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Chapter 9

School ground interventions for pedagogy and play

How can we evaluate the design?

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This chapter discusses a comprehensive framework for design, development and evaluation of children's environments. Using quasi-experimental action evaluation research in a redesigned school ground in Bangladesh as a case study, this chapter describes a range of methods that can be used to engage children in the design of their own spaces. Theories of affordances and behaviour settings have been used as a guideline to group children's preferred elements and places as areas/settings for different play and learning activities. The concept of affordance further guided the development of an evaluation framework that described elements of places in terms of potential affordances (intended affordances by designers), actualised affordances and new affordances discovered by children. The chapter ends with the implication of this framework for the design of new places or redesign of existing school grounds as a context for play and pedagogy.

Introduction

Whenever Matluba Khan, the lead author of this chapter, presents her research project about co-design, development and evaluation of a school ground intervention in Bangladesh, she is asked, ‘Oh, you mean the school playground?’ School grounds are often considered as places for play and not seen as having any role or value as places for teaching and learning. Although it is difficult to differentiate between learning and play as far as children are concerned, the common view is that play is not generally considered to be learning. Those who research children’s places, however, often view school grounds as potential outdoor learning environments, recognising that a well-designed outdoor learning environment can be valuable for the whole development of the child. Landscape architects also bring their unique perspectives to the design of school grounds where the spatial arrangement and functionality of different elements, combined with an appreciation of the role of sensory stimulation and aesthetics, can together create exciting and versatile spaces. Consultation with children when designing specific school grounds is becoming more common. However, the extent to which children’s perspectives are fully taken into account in the development of the design largely depends on adults’ (design professionals and relevant authorities’) perception of children’s competence to be able to express themselves and to conceptualise spatial ideas (Khan, [2018](#)).

Once a design is completed, constructed and handed over to the clients, landscape architects usually move on to their next project. Few return to their designed spaces to find out whether the project fulfilled its original design intentions. In addition to the affordances the designers intended, a well-designed school ground can create new opportunities that are only discovered by children when they start using it, while some elements might not work or be used

the way they were originally intended. In most cases, opportunities are missed when the designers fail to take what can be learnt from evaluation of their projects to their next designs. Post-occupancy evaluation (POE) is an increasingly important activity in some sectors, such as hospitals and care settings (Cervinka, et al., [2014](#) Davies, [2001](#)) and to some extent school buildings (Wheeler and Malekzadeh, [2015](#)), and is spreading to other sectors, but its implementation in playgrounds and/or school grounds is rare. POE of the school environment generally focuses on the accessibility and safety of different spaces in the school building and outdoors. Rarely does it offer any information on whether the designed outdoor spaces actually offer children the intended range of affordances or whether there are enough opportunities available for children's physical, social and cognitive development or for pedagogic possibilities.

Evaluation research on school ground interventions has so far investigated whether they had an impact on children's physical activity, reduction of stress, BMI levels, academic performance and well-being (Dyment et al., [2009](#); Kelz et al., [2013](#) Kelz, [2010](#) Kweon et al., [2017](#) Li and Sullivan, [2016](#)). While these studies provide the evidence for positive impacts of school ground design on those specific aspects, they do not evaluate the efficacy of the design itself. Very little research has explored these two aspects together – linking the design of the space with the impact on children. This again shows that school grounds are not seriously considered as places for pedagogy; the published research, to our knowledge, rarely investigates their efficacy as places for teaching and learning, let alone the important role of play in cognitive development.

This chapter attempts to fill the identified research gap to some extent, especially in terms of the methods that can be applied, presenting and discussing a comprehensive approach for the evaluation of a school ground intervention for both pedagogy and play. We first illustrate the

theoretical framework that underpins the approach and go on to discuss the pros and cons of using different methods by referring to several case studies. In particular, we focus on a realised design project at a school in Bangladesh, where there was a unique opportunity to follow and monitor the design development, implementation and post-implementation use and outcomes, applying several methods.

School ground interventions for pedagogy and play

Historically, as school grounds have been used mainly for purposes of physical education (Adams, [1993](#)) this also guided their design – although at break times these spaces were also used for spontaneous play of limited varieties (owing to the lack of facilities). More recently, the use of school grounds has extended beyond physical education to encompass a wide range of educational activities – at least in some places – and for demonstration purposes, even if the practice has not become universal. The outdoor environment of primary schools can be a valuable place for the development of cognitive and socio-emotional skills in young children (Khan, [2012](#)) when designed specifically to accommodate children’s learning. Rich and diverse outdoor environments afford more opportunities for play and learning (Moore and Wong, [1997](#); Cosco, [2006](#)), whereas barren school grounds discourage children from diverse play, social interaction, environmental experience and learning, which often leads to boredom and aggressive behaviour (Samborski, [2010](#)). Asphalt- or tarmac-surfaced playgrounds provide little or no opportunity for connection with nature compared with greener school grounds (Dyment and Bell, [2008](#)). Therefore, poorly designed outdoor environments can be just as limiting as dull indoor spaces.

How school grounds perform will depend on the purposes for which they are designed. The school grounds designed principally for physical activity might not create opportunities for cognitive and social play. Therefore, an evaluation which focuses only on a school ground's affordances for physical activity would not tell us whether the same design would also support pedagogy. For a school ground to be effective as a place for the 'whole development' of children it should be designed with their holistic development in mind. The evaluation should also focus on how the design supports all of these aspects. Only a comprehensive evaluation, looking into the effectiveness of school ground design for children's learning, play and well-being can test the impact in its totality and provide useful feedback for practitioners.

It is important to engage children in research concerning them and also in the design and planning of the places that they will use and which will affect their development. Researchers and designers are now, quite rightly, attempting to incorporate children's voices in their work by following the principles contained in the UN Convention on the Rights of the Child (UNICEF, 1989). Thus, comprehensive evaluation should also incorporate explorations of children's views and preferences on the design and use of school grounds.

