



Research Paper

The impact of greening schoolyards on the appreciation, and physical, cognitive and social-emotional well-being of schoolchildren: A prospective intervention study

J.E. van Dijk-Wesselius^{a,*}, J. Maas^b, D. Hovinga^a, M. van Vugt^b, A.E. van den Berg^c

^a University of Applied Sciences Leiden, The Netherlands

^b VU Amsterdam, The Netherlands

^c University of Groningen, The Netherlands

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ABSTRACT

Greening schoolyards is an initiative to reconnect children with nature and afford meaningful experiences that foster children's well-being. To strengthen the empirical basis for greening schoolyards, we conducted a longitudinal prospective intervention study with a two-year follow-up, to investigate the impact of greening schoolyards on schoolchildren's (age 7–11) appreciation of the schoolyard, and their physical, cognitive, and social-emotional well-being. Data were collected amongst nine elementary schools in moderate-to-high-urbanized areas in The Netherlands with approximately 700 children at each measurement. At baseline, all nine schoolyards were paved. Five schools greened their schoolyard between baseline and first-follow-up. Objective measurements included accelero-based measurements of physical activity during recess, attentional tests (Digit Letter Substitution Test, Natu & Argwal, 1995; Sky Search Task, Manly et al., 2001) and a social orientation test (Social Orientation Choice Card, Knight, 1981). Self-report questionnaires included children's appreciation of the schoolyard (naturalness, likability, attractiveness and perceived restoration), and their social- and emotional well-being (Strength and Difficulties Questionnaire, van Widenfelt, Goedhart, Treffers & Goodman, 2003; Social Support, RIVM, 2005; Pediatric Quality of Life Inventory, Varni, Seid & Kurtin, 2001). Multilevel data analyses support our expectation that greening has a positive impact on children's appreciation of the schoolyard, their attentional restoration after recess and social well-being. Furthermore, our results indicate that greening stimulates physical activity of girls. We found no impact on emotional well-being. These findings provide some support for the relevance of greening schoolyards and may guide further development of schoolyards that facilitate the well-being of schoolchildren.

1. Introduction

Children need experiences to wonder, explore, give meaning, take risks, feel comfortable, be challenged and physically modify the world around them. These sensory-motor experiences are well-known to support children's physical, cognitive and social-emotional development and well-being (Cole & Cole, 1989). An increasing body of evidence suggests that green spaces, like gardens, parks, woods and beaches, are essential elements of healthy communities for children to immerse in these experiences (for reviews, see Chawla & Nasar, 2015; Gill, 2014).

While evidence for the importance of nearby green spaces in

children's everyday lives is growing, opportunities for children to engage with natural environments continue to decrease (Ferguson, Cassells, MacAllister, & Evans, 2013; WHO, 2017). Concerned by this loss of access to green space, organizations and professionals worldwide have highlighted the importance of reconnecting children with nature to promote healthy, sustainable and livable cities (Douglas, Lennon, & Scott, 2017; WHO, 2017). One way to reconnect children with nature is through greening their schoolyards. Given that elementary schoolchildren, aged 7–11, on average spent most of their time at school, greening schoolyards could make an important contribution to their physical, cognitive and social-emotional development and well-being (Chawla & Nasar, 2015).

* Corresponding author at: Nature and Child Development, Department of Education, University of Applied Science Leiden, Zernikedreef 11 2333 CK, Leiden, The Netherlands.

E-mail addresses: dijk.van.j@hsleiden.nl (J.E. van Dijk-Wesselius), j2.maas@vu.nl (J. Maas), Hovinga.d@hsleiden.nl (D. Hovinga), m.van.vugt@vu.nl (M. van Vugt), a.e.van.den.berg@rug.nl (A.E. van den Berg).

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2. The case for greening schoolyards

In line with Bell and Dymont (2008) we describe a green schoolyard as an outdoor school environment where natural elements (such as trees, flowers, sand, water, grass, hills and bushes) are combined to create a more appealing schoolyard and improve the quality of children's (play) experiences. Ideally, a green schoolyard should be designed and used in such a way that it invites and encourages each child to interact, play and learn in and with nature in ways that fosters all aspects of their development and well-being.

Several theories provide guidance for understanding the potential benefits of greening schoolyards on children's development and well-being. First, according to the widely noted biophilia hypothesis (Kellert & Wilson, 1995), all human beings have a genetically inherited need to affiliate and connect with life and life-like forms. Playing on a green schoolyard can fulfil this need, and thereby foster a sense of connectedness to nature which induces increased feelings of psychological well-being. Connectedness to nature has also been linked to more prosocial behavior in children (Collado, Staats, & Corraliza, 2013). Other theories focus on nature's capacity to provide restoration from stress and mental fatigue, to explain the impact of greening schoolyards on children's cognitive and emotional well-being. More specifically, Stress Recovery Theory (SRT; Ulrich, 1983) states that exposure to unthreatening natural environments elicits an initial positive affective reaction which triggers a series of positive psychophysiological responses. In a related vein, Attention Restoration Theory (ART; Kaplan, 1995) posits that unthreatening natural environments automatically draw attention in a pleasant and involuntary way, which allows depleted cognitive resources to rest and replenish and could explain a positive impact of greening schoolyards on children's attention restoration. Natural environments may further support cognitive restoration by fostering a sense of being away and extent, and because their characteristics tend to be compatible with users' needs and purposes.

