

# Impact of Sustainable School Design on Primary School Children's Mental Health and Well-Being

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**Abstract**—Common mental health disorders encountered during childhood years. There is an important evidence that investment in promoting the mental health and well-being of parents and children notably in the preschool years, can avoid health and social problems later in life. Reaching out to a better health and well-being for all requires a sustained and systematic effort. The correlation among school's environment design and children's mental well-being has rarely been addressed from a sustainable architectural point of view, while it is believed that well-designed environment components of school can improve learning, creativity and other mental well-being outcomes. One of the school sustainable design can be a green environment considerations. School grounds can provide important consideration as a potential setting for intervention for children's health disorders. This paper explores how natural outdoor environment of school, which contain a greater diversity of landscaping and design features, influence the quality of mental health and well-being among preschool children. In other words, this paper argues whether primary school children's mental health and well-being promotion in future is correlated with the sustainable design of environment at schools. The department for children, schools, and families in UK recommends that: « By 2020 all schools manage and, where possible, design their buildings in ways that visibly demonstrate sustainable development to everyone who uses the school» (Department for children, 2008). So this approach can have a transmission role of environmental values for children. Findings show that sustainably designed schools can have a crucial role in the emergence of well-being outcomes of children.

**Keywords**— Environment, Mental health, Sustainable design, Well-being outcomes.

## I. INTRODUCTION

**C**HILDREN are most sensitive and the most affected age group that constitute society and are in the most important years of their lives that foundations of character development such as Mental, physical and social aspects forms. Therefore, a major consideration must be done for these foundations especially the mental aspect of children's health. In other words, mental health, well-being and resilience has a crucial role in supporting physical health, positive relationships, education and work. For this reason, reaching

out to the benefits of health and well-being needs a sustained, systematic and concentrated endeavor (Confident Communities, Brighter Futures, HM Government, 2010).

In recent years due to mental problems in children, there has been an intense attention for taking it in to account and also many important achievements has been made, but there are still many shortcomings and defects in this crucial issue [1]. For instance, England Department of Health believes that strong evidence has been laid on the avoidance of the health and social problems later in life by the investment in promoting the mental health and wellbeing of children in the pre-school years. This department stated that: “common mental health disorders encountered during childhood and teenage years”. So children and adolescents are at high risk of developing mental problems. Further results show that between 14 to 22 percent of children and adolescents face with the behavioral disorders [2]. These disorders include silence, depression, anxiety, hopelessness, resignation and social isolation and also physical complaints [3]. As a matter of fact, in order to sustain a person's mental health and to prevent from psychological problems at his/her future life, it is need to be considered and developed from childhood.

On the other hand, Researchers like: Banderoff & Scherer, 1994; Han, 2009; Humberstone & Lynch, 1991; Kuo & Taylor, 2004; Louv, 2009a; Noddings, 2006; Riebel, 2001; Robertson & Kiewit, 1998; Russell, 2002, have demonstrated positive relation between nature and well-being of children and adults [4]. Furthermore, Faber and Kuo have contributed important research to the understanding of the impact of nature on people's lives, and specifically to the well-being of children [5].

This approach of nature contact of children at schools can be reached through sustainable design. Accordingly, the term “sustainability” offers a wide focus in nature and green environments. According to World Health Organization, nowadays it is not possible to maintain population health without ecologically sustainable development. Although in the ecology of human development and ecological psychology, “ecology and environment” used to describe the effect of the human-built and social environment rather than the natural environment on children's health development [6]. For this reason, major considerations has to be paid for this aspect of sustainability towards sustainable mental health of children.

This paper aims to fulfil the questions below:

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- How sustainable design through natural environment, provides green schools?
- What are the children’s mental health and well-being outcomes?
- Is there any connection between mental health outcomes and nature contact of children?
- How sustainability approach positively affects these mental health and well-being outcomes in children?

School ground greening is an international approach that focuses on the design of school grounds. It can sustain mental health of children. Schools around the world have embraced the notion of school ground greening and are transforming hard, barren expanses of turf and asphalt into places that include a diversity of natural and built elements, such as shelters, trees, shrubs, meadows, ponds, grassy berms and vegetable gardens. School ground greening is particularly prominent in Canada, Australia, the United Kingdom, the United States, Scandinavia, New Zealand and South Africa [7].

This paper outlines the contribution that the sustainable green school grounds can make to improving mental health and well-being outcomes for primary school children. It describes nature’s positive effect on the five pillars of the mental health and well-being outcomes and green outdoor environment of school model. While the intersection of green school grounds and health has received some attention, few researches have directly explored the influence of greening for mental health and well-being of children. This research shows how sustainable school outdoor environment can provide input in terms of sustainable and early intervention for children’s mental health and well-being.

