



THE UNIVERSITY *of* EDINBURGH

This thesis has been submitted in fulfilment of the requirements for a postgraduate degree (e.g. PhD, MPhil, DClinPsychol) at the University of Edinburgh. Please note the following terms and conditions of use:

This work is protected by copyright and other intellectual property rights, which are retained by the thesis author, unless otherwise stated.

A copy can be downloaded for personal non-commercial research or study, without prior permission or charge.

This thesis cannot be reproduced or quoted extensively from without first obtaining permission in writing from the author.

The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the author.

When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given.

Environment, Engagement and Education

Investigating the relationship between primary school grounds and children's learning: a case study from Bangladesh

Matluba Khan

Doctorate of Philosophy

University of Edinburgh

December 2016

Declaration

I composed this thesis and the work is my own. No part of this thesis has been submitted for any other degree or qualification.

The copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that the copyright rests with its author and that no quotation from this thesis and no information derived from it may be published without the prior written consent of the author or of the university (as may be appropriate).

Matluba Khan

Abstract

More than 59 million children are out of schools across the globe (UNESCO Institute for Statistics and UNICEF, 2015), despite the promise of education for all children by the year 2015. The situation is more pronounced in developing countries particularly in Africa and South Asia. Strategies adopted globally to attract children towards schools rarely considered improving the existing physical environments, despite evidence that primary school aged children (five to 12 years) learn more effectively when their education is incorporated with surrounding environments (Khan & Islam, 2014; Lieberman & Hoody, 1998; Mygind, 2009). This study investigated the potential of a primary school ground to be an effective learning environment and explores how the design of an outdoor environment can contribute to children's learning.

This interdisciplinary project is underpinned by classic psychological theories of child development (e.g. Piaget, 1964 and Vygotsky et al., 1978), while Gibson's (1979) 'Concept of Affordance' and Barker's (1976) 'Theory of Behaviour Settings' have provided the framework for exploring the relationship between the school ground and children's learning.

A quasi-experimental action research project was carried out in a Government primary school in Bangladesh, which included the design and development of the school ground, with the direct participation of children, teachers and parents. Another primary school (with no change to the outdoor environment) was used as a control school to compare the outcomes. A mixed methods approach to conduct this quasi-experiment included data from existing exam scores, questionnaire survey, observation and behaviour-mapping, focus group discussions and in-depth interviews.

The key findings from this study indicate an overall positive influence of the designed outdoor environment on children's academic performance and their motivation to learn. An increase in children's cognitive, social and physical activities in the school ground is also evidenced by the study. The analysis of the data likewise reveals that different behaviour settings of the school ground offered opportunities for different teaching and learning activities. Both natural settings and settings with built features afforded more focused activities (e.g. gardens afforded exploration and connection with nature, while the play area afforded more functional play). Additionally, settings comprised of both natural and built elements (e.g. the area with loose materials and huts) and areas in close proximity with natural ones (i.e. the open yard) accommodated diverse and multiple teaching and

learning activities (e.g. measuring, building/constructing and exploring). The findings further suggest that the design and use of the school ground had a surprising and unintended positive effect on teachers' motivation and pedagogy. Through reflecting on the use of different landscape elements and settings in the school ground during formal outdoor classes and informal play times, the study has further come to propose some design recommendations for other new school grounds as well as the redesign of existing ones.

Acknowledgement

I am indebted to my supervisors — Dr Simon Bell, Dr Eva Silveirinha de Oliveira and Dr Sarah McGeown for their support, guidance and critical feedback over the last three years which were invaluable for the accomplishment of this research. Thank you Simon for believing in me and recognising my quest to learn and determination to excel. Thank you Eva and Sarah for being more than my guides and lending your support whenever I asked for it.

I am also grateful to Professor Catharine Ward Thompson and Professor Peter Aspinall for their input on different occasions throughout the course of this research. Thank you for sharing your vast knowledge and experience — your work and support have always been an inspiration. Thanks to Anna Buxton and Dee Rees for the support with the English language.

A pilot study conducted in a primary school in Edinburgh was very helpful in understanding the relationship between school ground and formal learning, therefore I want to thank the children and teachers of that primary school who did not mind my presence in their classrooms and outdoor classes and also participated in piloting the methods.

Most of all I would like to thank the teachers and children of the two Government primary schools in Bangladesh who with enthusiasm participated in the research, without whom the research was not possible. My heartfelt thanks go to the headmaster, the science and the mathematics teacher and Grade IV children of the intervened primary school providing all the support for conducting the experiment.

I cannot thank enough the team who worked voluntarily in the development of the school ground. I am grateful to Fuad Abdul Quaium (Ghorami.jon) for all the creative and technical input in the design and development of the school ground. Thank you for being my strength and support during the construction days. I would also like to thank other members of my team Ahmad al Muhaymin, Kashfia Alam Khan, Sheikh Rezwan, Abdullah Al Shafi and Abdullah Al Kafi for lending their voluntary support whenever needed during the course of field study. I am grateful to Mr Abdur Rahman, a member of the School Managing Committee who offered his job as a contractor free of cost and managed the resources of the site. I also acknowledge the support of the members of the community who participated in various ways and helped with their resources at minimal cost. I express my gratitude to the person who sponsored the construction of the school ground, without whose contribution this study was not possible.

I would also like to thank my colleague and mentor Professor Mohammed Zakiul Islam for his support and co-operation in the successful completion of the workshop with the teachers. Special thanks to all the contributors to the workshop from home and abroad. I acknowledge the support I received from Ms Rahima Akhter, Superintendent of Raipura Primary Training Institute with the logistics of the workshop.

Thanks to all my friends in Edinburgh who kept up my spirits throughout my work and helped with the research making this research special in particular Katie, Dan, Tess, Sorour, Francisca, Nik, Hanis, Azlina, Sabere, Reyhaneh, Meilin, Jill, Tarek, Fancy and Ana. Thanks to Jamie and Luca for all our discussions over coffee, which were the birthplace of many creative ideas for this research. Thanks to Lore for walking with me to and from the college and also at those times when I needed a break during the intense writing days.

I give my warmest thanks to my husband and best friend Rana who though at times made the PhD difficult for me, without his support, love and encouragement this journey would not have been so delightful. I could give my entire focus on the thesis, only because you have been always there for me. Thanks to my mother and our family in Bangladesh for their unwavering belief in me and accepting our choices. Finally, I would like to remember my *bazan* (father), who I know today is the happiest person in the heaven for this accomplishment of his little angel.

Dedication

To

Ma

Everyone knows that I am daddy's daughter. But I am ma's *meye* too, you know that. I have never said 'thank you' for your unconditional love, affection, sacrifice and blessings. I want to say that here — *Thank you, ma for letting me fly*. I know you will not read this page and any acknowledgement or dedication bothers you the least. All you want is to see my smiling face, all you wish for are the things that would make me feel happy, proud and accomplished — this thesis is one of them.

Preface

As a 5th year undergraduate student, I was willing to explore the role of architects in providing an effective learning environment for the children of Bangladesh in my final project/thesis in 2008. The common response from many of my acquaintances was — *‘The children have school buildings, mostly facing north-south, they have cold breezes from the south while it is hot. What can you do as an architect?’* But what I learnt in my undergraduate studies told me that the aesthetics of a building, or the physical comfort of being in it are not everything for which architects design. What about the psychology of the child that goes to school? Are not the school building and its surroundings important for the development of children and for their experience of learning? I was eager to investigate whether the present design of the school environments provides children with all the opportunities for their holistic development.

However, this exploration began much earlier than my 5th year, rather it began during my childhood as I belong to a family where most of the members are involved in teaching. My father spent his life exploring creative ways of teaching children and enlightening the teachers on how they could facilitate children’s learning in a joyous way. Teachers are doing the most important job of shaping the mind of the children who will be the future of the country. However, does the design of primary schools offer the teachers the scope to explore creative ways of teaching, and motivate them to perform their job? As an architect, could I contribute to shaping the environment where they perform that noble job of shaping the future of the country?

Visiting more than 30 primary schools in Narsingdi, some 90 kilometres from Dhaka, the capital city of Bangladesh, I found that not all buildings face south, even if they do, the classrooms are over-crowded with stacks of benches. The windows covered with grilles barely let the light come in or the breeze pass through. Based on my research on case studies in Bangladesh, I proposed a set of design recommendations for the architecture of primary schools. I also proposed a standardised modular design for Government primary schools in Bangladesh.

I kept thinking about the project and the children. During my visits to the schools, I found many children spending time in the neighbourhood open spaces (e.g. climbing trees, picking water-lilies in the ponds, catching fish and running tyres) during school hours. I chose to talk to these children in the neighbourhood spaces where they were more likely to speak up without any fear. Many of them said that they did not find anything interesting in school and also they felt hot in the classroom. Picturing these free souls reading texts from books sitting in a poorly lit and ill-ventilated classroom distressed me. It then occurred to me that while the indoor environment of Government primary schools does not offer much, why not we utilise the school grounds? I decided to investigate this in my M.Arch thesis and develop further on it in PhD research.