Theoretical foundations

Theories of child development

In order to design with the 'whole' development of the child in mind, and to evaluate that post-occupancy, it is important that designers of children's environments have a basic understanding of how children undergo the cognitive, socio-emotional and physical development process.

Children from 6 to 11 years old – the age of most primary or elementary school education systems – learn most effectively when their learning is associated with doing. This stage is

termed the 'Concrete Operational Stage' by Piaget, who placed an emphasis on children as intellectual explorers, constructing their knowledge through the exploration of their surroundings (Wood, 1998; Mårtensson et al., 2014; Turner, 1984). Children explore the surrounding environment, make their own discoveries and construct knowledge according to their personal experiences (Wood, 1998; Biehler and Snowman, 1982; Turner, 1984).

Vygotsky, known for his theory of social constructivism, believed that learning depends on the Zone of Proximal Development (ZPD), when children are active in the context of both socialization and education. Children internalise the experiences gathered from their contact with the social environment on an interpersonal level. The earlier knowledge base developed in the child's schema and new experiences that they come across in their immediate surroundings influence the child, who then constructs new ideas (Vygotsky et al., 1978). Vygotsky puts more emphasis on the roles that adults and more mature peers play in influencing children's cognitive development. Piaget believes that a constructivist environment must provide a variety of activities to challenge the children to accept individual differences, to increase their readiness to learn, to discover new ideas and to construct their own knowledge (Biehler and Snowman, 1982). A well-designed school ground would be one where children would have more opportunities to explore, experience and work co-operatively with their peers.

The socio-emotional development of children between the ages of infant and adolescent includes the development of their self-concept and self-esteem, motivation, personality, moral development and use of social comparison to evaluate and judge their own capabilities (Biehler and Snowman, 1982). Self-concept is often considered to be the cognitive or thinking aspect of self (belief or opinion about one's personal existence) whereas self-esteem refers to the emotional or affective aspect of self (how one feels about or values oneself) (Huitt, 2011).

According to Erikson (2014), at this age, children try to prove themselves ‘grown up’ through independent action, in co-operation with groups and by performing in socially acceptable ways. Children who have difficulty in school tend to develop poorer self-concepts, which might result in poor performance in upper grades (Biehler and Snowman, 1982). If a child can make and do things well, his or her self-concept develops, which often confers positive benefits on motivation to learn. In well-designed and facilitated outdoor classes, children are provided with the opportunities to form groups, to reach consensus and to develop critical thinking and problem-solving skills with their peers.

Children experience many physical changes between the ages of 6 and 12, for example the development of physical or gross motor skills used in different activities such as running and jumping, and fine motor skills, used in activities such as different art, science or craft projects (Biehler and Snowman, 1982). The capacity of the outdoors to contribute to this overall development of children has been largely ignored (Dudek and Baumann, 2007) as a result of an adherence to the ‘surplus energy theory’ (Spencer, 1855). The ‘surplus energy theory’, very dominant in play theory, was first proposed by the nineteenth-century psychologist Herbert Spencer. It has had a great influence in the design of the outdoor environment of children ever since and is still found to be deeply embedded in school-culture (Malone and Tranter, 2003). Spencer believed that the main reason children play is to get rid of their excess energy and this belief has been profoundly debated by many researchers and developmental theorists. Consequently, people have generally considered the outdoor as a place for play, games and sports and not for formal learning or educational purposes. However, the character and form of the outdoors, holding two different types of activity – physical education or sports-based activity, and learning through environmental interaction, exploration and play – can be easily

distinguished (Malone and Tranter, 2003) (see [Figure 9.1a and b](#)). It is the responsibility of the designer to design school grounds in a way that can provide opportunities for both.



(a)



(b)

Figure 9.1 Contrast in the design of children's environments in elementary schools in Bangladesh, supporting different activities: a) shows that the grounds lack opportunities for exploration (what the setting in the second image offers) but can afford ball games and running while b) contains opportunities for exploration and discovery (Source: Matluba Khan).

Affordance theory

The affordances of an environment (a term already used earlier in this chapter) are those possibilities it offers or provides for the user, depending on what the user wants or needs

(Gibson, 1979; Heft, 2010). For example, a simple object such as a wooden box can offer the opportunity for the child to climb up on, jump off, sit on, hide behind, use as a table or game board, etc.; many more could be thought of and all are beyond the original purpose of the box (as a container). This concept of affordance has substantially contributed to the development of research in landscape architecture, environmental preference and environment–behaviour interactions (Ward Thompson, 2013). The concept of affordance is important in developing the framework for design evaluation as it helps to identify the environmental attributes that are associated with specific behavioural responses (Gibson and Pick, 2000). Affordance theory stresses the possibility or potential for action in an environment; it may therefore help the designer in formulating design features with specific user needs in mind or with a range of potential uses.

In the field of design, affordances are generally regarded as the functional property of the environment relative to an individual (affordances of grasping, twisting, throwing, etc.) (Heft, 2010). Heft (1988) formulated a functional taxonomy for children’s environments based on the physical properties, for example of a flat surface to walk on, relatively smooth slope to roll down, etc. But the concept of affordances has the ‘potential to be extended to comprise even emotional, social, and cultural opportunities that the individual perceives in the environment’ (Kyttä, 2004, p181). Kyttä’s affordances for sociality include possibilities to play rule games and role play, playing home or war, being noisy and the possibility of sharing or following adults’ business (Kyttä, 2002). Subsequently, Roe (2008) explored ‘emotional affordances’ in forest settings and defined them in terms of how the attributes of the environment make a person feel. Additionally, Gaver (1996) used the concept of affordance to study how different properties of indoor and outdoor environments might influence social interaction among people in the field of architecture and landscape architecture. Matluba Khan introduced ‘cognitive affordance’ in her

PhD thesis, which was helpful to understand the relationship between environment and cognition in the school ground in Bangladesh that forms the case study discussed in this chapter (Khan, 2017).