## II. MENTAL HEALTH AND WELL-BEING

According to experts in the field of humanism, mental disorder and mental health and well-being should not be seen as two sides of a continuum but should distinguish between them. Therefore the meaning of “mental health” is promoting the positive aspects in humans and their well-being. In cognitive perspective as well as humanism the positive aspects of human cognition and mental health is stressed. Therefore, in positive psychology “well-being” was introduced as a concept of mental health, and well-being is viewed as a positive attribute, even if the person does not have any diagnosed mental health condition. For this reason, to sustain children’s positive attributes it is essential to identify the effective well-being models that researchers have introduced.

Myers, Sweeney and Witmer give an example of a well-being model including twelve sub tasks that are “sense of worth, sense of control, realistic beliefs, emotional awareness and coping, problem solving and creativity, sense of humor, nutrition, exercise, self-care, stress management, gender identity, and cultural identity, which are identified as characteristics of healthy functioning and a major component of well-being [8]. On the other hand, Kellert stated that: “Nature is important to children’s development of intellectually, emotionally, socially, and physically” [6]. These statements of researchers can get under a survey of a major connectivity between nature and mental well-being.

## III. NATURE, MENTAL HEALTH AND WELL-BEING

Kellert stated that many researchers have found a deep effect of the natural environment on human health like: Barton & Pretty, 2010; Brymer, 2009; Brymer & Oades, 2009; Brymer, Schweitzer, & Sharma-Brymer, 2010; Gorrell, 2001; Leather, Pyrgas, Beale, & Lawrence, 1998; Maas et al., 2009; Maas, Verheij, Groenewegen, de Vries, & Spreeuwenberg, 2006; Maller et al., 2008; Reser, 2008; Townsend & Moore, 2005; Weber & Anderson, 2010”. Moreover, in the research of nature and health, Maller et al. (2008) stated: “That the natural environment is a key determinant of health is unquestionable” [6].

Meanwhile, for centuries psychologists and philosophers have found out the important role of natural world to human health and well-being (Deloria, 1994; Dewey, 1958; Harvey, 2000; Jung, 2008; Knudtson & Suzuki, 1996; Marano, 2008; Watts, 1970; Watts, 2003) [4].

Moreover, connecting with nature has been proved to increase positive status (Maller, Townsend, Pryor, Brown, & St Leger, 2006), enhance life skills (Mayer & Frantz, 2005), decrease the mental disorders and increase focusing (Maller et al., 2008) [4]. Therefore, it is a necessity to promote mentally healthy green environments and giving an access to them.

## IV. MENTAL HEALTH AND WELL-BEING OUTCOMES

Analyses proved that outcomes of well-being asserted to be particularly important and has been noticed through mentally healthy children. For instance, in a survey reported in children’s society, the bar chart, Figure 1, shows the proportion of variation in subjective well-being explained by each five ways activity. These activities are the predictors of well-being. As this chart displays, one activity in each of these five activities has the effective role on children’s well-being that are mentioned below:

- Non-team exercise like running or individual playing (nearly 3%): physical activity (be active)
- Teach yourself (nearly 6%): creativity and curiosity (keep learning)
- Help at home (less than 2%): give
- Talk to family (nearly 5%): social interaction (connect)
- Notice surroundings (nearly 11%): take notice

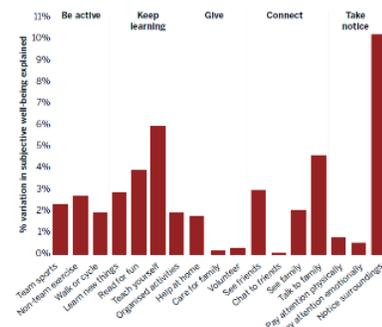


Fig. 1 Proportion of variation in subjective well-being explained by each five ways activity [9].

Nowadays these five ways of well-being such as “Connect, Be active, Take notice, Keep learning and Give” used in a wide range of contexts in the world [10]. For instance, the Children’s Society and New Economics Foundation have demonstrated the five ways to well-being of children and young people including- helping and caring for family (give), social interaction, physical activity, take notice and keep learning (curiosity). This foundation has also found evidence for another way for well-being specific to children such as: creativity, imagination and play [10]. Figure 2, mentions this five well-being outcomes.



Fig. 2 Five well-being outcomes [11].