In addition to my growing interest in this research and the theoretical aspects related to child development, the practice side of the issue was always a major driver for me. This has become an integral part in my approach to research as I have always wanted to bring

changes in the lives of children not only in theory but also in practice. Therefore, the human side of the research was also a major inspiration for me. Throughout the research, I became a part of the everyday lives of children who shared their thoughts and feelings with me. Sharing the office space with the teachers, I was almost a colleague to them. I had to reflect on these positionalities, whether my relationship with them had any effect on their responses or activities.

As a designer, I co-designed the environment with children, teachers and the community but as a researcher I had to be reflexive. Being aware of all these potential influences, I had to step back and take a critical look at my role in the research process. I had to be critical not only when I was collecting the data but also at the early stages of the research when I was selecting the case studies; and later on analysing the data and writing my thesis, driven by my commitment to produce high-quality research that can have a significant impact on education and society.

Table of contents

List of figures.....	xvii
List of tables.....	xxv
List of abbreviations	xxvii
Introduction.....	1
Part I: Background and research questions	5
Chapter 1 Background of the study	7
1.1 Definition of the key terms	7
1.1.1 Children.....	7
1.1.2 Learning	7
1.1.3 Outdoor environment	9
1.2 Definition of the problem	9
1.2.1 Primary school environments for child-development	9
1.2.2 International scenario: children’s learning.....	10
1.2.3 Context: Bangladesh	12
1.2.4 Lack of research on where education occurs	18
1.2.5 Why school grounds?	18
1.3 Objectives of the study	21
1.4 Significance of conducting this research	21
Chapter 2 Literature review	23
2.1 Theoretical framework	24
2.1.1 Theories of child development.....	24
2.1.2 Motivation to learn.....	30
2.1.3 Theories of play.....	33
2.1.4 Ecological approaches to environmental design	35
2.1.5 A summary of the key theories that underpinned the research	40
2.2 Empirical research on children’s outdoor learning environment.....	42
2.2.1 Impact of the outdoor environment on children’s learning.....	43
2.2.2 Emerging data on qualities of outdoor environments for children’s learning..	46
2.3 School ground design for learning: insights from literature	49
2.3.1 How children perceive the school ground.....	50
2.3.2 Children’s desires of different settings in the school ground.....	52
2.3.3 Design of a school ground as a combination of ‘behaviour settings’	53
2.3.4 Taking the curriculum outdoors	56
2.3.5 Children’s participation in research and design	59
2.4 Summary.....	61
Chapter 3 Conceptual framework and research questions.....	63
3.1 Conceptual framework	63

3.2	Research aims	66
3.3	Research questions and objectives	66
Part II: Research strategy and methodology.....		69
Chapter 4 Methodology.....		71
4.1	Research strategies.....	71
4.1.1	Why experimental research?	72
4.1.2	Why case study research?.....	74
4.1.3	Why participatory action research?.....	75
4.1.4	Why mixed methods research?.....	76
4.2	Research methods	76
4.2.1	Secondary data on attainment.....	77
4.2.2	Questionnaires	78
4.2.3	Participant observation and behaviour mapping.....	79
4.2.4	Focus groups with children, teachers and parents	80
4.2.5	Visual methods to learn children’s and teachers’ preferences.....	80
4.2.6	Semi-structured interviews	81
4.2.7	Research methods summary table	81
4.3	Piloting of research methods in Edinburgh.....	83
4.3.1	Selection of school	83
4.3.2	The initial approach.....	84
4.3.3	Piloting the methods	85
4.4	Preparation for the data collection	90
4.4.1	Ethical considerations.....	91
4.5	Summary	92
Chapter 5 Data collection and analysis		93
5.1	Selection of school.....	93
5.1.1	School Profile	96
5.1.2	Children’s profile.....	97
5.1.3	Preparation for data collection – permissions and consents	99
5.2	Data collection	100
5.2.1	Secondary data on attainment.....	101
5.2.2	Questionnaire survey	102
5.2.3	Participant observation and behaviour mapping.....	102
5.2.4	Focus groups.....	108
5.2.5	Visual methods	112
5.2.6	Semi-structured interviews	113
5.3	Data analysis	114
5.3.1	Analysis of data from exam scores and questionnaire survey	115

5.3.2	Analysis of data from participant observation and behaviour mapping.....	115
5.3.3	Analysis of the data from visual methods	116
5.3.4	Analysis of the data from focus groups and interviews	117
5.4	Summary.....	118
Chapter 6	Design and construction of the school ground.....	119
6.1	Findings from the methods: ideas for an outdoor learning environment.....	120
6.1.1	Natural learning area – to connect with nature, to explore and to learn from nature	121
6.1.2	Gardens – growing for aesthetics, imagination and agency.....	123
6.1.3	Play area and play objects – being physically active	125
6.1.4	Places to be in contact with others and also to be alone.....	126
6.1.5	Area with loose materials – imagining, building and learning by themselves	127
6.1.6	Bringing all themes together – rich and diverse elements to arouse curiosity	127
6.2	Identification of behaviour settings	128
6.3	Layout of the school ground.....	131
6.4	Proposed preliminary design of the school ground	132
6.5	Construction of the school ground.....	134
6.5.1	Involvement of the community	134
6.5.2	Children’s active participation in the construction.....	135
6.5.3	Children’s activities during the construction days	136
6.5.4	Attitude of the general villagers	137
6.6	Completion and use of the school ground	138
6.7	Summary.....	141
Part III: Results	143
Chapter 7	Results from exam scores and questionnaire survey data	145
7.1	Descriptive analysis.....	146
7.2	Results from exam scores data	147
7.2.1	Comparison between the treatment group (TIS) and the control school (CS)	147
7.2.2	Comparison between the treatment group (TIS) and the comparison group (CIS) within the intervention school	148
7.2.3	Comparison between the intervention school (IS) and the control school (CS)	149
7.2.4	Gender difference.....	150
7.3	Results from questionnaire survey data.....	151
7.3.1	Motivation.....	152
7.3.2	Exploration of the environment.....	157
7.3.3	Peer relation	162

7.4	Summary	166
7.4.1	Demographic measures.....	166
7.4.2	Exam scores.....	166
7.4.3	Questionnaire survey	167
Chapter 8	Results from participant observation and behaviour mapping	169
8.1	Comparison of pre and post intervention results.....	170
8.1.1	Comparison of observed interactions at different times	170
8.1.2	Comparison of different activities or play behaviours	170
8.1.3	Gender difference in observed interactions	174
8.1.4	Summary.....	176
8.2	Observation and behaviour mapping in different behaviour settings during formal learning	176
8.2.1	Structure of the classroom teaching.....	176
8.2.2	The structure of the outdoor classes	177
8.2.3	Frequency of occurrences in different settings.....	182
8.2.4	The patterns of use of different behaviour settings	183
8.2.5	Gender difference in observed interactions in the outdoor classes.....	194
8.2.6	Pattern of movement.....	195
8.2.7	Summary.....	196
8.3	Observation and behaviour mapping in different settings during informal learning	198
8.3.1	Frequencies of the users and main activities in different behaviour settings	198
8.3.2	Gender difference in observed interactions during informal learning	199
8.3.3	The patterns of use of different behaviour settings	200
8.3.4	Pattern of movement.....	212
8.3.5	Summary.....	212
Chapter 9	Results from focus groups and interviews.....	215
9.1	Participants.....	215
9.2	Structure of the focus group discussion	216
9.3	Pre-intervention results from qualitative measures.....	216
9.3.1	Activities in the school ground before intervention (T1)	216
9.3.2	Activities in the neighbourhood	218
9.3.3	Use of the school ground for teaching the curriculum	221
9.3.4	Scope for improvement of the school ground for learning.....	223
9.3.5	Summary of the pre-intervention results	224
9.4	Post-intervention results from qualitative measures	225
9.4.1	Children's activities in the school ground after intervention (T3).....	225
9.4.2	Learning in the school ground	228

9.4.3	Change in children	230
9.4.4	Change in teachers	234
9.4.5	Additional benefits of outdoor teaching.....	236
9.4.6	Challenges and difficulties of teaching in the outdoor environment.....	237
9.4.7	Place experiences	238
9.4.8	Others	241
9.4.9	Summary of the post-intervention results	242
Part IV:	Discussion and conclusion	245
Chapter 10	Discussion	247
10.1	Discussion of research questions	247
10.1.1	Research question 1	247
10.1.2	Research question 2	250
10.1.3	Research question 3	252
10.2	Design intentions, use (actualised by children and teachers) and evaluation	267
10.3	Towards a definition of cognitive affordance – a potential new conceptualisation 273	
10.4	How much of the changes in children’s learning can be attributed to the design of the environment?	276
10.4.1	The influence of the environment on pedagogy.....	276
10.4.2	The influence of children’s participation	278
10.5	Summary of findings	279
Chapter 11	Conclusion and design recommendations	283
11.1	Contributions to knowledge.....	286
11.1.1	Methodological contribution.....	286
11.1.2	Contribution to environment-behaviour research	286
11.1.3	Contribution to educational research	287
11.1.4	Contribution to environmental psychology – a new conceptualization of Gibson’s affordances.....	287
11.1.5	A comprehensive view of the educational setting	288
11.1.6	Direct design implications	288
11.1.7	Evidence for policy level decisions and implementations	289
11.1.8	Contribution to research in a unique context	289
11.2	Limitations of the study	290
11.2.1	Limitations related to methods and data collection	290
11.2.2	The dual role of designing and evaluating the design.....	291
11.2.3	The design was specific to this site.....	291
11.2.4	Novelty of the environment	292
11.2.5	What about new students who did not participate?.....	292
11.3	Implications for policy and curriculum	293