Theory of behaviour settings

Closely related to the concept of affordances is the theory of behaviour settings. These are 'ecological units' (or specific parts of a site) where the physical environment and behaviour are linked together in time and space (Barker, 1968, 1976). Barker (1976) described the concept based on his observation of children's behaviour over many years. Behaviour settings are composed of two sets of identifying characteristics: 1) a specific set of time, place and object props (such as tree logs, sand, rocks) and 2) a specific set of attached standing behaviour or behaviour episodes (climbing, sitting, walking, reading a book) (Barker, 1968, Scott, 2005). Both of these clusters together form a behaviour setting (Scott, 2005). This concept can be applied within design research for analysing human behaviour in different type of spaces or settings. It can help identify specific behaviour settings in the landscape of schools and their association with pedagogy and play, which is essential for understanding the impact of different elements of nature on children's learning and play. Behaviour settings thus act as a medium for the identification of potential affordances of different types of spaces and associated materials and equipment.

Behaviour settings can therefore be rich with many interconnected elements and they regulate the behaviour episodes occurring within them (Barker, 1976). They are objective, occurring naturally in a specified time-space locus and independently of any individual's perception of it (Barker, 1976, Scott, 2005). The variables of behaviour settings have a stronger

influence than individual difference variables, i.e. children's behaviour varies less across different children within a given setting than within the same child across different settings (Barker, 1976, Ward Thompson, 2013). Certain environments or settings elicit particular kinds of behaviour and different sets of people and objects exhibit the same patterns of behaviour within the same behaviour setting. These attributes of the ecological environment are important in order to understand how much an environment can influence children's behaviour.

Towards a theoretical framework for evaluation of school ground design

No single theory can therefore guide the framework for evaluation of a design. Since the nature of such an evaluation is multidisciplinary and comprehensive, different theories should be considered together in order to obtain a better understanding of the multidirectional relationship between the environment and learning. To understand how the physical environment influences the teaching and learning process, it is necessary to understand how children construct their knowledge. The theories of Piaget and Vygotsky can provide the basis for this understanding, stating that children construct knowledge through exploration of their surrounding environment and interaction with their peers. Therefore, the physical environment of the school should be designed in ways that offer opportunities for such exploration and interaction. In order to investigate whether the designed outdoor environment supports both pedagogy and play, theories of ecological psychology (i.e. the concept of affordance and the theory of behaviour settings) are crucial.

Research methods

A wide variety of approaches and methods have been used in research with and for children. No single method can obtain a holistic picture of children's use of school grounds and their impact on learning and behaviour. In an evaluation of a design different methods can help to answer different questions, taking into account the particular needs and characteristics of the participants, ethical issues, the cultural and physical context of the study and limitations of time and resources, as recommended by Punch (2002) and Christensen and James (2008). Thus, a range of strategies and methods that have been applied in different research contexts and have been developed in different disciplines can be adapted for application in a specific context. The strategy for a holistic evaluation of a school ground design that we are proposing can be termed a *quasi-experimental action evaluation strategy*.

This particular strategy involves three phases: exploration, design implementation and evaluation, with data collection taking place during the exploration and evaluation phases. The *exploration* phase may include seeking the preferences and desires of teachers and children about the design and use of the outdoor environment. This is also the period for collecting any pre-test (pre-experiment) data (e.g. attainment scores, surveys using standardised tools and behaviour mapping and observational data of the school ground before any design work). The second phase is the *implementation* of the design (in the case of a POE this is a real design to be evaluated) and intervention (could be an experimental design for a research), i.e. use of the designed outdoor environment for teaching and learning by teachers and school students. In the *evaluation* phase, post-test data is collected and analysed to find out the effective settings for learning and also the criteria for the design of those settings. [Figure 9.2](#) presents a schema for this quasi-experiment action evaluation strategy, where the design is considered as an experiment as noted above.

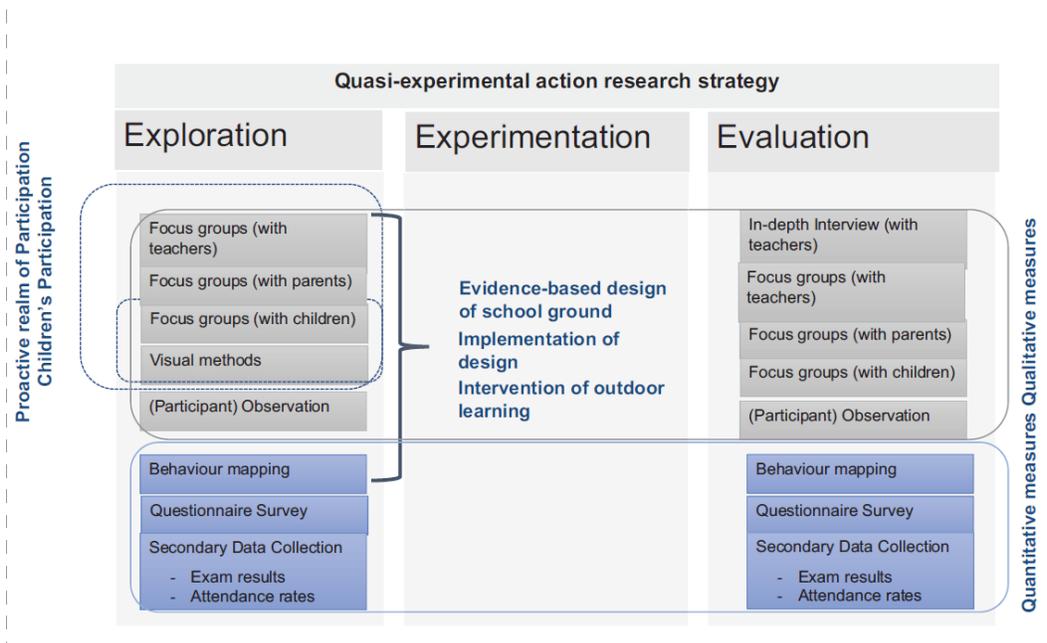


Figure 9.2 Methodological framework for the quasi-experimental action evaluation strategy (Source: Matluba Khan)

