project was designed to be easily replicable (see Table 1), combining user-based research (drawings, a pictorial survey and classroom brainstorming sessions)

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[7] In 2008, Sherri Norbury, a former Strawberry Vale teacher who worked for many years with Lenny Ross, initiated the FLOW program (For the Love of Water) along with a team of Glanford staff. FLOW is a school-wide exploration of local water issues combining wetland exploration, wastewater study and marine science. At the culmination of their study, Sherri's grade 6 and 7 students set up stations to teach FLOW concepts to children from other schools.

[8] Structural corroboration or triangulation (Eisner 1998) involves gathering multiple sources of evidence and using multiple analytic procedures to support one's conclusions.

with traditional planning research (photographs, field notes and interview questions). The study employed both qualitative and quantitative methods to address three questions:

1. How does the physical landscape design affect the children's stated use of their school ground?
2. How does the physical landscape design affect their preferences with respect to their school ground?
3. How does the physical landscape design affect their perceptions of their school ground?

To assess children's use of their school ground, I collected and analyzed the drawings of each school ground sketched by 264 children of two age groups, 6 to 9 (primary) and 10 to 13 (intermediate). To assess children's preferences of their school ground I collected and analyzed surveys at each school on which I asked 349 children of the same two age groups to rate the relative importance of various elements of their school ground. To assess children's perceptions of their school ground, I recorded group brainstorming on large sheets at each school, with 148 of the children aged 8 through 11 describing the qualities of their school ground with metaphors and descriptors. I also observed and recorded children's movements during recess and noon-hour breaks by way of field notes, photographs and audio-recordings (see example in Appendix A) and audiorecorded informal individual "walkabout" interviews (see example in Appendix B). More details regarding methods are outlined in Table 1. The following sections present the results and a discussion of each phase of the study.

**Table 1. Child-centered research methods for the study**

| **To assess children's:** | **Research method** | **Type of research/ place conducted** | **Ages, grades, learning level (primary or intermediate)** | **Number of children involved** |
|---|---|---|---|---|
| Use | Drawings | Qualitative and quantitative/ in classrooms | At each school: 4 primary classrooms (grades 1-3, ages 6-9) and 2 intermediate classrooms (grades 4-7, ages 10-13) | Total: 264 (At each school: 41 primary girls, 41 primary boys, 25 intermediate girls and 25 intermediate boys) |
| Preferences | Survey | Quantitative/in classrooms | At each school: 5 primary classrooms, (grades 1-3, ages 6-9) and 3 intermediate classrooms (grades 4-7, ages 10-13) | Total: 349 (At each school: 208 primary children and 141 intermediate children (mixed boys and girls) |
| Perceptions | Brainstorming sessions | Qualitative/ in classrooms | At each school: 3 classes (grades 3-5, ages 8-11) | Total: 148 (74 children at each school, mixed girls and boys) |

| | | | | |
|---|---|---|---|---|
| | "Walkabout" audio-recorded interviews | Qualitative/ on school ground | At each school: 2 primary girls, 2 primary boys, 2 intermediate girls, 2 intermediate boys | Total: 16 |
| | Informal audio-recorded observations and photographs | Qualitative/ on school ground | Grades 1-7 (ages 6-13) | Children from both school populations |

## Part 1. Drawings: Children's Use of the School Ground

### Methods

In order to examine how they used it, I asked children to draw their own representation of their school ground. The drawings represented a child's understanding of the school ground's potentiality, indicating what the place offered or afforded that child in terms of significant elements (Titman 1994). All drawings were done from memory, based on a child's recent and past experiences on the school ground.

Participants in the drawing exercises included 82 primary children (four classrooms, ages 6 to 9) and 50 intermediate children (two classrooms, ages 10 to 13) from each school, for a total of 264 children. Before they went outside for recess I asked the children of each class to imagine their school ground and the many ways they used it over the year. I showed the very youngest children pictures representing the five senses and said, "Think about what you smell, what you see, what you feel, what you taste, what you hear, what you do, and where you go when you are outside."

After recess, I gave out sheets of 11" by 17" paper and black felt pens and asked the children to draw the school ground the way they used it. They also printed their age and gender but not their name. I emphasized that their drawing had no bearing on their grades, and that their teacher supported the project. As they drew, the classroom teacher and I circulated and asked children to explain unclear drawings, adding notes in the margins if necessary for clarification (Moore 1986a). In order to minimize their influence on one another, we encouraged the children to draw their own original representations without sharing ideas.

For example, 6-year-old Stanley drew a representation of his route at Strawberry Vale School from the tree—which he told me was an Indian plum (*Oemlaria cerasiformis*)—to the Garry oak and then to an evergreen tree (see Figure 5). Along the way he passed flowers, rocks, bushes, a crow, a robin and a seagull, a total of 12 different environmental elements, termed "mentions" (after Moore 1986a). The elements and route symbolized objects and experiences that were important to him in that place.

Figures 1 and 2 are examples of typical drawings by primary children from both schools with a tally of mentions. Figures 3 and 4 show examples of typical drawings by intermediate children from both schools.

**Figure 1. Example of a drawing by a primary girl (age 6) from Strawberry Vale School, demonstrating the process for tallying mentions**

| | | |
|---|---|---|
| Vegetative Elements | tall grass | 1 |
| Aquatic Features | pond | 1 |
| Climatic Conditions | sun<br>clouds<br>rain<br>lightening | 1<br>1<br>1<br>1 |
| Animals and Signs | ducks | 1 |
| Human Constructions | play equipment<br>school | 1<br>1 |
| People | self portrait<br>child's friend<br>adult (teacher) | 1<br>1<br>1 |
| Total Mentions | | 12 |

Raylene represented her school and pond as elements of the watershed.

**Figure 2. Example of a drawing by a primary boy (age 6) from Glanford School, demonstrating the process for tallying mentions**

| | | |
|---|---|---|
| Vegetative Elements | bushes (quiet ar | 1 |
| Natural Surface Elements | lawn | 1 |
| Climatic Conditions | sun | 1 |
| Human Constructions | net | 1 |
| People | self portrait<br>group of friends | 1<br>1 |
| Human Activity | soccer (ball) | 1 |
| Total Mentions | | 7 |

Ravinder had 7 mentions, typical for Glanford School, which averaged 6.9 per child. Although the ball was drawn many times, as a repeated item it was tallied only once.

**Figure 3. Drawing by an intermediate girl (age 13) at Strawberry Vale of places on the school ground she used regularly. She marked quiet places where she could socialize with her friends with a Q. The school also reserved a special spot in the library for the older girls (upper left). (10 mentions)**

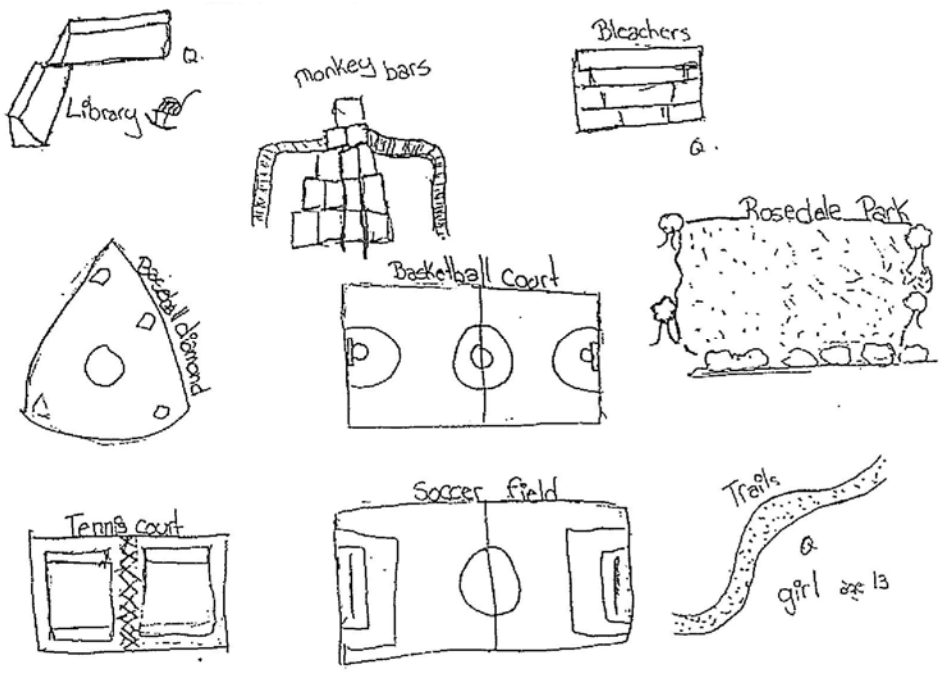
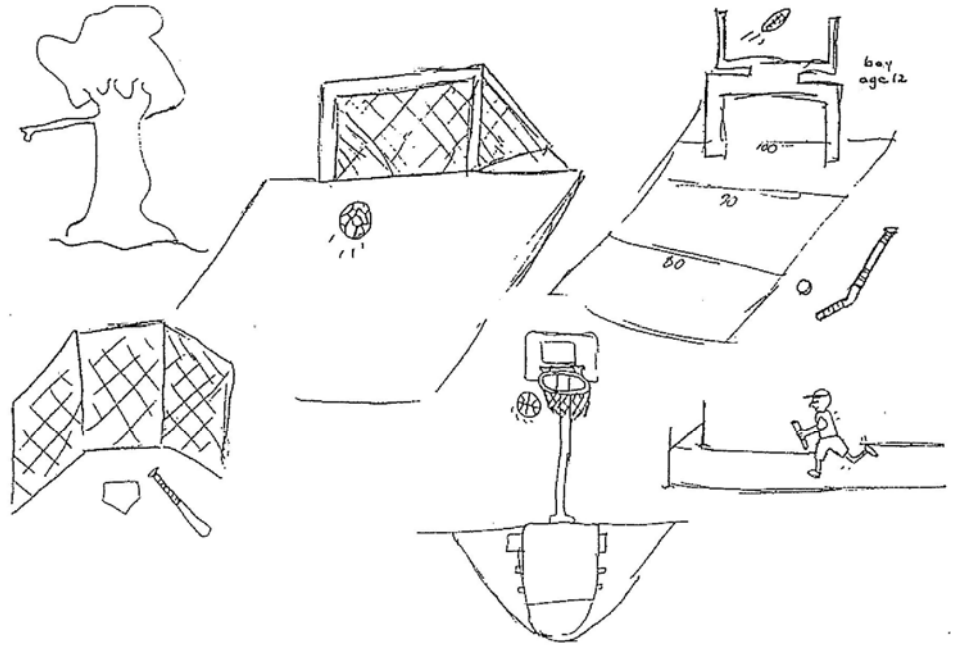



**Figure 4. Drawing by an intermediate boy (age 12) at Glanford. (8 mentions)**



After the children completed the drawing exercise, I conducted a qualitative overview to identify the various elements of the children's drawings. This was followed by a quantitative phase, during which I counted how many times the different elements appeared. When tallying elements on each drawing, I counted each type of element as one mention of that element, even if it was included more than once in the picture (e.g., one mention of broad-leaf trees on a map that included two broad-leaf trees)—unless the tree was named as a specific type (e.g., Douglas fir, or Jenny's "weird-shaped tree" (see Figure 7)). Similarly, although a ball was drawn many times to represent a game of soccer, the ball only counted as one mention (see Figure 2). Mention rates, the average number of mentions per child, were calculated for each element by school. For each school, I tabulated total scores for each element under six categories: plants, surface elements, animals and their signs, constructions, people, and activities. I included "loose parts" (such as pebbles, sticks and wood chips they could collect and manipulate) in the "surface elements" category. A representation of imaginative play (e.g., "forts") was included with activities.