11.4	Recommendations for a well-designed learning environment.....	300
11.4.1	Spatial layout and location in relation to the site	300
11.4.2	Accessibility and connectivity of the settings	301
11.4.3	Design of natural settings.....	301
11.4.4	Behaviour settings of mixed nature.....	301
11.4.5	Provision for large and small group activities.....	302
11.4.6	Provision of loose materials	302
11.4.7	Repetition of elements and variety of shapes.....	302
11.4.8	Variation and Diversity	303
11.4.9	Determination of size and elements of behaviour settings	303
11.4.10	Flexibility and growth	303
11.4.11	Designing for age and gender.....	303
11.5	Future research directions	304
11.6	Dissemination of the knowledge.....	305
11.7	A final word: have the research objectives been met?	306
	References	309
	Appendices	Vol II

List of figures

Figure 1.1: The school attractiveness program (1991-96) adopted by the Department of Primary Education (DPE) (Source: Khan 2012).....	13
Figure 1.2: Plan, section and elevation of a standard Government primary school in Bangladesh (Source: LGED, Bangladesh).....	15
Figure 1.3: Inside a classroom in a Government primary school in Bangladesh (Photo: Matluba Khan)	16
Figure 2.1: Structure of the literature review	24
Figure 2.2: Graphical representation of the theories on how children learn	26
Figure 2.3: Theoretical framework: dynamic systems theories in relation to environment... ..	29
Figure 2.4: Graphical representation of classification of motivation.....	31
Figure 2.5: Theoretical framework: behaviour settings, affordances and learning.....	42
Figure 2.6: Approaches to investigate children’s learning in the outdoor environment in relevant literature	44
Figure 2.7: The concept of behaviour settings applied in a primary school (Adapted from Refshauge et al., 2013).....	56
Figure 3.1: Conceptual framework of the study.....	64
Figure 3.2: Factors that influence children’s learning	65
Figure 4.1: Design of the experimental and the comparison groups.....	73
Figure 4.2: Plan of methodologies used in this research.....	77
Figure 4.3: The Scottish primary school with identified behaviour settings (Map data: Google, Infoterra Ltd and Bluesky)	84
Figure 4.4: The Google Earth image used during the focus groups showing children’s favourite and least liked places (Map data: Google, Infoterra Ltd and Bluesky)	87
Figure 5.1: Map of Bangladesh with the location of the school (Map data: Google).....	94
Figure 5.2: Location of the school within the village (Map data: Google, DigitalGlobe)	94
Figure 5.3: Selection of the intervention school	95
Figure 5.4: View of the I Government primary school (IS) from the road (Photo: Matluba Khan)	97
Figure 5.5: View of the C Government primary school (CS) from the north-east side of the school (Photo: Matluba Khan)	97
Figure 5.6: Drop-out rate by grade in primary schools (BANBEIS, 2014)	98
Figure 5.7: Behaviour mapping during lunch break on one observation day	108
Figure 6.1: Design and development process of the school ground	120

Figure 6.2: A child’s drawing of the school ground showing interdependence of plants and animals (tree and beehive).....	122
Figure 6.3: A drawing showing children engaged in play with natural and manufactured play equipment.....	123
Figure 6.4: A child’s drawing of the school ground with a fenced flower garden.....	125
Figure 6.5: Children’s finished model of their dream school ground (Photo: Matluba Khan)	131
Figure 6.6: A girl making a slide with care (Photo: Matluba Khan).....	132
Figure 6.7: Proposed preliminary design of the school ground (Source: Matluba Khan)....	133
Figure 6.8: View from the south-west corner of the school ground (Source: Matluba Khan)	133
Figure 6.9: View from the office building, west part of the school ground (Source: Matluba Khan).....	134
Figures 6.10a and 6.10b: Children preparing garden beds carrying soil and planting the first plant (Photo: Matluba Khan).....	135
Figures 6.11a and 6.11b: Children themselves painted the boundary wall (Photo: Matluba Khan).....	136
Figure 6.12: Children making a sandcastle with fountains using sand and water (Photo: Matluba Khan).....	136
Figures 6.13a and 6.13b: Children making houses using sand (Photo: Matluba Khan).....	137
Figure 6.14: A page from the field journal (Photo: Matluba Khan).....	137
Figure 6.15: Children jumping from the outside wall of the amphitheatre (Photo: Matluba Khan).....	137
Figure 6.16: The school ground after intervention in January 2015 (Photo: Goopy Bagha productions).....	139
Figure 6.17: As-built drawing of the school ground (Source: Matluba Khan).....	140
Figure 6.18: Research stages with methods	142
Figure 7.1: Different levels of analysis between the groups as presented in Chapter 7	146
Figure 7.2: Percentages of children by groups	146
Figure 7.3: Children’s gender by group	147
Figure 7.4: Difference in mathematics and science between the TIS and the CS at T1 and T3	147
Figure 7.5: Differences between the TIS and the CIS in mathematics and science at T1 and T3	148

Figure 7.6: Difference between the IS and the CS in mathematics and science at T1 and T3	150
Figure 7.7: Difference between boys and girls within the TIS at T1 and T3.....	151
Figure 7.8: Difference in children’s perceived motivation to learn in the outdoor classes between the TIS and CS at T1 and T3	152
Figure 7.9: Difference in children’s perceived overall motivation in the outdoors between the TIS and CIS at T1, T2 and T3.....	154
Figure 7.10: Difference in children’s perceived motivation between the intervention and the control school at T1 and T3	154
Figure 7.11: Difference in children’s perceived motivation to learn in the outdoor classes between boys and girls.....	156
Figure 7.12: Comparison of children’s motivation to learn in the classrooms and the outdoors	157
Figure 7.13: Difference in exploration of the environment between the TIS and the CS....	158
Figure 7.14: Difference in children’s reports of opportunities of exploration in the outdoor environment between the TIS and the CIS	159
Figure 7.15: Comparison in children’s perceived exploration of the environment between the intervention school and the control school at T1 and T3	160
Figure 7.16: Difference between boys’ and girls’ reported opportunities for exploration within the TIS	161
Figure 7.17: Comparison of children’s perceived exploration in the classroom and outdoors	162
Figure 7.18: Difference in children’s perceived peer relation between the TIS and the CS	163
Figure 7.19: Difference in children’s perceived overall peer relation in the outdoor environment between the TIS and the CIS	164
Figure 7.20: Difference in overall peer relation in the outdoor environment between the IS and the CS at T1 and T3	165
Figure 7.21: Difference in children’s perceived peer relation between boys and girls in the TIS	166
Figure 8.1: Children’s interaction at different times of a usual school day on the school ground at T1 and T3.....	170
Figure 8.2: Average number of children engaged in different activities on a typical school day.....	171
Figure 8.3: Typical daily occupancy of the school ground before intervention at three different times: (A) before school, (B) during lunch break and (C) after school.....	172

Figure 8.4: Typical daily occupancy of the school ground after intervention at three different times: (A) before school, (B) during lunch break and (C) after school.....	172
Figure 8.5: Cumulative maps of spatial occupancies at different times of the day: (A) before school, (B) during lunch break and (C) after school for the whole observation period before intervention.....	173
Figure 8.6: Cumulative maps of spatial occupancies at different times of the day (A) before school, (B) during lunch break and (C) after school of the whole observation period after intervention.....	174
Figure 8.7: Average number of girls and boys every day in the school ground at T1 and T3	174
Figure 8.8: Average number of girls and boys at different playtimes every day at T1 and T3	175
Figure 8.9: Total number of girls and boys in different activities at T1 and T3	175
Figure 8.10: Structure of formal teaching in the classroom settings (Photo: Matluba Khan)	177
Figure 8.11: Spatial occupancy during mathematics class in the classroom (A) after five mins, (B) after 20 mins and (C) after 35 mins on a typical school day	177
Figures 8.12a and 8.12b: The only outdoor formal learning activity before the intervention with Grade II children (Photo: Matluba Khan)	178
Figure 8.13: The structure of the classes in the outdoor environment	179
Figure 8.14: Spatial occupancy during science class (A) after five mins, (B) after 20 mins and (C) after 35 mins on 14 May 2015.....	179
Figure 8.15: Spatial occupancy during Mathematics class (A) after five mins, (B) after 20 mins and (C) after 35 mins on 06 May 2015.....	180
Figure 8.16: The teacher demonstrating the difference between plants and animals (Photo: Matluba Khan).....	181
Figure 8.17: Children’s interaction with different settings during outdoor class.....	182
Figure 8.18: Children’s interaction with different settings during the second part of outdoor class only	182
Figure 8.19: Percentage of different activities in the natural learning area	183
Figure 8.20: Girls counting plants in the natural learning area (Photo: Matluba Khan)	184
Figure 8.21: Children measuring the circumference of the tree (Photo: Matluba Khan)	184
Figure 8.22: Percentage of different class activities in gardens	184
Figure 8.23: Girls observing gardens closely (Photo: Matluba Khan)	185