We applied the above-mentioned strategy in a research study conducted in Bangladesh which included co-design and development of a primary school ground with children, teachers and the community, bearing in mind the educational needs and evaluation of the school ground for pedagogy and play (see [Figure 9.3a and b](#)). We compared the data collected from this school through a questionnaire survey, attainment scores, observation and behaviour mapping, focus groups and semi-structured interviews with a control school which did not undergo any change in the environment. We also examined the impact on the experimental school through before-and-after evaluation of the school ground design. We will refer to this study in our discussion of methods for application in different phases of an evaluation study.

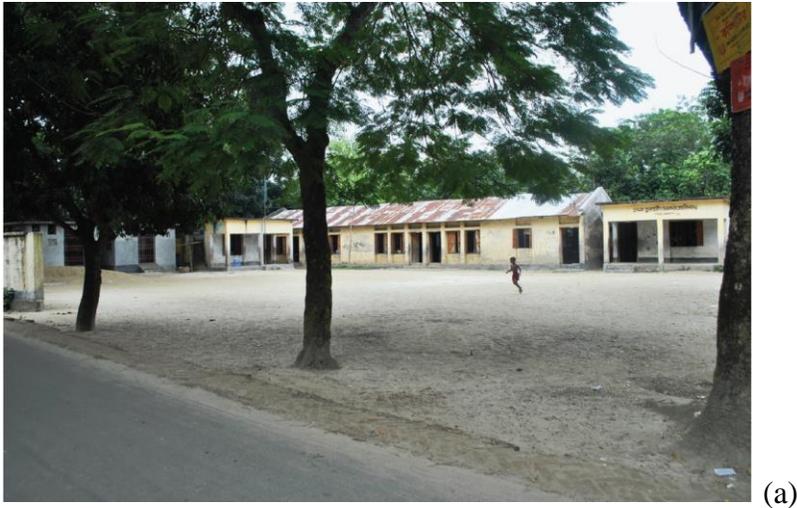


Figure 9.3 The case-study primary school ground in Bangladesh before and after an experimental intervention (Source: Matluba Khan)

Methods for engaging children and teachers

Different methods have been used in research studies to engage children and adults in the design process. Clark and Moss (2005) introduced the so-called mosaic approach for effective participation of young children in the design of spaces. Methodological elements of the mosaic approach include observation, interviews with children, informal interviews with parents and practitioners, book-making, photography, child-led tours and ‘magic carpet’ (slide show of

familiar and different places). A combination of methods is useful for engaging children at different developmental stages. We believe the selection of methods depends on many aspects, and the pieces of the mosaic might vary for children of different ages in different contexts. We will cover focus group discussions, children's drawings and a model-making exercise that we used in our research project.

Focus group discussion

We used focus group discussions in order to gain insight into the participants' experiences, attitudes and perceptions regarding the design and use of the outdoor school environment for learning. Focus groups are considered a better method than interviews for gathering qualitative data from children (Greene and Hogan, [2005](#)). Children are more comfortable sharing ideas and discussing in groups rather than being asked as individuals (Darbyshire et al., [2005](#)), which has led to an increased use of this method in research with children. Children are willing to share their opinions when they find their friends doing so; some children's opinions can also trigger others' memories. The duration of focus groups with children under 10 years should be less than 45 minutes (Greene and Hogan, [2005](#)). The ideal size is five to eight participants, but small focus groups comprising four to six participants are more popular since they are easy to administer and participants feel more comfortable (Krueger and Casey, [2009](#)). A wide range of techniques can be used during focus groups to make the experience more fun and to promote and prompt discussion among the participants (Fargas-Malet et al., [2010](#)). The use of visual stimuli can liberate participants' ideas about the design of the environment and also make the experience enjoyable (Greene and Hogan, [2005](#); Fargas-Malet et al., [2010](#)).

We found focus group discussion to be a useful tool to obtain qualitative information about the use of the outdoor environment. The purpose of focus group discussion in quasi-experiment action evaluation research can be twofold: 1) to learn about the existing use of the school ground; and 2) to generate ideas for the design of the school ground that would be conducive to pedagogy and play.

Focus group discussion is also very effective as an exploratory tool after the intervention in order to gather data on children's use of the different designed settings for pedagogy and play and the underlying reasons for any expected (or unexpected) changes in behaviour. It is also a useful tool to use with adults; we used it as a brain-storming tool with teachers in order to generate ideas on how the school ground could be designed as a place for teaching and learning. Separate focus group discussions should be held with children, teachers and parents.

Children's drawing

Visual methods have been increasingly used in research as they can help in improving the degree of participation by children and even adults (Hart, 1997; Greene and Hogan, 2005; Monsoureh and Ismail, 2012). The visual method that is often considered first in research with children is drawing. However, Hart (1997) discouraged the use of *individual* drawing as the primary method to listen to children's voices because children may come up with stereotyped images they have learned to draw. In a small study in Bangladesh in 2009 with children of a primary school, Matluba asked the children to draw their dream school. The children came out with drawings of the school exactly as it looked at that time! However, drawings can be an effective warm-up exercise for pre-adolescent children to stimulate further discussion or activities (Hart, 1997).