Of the 291 drawings collected, nine were illegible and discarded. The 282 legible samples were divided into four sets from each school: primary boys, primary girls, intermediate boys and intermediate girls. The sets were then equalized according to gender by blind selection, making the final number of children involved 41 primary girls, 41 primary boys, 25 intermediate girls and 25 intermediate boys at each school, for a grand total of 264 drawings used in this study.

**Results of Drawings**

As the drawings from each school were collected, sorted and tabulated, patterns began to emerge. Figure 9 (below) summarizes these data, showing the average number of mentions per child of elements on each school ground in the six categories for primary and intermediate children respectively. Figure 10 (below) compares the mention rates of boys and girls separately.

***Whole School Tally***

At the biodiverse Strawberry Vale School, the 132 drawings by primary and intermediate children had a total of 1409 mentions. On average, each child mentioned 10.7 different school ground elements.

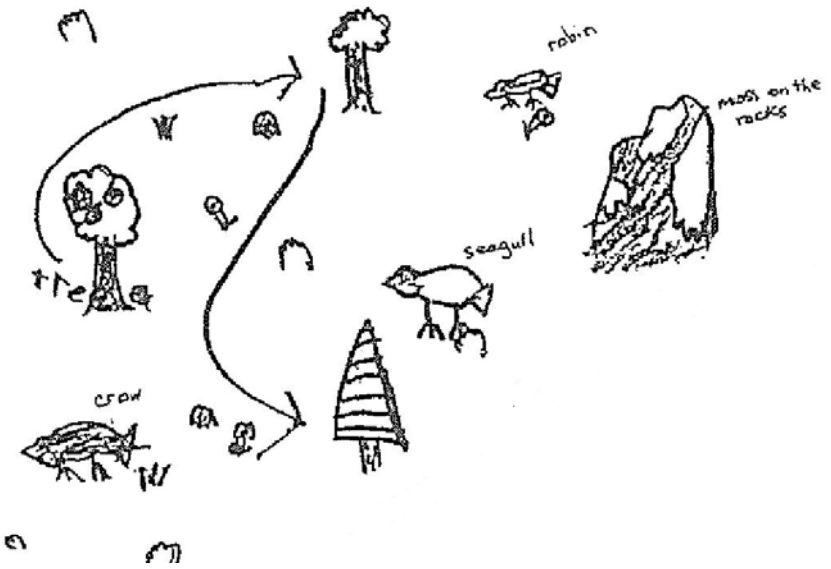
At Glanford School, the 132 drawings by primary and intermediate children had a total number of 904 mentions, or 64 percent as many as Strawberry Vale. The total Glanford mention rate was 6.8 different elements per child.

Strawberry Vale children mentioned over three times more plants and animals (4.1 mentions per child on average) than Glanford children (1.3 mentions per child on average). Strawberry Vale children also mentioned more constructions and surface elements than Glanford children, with an average of 4.5 mentions per child at Strawberry Vale, versus 3.0 mentions per child at Glanford.

***Comparing Primary Children's Drawings***

Primary children from Strawberry Vale averaged 10.3 mentions per drawing, as compared to Glanford's average of 6.9 mentions. On average, each primary child from Strawberry Vale mentioned plants 3.6 times, more than three times the rate at Glanford, with 1.1 plant mentions per child (see Figure 9a below). Strawberry Vale children named, or drew in botanically recognizable detail, 79 specific plants such as cattail, camas or Garry oak. In contrast, only two plants were named at Glanford: a dandelion and a buttercup. Strawberry Vale primary children mentioned animals and their signs more than five times as often as Glanford primary children (Figure 5).

**Figure 5. Drawing by a primary boy (age 6) at Strawberry Vale (12 mentions)**




Strawberry Vale primary children mentioned surface elements 2.1 times on average, compared to an average of 1.6 times by Glanford primary children. Surface elements unique to Strawberry Vale included loose dirt, small rocks, rock outcrops with moss and wildflowers, the aquatic elements of pond and stream, and little caves, holes or habitats under rocks. Strawberry Vale primary children also drew almost three times more "loose parts" (manipulable elements) including leaves, sticks and pebbles.

The two groups of primary children mentioned a similar number of constructions, but the kinds of constructions mentioned were different. Though both schools had large fixed play equipment, Strawberry Vale children mentioned the play equipment only 27 times (0.3 times per child on average), as compared to 98 mentions by Glanford children (1.2 times per child) (Figure 6). Child-built artifacts such as forts made of leaves, or sticks and stones crafted into campfires (Photo F) were popular at Strawberry Vale where many more "bits and pieces" or loose parts existed for the children to manipulate. These children's constructions numbered 22 in the Strawberry Vale drawings, but at Glanford there were only four, all sand tunnels.

Other constructions mentioned by Strawberry Vale children included the dock at the pond, paths and trails, a picnic table and a bridge. Glanford children mentioned other features such as the stairs to the portable classrooms and the "cage" or covered asphalt area surrounded by chain-link fencing where children played on rainy days.

**Figure 6. Drawing by a primary girl (age 7) at Glanford School. "Today I played lava tag. If you touch the wookships you are out." (4 mentions)**

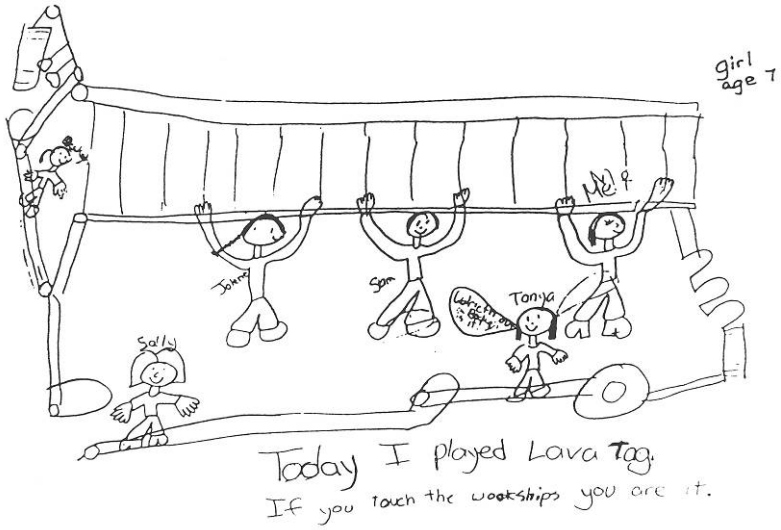



**Photo F. Pretend campfire under the cedars in the Strawberry Vale School Native Forest**

Strawberry Vale children had only 24 mentions of people (0.3 per child) compared to 89 (1.1 per child) at Glanford, where there were very few things to see except people. Most of the "people pictures" at Glanford featured children playing team sports such as soccer or playing on the fixed play equipment.

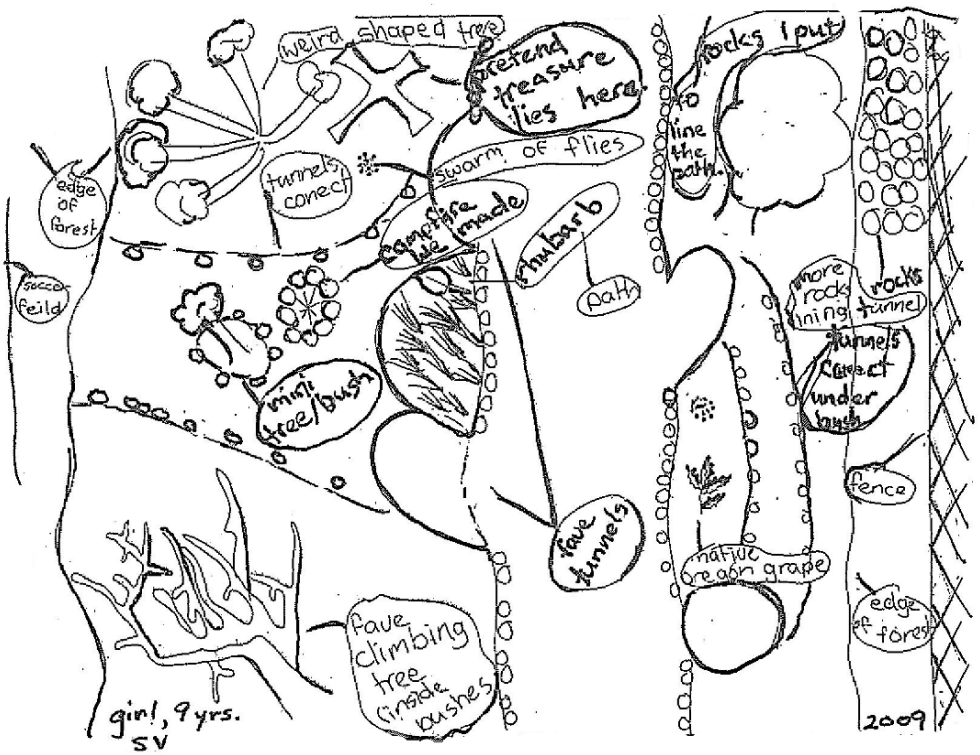
Though primary children mentioned about the same number of activities at each school, the quality of play was different. Activities unique to Strawberry Vale primary children included collecting, planting, mulching, spying, exploring, playing hide and go seek, piling rocks and sticks, and playing house and forts in the hollow bushes. Activities at Glanford were more focused on organized sports, skipping, and tag.

At Glanford School, a hollowed-out bush covered less than 0.02 percent of the school ground. Nevertheless, primary children mentioned it 29 times, the same number of times they mentioned the soccer fields that covered 70 percent of the grounds.

***Comparing Intermediate Children's Drawings***

Intermediate children's use of the elements at each school environment also differed, with an average of 11.3 mentions per drawing by Strawberry Vale children and 6.7 mentions by Glanford children. On average, Strawberry Vale intermediate children mentioned plants 2.2 times each, almost three times the mention rate of Glanford children, with 0.8 (see Figure 9b). Strawberry Vale intermediate children also mentioned surface elements at an average rate of 2.2 times per child as compared with Glanford's 1.2 mentions per child. Surface elements unique to Strawberry Vale drawings included mud, rock outcrops, boulders, the stream and the pond (Figure 7). Mentions of people by intermediate children were similar between Strawberry Vale and Glanford, as were mentions of animals and their signs.