On the other hand, sub tasks of mental health and well-being that mentioned in section 1, can be provided at sustainable environments. In other words, Contact with nature, has crucial influence in the development of the creativity, problem-solving attitudes, and emotionally and intellectually aspects during the critical period of childhood. Therefore, we can conceive the intersection of nature’s causes for development and outcomes of well-being in terms mentioned below:

- Creativity and curiosity (keep learning): intellectual development aspect
- Social interaction (connect): social development aspect
- Physical activity and play (be active): physical development aspect
- Pay attention to feelings, emotions and surroundings (take notice): emotional development aspect

These activities have been identified as an important and the most noticeable outcomes of child’s mental well-being. According to the England Department of Health, those who carry out these attributes, have high levels of well-being.

All the activities can be seen in the behavior of a mentally healthy child, but since “helping at home” activity can be seen in the behavior of older children and teenagers than primary school children and has a slight effect percentage of less than 2%, the focus will be on the four remaining activities mentioned, plus creativity and play in children [9].

As mentioned about the inevitable relation between nature and these outcomes, the so called green approach and sustainability can establish these outcomes of children’s mental health and well-being.

### V. NATURAL SCHOOL ENVIRONMENT AS A SUSTAINABLE APPROACH

Within a health promotion side of contact with the natural world, this contact has increasingly been recognized as a valuable connection [12].

Today’s children often get a little chance to connect with natural environment, while recent researches show six priorities for children’s well-being that one of them is environment (figure3). ‘Nature-deficit disorder’ is one of the negative outcomes that Louv mentioned in his book, *The Last Child in the Woods*, and pointed to the positive effects that nature has on children [13]. While, children desire natural, complex, challenging and exciting environments that provide options and choice for play [14]. Also different researches indicate that children who are given a chance to select an environment to play, prefer natural settings.

Open spaces provide more opportunity than the closed spaces [15]. Therefore, centralizing natural outdoors for children’s health must be an issue of considerations. Most of the children’s time is spent on watching television and playing video games than being spent on outside activities and connections. On the other hand, it is evident that the school aspect of happiness is the lowest aspect in the children’s point of view, while it should be as important as the family aspect (figure4). For this reason, the suitable place to consider natural connectivity for children are schools. According to the book “*Last Child in the Woods*,” School communities can play a crucial role to a dramatic improvement of children’s connection to the natural world and school’s environment can establish a great opportunity for children to get a chance of connection with nature [13]. In other words, it can be possible to achieve mental health and well-being of children by considering a natural site for schools. Since nowadays sustainability has become a solution for bringing nature to buildings, it will be under a more detailed study for enhancing well-being of pre-school children.



Fig. 3 Six priorities for children’s well-being [10].

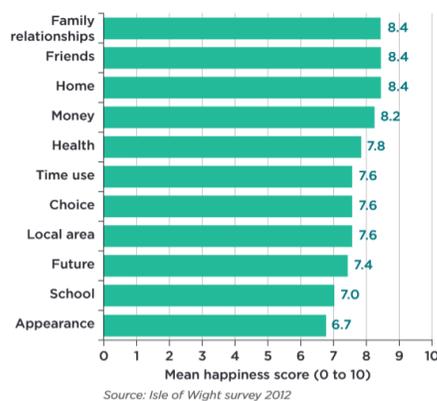


Fig. 4 Happiness with different aspects of life (Isle of wight) [10]

### VI. SUSTAINABLE SCHOOL ENVIRONMENTS

Sustainable schools aim to be models of social inclusion, health, and well-being [16]. The DfES consultation paper has demonstrated eight aspects of a schools so called ‘sustainability themes’ or ‘doorways’ that can be occurred in sustainable schools [17]. Engaging with any of these aspects will enable schools to develop sustainable approaches (Table 1).

The eight *themes* can be noticed in the table 1:

TABLE I  
SUSTAINABILITY THEMES FOR SUSTAINABLE SCHOOLS

<i>Building and grounds</i>	<i>Food and drink</i>
<i>Energy and water</i>	<i>Inclusion and participation</i>
<i>Travel and traffic</i>	<i>Local well-being</i>
<i>Purchasing and waste</i>	<i>The global dimension</i>

As it is obvious from this table, the “buildings and grounds” aspect of sustainable design enable us for a further research of the way to have a green sustainable environment for the enhancement of healthy children through a contact with natural school environment. Moreover, according to the green schools initiative, sustainable schools have four pillars mentioned below:

- 1- Toxics free in environment: children’s environmental health, green building and cleaning materials
- 2- Use sustainable resources: energy efficiency and alternatives, green building design ...
- 3- Create a green healthy space: green schoolyards and gardens ...
- 4- Teach, learn and engage: environmental education...[18]

Furthermore, children spend about 110 minutes a day on the school ground. This amounts to about 25% of their school day and includes:

- 15 minutes before school (range of 1-45 minutes)
- 17 minutes during morning recess (range of 5-25 minutes)
- 37 minutes during lunch (range of 5-90 minutes)
- 17 minutes during afternoon recess (range of 5-45 minutes)
- 23 minutes after school (range: 1-120 minutes) [7].