Figure 8.24: Girls counting plants and bamboo pieces used in the fence of the gardens (Photo: Matluba Khan)	185
Figure 8.25: Percentage of different activities in the amphitheatre	187
Figure 8.26: The teacher talking about various scales of measuring at the beginning of the class (Photo: Matluba Khan).....	187
Figure 8.27: A girl writing on the blackboard about what they worked on (Photo: Matluba Khan)	187
Figure 8.28: A boy explaining food values to everybody (Photo: Matluba Khan).....	187
Figure 8.29: Percentage of different activities in the water learning area.....	188
Figure 8.30: Children closely interacting with water features (Photo: Matluba Khan)	188
Figure 8.31: Children learning about water habitat from their teacher (Photo: Matluba Khan)	188
Figure 8.32: Percentage of different activities in the area with loose materials	189
Figure 8.33: Children collecting loose materials (Photo: Matluba Khan)	189
Figure 8.34: Children building a house in the area with loose materials (Photo: Matluba Khan)	189
Figure 8.35: Children working on different food values on top of the storage shelf in the area with loose materials (Photo: Matluba Khan)	189
Figure 8.36: Percentage of different activities in the open yard	190
Figure 8.37: Children drawing a table to learn numbers with seeds in the open yard (Photo: Matluba Khan)	190
Figure 8.38: Children making a house in the open yard (Photo: Matluba Khan)	190
Figure 8.39: Children measuring the length of the open yard (Photo: Matluba Khan).....	190
Figure 8.40: Percentage of different activities in the play area.....	191
Figure 8.41: The teacher helping with measuring in the playhouse (Photo: Matluba Khan).....	191
Figure 8.42: Children working in a group in the playhouse (Photo: Matluba Khan)	191
Figure 8.43: Children sliding down the playhouse after completion of their work in a group (Photo: Matluba Khan)	191
Figure 8.44: Percentage of different activities in the huts	193
Figure 8.45: Children counting bamboo in a hut (Photo: Matluba Khan)	193
Figure 8.46: Children measuring the diameter of the floor of one hut (Photo: Matluba Khan)	193
Figure 8.47: Children working in a group in a hut (Photo: Matluba Khan).....	193
Figure 8.48: Percentage of different activities on the pathway.....	194
Figure 8.49: Prime number or composite number? (Photo: Matluba Khan).....	194

Figure 8.50: Children measuring the length/width of a stepping stone (Photo: Matluba Khan)	194
Figure 8.51: Cumulative maps of spatial occupancy and movement pattern during (A) mathematics class and (B) science class in the outdoor environment	196
Figure 8.52: The cumulative graph of percentage of different activities in different behaviour settings	197
Figure 8.53: Children’s play behaviours in different settings in relation to their area during behaviour mapping	198
Figure 8.54: Children’s various activities in different settings during behaviour mapping	199
Figure 8.55: Percentage of girls and boys in different settings	199
Figure 8.56: Percentage of different activities in the natural learning area	200
Figure 8.57: Percentage of girls and boys in the natural learning area	200
Figure 8.58: Two boys ready to roll the tyres down the hill in the natural learning area (Photo: Matluba Khan)	201
Figure 8.59: Children exploring the natural environment (Photo: Matluba Khan)	201
Figure 8.60: Percentage of different activities in gardens	201
Figure 8.61: Percentage of girls and boys in the gardens	201
Figure 8.62: Girls picking leaves as part of the game pata-pata (Photo: Matluba Khan)	202
Figure 8.63: Two boys taking care of the gardens (Photo: Matluba Khan)	202
Figure 8.64: Percentage of different activities in the amphitheatre (Photo: Matluba Khan)	203
Figure 8.65: Percentage of girls and boys in the amphitheatre (Photo: Matluba Khan)	203
Figure 8.66: Girls playing hopscotch in the amphitheatre (Photo: Matluba Khan)	203
Figure 8.67: A girl enjoying reading in the amphitheatre (Photo: Matluba Khan)	203
Figure 8.68: Girls cleaning the amphitheatre (Photo: Matluba Khan)	203
Figure 8.69: Boys jumping from the outer wall of the amphitheatre (Photo: Matluba Khan)	203
Figure 8.70: Percentage of different activities in the water learning area	204
Figure 8.71: Percentage of girls and boys in the water learning area	204
Figure 8.72: A boy working in the water area, with some others observing (Photo: Matluba Khan)	204
Figure 8.73: Children observing fish in the water tub (Photo: Matluba Khan)	204
Figure 8.74: Percentage of different activities in the area with loose materials	205
Figure 8.75: Percentage of girls and boys in the area with loose materials	205
Figure 8.76: The view of the area with loose materials (Photo: Matluba Khan)	206

Figure 8.77: Girls interacting with each other on top of the storage (Photo: Matluba Khan)	206
Figure 8.78: Percentage of different activities in the open yard	207
Figure 8.79: Percentage of girls and boys in the open yard	207
Figure 8.80: Girls playing pata-pata in the open yard (Photo: Matluba Khan)	207
Figure 8.81: Boys rolling tyres in the open yard (Photo: Matluba Khan)	207
Figure 8.82: Percentage of different activities in the play area	208
Figure 8.83: Percentage of girls and boys in the play area	208
Figure 8.84: Children on the see-saw a few days into T3 (Photo: Matluba Khan)	209
Figure 8.85: Usual physical activities in the play area after four months of intervention (Photo: Matluba Khan)	209
Figure 8.86: Younger children from the neighbourhood engaged in different functional activities in the play area (Photo: Matluba Khan)	209
Figure 8.87: A child taking shelter under the playhouse during the rain (Photo: Matluba Khan)	209
Figure 8.88: Percentage of different activities in the huts	210
Figure 8.89: Percentage of girls and boys in the huts	210
Figure 8.90: Children chatting in the huts (Photo: Matluba Khan)	210
Figure 8.91: A child on his own in the shelter (Photo: Matluba Khan)	210
Figure 8.92: A parent helping his child with homework (Photo: Matluba Khan)	210
Figure 8.93: Percentage of different activities on the pathway	211
Figure 8.94: Percentage of girls and boys on the pathway	211
Figure 8.95: Young children reading numbers while walking (Photo: Matluba Khan)	211
Figure 8.96: A child resting in the middle of play (Photo: Matluba Khan)	211
Figure 8.97: Girls walking to their classroom (Photo: Matluba Khan)	212
Figure 8.98: Children using the pathway during the rain (Photo: Matluba Khan)	212
Figure 9.1: A word cloud of children's formal and informal learning activities before intervention (T1)	224
Figure 9.2: Change in percentage of children's average attendance per month	233
Figure 9.3: A word cloud of children's formal and informal learning activities after intervention (T3)	243
Figure 10.1: Affordances of various levels identified as existing between environment and child (adapted from Kytta, 2002)	274
Figure 10.2: Cognitive affordances existing between environment and child-teacher interaction within a formal educational setting	275

Figure 10.3: The relationship of the designed school ground and children’s increased motivation and academic performance.....278

Figure 10.4: The relationship between environment and children’s learning279

List of tables

Table 0.1: Thesis structure.....	3
Table 2.1: A summary of research findings concerning outdoor environments in school.....	48
Table 4.1: Research methods and approach to analysis.....	82
Table 5.1: The attributes of the intervention and the control school.....	96
Table 5.2: The schedule of data collection	101
Table 5.3: The weather condition during behaviour map data collection of outdoor classes at T3	104
Table 5.4: Weather conditions during behaviour map data collection of children’s informal learning activities at T1.....	106
Table 5.5: Weather conditions during behaviour map data collection of children’s informal learning activities at T3.....	107
Table 5.6: Data analysis process.....	114
Table 6.1: Elements of school ground that appeared in children’s drawings	121
Table 6.2: Behaviour settings in the school ground with their affordances.....	129
Table 7.1: One-way ANCOVA to compare the TIS and the CS in mathematics and science	148
Table 7.2: One-way ANCOVA to compare the TIS and the CIS in mathematics and science	149
Table 7.3: One-way ANCOVA to compare the IS and the CS.....	150
Table 7.4: One-way ANCOVA to compare children’s perceived motivation to learn in the outdoor classes between the TIS and the CS at T3	153
Table 7.5: One-way ANCOVA to compare indicators of motivation between the IS and the CS.....	155
Table 7.6: One-way ANCOVA to compare children’s perceived exploration of the environment between the TIS and the CS.....	158
Table 7.7: One-way ANCOVA for measures of exploration of the environment between the IS and the CS	160
Table 7.8: One-way ANCOVA for indicators of exploration of the environment between boys and girls in the TIS	161
Table 7.9: One-way ANCOVA at T3 for children’s perceived peer relation in the school ground between the TIS and the CS.....	163
Table 7.10: One-way ANCOVA for children’s perceived peer relation between the TIS and the CIS	164