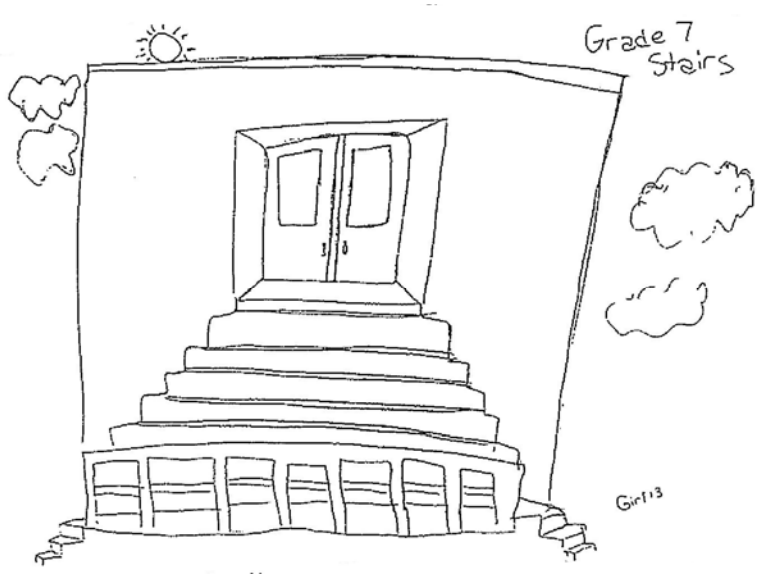
**Figure 7. Drawing by an intermediate girl, Jenny, age 9, at Strawberry Vale drawn in 2009. (18 mentions)**




Intermediate children at Strawberry Vale drew three times more constructed elements in their drawings as their counterparts at Glanford (Figure 9b). In fact, at 3.3 mentions per child, this is the most highly reported category for intermediate children. Several teachers suggested that awareness of constructions intensified at Strawberry Vale when the new school was built. Some of the older children and their families had given input toward the design of the school. They were also proud of the fact that their school was a model watershed. However, Strawberry Vale students mentioned the school only 33 times out of 164 mentions (~20 percent) in the constructions category. The other 80 percent of mentions in this category came from the diversity of constructions available for the children's use, such as bleachers, picnic tables, child-built forts and trails. None of these constructions were available to children at Glanford.

The total number of mentions for sports and types of sport activities by intermediate boys was almost identical at both schools. Intermediate girls also mentioned about the same number of activities, but 24 of the Glanford intermediate girls' 66 activities (36 percent) consisted of hanging out inside, coloring, reading, "doing nothing" or sitting on the bleak, windswept stairs behind the school (Figure 8). This stairway, they told me, was the only place they could sit and not be bothered by adults or younger children. In contrast, at Strawberry Vale, only three of the intermediate girls' 65 activity mentions were sedentary (hiding, sitting/talking, reading), though their drawings illustrated a variety of inviting places to sit and reflect.

**Figure 8. Drawing by an intermediate girl at Glanford. 13-year-old Lisa and many of her friends voiced dissatisfaction with their school ground. "We mostly stay inside," she said, "except sometimes we hang out on the grade seven stairs." (4 mentions)**




## Discussion of Drawings

The children's use of the landscape was far more complex on the Strawberry Vale school ground than on the Glanford school ground. Children at Strawberry Vale made more intricate drawings with a higher total mention rate (10.7 versus 6.8 average mentions per drawing). The four graphs, Figures 9a, 9b, 10a and 10b show a marked contrast between the drawings of the two school populations in several categories.

**Figure 9a. Summary of the drawings by 82 primary children from each school showing the average number of times each child mentioned elements in six categories**

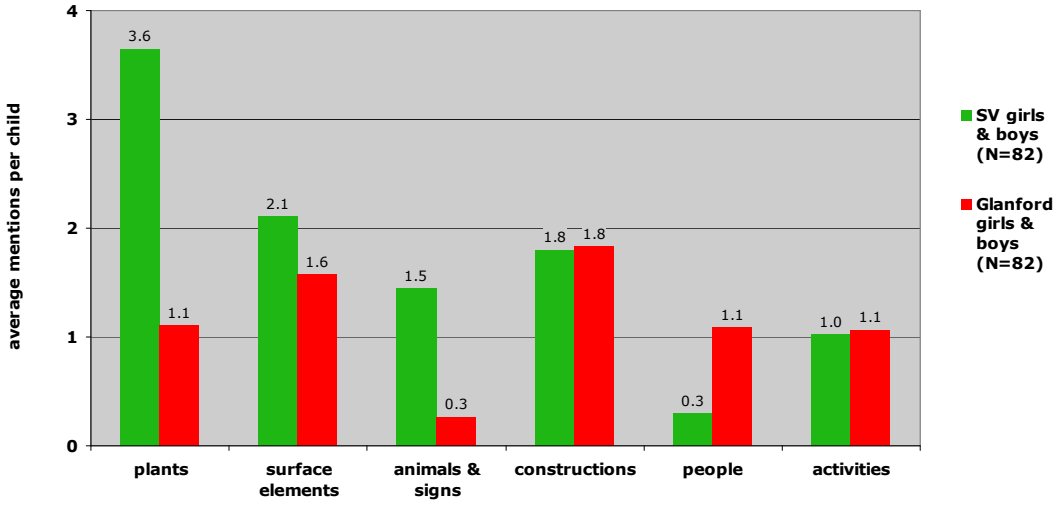


**Figure 9b. Summary of the drawings by 50 intermediate children from each school showing the average number of times each child mentioned elements in six categories**

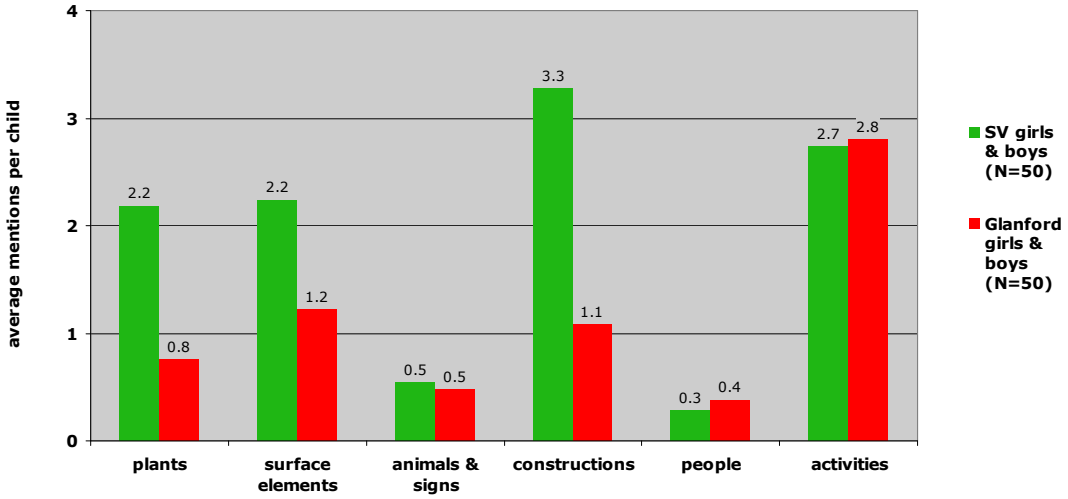



**Figure 10a. Summary of the drawings by 82 primary children from each school, comparing the mention rates of boys and girls separately**

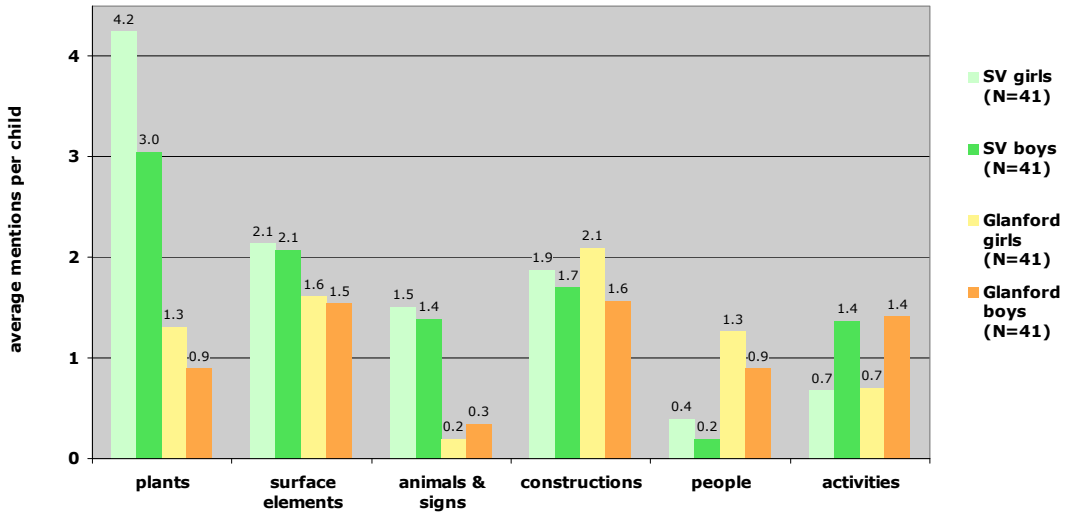
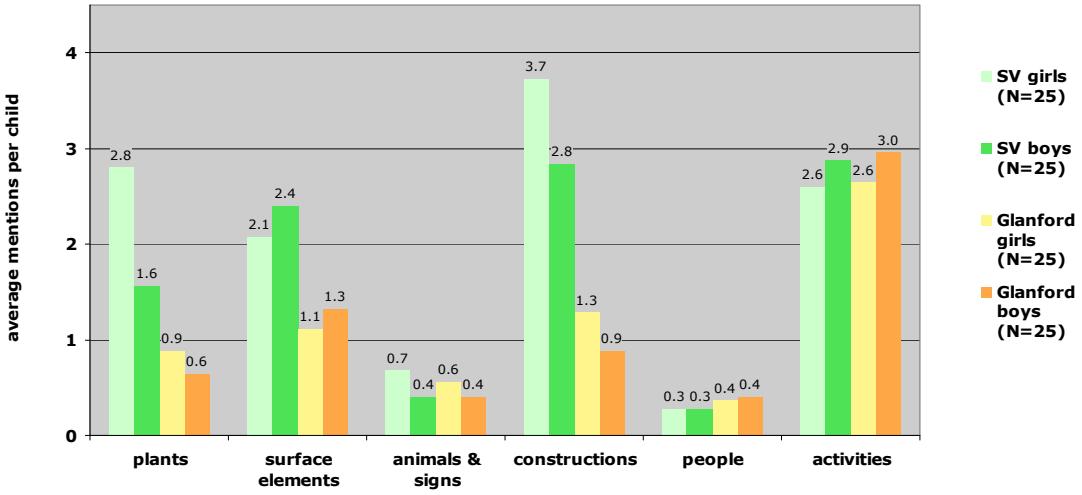


**Figure 10b. Summary of the drawings by 50 intermediate children from each school, comparing the mention rates of boys and girls separately**




The outcomes of the drawing exercise reaffirmed the value of designing play spaces not merely to instill children with discipline, but to "build brains by fostering creativity and independent thinking" (Mead 2010). As children approach the formal operational period of development with its capacity for abstract, relational thinking, their environmental needs change (Ziegler and Andrews 1987). Younger children are concerned with exploring and understanding their world, while older children need to demonstrate their competence in the world and reflect on its complexities (Vygotsky 1979; Wertsch 1985). For example (see Figures 9a and b), Strawberry Vale primary children had relatively very high mention rates for plants and animals compared to all the older children as well as the younger Glanford children. Plants and animals are important elements in the world they are able to explore. The intermediate children at Strawberry Vale had a very high mention rate for constructions; intermediate children of both schools showed very high mention rates for activities (mostly sports), compared to the younger children.

The Strawberry Vale girls' of both age groups voices are particularly strong in regard to their use of plants (Figures 9a and 9b: both younger and older girls) and in the older girls' mention of constructions (Figure 9b). Many intermediate girls at both schools also emphasized that they needed places for quiet reflection, without interruptions from younger children or adults. The drawings of two intermediate girls (see Figures 3 and 7) illustrated their use of their school ground: Shaina at Strawberry Vale expressed affection for the many attractive, inviting features of her school ground, whereas Lisa at Glanford rejected the "ugly school grounds" which she said gave her no place to "just be."