In our study, we found the combination of focus groups with drawings to be very useful. At the end of each focus group the children were asked, when still in groups of five or six, to make a *combined* drawing, on a 50x75cm sheet of paper, of their school ground as they wanted it to be, including different elements they would like to see and activities they would like to do either with their peers or alone (Figure 9.4). While drawing, the children interacted with each other, discussed what they wanted and also conveyed their desires to us. After they had finished, the children were asked to explain their drawings of their dream school ground. They were also asked whether any of the elements they wanted in the school ground had any implications for what they learnt from their textbooks or were taught in classrooms. There might be debate on whether children can provide useful information or to what extent they can contribute to the design of a play for pedagogy; however, we found the children's contributions useful (for more information on the detail of co-design and development of the school ground see Khan et al, 2020). We found the combination of focus group discussion and drawings useful, as they did not leave any scope for ambiguity in their interpretation, since they themselves explained them during the discussion.



Figure 9.4 Combined drawing exercise as part of focus group discussion at the study school in Bangladesh (Source: Matluba Khan)

Model-making

Model-making, according to Hart, is a ‘highly effective strategy for involving children of all ages from 5 years and older in the design of school grounds and playgrounds’ (Hart, 1997, p109). In everyday play, children communicate with each other using toys, which can also be used as a medium for engaging them in activities that help us to discover their desires. Even very young children can express their design preference through manipulation of their toys. However, children’s individual spontaneous statements might not be sufficient for ascertaining their true desires for activities in the school ground. Hart (1997) referred to the use of visuals, e.g. video clips or images, to trigger children’s thoughts and ideas. Sometimes our actions are based on pre-conscious factors of which we are unaware (Eiser, 1986). Visuals of children engaging in such activities, i.e. building or making something, might stimulate individual responses in focus groups, and model-making exercises (for both children and adults) can draw out aspects of place experience, activities and artefacts that the participants identify in a positive way. Later on, this may help in generating newer themes through the modelling of the school ground to give a visual form to the preferences of children.

Model making can be designed as a child-led activity. Children should be the main performers in such an activity, although participation of teachers in leading children can also create an environment where children can learn how to negotiate. We conducted the first – to our knowledge – model-making workshop with children and teachers in Bangladesh as part of the project (Figure 9.5). Adults often think children are not competent enough to be engaged in a model-making exercise; many do not think highly of children from a developing country. We found child-led model-making very useful for discovering how children viewed their dream

school ground. Two teachers also participated in the model-making exercise led by five children. Though the principal performers were the children, there were some negotiations between children and teachers.

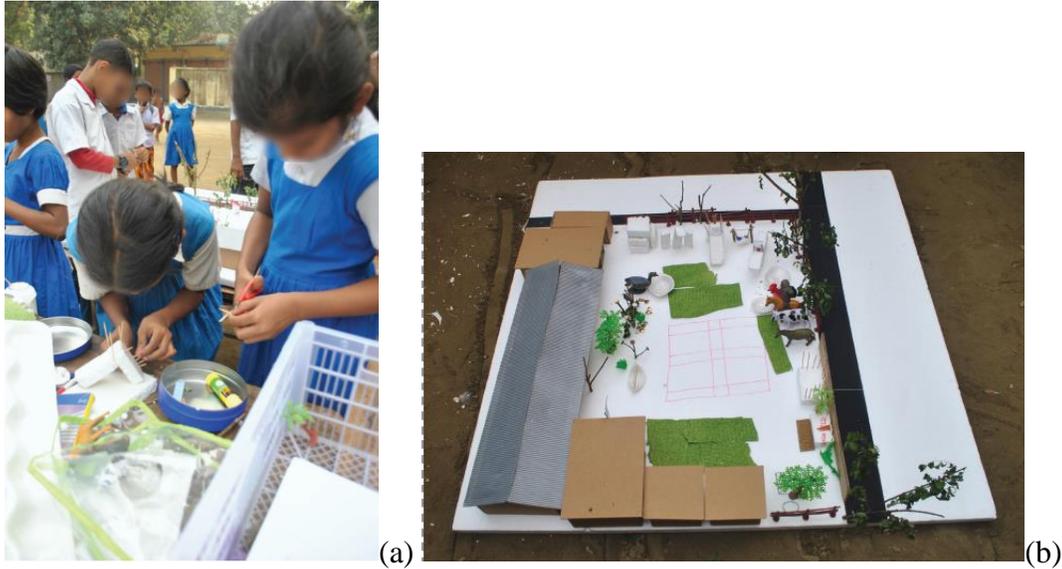


Figure 9.5 a) Model making activity and b) the resulting model (Source: Matluba Khan)

We found children were more attentive to the details of each element they wanted in their school ground rather than considering the whole layout as a single scheme. They seemed to view the school ground as a place for performing different activities and cared less about how the school ground would look as a whole. Thus, it is the role of the landscape architect to make a school ground a functional and aesthetically satisfying whole, incorporating all the elements that children wished to have in their school ground as far as is practically possible.

Methods for evaluating the efficacy of the environment for pedagogy and play

One objective of a quasi-experiment study is to find connections between two or more variables (Groat and Wang, 2002). The use of quantitative measures, such as questionnaires and/or standardised tools, objective measures through an instrument (e.g. accelerometer or pedometer) or standardised test scores can help to measure objectively to what extent a school ground design can contribute to an outcome, for example academic attainment, motivation to learn or Body Mass Index (BMI).

Questionnaires

Questionnaires are considered to be instruments for a deductive approach in empirical measurement and data analysis (Neuman, 2003). The main purpose of using a questionnaire is 'to discover regularities among groups of people by comparing answers to the same set of questions asked of a large number of people' (Zeisel, 1984, p157). In an evaluation research design, rather than using a single primary data collection method, a mix of different instruments can be adopted to collect data, according to their suitability for the type of study. A form of questionnaire (there are many varieties) can provide useful data when there is a well-defined problem and the major concepts are already clear to the researchers when they begin the study (Zeisel, 1984). The ability of children to provide reliable responses is often undervalued (Matthews, 1985); however, Christensen and James (2008) argue that children can provide reliable answers if they find the questions meaningful to their lives. Again, with age, children become better able to assess their competences realistically (Harter, 1982).