Table 7.11: One-way ANCOVA for children’s perceived peer relation between the IS and the CS	165
Table 9.1: Children’s activities in the school ground before and after the intervention	226
Table 10.1: Potential (perceived by designers) and actualised affordances of different behaviour settings during formal learning in outdoor classes	271
Table 10.2: Potential (perceived by designers) and actualised affordances of different behaviour settings during informal learning.....	272
Table 10.3: Summary of findings from different methods.....	280
Table 10.4: Summary of findings evaluating the design of the outdoor learning environment	281
Table 11.1: Implications for policy and curriculum in relation to findings	298

List of abbreviations

MoPME	Ministry of Primary and Mass Education
DPE	Department of Primary Education
EGMA	Early Grades Mathematics Assessment
EGRA	Early Grades Reading Assessment
LGED	Local Government and Engineering Division
PE	Physical Education
GPS	Government Primary School
SMC	School Managing Committee
DfID	Department for International Development
NCTB	National Curriculum and Textbook Board
OLE	Outdoor Learning Environment
PEDP	Primary Education Development Program
SPS	Scottish Primary School
IS	Intervention School (The Government Primary School with change in the environment in Bangladesh)
CS	Control School (The Government Primary School in Bangladesh which acted as a control with no change in the environment)
TIS	Treatment group in the Intervention School
CIS	Comparison group in the Intervention School
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund

Introduction

Primary schools are the first formal institutes in the majority of countries in the world, where children aged five to 12 years spend most of their day time. Therefore, school and/or classroom architecture as a possible influence on children's learning has become an emerging issue in the field of design and research. The outdoor environment of primary schools, though a major part of the primary school premises, is often ignored in school-design as it is not directly linked to the education of children. Although, open spaces have been found to be the most favourite places of children in the whole school environment in relevant studies (Khan, 2012), outdoor environments of schools are often not utilised to their full potential due to poor design (primarily focusing on physical activities e.g. in Australia, the USA and the UK) or lack of design (e.g. in Bangladesh and India).

Physical environments can influence people's behaviour in both a positive and a negative way. Barren school grounds can invite negative behaviour among children (Samborski, 2010), whereas experience in natural environments can mitigate those behaviours (Roe & Aspinall, 2011). Research findings indicate the benefits of designing school grounds for children's physical activity and free play, however, the relationship between the design of school grounds and children's learning is yet to be explored, particularly in developing countries. The present study explored this inter-relationship in the context of Bangladesh, applying a quasi-experimental action evaluation research strategy which included co-design and development of a school ground engaging the key stakeholders. Therefore, unlike other research based PhD theses, this study includes a 'design' part within its 'research design'.

Related research has explored the influence of design on a single area (e.g. physical activity, play or environmental learning) as a result of the need to narrow down the scope for a more in-depth understanding of the relationship between humans and environment. However, such a narrow focus can limit our understanding of the environment's simultaneous influences on many other aspects. Therefore, the design of a space guided by recommendations based on a single aspect of the children's environment might limit other aspects of their development. Taking these issues into consideration, the present research applied multiple methods in order to capture the whole story of how the design of physical environments can influence children's learning. Different methods were applied at the same time which complemented each other while also enabled triangulation of the research findings.

The thesis is organised in four parts (detailed in Table 0.1) to tell the whole story in a more legible, structured and understandable way. Part I establishes the ground for undertaking this research by presenting the research context and identifying the research gaps by a thorough examination of existing literature. Once the framework for conducting the study is established and the research plan is outlined, Part II of the thesis opens with an explanation of why certain strategies and methods were chosen for this research followed by a detailed account on how they were applied in the particular context of this study. It also presents how the school ground has been developed for the conduct of the experiment. Afterwards, Part III presents the results from analysis of the methods in three separate chapters. Finally, Part IV discusses the findings with reference to previous studies and concludes with the main research findings, their implications and recommendations for planning and design.

Table 0.1: Thesis structure

Part I Background and research questions	Chapter 1 Background of the study	Presents the background of the research, the definition of the problem and also the significance of conducting this research
	Chapter 2 Literature review	Discusses the main theoretical concepts and presents a survey of the existing literature
	Chapter 3 Conceptual framework and research questions	Illustrates the conceptual framework and the key research questions
Part II Research strategy and methodology	Chapter 4 Methodology	Discusses why certain research strategy and methods were chosen for the research, development of the instruments and ethics of researching with children
	Chapter 5 Data collection and analysis	Focuses on how the data were collected and analysed
	Chapter 6 Design and construction of the school ground	Discusses the design and development of the setting of the experiment i.e. the school ground in detail
Part III Results	Chapter 7 Results from exam scores and questionnaire survey data	Presents the baseline measures and results from analysis of quantitative data on exam scores and from questionnaire survey
	Chapter 8 Results from participant observation and behaviour mapping	Presents the findings from analysis of observational data from participant observation and behaviour mapping
	Chapter 9 Results from focus groups and interviews	Presents the findings from analysis of qualitative data from focus groups and interviews
Part IV Discussion and conclusion	Chapter 10 Discussion	Discusses the results, answering the research questions and presents a summary of the findings
	Chapter 11 Conclusion and design recommendations	Concludes the research, presents implications for policy, education and future research and presents a sub set of design recommendations

Part I: Background and research questions

The first part of this dissertation sets the ground for undertaking this research and comprises three chapters. Chapter 1 presents the background of the research defining the key terms and the research problem while Chapter 2 discusses the main theoretical concepts and identifies the gap this research is addressing through a critical survey of the existing literature on children's outdoor environment. Chapter 3 illustrates the key research questions that this study addressed building upon the many unanswered questions in the realm of children's outdoor learning environment.

Chapter 1 Background of the study

This chapter lays out the background of conducting this research through presenting a definition of the key terms and stating the research problem. The research problem is discussed in relation to the present international scenario of children's education and the research and practice of children's educational environment design focusing on the particular context (i.e. Bangladesh) where the study has been conducted. The chapter further elucidates the rationale of research on outdoor learning environments i.e. school grounds and presents the objectives of the study. Therefore, the overall aim of this chapter is to map out the present scenario of children's education and environment to establish an appropriate background for the study and it concludes by pointing out the significance of conducting this research.

1.1 Definition of the key terms

1.1.1 Children

The United Nations Convention on the Rights of the Child defines a child as '*every human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier*' (Unicef, 1989, p2). A child is anyone in the developmental stage of childhood, below the age of puberty or adulthood (Pearsall & Hanks, 1998). Child development refers to the physical, cognitive, social and emotional changes that occur in human beings starting from birth to the end of adolescence. Age-related development terms are: new-born (ages 0 – one month); infant (ages one month – one year); toddler (ages one – three years); pre-schooler (ages three – six years); school-aged child (ages six –12 years) and adolescent (ages 13–18 years) (Kail, 2015). For purpose of this research, children between the ages of 6 and 12 are included as during this period children explore their surrounding environment to a great extent and develop their own preferences about the places they use and activities they perform (Nor Fadzila & Ismail, 2012). At this age children are less able to think in an abstract way, therefore, they learn about things through direct exploration and experience (Haq & Jahan, 1999; Tai et al., 2006; Inhelder & Piaget, 1969).

1.1.2 Learning

Learning is an important process that allows children to fulfil their potential by achieving skills. It is a basic everyday human experience which is defined as '*an enduring change in the mechanisms of behaviour involving specific stimuli and/or responses that results from prior experience of those or similar stimuli/responses*' (Domjan, 2014, p14). Stimuli can be internal

or external. However, in this study stimuli from the external environment, more specifically a designed outdoor learning environment, is being looked into. These stimuli motivate children to respond and activate their brains, muscles and glands. Therefore, learning has a close relationship with motivation and happens when a child is motivated by the stimuli in its external environment (Lepper, Corpus and Iyengar, 2005). Children work with different elements in their surrounding environment through exploration, interaction and movement leading to a change in their behaviour or learning (Berlyne, 1971).

Learning leads to the development of new capacities, skills, values, understanding, and preferences. It is the acquisition of knowledge in everyday life (Pearsall & Hanks, 1998) thereby it ranges from children's capability of eating something to knowing about the life cycle of frogs in the school pond. Learning can take place in both conscious and unconscious ways. There are three approaches to learning — formal, informal and non-formal. The outdoor environment of a school can support all three types of learning (Moore & Wong, 1997).

- 1) *Formal learning*: Formal learning is the learning that takes place within a teacher-student relationship, such as in a school system. There prevails a preconceived notion that formal learning occurs only in the classroom and what can be done outdoors is play and not learning. There are many subject matters in the school curriculum for example — mathematics and science that can be taught outdoors with the direct supervision of teachers (Adams, 1990, Funnell et al., 1997, Billmore et al., 1999).
- 2) *Informal learning*: Informal learning occurs outside the direct supervision of teachers; it takes place through the experience of day to day situations. It is more likely to happen in social situations when children are engaged in other activities outside formal lessons — playing, gossiping, roaming around in the school ground, playing with friends etc. It is an important aspect of school life (Adams, 1993).
- 3) *Non-formal learning*: Non-formal learning occurs *'in a planned but highly adaptable manner in institutions, organisations, and situations beyond the spheres of formal or informal education. It shares the characteristic of being mediated with formal education, but the motivation for learning may be wholly intrinsic to the learner'* (Eshach, 2007, p173). Non-formal learning in the school ground relates to the hidden curriculum or learning about the ethos of the school. School grounds can convey important messages about the ethos of the school which can also be regarded as an external expression of the hidden curriculum (Adams, 1993).