Strawberry Vale primary children drew almost three times more types of "loose part" (manipulable) elements, including leaves, sticks and pebbles than Glanford children. Such loose parts were almost totally lacking at Glanford other than the

wood chips ("wookships," Figure 6), which some children collected, naming chips with unusual shapes: dinosaurs, cats, crystals, and so on. Natural and manipulable elements offer children the potentiality for change, variety and diversity in their play (Titman 1994). They also provide children with props, which appeared to be important elements in stimulating the children's imaginations and spurring socio-dramatic play. A stick became a horse on which a child led a group of friends on a cougar hunt or on a voyage to meet with the king and queen of a neighboring kingdom. I witnessed episodes of these and similar dramatic events, in which leaves, rocks and small sticks played an important role on the grounds of Strawberry Vale School.

The most noticeable difference between the children's use of the two school grounds was the quality, complexity and amount of constructive, symbolic and sociodramatic play as documented in the children's mentions and my own observations. At Strawberry Vale, the many dens, nooks and crannies enhanced children's dramatic play, giving them privacy and secret places to reflect, imagine and play "make-believe" together. The fact that Glanford primary children mentioned their single vegetative room or den as often as they mentioned the seven acres of soccer fields indicates that the den had a symbolic importance far exceeding the actual number of times an individual child was able to play inside it.

## Part 2. Preference Surveys: The Most Important Things on Each School Ground

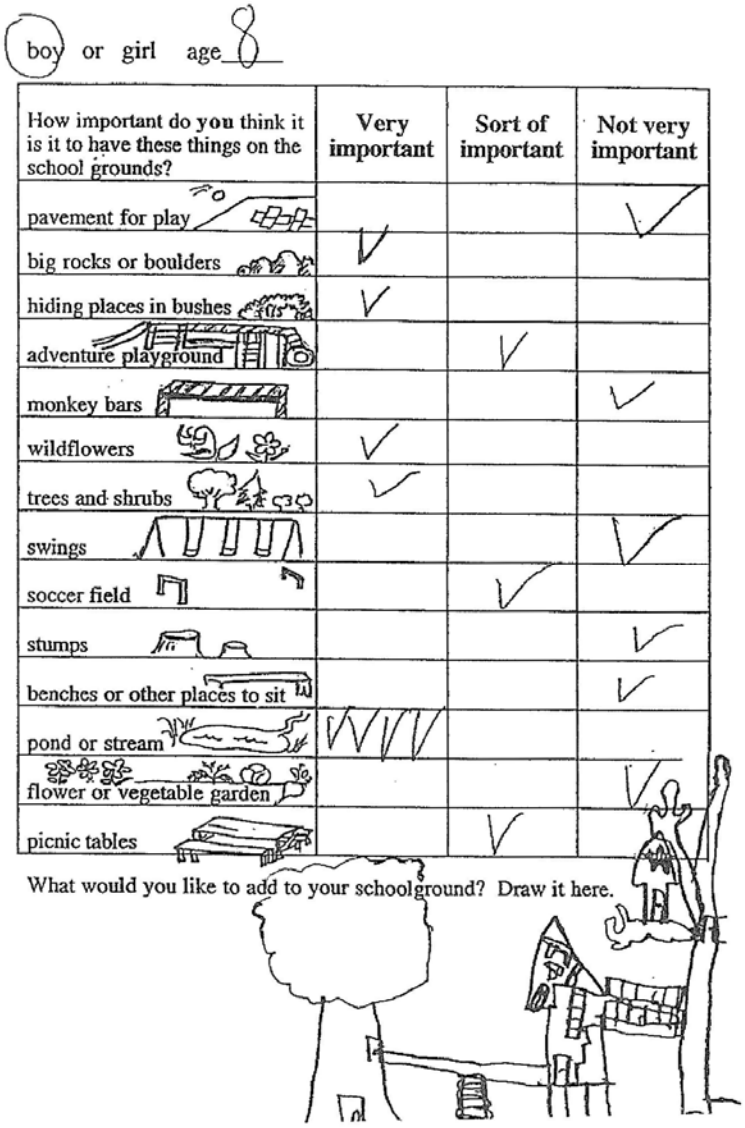
### Methods

A total of 349 children participated in the preference survey (four primary classrooms, ages 6 to 9, and three intermediate classrooms, ages 10 to 13, at each school). They scored each of 14 elements shown on the survey on three options: "very important," "sort of important" and "not important." The survey form is typical of many comparative studies (e.g., Dyment and Bell 2007; 2008). Atypically, however, it directly asks the children's opinions.

I chose seven natural elements and seven constructed elements from items that children had mentioned frequently during the pilot project. I then arranged them randomly on the survey form. Since the surveys took a short time to complete, children in most classes filled them out immediately after the drawing activity. The pictures of the 14 elements on the survey form made it easy for even the youngest children to understand the choices they were asked to make (Figure 11). After we read through the questions together, the children completed the survey as the classroom teacher and I circulated among them.

After tabulating the preference rankings, I conducted nonparametric 2-tailed Mann-Whitney tests (Zar 1999) using an asymptotic sigmoidal model. If the Mann-Whitney test showed a significant difference in z-scores, the group that showed the significantly higher preference for the element was indicated in bold print (Appendix C). The results for all 19 statistical comparisons were condensed in Tables 2 and 3.

**Figure 11. Example of a preference survey completed by David, age 8, from Strawberry Vale School. He told me the pond and stream were "very very very very important" to him. Despite his enthusiasm, they were scored only once as "very important."**

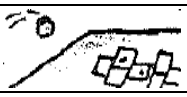
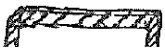
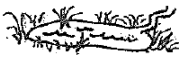
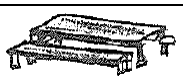



## Results and Discussion of Preference Survey

### *Differences between School Populations*

Children's preferences for seven elements differed significantly between schools (Table 2). Both primary and intermediate children of the more biodiverse school ground at Strawberry Vale showed a significantly higher preference for wildflowers, trees and shrubs, and a pond or stream. Primary Strawberry Vale children also showed a significantly higher preference for boulders and a garden. Children at Glanford School, with its relatively barren school ground, showed a significantly higher preference for swings and fixed play equipment.

**Table 2. Summary of preference survey differences for school ground elements between school population and gender**

| | Group | All Children | Primary Children | Intermediate Children | | All Children | Primary Children | Glanford Primary Children | SV Primary Children | Intermediate Children | Glanford Intermediate Children | SV Intermediate Children |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mann-Whitney Test Number | 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **School Ground Element** | | **School** | | | | **Gender** | | | | | | |
| Pavement for Play |  | | | | | | | | | | | |
| Big Rocks or Boulders |  | | SV | | | boys | boys | boys | | boys | boys | |
| Hiding Places in Bushes |  | | | | | boys | boys | | boys | | boys | |
| Adventure Playground |  | G | | G | | girls | | girls | | | | |
| Monkey Bars |  | | | | | | | | | | | |
| Wildflowers |  | SV | SV | | | girls | girls | | girls | girls | | girls |
| Trees and Shrubs |  | SV | SV | | | girls | | | | girls | | girls |
| Swings |  | G | | G | | | | | | girls | | girls |
| Soccer Field |  | | | | | boys | boys | boys | boys | boys | boys | |
| Stumps |  | | | | | | | | | | boys | |
| Benches/ Places to Sit |  | | | | | girls | girls | | | | | girls |
| Pond or Stream |  | SV | SV | | | | | | | | boys | boys |
| Flower or Vegetable Garden |  | | SV | | | girls | | | | girls | | girls |
| Picnic Tables |  | | | | | | | | | | boys | girls |

SV = Strawberry Vale School; G = Glanford School

Note: Children scored each of the 14 elements as very important [1], sort of important [2] or not important [3]. If a Mann-Whitney Test (Zar 1999) showed a significant difference between groups, the group that ranked that element to be most important is shown on the table. A blank space indicates no significant difference in scoring between the two groups.

The results demonstrate a clear preference by children of the more biodiverse school ground for natural elements.[9] Specifically, Strawberry Vale children indicated significant preference for five natural elements (boulders, wildflowers, trees, pond, and garden), which existed exclusively or to a greater degree on their school ground. Glanford children showed significant preference for two constructed elements: fixed play equipment, which existed at both schools, and swings, which did not exist at either school ground. Perhaps because the Glanford children had never associated school ground play with natural features, they did not give these features high preference.

***Age and Gender Differences***

The boys at both schools showed significant preference for big rocks or boulders, hiding places in bushes, and the soccer field (Table 2, tests 4 to 10). The girls at both schools showed significant preference for the fixed play equipment, wildflowers, trees and shrubs, benches, and a flower or vegetable garden.

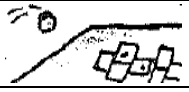
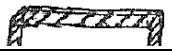
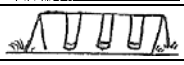
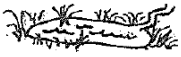
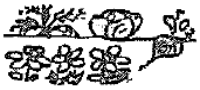
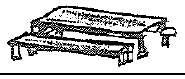
The gender comparison seems to reflect fairly traditional sex role stereotypes: girls preferred flowers, gardens, trees, benches, swings and play equipment; boys preferred soccer, dens and boulders. However, I frequently observed girls playing in the bushes and rocky outcrops at Strawberry Vale as well as in the hollow bush at Glanford.

Boys of both schools showed a strong preference for soccer fields (Table 2, tests 4 to 9, soccer field). However, several older boys who were involved in environmental education projects at Strawberry Vale told me that even though "sports and stuff" took up most of their time, they still valued wildlife, and still liked to find places to do quiet activities and sit on the rocks.

At Strawberry Vale the intermediate girls were actively involved in environmental education activities on the school grounds, helping with a variety of activities (planning, planting, mulching, and mentoring younger students). These girls rated wildflowers, trees and shrubs, benches, swings, gardens and picnic tables significantly higher than did the Strawberry Vale boys (Table 2, Test 10). However, the most common activities mentioned by grade 6 and 7 girls at Strawberry Vale in the drawing exercise were soccer and basketball. This suggests that the older girls enjoyed a richly varied use of the school ground. In contrast, the older girls at Glanford had a very weak voice in the preference survey; only the Glanford boys showed significant preferences (Table 2, test 9). One 13-year-old girl wrote on the bottom of her survey, "…there should be a place that the gr. 7s can go to and be with their own age group without getting hassled by little kids and/or adults."

[9] The element "big rocks or boulders" was considered to be a natural element because the rock outcrop was associated with moss, wildflowers, weeds, bushes and trees. Though surfaced with grass, the soccer field with its goals was considered to be a constructed element.