Self-reported questionnaires have been used in research with children to compare their opinions and experiences in different contexts. Mygind (2009) used questionnaires to compare children's statements about social relations and teaching in the classroom and in a forest setting. In our study in Bangladesh we used questionnaires to compare the responses of children related to their experiences in the classroom and outdoors both before and after the intervention (the school ground design). Two sets of questionnaires were administered at the same time, one in the intervention school and one in the control school, asking about their experiences in the classroom and their perceptions related to taking classes outdoors. The responses of children in the experiment school were compared to that of the control school in order to measure the impact of intervention.

Standardised instruments

In order to find the link between the design of the school ground and outcome measures, it is important to test the impact on children objectively. The design and use of a school ground can have an impact on children's academic attainment (Khan et al., 2019a; Kweon et al., 2017), their perceived motivation to learn (Khan, 2017), recovery from stress (Kelz et al., 2013) and well-being (Kelz, 2010; Khan, 2017). Rather than preparing a new instrument for measuring certain outcomes, already established and validated ones should be used. For example, Kelz et al. (2013) used the Basler Well-Being Questionnaire, a standardised German instrument, to measure well-being, the Perceived Restorativeness Scale (Hartig, 1996) to determine the subjective restorative qualities of the school ground and the Attention Network Test (ANT) to determine the change in executive functioning among children.

Standardised tests

The use of standardised tests as outcome measures is not new in this research field; however, they have not often been applied in the field of environment behaviour research in order to find the relationship between attributes of the primary school landscape and children's academic outcomes. In 2010, Matsuoka investigated the association between the degree of naturalness in high-school grounds and students' academic performance (Matsuoka, [2010](#)). The influence of the overall school architecture on student outcomes in the USA was investigated by Tanner using standardised tests as the outcome measures (Tanner, [2000](#), [2009](#)). In an absence of standardised tests, we used exam scores in key subject areas as a measure of children's academic attainment in our study. Most Government primary schools in Bangladesh do not use standardised tests. However, three exams are taken at four month intervals in April, August and December, called the first terminal, second terminal and annual examinations respectively. The questions for different subjects like mathematics or science for these examinations are the same across all the schools within a single sub-district. Since there can be issues related to the reliability of tests which are not standardised but might be marked in a subjective or imperative manner, we only used mathematics and science exam scores as outcome measures since the questions and scoring of these subjects are more objective (there are right and wrong answers). These were also the subjects that were taught in the outdoor environment after the intervention design was implemented.

Objective measures

An instrument like an accelerometer can be used to measure children's physical activity objectively. Such measures can be a reliable tool for obtaining more accurate information on

physical activity levels but they also present some limitations. For example, children would need to wear a device which might fall off or the child might forget to put it back on after taking a shower. Physical activity is also the measure that has been examined most in studies related to children. We could say that there is enough evidence already about what kind of landscape elements can lead to increased physical activity. However, in a holistic evaluation it is worth exploring how and whether elements designed to enable pedagogical processes stimulate more physical activity or what kind of physical activity – sedentary, moderate or vigorous – takes place in different behaviour settings.

Methods used for finding the links between design and pedagogy and play

Participant observation

For an in-depth understanding of the influence of the outdoor environment, especially the relationship of affordances to behaviour settings as well as social processes, participant observation is considered to be suitable (Humberstone and Stan, [2011](#)). The term ‘participant observation’ refers to the role of the researcher as observer in a group or setting, observing behaviour and listening to conversations with each other and also with the observer (Bryman, [2012](#)). However, observers in environment–behaviour research also look at whether behaviour in the physical environment is supported or deterred by its characteristics (Zeisel, [1984](#)). Participant observation has been widely used in research with children as it is regarded as being able to obtain the most authentic impression of human behaviour (Christidou et al., [2013](#), p63). With this method, researchers not only observe what is happening in a place but also try to identify

what is not there. They can try to uncover the silent voices of children (Greig et al., 2007). Participant observation can be particularly useful for landscape architects to test the extent to which their design enabled or deterred different kinds of activities (planned for as well as spontaneous) in the school ground. In a quasi-experiment action evaluation study such as ours, participant observation was used to examine children's behaviour in the outdoor environment, and to find out what activities children were engaged in before and after the intervention.

Exploration of what the school ground can offer for teaching the curriculum requires careful observation of the actions in order to understand the meanings. Therefore, participant observation can be used to understand the educational context in order to find the underlying reasons behind teachers' use of the outdoors for teaching, children's response to the tasks and to ascertain how the environment helped or deterred the process of teaching and learning. In our study, Matluba recorded observations in the form of blog posts in order to interact with her co-authors (<https://matlubafrombangladesh.blogspot.co.uk/>) and also kept a field journal and took photographs that complemented it. The field journal contained a reflexive account of thoughts for the day, reasons behind children's reactions to certain situations or to the presence of the researcher, the interactions of the children with the environment and the dialogue between Matluba and the teachers and visitors to the school (mostly parents and community people). The dialogue between Matluba and her research assistant (an architecture and urban design graduate who helped with data collection) reflecting upon the data was also recorded in the field journal. Reflexivity is considered a valuable feature of social research, as researchers participate in the social world and eventually reflect on the products of that participation (Humberstone and Stan, 2012). The field journal, accompanied by photographs taken during the whole period, gave useful information about the pattern of use of the school ground throughout the time.

Behaviour mapping

The observation of children can also be carried out by mapping their activities in different settings within the school ground, using the behaviour mapping approach, which is characterised as an objective method to measure how spaces are used (Moore and Cosco, 2010). It can be used to record simultaneously both the location of the participants in the space and their activity. It can provide useful information about the relationship between environment and behaviour and can guide design interventions (Cosco et al., 2010) (see also Chapter 3). Behaviour mapping has been used as the primary investigation tool in many research projects involving children (Cosco, 2006; Hussein, 2009). The theory of behaviour settings and concept of affordances are the basis for this observational tool. Behaviour mapping can be used to determine which settings and components are used to what degree by children and to identify the physical components that most support learning, social interaction and exploration of the environment in the school ground.