In this study, how children learn will be discussed in relation to theories of 'cognitive development' (defined later in Chapter 2, Section 2.1.1.1) and the change in learning will be denoted by developmental changes. The study will focus on the formal learning of children in the school ground (measured by change in academic attainment, and perceived exploration and peer relation), though informal learning through play (measured by change in children's

activities in the school ground) will also be looked into. In order to measure learning, sometimes a test is needed. In this study, the evidence of learning is determined by the scores children get in their academic exams in primary schools.

1.1.3 Outdoor environment

The outdoor environment for children's learning can encompass a wide area from the school ground to the local woodland, or any other outdoor setting. In this study, outdoor environment refers to the immediate surroundings of the school building, the open space in the school premises excluding the school building in the ownership of the school authority. Generally the outdoors in the school premises is defined as 'school ground' in the UK and more widely known as 'schoolyard' in the USA (Adams, 1993). The term 'school ground' will be used throughout this thesis to mean the outdoor environment of primary schools.

Learning that takes place in the outdoor environment can be generally named 'outdoor learning', while 'outdoor education' means the use of outdoor environment as a tool for learning (Broda, 2007). As mentioned by the same author, outdoor environment can be used as the context as well as the content for learning. Outdoor learning can also be regarded as a sub-set of experiential learning which refers to learning through experience and experiment. Experiential learning, a philosophy developed by Dewey (1963) is defined as a process and it can take place indoors or outdoors. Outdoor learning provides children with the opportunity to experience this process in a free and wider space (Rowe and Humphries, 2012). According to Disinger (1990), learning in the outdoor environment has three dimensions — *learning about the environment*, which supports environmental knowledge and understanding; *learning for the environment*, which is directed towards caring for the environment or environmental stewardship and action and *learning in the environment*, which encourages using the environment as a venue for learning. In this study, the emphasis has been on *learning in the environment*, and to a lesser extent, *learning about the environment*, which eventually can build the quality of environmental stewardship in children.

1.2 Definition of the problem

1.2.1 Primary school environments for child-development

Primary Schools are where school aged children (from six to 12 years old) spend most of the 'awake' time, hence are one of the most important places in a child's life (Rasmussen, 2004, Altman, 2012). This age group is crucial to children's development; primary schools where

the formal training to become a mature and responsible citizen is given at this age, therefore should provide the best opportunities to develop the ‘whole’ child (Pellegrini et al., 2004). Henceforth, how school architecture impacts on children’s behaviour and activities has become an increasingly important issue in the field of design and educational research. However, the relationship between the design of the primary school outdoor environment and children’s learning has not been articulated or studied in the same way as has been done in the case of classroom design.

When designing a school, generally the focus is kept upon the design of school buildings and internal structures. The outdoor environment is often the ‘left over’ space after positioning the school building in the site guided by the idea that ‘learning occurs only in the classroom’. In many cases, especially in Dhaka (the capital city of Bangladesh), residences are converted into schools, with little concern for the necessity of outdoor spaces. In addition, often the large open spaces in front of the school building in rural primary schools are unutilised or underutilised. This trend is universal, for example, in Australia, large open spaces designed mainly for games and sports related activities do not have a significant number of users or intensity of use (Malone & Tranter, 2003). The increase in obesity rates gave a boost to the outdoor environment design and research in the developed world to encourage children’s physical activity. For the same reason, taking the curriculum outdoors is given emphasis in school curriculum and national policy. However, when it comes to the design of school grounds, it is difficult to find empirical research investigating the impact of outdoor environmental design on children’s learning. This study is focused on the consequences of a designed school ground — examining its potential for children’s formal and informal learning and their motivation to learn.

1.2.2 International scenario: children’s learning

While the research focus in the developed world is on improving children’s quality of education, the United Nations is yet to fulfil its promise to give every child in the world access to education. The recent report published by UNESCO revealed that the net enrolment rate of children in primary schools across the world has increased over the years but more than 59 million primary school-aged children are still out of school (UNESCO Institute for Statistics and UNICEF, 2015). The scenario is more pronounced in developing countries particularly in Asia and South Africa, for example in Bangladesh 0.6 million children are not continuing their primary education (BANBEIS, 2015). Even in the USA, the high school drop-out rate is considerably high in major urban areas (Digest, 2013) which has created concern among the policy makers and educationalists. There are many reasons

for this high drop-out rate, but rarely considered is the design of the environment, ignoring evidence of the positive impact that a school's design can have on children's academic achievement (Tanner, 2000, 2009).

National and international policies regarding education in developing countries until recently mostly focused on extrinsic motivational factors like abolishing school fees, cash transfer, take home ration and school feeding to attract children towards school (UNESCO, 2015). While take home ration had an impact on bringing children to school in some parts of Bangladesh, these measures did not have any impact on school progression indicators in Chile and Uganda. Enrolment ratios increased significantly during the EFA period, however, schools were not successful in keeping children in school, 20% of the children not completing their primary education. Although extrinsic motivational factors can attract children to school for short term, do not engage children in learning activities (Ryan & Deci, 2000) and therefore have negligible influences on children's academic attainment (Lepper, Corpus and Iyengar, 2005).

EGRA¹ and EGMA² assessment scores showed that in Tanzania, Ghana, Malawi, Chichewa, Pakistan, Iraq and Nicaragua most children leave primary schools without attaining minimum competence of that level (UNESCO, 2015). Again, children who do not perform well academically struggle throughout the school years and are more likely to drop-out (Chowdhury et al., 2009, UNESCO, 2014). Research also highlights lower levels of student engagement (i.e., motivation to learn) with increasing age during the school years (Lepper et al., 2005). This explains why a large number of children across the globe are not continuing their education and also repeating their grades in primary schools (UNESCO Institute for Statistics, 2012). The focus on quantity influenced the increase in the net enrolment rate over the years, however, *'globally, 250 million children of primary school age are not learning the basics in reading and mathematics, whether they are in school or not'* (UNESCO, 2014, p3). This questions the strategies based on 'more teachers', 'more classrooms' and 'more textbooks' (UNESCO Institute for Statistics, 2015) without any consideration of the quality of the physical environment. Researching this issue of education deficit from the perspective of an environmental designer may benefit a significant proportion of the population of the world.

¹ Early Grades Reading Assessments conducted in more than 60 countries

² Early Grades Mathematics Assessments conducted in more than 20 countries

1.2.3 Context: Bangladesh

1.2.3.1 *Primary education in Bangladesh: increased enrolment rate but high drop-out rate and poor academic competence*

Bangladesh, located in the south-east Asia is dealing with this burning issue of high drop-out rate and poor academic competence of children in primary schools like many other developing countries. There are four different primary level educational institutions in Bangladesh — Government-run schools, private schools, *madrassas* (Islamic religious schools), and schools run by non-Governmental organizations (NGOs). However, the Government-run schools provide education to the majority children of Bangladesh (Ardt et al., 2005). Around 83% of the total children enrolled in a primary level educational institution go to the Government primary schools (Baseline Report of PEDP-II 2006). There are currently 38,033 Government primary schools in Bangladesh being attended by more than 10 million students (BANBEIS, 2015). The net enrolment rate in these primary schools has increased to 97.3% in 2013 (DPE, 2014), however 21.4 % of the children who enter primary schools leave before completion and 6.9 % children repeat in all grades (DPE, 2014). Many children who cross the boundary of primary schools without reaching the standard level of academic competence tend to drop out from secondary schools (Ardt et al., 2005) resulting in a high drop-out rate in secondary schools (Ahmed, Rahman and Pal, 2010, MoPME, 2015).

1.2.3.2 *Reasons for drop-out and poor academic competence*

There are many reasons for this high drop-out rate but something which is often missing from the discussion, is the quality and the design of the school environment. In a study investigating the reasons for drop-out conducted under the supervision of MoPME (2009), one of the main causes identified by 90% of the teachers interviewed was poor academic performance. In the same report there was an attempt to listen to children's voice too, and the children identified the school environment as boring and unattractive. Many children did not attend school despite being beaten by parents or provided with food, uniform or money as part of the school attractiveness program (1991-96) (DPE, 2012) (see Figure 1.1).

'I always loved to play truant. I started bunking class when, I was in class three. My parents used to tell me to go to school. Even sometimes they beat me for that. My father confined me in a room for three days on two occasions to go back to school. But my mind was inclined to that bazar³. I like to go to the mazar⁴ and stay there overnight for listening song that attract me very much.' (Chowdhury et al. 2009, p35).