**Table 3. Summary of preference survey comparing preference differences for school ground elements between primary and intermediate schooling levels**

| | Group | All Children | Boys and Girls of Glanford | Boys and Girls of SV | All Boys | Boys of Glanford | Boys of SV | All Girls | Girls of Glanford | Girls of SV |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mann-Whitney Test Number | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| **School Ground Element** | | **Schooling Level** | | | | | | | | |
| Pavement for Play |  | Int. | Int. | Int. | Int. | | Int. | Int. | Int. | Int. |
| Big Rocks or Boulders |  | | | Prim. | | | | | | Prim. |
| Hiding Places in Bushes |  | | | | | Int. | Prim. | | | |
| Adventure Playground |  | Prim. | | Prim. | Prim. | | Prim. | Prim. | Prim. | |
| Monkey Bars |  | | | | | | | | | |
| Wildflowers |  | Prim. | | Prim. | Prim. | | Prim. | | | Prim. |
| Trees and Shrubs |  | | Int. | Prim. | | Int. | Prim. | | Int. | |
| Swings |  | | Int. | | | Int. | Prim. | Int. | Int. | |
| Soccer Field |  | Int. | | Int. | | | | Int. | | Int. |
| Stumps |  | Prim. | | Prim. | | | Prim. | Prim. | | Prim. |
| Benches/ Places to Sit |  | Int. | Int. | | | Int. | | | | |
| Pond or Stream |  | | | Prim. | Prim. | Int. | Prim. | | | |
| Flower or Vegetable Garden |  | Prim. | | Prim. | Prim. | | Prim. | Prim. | | Prim. |
| Picnic Tables |  | Int. | Int. | | | Int. | | | | Int. |

Prim. = primary (children aged 6 to 9); Int. = intermediate (children aged 10 to 13); SV = Strawberry Vale School; G = Glanford School.

Note: Children scored each of the 14 elements as very important [1], sort of important [2] or not important [3]. If a Mann-Whitney Test (Zar 1999) showed a significant difference between groups, the group that ranked that element to be most important is shown on the table. A blank space indicates no significant difference in scoring between the two groups.

Intermediate children of both schools showed significant preference for pavement, the soccer field, benches, and picnic tables (Table 3, test 11). Primary children of both schools showed significant preferences for the adventure playground play equipment, wildflowers, stumps, and a flower or vegetable garden.

Despite the fact that I observed mixing of older and younger children in the biodiverse areas at Strawberry Vale, it was the younger children who showed significant preference for natural elements (rocks, stumps, wildflowers and gardens) where they could explore and create their own worlds (Table 3, test 13). The older children significantly preferred asphalt and field areas as well as benches and picnic tables for socializing. These findings support my results from the drawing phase of the study, as well as Vygotky's observation that young children are involved in exploring and understanding their world, and older children in showing their competence in the world and reflecting on its complexities (Vygotsky 1979; Wertsch 1985).

## Part 3. The Children's Perceptions of Their School Ground: Metaphors and Statements from Classroom Brainstorming Sessions, Observations, and Stories from "Walkabout" Interviews

### Methods

#### *Brainstorming Sessions*

A total of 148 children aged 8 to 11 (three classrooms at each school, grades 3, 4 and 5) participated in the group brainstorming sessions. I selected children this age because they were in the "free-ranging" period of development, drawn to explore their world beyond the bounds of adult supervision, but not yet involved in the social complexities of puberty (Hart 1979; Moore 1986a). These group sessions were conducted in the final stage of the research so that the ideas of other children would not influence individual children's drawings or survey choices in the other phases of the study. The classroom teacher was also present during the brainstorming sessions.

Children at both schools had studied and created metaphors, similes and descriptions as part of their regular curriculum over the course of the school year. I asked the children to share examples of colorful metaphors and then I asked them to think of as many ways as possible to describe various elements of the school grounds (Snively 1987). I recorded the children's descriptions of their school ground with brightly colored felt pens on large blank sheets of paper.

#### *Observations and "Walkabout" Interviews*

For the 20- to 30-minute "walkabout" interviews, two teachers from each school selected a total of 16 children (two primary girls, two primary boys, two intermediate girls and two intermediate boys at each school). Many children volunteered for the "walkabout" interviews; teachers chose the children based on their enthusiasm, confidence and verbal skills. Each child led me to significant places on the school ground, sharing ideas and telling stories in response to interview questions that I selected from a list (Appendix D). Most photography,

note taking and audiorecording took place during recess and lunch breaks. Although the focus of this phase of the study was on children's perceptions, many of the children included some of their favorite places (preferences) and their uses along with their perceptions of the school grounds.

**Results and Discussion of Children's Perceptions**

The brainstorming sessions, "walkabout" interviews and observations yielded some results in common, therefore their findings are discussed together. (A sample of a child's story is included as Appendix A, and a transcript of an audiorecorded interview is included as Appendix B.)

The children's metaphors and descriptors, recorded during the group brainstorming sessions, are listed in Table 4. Children often gave the same element both positive and negative meanings, as summarized in Table 5, below.

**Table 4. Summary of children's perceptions about their school grounds using metaphors and descriptors, as described by children aged 8 to 11. *(Researcher's comments are in italics.)***

| **Strawberry Vale (biodiverse)** | **Glanford (low diversity or barren)** |
|---|---|
| **Our school ground is...** | |
| - adventuresome, exciting, mysterious, fun<br>- a place with lots of animals, like squirrels<br>- respecting, peaceful, relaxing<br>- full of lots of things to do, scary (*wasps!*)<br>- natureful, natural<br>- rocky, hilly<br>- shady, cozy, safe<br>- a place to explore after school<br>- a watershed<br>- a park, space<br>- a forest, because there are green places<br>- a meadow full of wildlife<br>- a habitat for ducklings<br>- a garden<br>- not polluted | - big, grassy, hyper, athletic, hot<br>- safe, happy<br>- a place for walking and talking<br>- a fun place to play tag, with lots of room<br>- a place to hang out after school<br>- a place to ride bikes, like down the hill<br>- colorful, enjoyable, dirty, sandy<br>- cold, noisy<br>- boring, with no place to sit and talk: "We don't go outside now" (*11-year-old girls*)<br>- a rainbow park (*children provide the colors*)<br>- a soccer field in South America, and I'm world famous, playing against Brazil<br>- my back yard: lots of room (*asphalt area*)<br>- a city with all the people<br>- a cozy, warm jacuzzi (*the tunnel slide when the children fill it with people*)<br>- an equipment room |
| **The monkey bars are...** | |
| - an airplane<br>- a ship full of pirates on the sea<br>- a lookout<br>- a hideout for lava monster, water monster and toilet monster. The tires are toilets! | - a cage with a wild animal<br>- like lying on a rock in the warm sunshine<br>- an airplane (*jumping*) flying down! |
| | **The space under the stairs is...** |
| | - a house<br>- Hollywood |

| | |
|---|---|
| | - an uncomfortable couch (*where the wooden supports form an X*)<br>- a jail, when we play cops and robbers and puppy guards<br>- a closet under the stairs where I can hide (except I can't really hide there) |
| **The areas of most imaginative play (the bushes, oak trees and the rock outcrop above the school) became…** | **The area of most imaginative play (the vegetative room) became…** |
| - a cave, where we make witches' brew<br>- a camp—we can make a pretend campfire<br>- a fort, where we can spy and pile masses of leaves in the fall, and collect things like bugs and little rocks<br>- a sea of leaves, when we jump in them<br>- a war in the leaves<br>- a helmet (*leaves on the child's head*)<br>- a house. The stump is the stove, and you can pound the chickweed into soup in the hole in the middle, like a pot. The shelves are ledges on the rock...<br>- a castle, where I was queen one whole week and all the grade twos were my subjects!<br>- a boat, like Noah's Ark School | - a hideout or quiet area<br>- a jungle<br>- thunder bushes<br>- a room to read and color<br>- the lion's den! |

Children at Strawberry Vale consistently viewed their school ground as a place where nature enhanced their experiences, whereas children at Glanford mentioned the few structurally diverse and natural elements and sometimes expressed dissatisfaction with their school ground. Most of the responses at Strawberry Vale referred to natural or biotic elements and their imaginative use. Exploration was important to the children; the school ground provided "lots of things to do." The bushes and rock outcrop area under the oak trees appeared to be the area of the greatest potentiality, where the most highly imaginative free-flow play happened. The children's imagination transformed various parts of this area into a cave, a camp with a pretend campfire, a sea of leaves, a fort, a house, a castle and a boat "like Noah's Ark School." Each of these images or metaphors provided the framework for hours of sociodramatic play that flowed with the children's input and discoveries.

The Glanford children's dominant metaphor for their school ground was "space." The children were drawn to things that defined the space and gave some shelter. The space under the stairs to a portable classroom became a jail, a house, an uncomfortable couch, a closet and even Hollywood in various play sessions (Photo G). Here they could pretend to hide ("except I can't really hide there," one child said). The hollowed area in the bushes was the children's only real hiding place. It became transformed by their imagination into a tropical rain forest, "thunder bushes," and a cave with walls.

**Photo G. "At least we can pretend to hide there." Glanford School's portable stairs**

Because of the openness and barren nature of the grounds at Glanford School, children were almost always exposed to the scrutiny of supervisors, teachers, or other students. Most of the statements, images and descriptions from the brainstorming sessions reflect this sense of exposure. A few children played house or "Lion King" in the open grassy areas (Photo H) or under the busy play structure. Imaginative play, which usually takes place in semi-concealed areas, happened at Glanford where there was something that defined the ground in a small way, such as a small rise in the field. "I'll meet you at the bump," I heard one child call to a friend.

**Photo H. Glanford School children playing Lion King at the "bump"**

In contrast, children at Strawberry Vale had such a wealth of places to hide and pretend that it took some discussion to come up with a meeting place: "I'll meet you under the bush at the witches' brew stump." "No, let's make a campfire in the giant's house." "How about the treasure tunnel?" "Okay, we can get mud from the stream and make a new treasure chest." (Photo I)

**Photo I. Children inside the "spaceship" (bouncing on the red-osier dogwood branches) in the Strawberry Vale School Native Forest**

Eight-year-old Samantha took me to her favorite rock outcrop at Strawberry Vale (Photo J) surrounded by a sea of blue camas flowers waving in the breeze.

> *This is where I was queen for a whole week, every recess. And all the grade twos were my subjects. This is my throne, and we were allowed to go all the way up to here (her arm sweeping toward the crest of the rocky outcrop). But we weren't allowed to go on those rocks over there, so that the moss and the flowers would keep growing. We played castle here in the fall, when there weren't any flowers blooming.*

**Photo J. "This is where I was queen for a whole week…"—Samantha on the Strawberry Vale rocky outcrop with oaks and camas flowers**

At Glanford School, even though opportunities for hiding and pretending were sparse, children relished the few places their school ground afforded. For example, 9-year-old Trevor was anxious to show me his cave inside the bushes (Photo K). He insisted on my coming in to see how wonderful it was. It was a tight fit for an adult, but just right for two or three young children. The busy world was shut out. Mottled sunlight speckled the entrance, but inside, soft leaves dimmed the light and muted the sounds of traffic and children's play. We sat on the thick horizontal trunk of the spreading juniper, polished from decades of children's play. In a hushed voice he said, "This is the Lion's Den."

**Photo K. "This is the Lion's Den." —Trevor at Glanford School**

Most of the children's metaphors reflected their imaginative symbolic or free-flow play on the school ground (Bruce 1991). The messages and meanings conveyed by the children's metaphors and statements constituted the "hidden curriculum" or cultural context of each school ground (Titman 1994). The way children read the elements or affordances of their school ground reflected their own needs for being, doing, thinking and feeling. They created their own meanings for various elements of the school ground.