There are established behaviour mapping protocols (Moore and Cosco, 2007, 2010) that can be used to observe children's activities during play and recess. SOPLAY (System for Observing Play and Leisure Activity in Youth) is one technique that has been widely used to investigate children's play and recess activities in school grounds and playgrounds (Anthamatten et al., 2011; Colabianchi et al., 2009; Janssen et al., 2013; Willenberg et al., 2010). Since children are engaged in diverse play activities in different cultures and spaces, the behaviour mapping coding protocols need to be adjusted and adapted to specific contexts. We used behaviour mapping in our study for the first time in Bangladesh. We studied children's play behaviour in order to develop a coding protocol suitable for the context. Matluba's upbringing in

a rural area in Bangladesh contributed to an in-depth understanding of the nature of play behaviours of primary school children there.

Though there are established behaviour mapping protocols for observing children's behaviour during play and leisure, there was nothing for observing children during their outdoor learning activities as part of the curricular teaching and learning. We therefore developed a specific protocol and coding system for observing pedagogical activities during outdoor classes. Environment behaviour researchers suggest recording answers to specific questions during the behaviour mapping procedure. For example Goličnik (2005, p66) suggested thinking about 'Who is doing what, where and with whom?' or 'Where and for how long is what taking place?' to make the behaviour maps condensed and inclusive. However, while recording children's outdoor activities during their outdoor lessons, more questions should be considered to make those maps meaningful, for example: *'What is being taught in the outdoor classes?'*, *'How did the teacher integrate different settings of the environment with the contents she was teaching?'* and *'How did the children respond to those tasks through the use of different elements?'* The procedures and the categories of behaviour maps were standardised for this specific location in order to make the maps useful (Zeisel, 1984; for more about behaviour mapping protocols during outdoor lessons see Khan, 2017).

Qualitative methods (exploratory)

While quantitative measures are useful to measure the impact of the design and observation and behaviour mapping give information on how different settings in the school grounds are used, qualitative methods after the intervention are also necessary to learn the underlying reasons for any impact that the change in the school ground has had on children. Focus groups with children

can be used to learn about their experiences of place and their preferences, their feelings about learning in the school ground, whether they themselves perceive any change in their behaviour and attitude and their views on methods of teaching used in the school ground. In-depth interviews and/or focus group discussions with teachers can provide useful information on these aspects from the teachers' perspective. The teachers can also provide additional information on the benefits and challenges they encountered when teaching in the school ground and how different settings helped or hindered them in their teaching practice. It is important that landscape architects know of this information to improve the design of their next projects or to rectify the problems which emerged in the existing design. Furthermore, focus groups with parents can provide useful information on the extent to which they have seen attitudinal changes in their children because of the change in the environment.

Semi-structured interviews

In-depth interviews with teachers can be used as a follow-up to the other data collection methods in order to achieve a fuller picture. While structured interviews are used to ensure consistency and to keep interview-related error to a minimum, semi-structured interviews provide the flexibility to follow the respondents' replies (Bryman, [2012](#)). Interviewing in person can also offer the opportunity to note the expressions of the individuals while recording the answers to the questions. We interviewed the teachers who were engaged in teaching outdoors in our study. Two teachers who were involved in teaching science and mathematics to children in the outdoors were interviewed after the intervention in order to gain an in-depth insight into the influence of the designed outdoor environment. While we developed a structured questionnaire, Matluba also

used the freedom to ask follow-up questions in response to any interesting or unexpected points made by the teachers.

For an evaluation of a design, the location of focus group discussion or in-depth interviews is important. Conducting the interviews within the environment under consideration is a useful tool to explore different dimensions of place and examine participants' experiences, interpretations and practices (Khan, [2012](#); [2017](#)). Often 'go-along interviews' are conducted by researchers with the same purpose – to observe participants' experiences and interpretations at the same time (Kusenbach, [2003](#); Carpiano, [2009](#)). Go-along interviews are useful for a large site when the whole school ground cannot be seen from any suitable location for a sit-down interview.

A framework for analysis to link children's behaviour with design elements

The analysis of data gathered from all these methods can yield a holistic picture of how a school ground design can influence the everyday lives of children in their primary schools. A school ground designed as a combination of different behaviour settings offering multiple affordances (cognitive, physical, social and emotional) can influence pedagogy and play (Khan, [2017](#)).

However, as already described, the design of the school ground should be guided by: 1) the views and preferences of children, teachers and parents; 2) evidence from relevant research; and 3) the intuitions and judgments of the designers involved in interpreting the perceived affordances of different behaviour settings in physical forms. The same behaviour settings could take different physical forms in the hands of different designers. Therefore, we do not propose to evaluate the quality of physical forms of the various elements in terms of landscape architecture design quality, but rather to focus on the affordances that the newly designed school ground

provides. Unlike adults who see the forms in the environment, children usually look for their functional properties (Heft, 2010). Instead of an artefact or an element which offers little or no activity potential, children are more likely to be attracted to those which afford any or many functions, like the opportunity to sit on or to step into them (Ward Thompson, 1995).

Therefore, the framework for analysis in an evaluation of a school ground design should include: 1) looking into the intention of the designers (perceived as potential affordancesⁱ of the settings); 2) the affordances actualised as per designers' perceptions; 3) new affordances discovered by the users beyond designers' expectations; and 4) the perceived affordances that are not actualised. An inclusive picture of potential, intended actualised, unintended actualised and intended but not actualised affordances of different behaviour settings can help researchers and designers look into what elements of design are successful and what can be modified, rectified or improved to match intentions. The actualisation of the affordance of a design element can depend on the ability of the perceiver, in this case a child, yet if the affordance of a design element intended by the designer is not actualised the way it was intended, then this can refer to a problem within the design rather than a child's inability to recognise the affordance. If these can be pointed out to the designer, then they can revisit the design and rectify the problem in the existing design or avoid the same mistake in future.