From this research by Bell and Dymont, it can be exploited that further attention must be paid for school grounds for the enhancement of children’s mental health and well-being.

Therefore, “Buildings and ground” aspect mentioned in figure 4, can give children opportunities to enjoy the school grounds [19]. According to these pillars it can be possible to create a sustainable design, by green schoolyards. Moreover, schools are starting to pay attention to the idea of greening and are transforming hard, barren expanses of turf and asphalt into places that include a diversity of natural and built elements, such as shelters, rock, trees, shrubs, wildflower meadows, ponds, grassy berms and food gardens [7].

The design includes creating green spaces between architecture and exterior spaces. So, the focus on the health and well-being is exemplified in the exterior school environments, whether near entrances or in the schoolyards. Emphasizing on sustainable schools as a means for delivering every child’s future matters will make a better future for adults and their lives as well [20].

### VII. GUIDANCE OF SUSTAINABLE DESIGN OF SCHOOL ENVIRONMENT

Sustainable design of school environment range from tree planting and naturally design of school yards; sustainable build features; to establishing a deeper connection between children and environment.

On the other side, children's connection with nature involves three kinds of contact that are direct, indirect, and symbolic. The ideal connection for children is direct contact with nature [15].

Direct contact brings interaction with self-sustaining aspect and the natural environment. Direct experience of nature is not planned, establishing in unmanaged environment, like a meadow or a forest, a park or a schoolyard. This features can be a way for a sustainable environment.

### VIII. GREEN SCHOOL YARDS

As mentioned before, bringing nature to schoolyards can be a possibility to a sustainable design as well as well-being of preschool children.

Natural school yards positive effects have been demonstrated in many researches.

These positive impacts are:

- Creativity and problem solving enhancement. A survey of children in schoolyards demonstrated that children participate in more creative forms in their play in the green environment.
- Cognitive abilities enhancement. Connecting to natural settings increases children’s ability of focusing (Wells, 2000).
- Attention Deficit Disorder (ADD) symptoms reduction. Natural world can significantly reduce symptoms of attention deficit disorder in children as young as five years old (Kuo and Taylor, 2004). Natural school yard can be a natural world for preschool children.
- Physical activity enhancement. Children who experience school grounds with diverse natural settings are more physically active (Bell and Dymont, 2006).

- Social interaction enhancement. Children will be able to interact with others (Burdette and Whitaker, 2005).
- Self-discipline enhancement (Taylor, Kuo and Sullivan, 2001).
- Stress reduction. Green plants and vistas have an inevitable role in reducing stress among children. Places with greener views and natural play areas show more significant results (Wells and Evans, 2003) [21].

*A. Green schoolyard’s natural primary components*

The primary proceedings for natural components of sustainable school design can be formed with these terms in the table 2:

TABLE II

PRIMARY PROCEEDINGS FOR NATURAL COMPONENTS		
Components	Positive impact	Well-being outcomes
Plant	It will improve children's intellectual, creativity and curiosity development.  Enables the children to learn the natural cycle by using of nature	<i>Keep learning</i>
Water	Attracts the attention of children (It can be used such as a fountain, water gushing from the ground, pied feet of small puddles of water and sand)	<i>Take notice</i>
Topography	Enables children to slide, climbing and rolling over	<i>Play Physical activity</i>
Seating spaces	Spaces for children’s interaction with each other or small-scale spaces allowing two children to sit and chat in more quiet corners of the field	<i>Social interaction</i>

*B. Green schoolyard’s natural primary components*

The table 3, shows the principles of the way for designing preschool landscapes that can be done for the sustainable outdoors of the preschools:

TABLE III

SUSTAINABLE SCHOOLYARD DESIGN			
Design principles	Benefits for sustainability	Benefits for well-being	Image sample
Creating shade with canopy trees	- Protection from harmful effect of sun’s rays -Reduce heat and light -Decrease the demand for fossil fuels to reduce air conditioning use	-Provides safe play environments for children to social gathering ( <i>social interaction, safety and play</i> ) -Increase children’s awareness ( <i>take notice</i> )	