These elements can signify both positive and negative messages to a child (Table 5). For example, an element like grass can signify a wonderful medium to explore for insects and other animals, to play soccer on, to sit on in the sunshine and make daisy chains, or to roll down in hilly areas. To another child the same element can signify a boring place (if there is nothing but grass on the playground), a dry, dusty place (in the summer if the grass is brown), or a disappointing place (in the winter when the grass is soggy). An element such as dirt can signify a wonderful medium in which to dig, to plant salmonberry bushes and to find worms and other animals. To another child this very same element can signify a messy, muddy substance that will lead to trouble with a parent or teacher. Even the various words for dirt—soil, earth, mud, muck, humus, compost, and so on—have very different connotations depending on an individual's needs and experiences.

**Table 5. Summary of positive and negative perceptions of the same element demonstrating how children read their environment (transcribed from brainstorming sessions, "walkabout" interviews and observations at both schools)**

| School Ground Element | Positive Perception | Negative Perception |
|---|---|---|
| Trees | Shady, play in leaves (fall), lie on trunks, hide behind trunks, lots of caterpillars, bark feels nice. | Scary when it's windy. |
| Den Areas (Vegetative Rooms) | Exciting, cozy, bushy, mysterious, fun, comfortable, adventureful. | Spooky, dark, scary (wasps). |
| Moth | Beautiful, "perfume colours", exciting. camouflage patterns. | Bad. Kill it! |
| Dirt, Soil | Can dig in it, plant trees, discover pill bugs, worms and other animals. | Messy. Some teachers don't -like you to get dirty. |
| Pond | Very important. Place for ducks, pond insects, cattails, red-winged blackbirds. | Why have one if we can't go in there at recess and lunch hour? |
| Rock Outcrop | Places for making forts, playing spy games, playing house, putting insects on "shelves", piling leaves in the fall. | We want to climb them but aren't allowed. Adults say it's dangerous. Have to protect the moss and wildflowers. |
| Pieces of Glass on Rock Shelves | Like crystals. We pretend they are jewels. | Dangerous. Kids could get cut. |

| | | |
|---|---|---|
| Fixed Play Equipment (Adventure Playground) | Fun, place to play lava tag & toilet monster, hang on monkey bars, do tricks on flipping bars, rings, tunnel slide, pole. | Lots of kids get hurt. |
| Berries | Tasty (salmonberries, thimbleberries). | Might be dirty or poisonous. |
| Under the Stairs | Place to play jail and puppy guards. Wooden X makes a comfortable couch. | Can't really hide there. Wooden X makes an uncomfortable couch! |
| Dogs | Friendly, fun. | Scary, dirty (dog poop). |
| Grass | "If it's green, it's okay. If it's brown, it's not." Important for soccer. Great to roll down. Tall grass is best (*11 year old boys*) | Boring if that's all there is. Not allowed to go on it in the winter when it's soggy, or it gets wrecked. |
| Undiversified or Exposed School Ground | Friendly, happy, exciting, hyper, enjoyable, safe. | Boring, windy, cold, hot, nowhere to sit, no privacy. We just stay inside (*older girls*). |

## Conclusions

### Child-Centered Action Research

This is a multidisciplinary study, integrating educational and environmental psychology, ethnobotany and ecorestoration principles. As such, it offers a fresh perspective to the growing body of literature supporting greening school grounds as outdoor learning areas. It also brings together much evidence regarding the benefits of nature for children. It is the viewpoint of a teacher/researcher immersed in the social climate of the public educational system but not working as a teacher in the subject schools. My hope is that it will move the field of research with children's environments in a new direction: to see the environment through the children's eyes.

The action-based research was respectful of the children and sensitized to their words, actions and passions. It drew its authenticity from speaking directly to children, and from studying their movements and their responses. The study was designed to reflect as accurately as possible the children's own experience of the school ground, keeping adult biases to a minimum. By being attuned to the social climate of the schools and becoming familiar with children on the school grounds over time, the observer was able to blend into the background and work more authentically with the children.

This study clearly demonstrates that the biodiverse school ground provided many more affordances for play and discovery than the barren school ground. Affordances are the interactive possibilities or complementarity of a child and the environment (after Gibson 1977). For a child, a stream, for example, affords damming, leaping, splashing, mud pie dissolving…the possibilities are endless. At Glanford School, rainwater flowed into municipal drains and was gone. But

Strawberry Vale School was designed, with input from environmental educators, as a model watershed. Whenever it rained, children could look out their classroom windows to watch rainwater pouring in rivulets from the roof. They knew that when they ran out at recess, water would be bursting from the California drains into their stream below the school, ready for engineering experiments, "Pooh stick" racing or magical make believe. Every day the stream brought new and unexpected delights, its edges sparkling with rainbow crystals in winter, its pond surface dancing with water striders in the late spring (Photo L).

**Photo L. "This is my very favorite place."—Emily's little pond at the rainwater stream, Strawberry Vale**

During the course of the study, although individual children's perceptions, preferences, and actual use of the school ground varied, definite patterns emerged. On the biodiverse school ground the quality of the children's outdoor experience was richer, their stated preferences were more diverse and more oriented toward nature, and the use of their outdoor environment was more complex, especially for primary children and for intermediate girls.

A high preference for natural elements is considered a measure of success of environmental education (Harvey 1990). By this measure alone, Strawberry Vale's greening and environmental education programs achieved a high level of success. As the second phase of this study demonstrated, children at Strawberry Vale showed significant preference for the natural elements on their school ground, compared to the children of the barren school ground.

**Age, Developmental and Gender Differences and Similarities**

In the discussion of drawing results, I noted the vital importance of considering the developmental differences between the younger (primary, ages 6 to 9) and older (intermediate, ages 10 to 13) children. Young children are concerned with concrete operations: exploring and understanding their world. Older children have a growing capacity for formal operations and abstract thought and consequently a need for places to demonstrate their capabilities and for quiet reflection (Siegel 2007; Ziegler and Andrews 1987; Wertsch 1985; Vygotsky 1979). Strawberry Vale's natural areas beckoned the young children for manipulative and sociodramatic play. Older children were more drawn to these natural havens for reflective contemplation and conversation, though there was mixing of ages and activities in these areas. Along with Stanley (2010, iv) I found that the natural play settings provided "a respite from adult expectations and the opportunity to establish both personal identity and friendships in a dynamic, ongoing social setting." For children of all ages, nature provides a calming complexity: a place to study and ponder the beauty and intricacy of life.

As well, I agree with Dyment, Bell and Lucas (2009) that school grounds must have a multitude of natural elements and design features in order to promote physical activity. A study by Fjørtoft and Sageie (2000) showed a direct positive correlation between the number of natural features such as hills, trees, grass and water and the children's gross motor activity. Conversely, Bienenstock (2010, 15) noted that as many as 60 percent of unsupervised children on a barren playground "are completely sedentary."

In my own study, based on the expressed preferences of the children and their drawings, barren asphalt and grass school grounds most closely met the needs of sports-oriented boys aged 11 and older. The needs of other user groups tended to be ignored on the barren grounds. Sports-oriented boys aged 11 to 13 expressed the highest level of satisfaction with the barren school ground. As Jason, a 12-year-old Glanford boy summed it up, "We don't need trees. As long as the grass is green for soccer, the school ground is great."

Through the surveys, interviews, brainstorming sessions and drawings, girls aged 11 to 13 expressed high levels of satisfaction with the biodiverse school ground and dissatisfaction with the barren school ground. In fact, girls at Glanford School aged 12 and 13 for the most part voiced extreme dissatisfaction with their school ground. They often stayed inside because the school ground, in their opinion, was not only boring and ugly, but had no place for them to sit or to visit. The only "nice" place, the "quiet area" outside the staff room where they had no privacy, was busy and overrun with younger children. A bare, windswept stairway at the back of the school was their only private space (see Figure 7).

Areas on the school grounds with the most boy-girl interaction were the naturalized areas at Strawberry Vale and the den (vegetative room) at Glanford. Generally there was little boy-girl mixing at ball play. These observations affirm studies that have demonstrated that traditional school ground elements (fixed play equipment, asphalt and ball fields) reinforce sex-differentiated play, and that more natural and

diversified areas encourage mixing of sexes, ages, and other human variables such as ethnic background, personality, and disability (Dyment and Bell 2008; Moore 1974; 1986b; Moore and Wong 1997; Stanley 2010).

**Implications for School Ground Management**

Titman emphasized in her classic work, *Special Places, Special People* (1994) that the way school grounds are managed influences children's attitudes and behaviors. Both Titman's study and my own support Stanley's (2010) finding that

> *As schools are increasingly identified as potential havens for nurturing competent, enduring relationships with outdoor environments...the complex ecological context of schoolyard play should be considered in policy decisions affecting recess design and practice* (iv).

An example of good management on uninspiring grounds was a Glanford staff decision allowing children to play in the bushes outside the staffroom window ("the Lion's Den"). Conversely (and ironically), because of safety concerns, the wonderfully rich pond area at Strawberry Vale School was out of bounds to the children except during watershed studies and other supervised activities. Nevertheless, children were able to watch the ducks and other wildlife through the fence and expressed a strong sense of love and ownership of the pond.

Teachers and administrators must work to balance their perceptions of risk and safety on school grounds (Stanley 2010). For example, valuing the children's freedom to explore, Strawberry Vale teachers intervened with administrators and noon hour supervisors who threatened to constrain the children's activities. When a new principal forbade the children to play on the "dangerous" rocky bluff, their teacher intervened, explaining that the children respected the established safety rules for the rock. In fact, over the past 20 years, far more accidents have involved the climbing equipment, asphalt pavement and active sports such as soccer than all the natural features at Strawberry Vale (environmental educator Lenny Ross, personal communication 2010).

**Dens**

At both schools the dens—vegetative rooms consisting of shrubs that allow semi-concealment—contributed an element of complexity and mystery that stimulated the children's need for exploration (Kaplan and Kaplan 1989). The dens also provided a place for deep absorption (Tornyai 1999) into symbolic, constructive and sociodramatic play. They provided an environment for children to reflect and have conversations, to explore the minds of others as well as their own (Goleman and Lucas 2010; Siegel 2007). Many adults have spoken to me informally of memorable features on their childhood playgrounds: the hiding places in a twisted juniper; the glaciated rock they could slide down; the smooth, well loved bark of a maple tree. Small features such as these can provide a disproportionately positive effect, a focal point to distinguish that environment from all others and make it a special place.

The fact that Glanford primary children mentioned the single existing vegetative room as often as they mentioned the seven acres of soccer fields in their drawings

indicates that even the smallest natural hiding place makes a big difference in a young child's world. This suggests that the benefit of establishing and maintaining a few cluster plantings of native trees and shrubs far exceeds the material cost. It also supports reorienting maintenance practices so that the same level of expertise developed for lawn horticulture can be put toward establishing and maintaining dens.

Herrington and Studtmann (1998) emphasized that vegetative rooms enabled children to develop a sense of place within their play yard environment. Based on the results of this research, and in agreement with Stanley (2010), the most valuable and cost-effective contribution to children's cognitive, social and emotional development is to plant and maintain vegetative rooms with the children's participation. Other landscape features could then be established, such as stepping-stones, rocky hummocks, hills with slides built into them (Bienenstock 2010) and accessible water and sand play (Photo L).