In our project we designed an area with loose materials in the school ground which we found was not used to the extent it was intended or expected. After consultation with teachers and children we found out that the way it was designed was not suitable for the context: the area with recyclable waste materials (considered as 'loose parts') was perceived to be messy and dirty to the villagers (the school had no boundary walls and was therefore accessible to everyone after school hours), who had taken the responsibility to clean up the place. As these same loose

materials were found useful by teachers for pedagogical purposes and were used frequently, we figured out that we should have designed a mechanism for easy transport of loose materials between a storage space and the place for their use in the design. An example summary of the framework is given in [Table 9.1](#).

Behaviour settings	Design intentions (potential affordances as perceived by designers)	Actualised affordances	Unintended actualised affordances	Intended not actualised
Natural learning area	Collecting leaves for counting Learning about the interdependence of plants and animals Building knowledge of plants and trees	Learning the interdependence of plants and animals Building knowledge of plants and trees Counting	Digging, collecting leaves for compost bin Working in groups	
Gardens	Growing plants Building knowledge on how plants grow from seed, flower and fruit and reproduce Knowledge of different types of plants Learning about interdependence of plants and animals	Growing plants Taking care of plants Building knowledge on how plants grow from seed, flower and fruit and reproduce Knowledge of different types of plants Learning about the interdependence of plants and animals	Counting Working in groups	
Amphitheatre	Context for learning through interaction with peers and more	Learning through interaction with peers and more	Observing built and	

	mature adults in any area of curriculum	mature adults in any area of curriculum	natural environment Working with loose materials Measuring Drawing Working in groups	
Water area	Learning the water cycle Learning the life cycle of aquatic plants and animals Learning pressure and flow Measuring Experimenting with water and sand	Learning from close connection with nature: water cycle, life cycle of aquatic plants and animals	Working in groups	Measuring Experimenting with water and sand

Table 9.1: Potential (perceived by designers) and actualised affordances of different behaviour settings during formal learning in outdoor classes

Understanding of the complex dynamics of the school ground

Our Bangladesh research study confirmed our initial hypothesis that a well-designed outdoor learning environment (designed as a combination of different behaviour settings involving children, teachers and parents) can positively influence children’s formal (academic performance) and informal (cognitive, social and physical activities during playtime) learning, and their motivation to learn. However, the relationship between the design of the environment and children’s learning is more complex. Research that explores only one aspect of the impact of a school ground might miss out the complex dynamics that exist in the school environment.

Landscape architects in their designs, if the users are not involved, often focus on the use of new

materials and technology, boldness of forms and the overall aesthetics of the environment. In this whole picture the child itself is often missing and their perceptions are often not considered as reliable for evaluation of the environment that is designed *for* them, and it is rare that it is designed *with* them.

Can we bridge the gap between research and practice?

Existing studies of school ground evaluation yielded useful information on the benefits of the outdoor environment and the positive impact of school ground design, but offered very little information on the quality of the design itself that could be useful for architects, landscape architects and planners in their practices. Nor did the studies link impact to the quality of design elements. In school ground settings, research studies have investigated the relationship of environmental features with children's play (referred to as environmental learning in some research) comparing 'good' vs 'bad' (Lindholm, [1995](#)) or 'traditional' vs 'contemporary' (Susa and Benedict, [1994](#)) playgrounds. Later research studies investigated the association between the availability of 'greenness' and children's play and academic outcomes (Kuo et al., [2018](#); Mårtensson et al., [2014](#); Matsuoka, [2010](#)), but do not define 'greenness' in a way that designers might find useful.

Conversely, studies that focus on developing design recommendations rarely describe the design in terms of what it offers for children. Adams ([1990](#)) investigated the potential of school grounds as a context for teaching and learning and also reported on the design, management and use of school grounds in three counties in the UK. In order to come up with some design recommendations for school grounds, Adams and colleagues conducted a thorough literature search and investigated some school grounds, focusing on the qualities of the physical

environment: layout, sensory qualities, sense of place, differentiation of spaces, micro-climate and pollution, access and circulation, landforms and soils, hard surfaces and site furniture, planting and security and safety. These investigations relied on the researchers' perception of the quality of the environment and did not include an empirical account of affordances provided by the school ground based on children's interaction with the environment during formal and informal learning.

In order to make the research findings useful for practitioners, these two aspects of research should come together and look at the picture holistically in order to provide more useful recommendations for landscape architects. Landscape architects also need to look at the school grounds not only as a combination of different landforms, hard elements, site furniture, plants and safety and security, but also as a place offering numerous opportunities for children to explore, interact, create, modify and manipulate.

School ground design as a combination of different behaviour settings was found conducive to pedagogy and play (Khan, [2017](#); Khan and Bell, [2015](#)). There are large and small school grounds, some in urban areas in the middle of chaos and some in rural areas amidst the bounties of nature. Children in Bangladesh play 'patapata'; British children grow up playing hopscotch. Thus, school ground design should reflect the differences in culture and context. The implementation of this kind of research strategy can help to create recommendations on what kind of design features and behaviour settings might be useful for children in different parts of the world.

In an ideal world we would recommend that researchers and practitioners work together on every project, evaluating it as a whole rather than dividing it into separate parts which do not offer useful application. The quasi-experiment action evaluation research design can be helpful

for understanding the whole picture and also for giving useful recommendations to landscape architects. We have been able to implement the research design in one study, but a wide-scale implementation could lead to much stronger evidence of the benefits of school ground design and more useful recommendation to landscape architects.

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ⁱ Potential affordances are those that the designers intend to offer in the design, whereas actualised ones are those with which the users engage themselves.