According to another line of reasoning, children's (play)experiences in a natural environment are the central pathway to understand how engagement with nature fosters children's well-being. For instance, the Theory of Loose Parts (Nicholson, 1972) attributes the beneficial effects of nature to the presence of loose parts, or materials that can be moved around, designed and redesigned, like twigs, stones and sand. These loose parts create abundant opportunities for children to engage in open and flexible play experiences. Children are drawn in a creative engagement with the environment in which they experience immediate consequences of their own and other children's actions. As a result, in children's behavior there is an endless stream of transforming, exploring and modifying the environment with all their senses and abilities, and an ongoing interaction with the behavior and abilities of children surrounding them. (Chawla, Keena, Pevec, & Stanley, 2014). In a similar vein, Affordance Theory (Gibson, 1979) posits that there is an intertwined relation between people and the environment, in which affordances, the functions environmental objects can provide to people, are related to the individuals themselves. Natural settings tend to offer a rich variety of affordances, or perceived opportunities for play that tap into the child's current needs, interest and abilities. For example, a tree with low-lying branches invites children to immediately climb it, when they at least can reach the lowest branch.

Loose parts and affordances facilitate an enriched play situation through which nature fosters children's cognitive, social and emotional well-being and development by the behavior of children in these environments. Natural features are less set, children can derive their own meanings and are invited, challenged and encouraged to explore the world and their own and other children's abilities. These experiences, for instance, stimulate children's physical activity, social interaction, cooperation, skill mastering and feelings of self-resilience and competence. (Chawla et al., 2014; Dymont & Bell, 2007).

Together these theories propose an integrated framework of

affective, cognitive and behavioral explanations on why greening schoolyards could foster children's physical, cognitive and social-emotional well-being. Below, we discuss empirical evidence supporting these explanations.

2.1. Appreciation of the schoolyard

Several observational and explorative studies show that schoolchildren prefer to play in natural areas at the schoolyard (Chawla et al., 2014; Jansson, Gunnarsson, Mårtensson, & Andersson, 2014; Lucas & Dymont, 2010), and that children playing on a green schoolyard show greater appreciation of their schoolyard compared to a paved schoolyard (Maas, Tauritz, van der Wal, & Hovinga, 2013; Samborski, 2010). Furthermore, a Dutch study followed 308 children aged 6 to 9 of four elementary schools before and after greening and found that on two schools children's appreciation of the schoolyard increased after greening. In addition, they found that appreciation was positively related to attentional capacity, and social and emotional well-being (De Vries, Langers, Donders, Willeboer, & Van Den Berg, 2013).

2.2. Physical activity

Although the evidence is somewhat mixed and inconclusive, the idea that greening schoolyards can support children's physical activity is supported by several studies (Ferguson et al., 2013; Sharma-Brymer & Bland, 2016). For instance, 105 teachers, parents and administrators of 59 Canadian elementary schools consistently reported that greening their schoolyard created opportunities for children to be more physically active (Dymont & Bell, 2008). Furthermore, Fjørtoft (2004) showed that playing on a green schoolyard every day for one or two hours led to significant improvement of motor ability in children aged 5–7 in Norway, compared to children who played on a traditional schoolyard. However, other studies do not support the assumption of increased physical activity in green areas. For instance, Mårtensson et al. (2014) showed that although environments with more diverse features support a greater variety in play experiences, school children aged 10–13 on two schools in Sweden, were not more physically active on green schoolyards compared to paved schoolyards. This may be explained by the fact that paved open spaces and flat surfaces promote and invite locomotion in high speed – which may even result in higher level of physical activity compared to natural spaces, especially in boys (Fjørtoft, Kristoffersen, & Sageie, 2009).

2.3. Cognitive and social-emotional well-being

Empirical research on the impact of greening schoolyard on attentional capacity and social-emotional well-being of children is relatively scarce. One study among 14 elementary schools in a large Australian city showed that children's perceptions of the restorative qualities of their schoolyard were positively related to vegetation volume and self-reported positive affect (Bagot, Allen, & Toukhsati, 2015). Furthermore, based on parent and teacher's observations, alumni memories and ethnographic observations, Chawla et al. (2014) report that playing on a green schoolyard enables children aged 6–12 to escape from stress and supports social relationships. Furthermore, two Dutch studies showed that children playing on a green schoolyard reported that they had more friends and experienced less bullying behavior than children playing on a paved schoolyard (De Vries et al., 2013; Maas et al., 2013).

The available empirical knowledge partly supports the theoretical framework that greening schoolyards indeed provides opportunities for children to immerse in meaningful play experiences, and that these experiences can positively influence children's appreciation of the school ground, their physical activity, and cognitive, and social-emotional well-being. However, the available empirical evidence for school children is still limited and in some cases mixed or inconclusive. Moreover, most of the studies suffer from limitations such as a lack of

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