**Helping Children Co-Create Their Play/Learning environments, While Addressing All Five Child Development Areas**

Konner (2010, 512) noted that the most intelligent animals are the most playful ones and "people in positive and playful moods are more open to experience and learn in better and more varied ways" (Isen 1993). My findings support the work of Herrington and Studtmann (1998), who transformed outdoor play spaces for 2- to 6-year-old children with a variety of interventions including vegetative rooms, pine cones and other "loose parts," and widely spaced stepping stones meandering into previously under-used spaces. Their study addressed the children's social, emotional and cognitive development, typically ignored by playground designers who focused solely on physical development.

I believe that the degree of children's involvement in nature affects their full range of development, which I term "ESSRAePhIL." This is my acronym for children's five developmental areas: **e**motional and **s**ocial, **s**ocial **r**esponsiblity, **ae**sthetic, **ph**ysical, and **i**ntellectual/**l**anguage.[10] Of these, I consider social responsibility to be one of the most vital. A school ground native plant restoration project, such as Strawberry Vale's, can become a valuable social responsibility project. Through the hours spent planning, planting, playing and learning together and with their adult mentors, these children created a sense of place for themselves and for future children. In the course of these activities the children were given many opportunities to develop "the lost virtues": honesty, responsibility, integrity and compassion (Bronfenbrenner 1979).

The action and recognition built into each phase of the ongoing school ground biodiversification project at Strawberry Vale have provided a wealth of opportunities for the children to have fun, build a sense of belonging, and take pride in helping create their own natural play/learning environment. It has allowed them to "do something small that makes a big difference" (Goodall 2010).

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[10] *The Primary Program: A Framework for Teaching* (2000). British Columbia Ministry of Education.

## Directions for Further Research

### Management for Long-term Sustainability of Greening Projects

We need to strengthen the professional and political voice in support of children's healthy play experience in nature, because "unlike most curricula, its benefits are difficult to quantify, and it is highly susceptible to the same reductive pressures that are placed on classes that are deemed less important, such as arts or physical education" (Stanley 2009, 43).

Accordingly, we must examine the bigger picture in ecological restoration of school grounds through the following questions:

1. What are the forces that shape children's landscapes and what are the implications for management, instruction and research?

2. If organizations move in the direction of the questions they ask about themselves, then what questions should we be asking to begin a meaningful dialogue about the importance of creating biodiverse schools grounds? (Cooperrider, Whitney and Stavros 2005)

3. How do we address the adaptive challenges inherent in developing and maintaining flourishing and sustainable biodiverse playgrounds? That is, how do we alter perceptions and belief systems so that the same level of commitment, passion and advocacy that is brought to maintaining the barren school ground is also dedicated to developing and caring for the biodiverse playground? (Heifetz and Linsky 2002)

4. How do we address the technical challenges? That is, how do we retrain designers and maintenance personnel? The same level of expertise developed for lawn horticulture could then be put toward establishing and maintaining native shrub cluster plantings (dens or vegetative rooms) and other natural interventions to encourage children's sociodramatic play (Heifetz and Linsky 2002).

5. What factors do various stakeholders or partners identify as contributing to the long-term success of a school ground naturalization process and environmental education program?

6. How can we balance our perceptions of risk and safety to provide children with appropriately challenging and enticing natural learning environments?

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*extensively with children, educators, and the broader community to co-create sustainable naturalized school grounds and municipal playscapes. Her research interest is in bringing together people and ideas across disciplines, integrating the areas of education, developmental psychology, brain/mind research and restoration ecology.*

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## References

**Berman, M., J. Jonides and S. Kaplan** (2008). "The Cognitive Benefits of Interacting With Nature." *Psychological Science* 19(12): 1207-1212.

**Bienenstock, A.** (2010). "Making the Case for Natural Playgrounds." *Interaction: Canadian Child Care Federation.* Spring (24): 1.

**Bronfenbrenner, U.** (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge, MA: Harvard University Press.

**Bruce, T.** (1991). *Time to Play in Early Childhood Education*. London: Hodder and Stoughton.

**Carson, R.** (1956). *The Sense of Wonder*. New York: Harper and Row.

**Chatterjee, S.** (2005). "Children's Friendship with Place: A Conceptual Inquiry." *Children, Youth and Environments* 15(1): 1-26. Available from: http://www.colorado.edu/journals/cye.

**Chawla, L.** (1999). "Life Paths into Effective Environmental Action." *Journal of Environmental Education* 31(1): 15-26.

**-----**(2007). "Childhood Experiences Associated with Care for the Natural World: A Theoretical Framework for Empirical Results." *Children, Youth and Environments* 17(4): 144-170. Available from: http://www.colorado.edu/journals/cye.

**Cheskey, E.** (1996). "How Schoolyards Influence Behavior: What Common Sense and Research Tell Us." *Green Teacher* 47: 11-14.

**Cooperrider, D., D. Whitney and J. Stavros** (2005). *Appreciative Inquiry Handbook: The First in a Series of AI Workbooks for Leaders of Change*. Brunswick, OH: Crown Publishing.

**Dyment, J., and A. Bell** (2007). "Active by Design: Promoting Physical Activity through School Ground Greening." *Children's Geographies* 5(4): 463-477.

**-----**(2008). Our Garden is Colour Blind, Inclusive and Warm: Reflections on Green School Grounds and Social Inclusion. *International Journal of Inclusive Education* 12(2): 169-183.

**Dyment, J., A. Bell and A. Lucas** (2009). "The Relationship between School Ground Design and Intensity of Physical Activity." *Children's Geographies* 7(3): 261-267.

**Eisner, E.** (1998). *The Enlightened Eye: Qualitative Inquiry and the Enhancement of Educational Practice*. Upper Saddle River, NJ: Merrill/Prentice-Hall.

**Engleson, D. and D. Yockers** (1994). *A Guide to Curriculum Planning in Environmental Education*. Madison, WI: Wisconsin Department of Public Instruction.

**Faber Taylor, A. and F. Kuo** (2008). "Children with Attention Deficits Concentrate Better After Walk in the Park." *Journal of Attention Deficits* 20(10): 1-8.

**Faber Taylor, A., F. Kuo, and W. Sullivan** (2001). "Coping With ADD: The Surprising Connection to Green Play Settings." *Environment and Behavior* 33(1): 54-77.

**-----**(2002). "Views of Nature and Self Discipline: Evidence from Inner City Children." *Journal of Environmental Psychology* 22: 49-63.

**Fjørtoft, I.** (2001). "The Natural Environment as a Playground for Children." *Early Childhood Education Journal* 29(3): 111-117.

**-----**(2004). "Landscape as Playscape: The Effects of Natural Environments on Children's Play and Motor Development." *Children, Youth and Environments* 14(2): 21-44. Available from: http://www.colorado.edu/journals/cye.

**Fjørtoft, I., and J. Sageie** (2000). "The Natural Environment as a Playground for Children: Landscape Description and Analyses of a Natural Playscape." *Landscape and Urban Planning* 48: 83-97.

**Gibson, J.** (1977). "The Theory of Affordances." In Shaw, R. and J. Bransford, eds. *Perceiving, Acting, and Knowing: Toward an Ecological Psychology*. Hillsdale, NJ: Lawrence Erlbaum, 67-82.

**Glasser, W.** (1990). *The Quality School: Managing Students without Coercion*. New

York: Harper and Row.

**Goleman, D. and G. Lucas** (2010). *Rethinking Education: Educating Hearts and Minds*. Available from: http://www.learnoutloud.com/Audio-Books/Education-and-Professional/Teaching/Rethinking-Education-Educating-Hearts-and-Minds/33580

**Goodall, J.** (2010). HuffingtonPost.com. June 17. "Exclusive Interview with Dr. Jane Goodall." Available from: http://huff.to/a3ofRq

**Hart, R.** (1979). *Children's Experience of Place*. New York: Irvington Publishers.

**Harvey, M.** (1990). "The Relationship between Children's Experiences with Vegetation on School Grounds and Their Environmental Attitudes." *Journal of Environmental Education* 21(2): 9-15.

**Heft, H.** (1989). "Affordances and the Body: An Intentional Analysis of Gibson's Ecological Approach to Visual Perception." *Journal for the Theory of Social Behavior* 19(1): 1-30.

**Heifetz, R. and M. Linsky** (2002). *Leadership on the Line: Staying Alive Through the Dangers of Leading*. Boston: Harvard Business School Press.

**Herrington, S. and K. Studtmann** (1998). "Landscape Interventions: New Directions for the Design of Children's Outdoor Play Environments." *Landscape and Urban Planning* 42: 191-205.

**Isen**, **A.** (1993). "Positive Affect and Decision Making." In Lewis, M. and J. Haviland, eds. *Handbook of Emotions*. New York: The Guilford Press, 261-277.

**Kaplan, R. and S. Kaplan** (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge, UK: Cambridge University Press.

**Kirkby, M.** (1989). "Nature as Refuge in Children's Environments." *Children's Environments Quarterly* 6(1): 7-12. Available from: http://www.colorado.edu/journals/cye.

**Konner, M.** (2010). *The Evolution of Childhood: Relationships, Emotion, Mind*. Harvard University: Belknap Press.

**Louv, R.** (2005). *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder.* Chapel Hill, NC: Algonquin Books.

**Mead, R.** (2010). "State of Play: How Tot Lots Became Places to Build Children's Brains." Available from: http://www.newyorker.com/gp/outloud

**Moore, R.** (1974). "Anarchy Zone: Kids' Needs and School Yards." *School Review* (August): 621-645.

**-----**(1986a). *Childhood's Domain: Play and Place in Child Development*. London: Croom Helm.

**-----**(1986b). "The Power of Nature Orientations of Girls and Boys Toward Biotic and Abiotic Settings on a Reconstructed School Yard." *Children's Environments Quarterly.* Fall: 52-69. Available from: http://www.colorado.edu/journals/cye

**Moore, R. and H. Wong** (1997). *Natural Learning: the Life History of an Environmental Schoolyard*. Berkeley, CA: MIG Communications.

**Nabhan, G. and S. Trimble** (1994). *The Geography of Childhood*. Boston: Beacon Press.

**Samborski, S.** (2000). *Barren or Biodiverse Schoolgrounds: Their Effects on Children*. Master's Thesis: University of Victoria, Victoria, BC, Canada.

**Siegel, D.** (2007). *Mindful Brain: Reflection and Attunement in the Cultivation of Well-Being*. New York: Norton and Company.

**Snively, G.** (1987). "The Metaphor Interview and the Analysis of Conceptual Change." In Helm, H. and J. Novak, eds. *Proceedings of the Second International Seminar on Misconceptions in Science and Mathematics: Metacognitive Strategies, vol. 1.* Ithaca, NY: Cornell University Press, 434-443.

**Stanley, E.** (2009). "Replaying Recess: An Inquiry into the Values of Outdoor Play in School." *Thresholds in Education* 35(3): 37-44.

**-----**(2010) *Monkey Brains and Monkey Bars: An Ecological Approach to the Values of School Recess*. Doctoral Dissertation, Environmental Studies, Antioch University. Available from: http://etd.ohiolink.edu/view.cgi?acc_num=antioch1274047228

**Titman, W.** (1994). *Special Places, Special People: The Hidden Curriculum of School Grounds*. Surrey: Learning through Landscapes, Panda House.

**Tornyai, M.** (1999). *Cultivating Children's Intentional States: The Evolution of Cultural Adaptation and "Worldmaking" in the Medium of "Living Through" Drama*. Master's Thesis: University of Victoria, Victoria, British Columbia.

**Vygotsky, L.** (1979). *The Genesis of Higher Mental Functions: The Concept of Activity in Soviet Psychology*. New York: Sharpe.