No follow up research can be found investigating the reasons why the schools did not attract the children. Whether confining the children within the four walls of a classroom to teach the contents of a textbook was the effective approach was not questioned. The approaches that are appropriate for teaching the children who love to play truant were not explored. Moreover, in a study on the assessment of children's competence conducted on 3,236 children from randomly selected 12 districts of six divisions in Bangladesh, only 43% of the children were found to achieve the standard competence of primary level education (Asadullah & Chaudhury, 2013). The gap between low competence and high enrolment rate also indicates the poor quality of education which can be related to the quality of the physical environment in which children are being educated, and the teaching-learning process, with the former influencing the latter (MoPME, 2015). The suggestions made in the research reports to address the issue of dropping out and poor academic competence includes improvement of physical environment and making school attractive and student friendly (Ardt et al., 2005). However, no empirical research is evident in this context on how these schools can be made student-friendly.

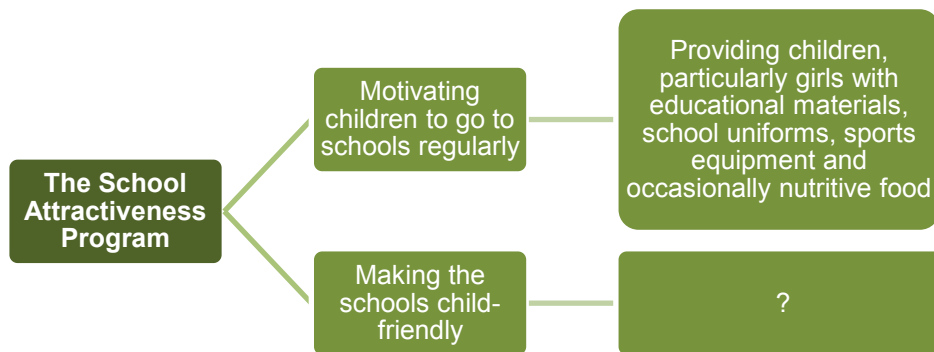


Figure 1.1: The school attractiveness program (1991-96) adopted by the Department of Primary Education (DPE) (Source: Khan 2012)

³ A marketplace or shopping quarter

⁴ A mausoleum or shrine, typically that of a saint or notable religious leader. Many activities are held surrounding a *mazar*.

1.2.3.3 *Physical environments of primary schools*

The design of the Government primary schools in Bangladesh follows a standard format based on the module of a classroom (see Figure 1.2), the size guided by a criteria outlined by UNESCO — 40 students per class and 10 ft² per pupil (DPE, 2014). The ‘good’ quality physical environment is defined as *pucca*⁵, 26’ x 19’6” classrooms and found in good condition though the classroom size in the newly constructed buildings is 17’ x 19’6” (DPE, 2014). Improvement of physical environment means adding more and more of these classrooms to the existing building or constructing a new building abandoning the previous dilapidated one. The same design is replicated across Bangladesh except on low lying land where the classrooms are on the 1st floor and connected with the ground by a stair. Almost all of these primary schools own an open yard in front of the school building under the requirement of mandatory 0.33 acre of land for primary schools. However, these school grounds are often underutilised or un-utilised being barren and devoid of any elements for formal or informal learning (Khan, 2009).

⁵ Made with durable materials

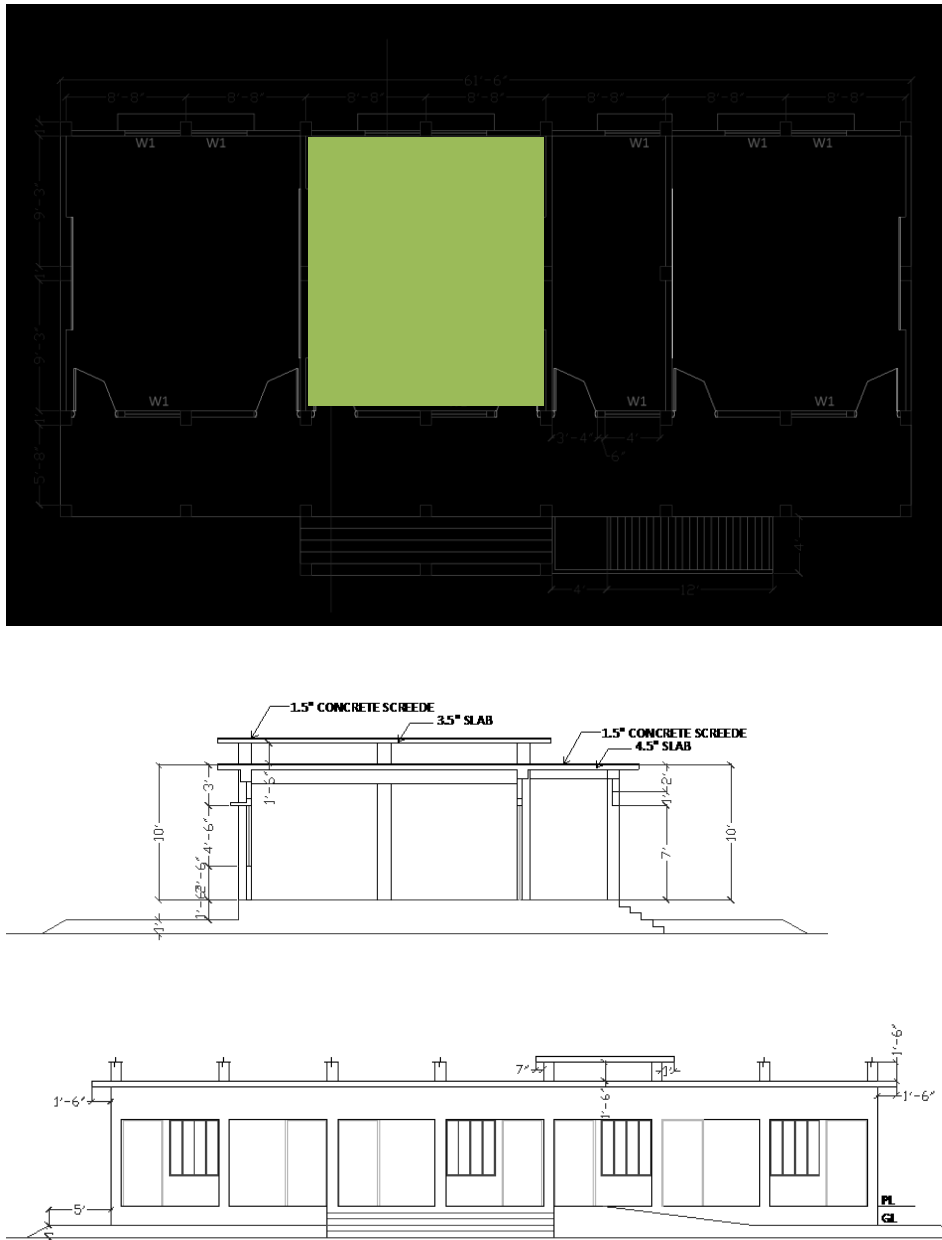


Figure 1.2: Plan, section and elevation of a standard Government primary school in Bangladesh (Source: LGED, Bangladesh)

The classrooms in the Government primary schools are full of benches (see Figure 1.3) providing no scope for learning by multiple activities, experimentation or exploration. Besides *'limited opportunities, such as deficiency of materials, crowded classes with small sizes prevent teachers to make various instructive activities'* (Ayvaci & Devocioğlu, 2010, p1977) and provide little chance *'to follow up student's educational achievements and weaknesses'* (Rabbi, 2005, p27). According to one building standard, at least 25 ft² is needed per student to hold multiple ways of teaching-learning process (Perkins & Cocking, 1949)

and more space is required for a primary science classroom — 700 ft² and for only 22 children (i.e. 45 ft² per person) (Collins, 2006). Therefore, the rural children who are more keen to play truant, are less likely to stay in the school for long and therefore, *'fail to catch up their lessons properly, at one point they lose interest in the school'*. (Chowdhury et al., 2009, p 18). Moreover, these barren school grounds provide fewer opportunities for informal learning activities through physical activity and play (Samborski, 2010).



Figure 1.3: Inside a classroom in a Government primary school in Bangladesh (Photo: Matluba Khan)

1.2.3.4 Outdoor education in Bangladesh: historical context

Though learning in the outdoor environment is not valued by most people as ‘real learning’, the practice of outdoor education is in the core of the history of the Indian sub-continent. Prior to the British era, primary education of the children or the disciples (*shishya*) in the Bengal Presidency commenced under the supervision of the master or *guru* in traditional schools called *pathshala*, where the classes often took place outdoors under a large tree. There was no division of grades, children of all age, class and caste studied in the same room and played together. *Pathshala* was very much different in its character than what we know as schools as its main objective was to enrich children with knowledge of practical skills. During the middle of the 19th century, in the UK, the school as an institute was formalised with standardised furniture, classroom sizes and design layouts (Saint, 1987, Uduku, 2015). The whole system was exported to then colonies of the UK and European countries, and gradually ‘schools’ replaced *pathshala*.