TABLE III  
SUSTAINABLE SCHOOLYARD DESIGN

Design principles	Benefits for sustainability	Benefits for well-being	Image sample
Native species like plants	<ul style="list-style-type: none"> <li>-Improve biodiversity</li> <li>-Provide natural environment</li> </ul>	<ul style="list-style-type: none"> <li>-Provide educational resources for children</li> </ul> <p><i>(Keep learning- take notice)</i></p>	
Soft surface areas like gradual slope hills, grassy space	<ul style="list-style-type: none"> <li>-Cooler surface than artificial turf and asphalt</li> <li>-Reducing soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>-Improve children's activity</li> </ul> <p><i>(Play and physical activity)</i></p> <ul style="list-style-type: none"> <li>-Provides safety ground</li> </ul>	
Pathways to explore like nature trails, wood mulch, straw, or mown grass	<ul style="list-style-type: none"> <li>-Increases sustainable materials</li> </ul>	<ul style="list-style-type: none"> <li>-Highly functional space by serving different functions in place</li> <li>-Different recreational spaces, helping children to orient themselves in space</li> <li>-Good circulation in a space</li> </ul> <p><i>(Creativity, play, take notice, exploration and curiosity)</i></p>	
Different moveable seating materials like sculpted logs, moveable stumps or rocks to wood benches or even cement mosaic in the shape of a turtle or tyres)	<ul style="list-style-type: none"> <li>-Sustainability by natural materials</li> </ul>	<ul style="list-style-type: none"> <li>-Possibility for children to create their own arrangement</li> </ul> <p><i>(Social interaction, creativity)</i></p>	
Sand play	<ul style="list-style-type: none"> <li>-Provides good grading and positive drainage</li> <li>-Usable in all seasons and weather conditions</li> </ul>	<ul style="list-style-type: none"> <li>-Provides rich, tactile experiments</li> <li>-Increase <i>Play, social interaction, physical activity, imagination and creativity</i></li> </ul>	

<p>Create sustainable gardens in low traffic areas like vegetable garden</p>	<ul style="list-style-type: none"> <li>-Decrease storm water runoff</li> <li>-Enhance sustainable environment by diversity of trees, flowers and natural materials</li> </ul>	<ul style="list-style-type: none"> <li>-Improves environment sustainability</li> <li>-Enhances children's learning</li> </ul> <p><i>(Keep learning and take notice)</i></p>	
<ul style="list-style-type: none"> <li>-Water play like ponds</li> <li>-Solar water pumps and low water falls</li> </ul>	<ul style="list-style-type: none"> <li>-Improves retention and infiltration of runoff precipitation</li> <li>-Provide constant movement in water</li> </ul>	<p><i>Improves play, physical activity, social interaction, keep learning and creativity</i></p>	
<p>Signage</p>	<ul style="list-style-type: none"> <li>-Improves children information of sustainability by pictures</li> <li>-Sustainability guidance</li> </ul>	<ul style="list-style-type: none"> <li>-Provide signs at decision points along pathways, interpretive signs to educate children about different plants <i>(Keep learning)</i></li> </ul>	
<p>Designing with trees and shrubs and planting variety of trees</p>	<ul style="list-style-type: none"> <li>-Ecological and economic benefits</li> <li>-Reduce storm water runoff</li> <li>-Absorb water and reduce the amount of time, energy and water required to maintain plants</li> <li>-Prevent soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>-Health benefits of mental and physical</li> <li>-Climbing trees and playing <i>(play, physical activity)</i></li> <li>-Increase the sense of curiosity by direct contact with trees and shrubs <i>(keep learning)</i></li> </ul>	

Principles and images has been exploited from “landscape and child development” and intersected with well-being outcomes in a table [22].

## IX. CONCLUSION AND RECOMMENDATIONS

This research clearly suggests that natural outdoor environment of preschools can play a significant role in promoting mental health and well-being of children. Schools can be equipped with objectives mentioned below:

- Design school's environments that enable children for a closer contact with the natural world.
- Using school environment as a resource for the emergence of well-being activities and outcomes.
- Develop environments within their grounds for biodiversity conservation and child health purposes.
- Use plants, materials and amenities in their school environment maintenance and development that focus on sustainable practices.

Throughout this approach, school's environment diversify children's activities and not only will improve their physical health but also will make mentally healthy childhood for a better future by providing a direct contact with nature. Sustainable designed school environment invites children to get moving in ways that nurture all aspects of their mental health and well-being outcomes. In other words, with sustainable school design, it will be possible to actively use the building's grounds and environment as learning resources and sustaining subjectively healthy children.

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