**Wells, N. and G. Evans** (2003). "Nearby Nature: A Buffer of Life Stress Among Rural Children." *Environment and Behavior* 35(3): 311-330.

**Wells, N. and K. Lekies** (2006). "Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism." *Children, Youth and Environments* 16(1): 1-24. Available from: http://www.colorado.edu/journals/cye.

**Wertsch, J.** (1985). *Vygotsky and the Social Formation of Mind*. Cambridge, MA: Harvard University Press.

**Wong, E.** (1995). "Challenges Facing the Teacher/Researcher: Conflicts of Purpose and Conduct." *Educational Researcher* 24: 3, 22-28.

**Zar, J.** (1999). *Biostatistical Analysis, 4th ed*. New Jersey: Prentice Hall.

**Ziegler, S. and H. Andrews** (1987). "Children and Built Environments: A Review of Methods for Environmental Research and Design." In Bechtel, R., R. Marans and W. Michelson, eds. *Methods in Environmental and Behavioral Research*. New York: Van Nostrand Reinhold Co, 301-336.

## Appendix A. Noon-Hour Observation Example: The Children's Discovery of a One-Eyed Sphinx Moth (*Smerinthus cerisyi*) on the Strawberry Vale School Ground

As the sunny lunch hour in late May was drawing to an end, a cool ocean breeze began to rustle the oak leaves above the children's heads. Nicola and Samantha (both age 8) had been showing me some of their favorite places. First they had shared their favorite area on the fixed play equipment, the tires where they played a game they had created with their friends, called "toilet monster." In the oak meadow area, one of their choice spots was the wide horizontal base of an oak's trunk where they played horses with their small stuffed animals, under the scented blossoms of the wild roses. Nicola told me they really liked playing there where they could smell the Nootka roses and see the camas blooming.

Samantha took me to another special place. This was a magical triangular hole at the centre of an oak stump where they made "witches' brew" by mashing weeds with a stick and arranged spiraling patterns of pebbles and clay balls when it rained. The two girls then led me to the ledges of their "house" in the rocks, where they had stacked little rocks to make dishes and pots, and bundled small sticks and grass stems together as knives and forks. They had just taken me to a little depression at the top of the rock where they kept their "pets"--three little green looper caterpillars with some Indian plum leaves for food--when the bell rang to call them back to afternoon classes.

As we walked toward the school we could hear children's voices raised in great excitement: "It's a gypsy moth!" "Jeremy's found a great big moth!" "It was where we were digging." "We should kill it. They're bad." "They're spraying gypsy moths and Jenny's allergic to the spray." "Jenny's parents were in the newspaper talking about spraying the moths."

Several dozen children were gathered around the concrete ledge outside the open classroom doors where a one-eyed sphinx moth *(Smerinthus cerisyi)* was quivering. It looked in very good condition, and had probably just emerged from its underground pupa case.

"That's not a gypsy moth," one girl protested. "Karla did a report on gypsy moths, and they're little." The moth shifted suddenly, exposing its dramatic red under wing with vivid blue and white eyespots. The children gasped, and Jeremy gently slipped a lichen-covered Garry oak twig under the moth.

"Look! It's camouflaged now," he said, as the moth's outer wings, with their protective bark-and-lichen coloration settled over the under wings. The moth clung to the twig, as Jeremy lifted it so that all the children could see.

"You're right, it's not a gypsy moth," I intervened. "This moth moves its wings quickly, like a hummingbird, so some people call it a hummingbird moth. The males, or dads, have feathery antennae so they can smell the female's perfume

and be attracted to her, from a long way away. Can you tell if this is a male or a female?"

"It's a female. She's got thin antennas." "She's fat! She's going to have babies." "She's going to lay eggs, you mean." "And then they'll be caterpillars." The children seemed proud of the knowledge they could share, and two teachers, who had also come to see the source of the excitement, allowed the children to stay outside to observe the moth, share the stories and information her presence generated, and experience this "learning moment" together.

As Samantha and Nicole returned to their classroom with the other children, Jeremy (age 10), whose teacher had given him permission to take care of his discovery, carried the moth up to his favorite fort surrounded by glacier-scoured boulders on a rocky promontory. The breeze picked up and he cradled the moth with his arm to protect it.

As he walked, he talked about the animal he was looking after. "And her wings, when she opens them, that scares the predators away. It looks like perfume coloring."

"What do you think perfume colors are like?" I asked him.

"Pink and purple. 'Cause it's to scare away their predators and attract males. That's what females do."

"Where did you learn all of this, Jeremy?"

"From our class. We were talking about insects on the wetlands. We're going to Salt Spring Island on Tuesday.

Monty (age 10) joined Jeremy, and they examined the moth together (see Photo C). "It's pink and brown. It sort of looks like a bat underneath," said Monty. "We should make a label," suggested Jeremy. "I'll get a piece of paper and some tape, and put 'Hummingbird Moth' on it and then kids could know."

Jeremy set the stick on a safe natural ledge between a contorted Garry oak tree and a wild apple tree, and then returned to his classroom for a piece of cardboard to make the sign.

## Appendix B. "Walkabout" Interview Example: Transcript of Part of Monty's Tour

(Researcher: What is your favorite place on the school ground, Monty?)

Monty: It's the baseball diamond and the basketball court. 'Cause I like playing California kickball and baseball up at the baseball diamond and I like playing basketball and hockey. {We walked around the higher grounds to the south of the school, under a canopy of Garry Oak and around sections of rocky outcrop softened by Indian plum *(Oemlaria)* and wild rose.}

Monty: I like building forts over here. So this—starting right there {path into rocks}... I come around and go around there, and come up here and like, there's a little part—through the rocks. {Monty led me through a narrow entrance into a fort.}

Monty: And we make stuff here. And that's the back door over there. And we gather interesting stuff up and put it up here in a little jar. Like red ants and we sometimes find little green things. I think I put that little green caterpillar there, with the ants. I found it up there, in the grass.

(R: Tell me what you pretend.)

Monty: Well, we get all our friends to help us, and we built leaves around it, and we put rocks in the middle. And we built a fort with leaves and rocks in it over there. There was about 20 people in there and Mrs. R. {the vice principal} took a picture of us.

(R: Were you there at lunch time today?)

Monty: No. I was playing hockey.

(R: What's a good place to be really imaginative?)

Monty: I think it's around the rocks and trees, 'cause we used to have a big stick here that had a handle. And we stuck it through there ...sort of like a missile. And we could move it up and down and sideways. And right here we had a little spy thing, 'cause we found a pipe and we could look through it. Those rocks were for blocking so we could put the big stick in there, so we could keep it stiff and stuff when we held it.

## Appendix C. Mean ranks used for the Mann-Whitney tests (Zar 1999) to determine differences in preference for school ground elements between primary- and intermediate-age children—"All Children" (col. 11, Table 3)

| Element | Schooling Level | N | Mean Rank | Sum of Ranks | Significant Preference |
|---|---|---|---|---|---|
| Pavement for Play | Primary | 208 | 192.30 | 39998.00 | |
| | Intermediate | 141 | **149.48** | 21077.00 | Intermediate |
| | Total | 349 | | | |
| Big Rocks or Boulders | Primary | 208 | 171.22 | 35614.50 | |
| | Intermediate | 141 | 180.57 | 25460.50 | |
| | Total | 349 | | | |
| Hiding Places in Bushes | Primary | 208 | 173.34 | 36055.00 | |
| | Intermediate | 141 | 177.45 | 25020.00 | |
| | Total | 349 | | | |
| Adventure Playground | Primary | 208 | **160.79** | 33445.00 | Primary |
| | Intermediate | 141 | 195.96 | 27630.00 | |
| | Total | 349 | | | |
| Monkey Bars | Primary | 208 | 174.45 | 36285.00 | |
| | Intermediate | 141 | 175.82 | 24790.00 | |
| | Total | 349 | | | |
| Wildflowers | Primary | 208 | **162.70** | 33842.00 | Primary |
| | Intermediate | 141 | 193.14 | 27233.00 | |
| | Total | 349 | | | |
| Trees and Shrubs | Primary | 208 | 176.26 | 36661.50 | |
| | Intermediate | 141 | 173.15 | 24413.50 | |
| | Total | 349 | | | |
| Swings | Primary | 208 | 177.95 | 37014.50 | |
| | Intermediate | 141 | 170.64 | 24060.50 | |
| | Total | 349 | | | |
| Soccer Field | Primary | 208 | 189.00 | 39311.50 | |
| | Intermediate | 141 | **154.35** | 21763.50 | Intermediate |
| | Total | 349 | | | |
| Stumps | Primary | 208 | **164.11** | 34135.00 | Primary |
| | Intermediate | 141 | 191.06 | 26940.00 | |
| | Total | 349 | | | |
| Benches or Other Places to Sit | Primary | 208 | 183.37 | 38140.00 | |
| | Intermediate | 141 | **162.66** | 22935.00 | Intermediate |
| | Total | 349 | | | |
| Pond or Stream | Primary | 208 | 167.96 | 34936.00 | |
| | Intermediate | 141 | 185.38 | 26139.00 | |
| | Total | 349 | | | |
| Flower or Vegetable Garden | Primary | 208 | **151.88** | 31591.50 | Primary |
| | Intermediate | 141 | 209.10 | 29483.50 | |
| | Total | 349 | | | |
| Picnic Tables | Primary | 208 | 184.48 | 38371.00 | |
| | Intermediate | 141 | **161.02** | 22704.00 | Intermediate |
| | Total | 349 | | | |

Note: Children scored the school ground elements as very important (1), somewhat important (2), or not important (3). If the asymptotic sigmoidal 2-tailed Mann-Whitney test indicated a significant difference between rankings, the lower rank (showing higher preference for the element) is in bold print in the table. If the preference is statistically significant, the group with higher preference is indicated in the right column. A blank space indicates no significant difference in scoring between the two groups.

## Appendix D. Interview Questions Used as Guidelines During "Walkabout" Interviews on the Two School Grounds.

The 16 children (two primary girls, two primary boys, two intermediate girls and two intermediate boys from each school) selected by their teachers from many volunteers, all led me on approximately 20-minute "walkabouts" during warm, sunny days in May and June 1999. Some children stayed longer to answer selected optional questions.

- What is your favorite place (or thing) on the school ground?
- What is one of the best times you've had on the school ground?
- Where do you play make-believe? Tell me what you pretend.
- What's a good place to be really imaginative?
- Which places do you go when you want to be with friends?
- Which places do you go when you want to be alone?
- Have you ever found there was someone or something you avoided or were afraid of on your school ground? What was it and why did you avoid it?
- Do you find the school ground a safe or a dangerous place at different times? In what ways?
- What games or sports do you like to like to play on your school ground? Where do you play them?
- Have you seen any animals on your school ground? (Examples might include vertebrates—squirrels, robins, etc. and invertebrates—caterpillars, ants, etc.) Where did you see them?

Optional questions:

- How would you design a school ground for yourself and your friends?
- How would you change the school ground if you could do anything you wanted?
- What are some of the benefits of greening the school ground, for a little child just starting school?
- What are the benefits for an older student in the school?
- If you were to create a school ground like yours at a different school site, what advice would you give the people at the other school?
- Do you feel satisfied that your ideas and the ideas of the other children have been used during the greening process?
- What do you think could help the greening project at your school to go on for a long time?