Rabindranath Tagore, the Nobel laureate poet from India revived the idea and culture of *pathshala* in 1901 in *Shantiniketan ashrama* based on the philosophy of learning in nature (Tagore, 1945). Outdoor teaching is still being practiced in *Patha Bhavana*,

Shantiniketan where the children are taught under the tree from Grade I to VII. *Shantiniketan* stands out as an exemplary educational institution following the philosophy of Rabindranath Tagore, however, outdoor education is practised within the boundary of it only. No other institute within the Indian sub-continent adopted the philosophy of outdoor learning. Empirical studies on outdoor education practice in *Shantiniketan* or in India are also less evident.

In a report published by the International Bureau of Education, Choudhury & Obaidullah (1980) described a pilot project on ‘Outdoor Primary Education in Bangladesh’ in 1976. Followed by a bumper production of crops in 1975, the classrooms in some primary schools in the areas of surplus production were used as temporary storage. Instead of closing the schools temporarily the children were taught outdoors, in the school premises. Outdoor education was introduced in 6,250 primary schools covering about one million children and 25,000 teachers in 94 sub-districts of the country from 26 January to 15 April 1976. These schools were called ‘*muktangon*’ or open air primary schools and the objective was not only to cater for the learning needs of the children during that period but also to experiment the potential of environment-based education. A separate curriculum was prepared for the outdoor education project and the syllabus included visits to agricultural farms, agricultural work and knowledge, handicrafts, knowledge of the local environment, irrigation etc. The project was evaluated based on interviews with teachers and children from 224 *muktangon* schools and comparing the attendance data with 42 non-*muktangon* schools. *Muktangon* schools were found beneficial to the children providing the opportunity to learn from their own environment making education more practical. 77% of the schools reported a 9% increase in the student attendance on *muktangon* days compared to non-*muktangon* days. Though the evaluation team recommended continuing the project in all the schools of 15 selected sub-districts, no follow up report can be found.

The most recent research was a quasi-experimental study conducted in a Government primary school which involved design and construction of an outdoor classroom i.e. an amphitheatre (Khan & Islam, 2014). The study was conducted on 30 children of Grade IV of the school. The children after being taught in the outdoor classroom showed better performance than after being taught in the classroom. Afterwards, the amphitheatre was used regularly for teaching pre-primary children and for holding extra-curricular activities like music and drama. The present research is based on that study thus extending its scope.

1.2.4 Lack of research on where education occurs

Though the link between neuroscience and architectural design is yet to be made through extensive research, Marian Diamond and colleagues demonstrate that environment has a major influence on behaviour in rats (Cheskey, 1995). They found that the size of the brain of rats increased when they were put in an enriched environment with more toys, playmates and opportunities to make choices while the size of others decreased when they were confined in an impoverished environment. They also found that those which experienced the enriched environment had increased intelligence which was measured by their ability to run mazes. Diamond's study posits that environmental stimulation was the reason for this change in the brain leading to the change in intelligence. Therefore, the environment's potential to influence children's behaviour and learning outcome is easily understandable. However, the surprising fact is that educational research has mainly focused on the content or the process of teaching, the place 'where' education occurs has been paid much less attention (Barrett et al., 2015, Sanoff, 2015) and the complex relation between children's learning and their physical environment still remains unexplored.

In Bangladesh, the degraded condition of the environment in primary schools is incapable of providing quality education and also cannot attract children to schools. Extensive research in this field is required to find out how this school environment can be designed that can accommodate an effective teaching-learning process. Though the Bangladesh Primary Education Annual Sector Performance Report 2009 emphasises studies addressing specific issues like infrastructure (DPE, 2009), no such research has been carried out. Now it is time to find out whether building more classrooms of minimal size is the solution when research provides evidence that children are fond of places with natural elements such as grass, trees and gardens; richness and variety, and places where interaction can take place (Van Andel, 1990)

1.2.5 Why school grounds?

There has been considerable improvement in the design and quality of classroom environments, however, the school grounds have been the least considered aspect of the school environment design (Armitage & Burke, 2005). From the growing concern related to children's increasingly sedentary behaviour in the developed world and the realisation of the positive influence of natural environments, a lot of information related to design and use of the playground has been generated. This mostly relied on intuition therefore lacking empirical observations. *'School grounds are significant locations for schools' provision of outdoor learning, yet many schools report significant reduction in area and suitable surfaces*

for outdoor learning' (Nicol et al, 2007, p4). In Bangladesh or most other developing countries where children are deterred to the poor classroom environment, the school ground can be utilised as a context and tool for teaching the curriculum and therefore, the potential of outdoor environments to accommodate such purpose needs to be investigated.

1.2.5.1 The impact of the outdoor environment on children's learning, health and well-being

A growing body of research has linked spending time in the outdoor environment with attention restoration, recovery from stress, informal learning through play and improved physical activity. School grounds with access to nature provide 'affordances' for more physical activity, play and environmental learning (Fjørtoft & Sageie, 2000; Herrington et al., 1998; Dowdell et al., 2011; Tranter & Malone, 2004; Malone & Tranter, 2003; Dymont & O'Connell, 2013; Lucas & Dymont, 2010; Wan & Zulkiflee, 2012). Also, exposure to outdoor environments were found to have an impact on children's attention restoration and recovery from stress (Chawla et al., 2014, Bagot, Allen and Toukhsati, 2015). Forest school experiences positively influence children's motivation, social relation, language and communication and physical skills (Swarbrick, Eastwood and Tutton, 2004, Davis, Rea and Waite, 2006, Dillon et al., 2006, O'Brien et al., 2007, Gambino, Davis and Rowntree, 2009, Mygind, 2009, O'Brien, 2009). In several studies in the USA (Lieberman et al., 1998) and the UK (O'Brien, 2009) it has been found that children showed improved achievement in the cognitive and affective domains when nature was used as an integrated context for learning. Learning in the school ground enhances children's botanical knowledge, science conceptions and mathematical skills (Harvey, 1990, Cronin-Jones, 2000, Maynard, Waters and Clement, 2013). In addition, using the outdoors for learning positively influences children's attendance (Price, 2013). Children were more engaged in their studies and gained better scores in a test after they had been taught in the outdoor classroom as part of a quasi-experimental study conducted in Bangladesh (Khan & Islam, 2014). However, the attributes of the outdoor environment of primary schools that help children in improving academic attainment and make them motivated are yet to be researched and understood.

1.2.5.2 Children's preference to be in the outdoors

Most children do have a preference to be outdoors (Chawla, 1992) which does not mean they would be a naturalist as an adult. In order to get an idea about children's preferred places, a longitudinal research project about children and their outdoor environment has been undertaken in the Netherlands where the pilot study involved 36 children and the main study involved 140 children of six to 12 years old. Most of the children mentioned either

playgrounds where they can be physically active and interact with friends or green areas as their favourite places (Van Andel, 1990). While young children value outdoors for the opportunity of physical play with friends, the adolescents associated good health with spending time in the outdoors in a Canadian study exploring the relationship between health and the environment (Woodgate & Skarlato, 2015), which indicates the inclination of children of different ages and regions to prefer outdoors.

A survey of 30 children in three different schools in Dhaka, the capital city of Bangladesh reveals that in general children mostly liked to be outdoors (Khan, 2012). In response to the question about their favourite place in their school, 100% of the children said the outdoor environment. In response to the question why they liked to come to school, they mentioned the opportunities to be engaged in different activities in the outdoor environment and meet with peers. However, the outdoors was not used for teaching the curriculum in any of the schools except for one project to clean the school premises. In another school, children were not even allowed to be in the school ground except for their physical education classes.

1.2.5.3 Learning right at the door step

There are many barriers that can restrain teachers from taking children outdoors for teaching the curriculum including fear and concern about children's health and safety; shortage of time and resources; weather, transportation, lack of expertise and qualification (Dyment, 2005; Rickinson et al., 2004; Ross, Nicol, & Higgins, 2007). However in a mixed-methods study in five Canadian schools exploring the hindrances related to outdoor teaching, Dyment (2005) states that these barriers can be minimised to a great extent and the opportunities can be maximised when the outdoor learning is held within the school premises. While a teacher might not get enough time in a 40-minute class for a visit to a distant outdoor place or even the local woodland or the funding can be limited for an outdoor excursion, it takes only a few seconds and no money to take the whole class out in the school ground.

In a study in California, Carey (2012) investigated the measures that can mitigate the barriers that prevented teachers from taking children outdoors. Through critical evaluation of three possible solutions — making changes to the school playground, working with a teacher to integrate the outdoors into formal lesson plans and training teachers on how to use the playground effectively, the author opted for changing the school ground. She considered time (high 'time', the development might take time yet children and teachers would have access to the school ground during that period and can participate in the process), reach (high 'reach', it would reach the whole school) and reasonableness (medium 'reasonableness', bad

weather might affect the use) compared to the low ‘reach’ of working with only a teacher and low reasonableness of teacher training.

1.3 Objectives of the study

The key purpose of this study is to find ways for the better education of children, the research being an exploration of children’s learning from a designer’s perspective. Utilising the outdoor environment and developing effective design characteristics aimed at enhancing children’s learning may be a fruitful way to improve children’s academic outcomes and increase their motivation towards learning. The study investigates the relationship of different environmental conditions and children’s learning behaviour (both formal and informal) by adopting an appropriate strategy and methodological approach (illustrated in Chapter 4). Through a comprehensive account of how different attributes of the outdoor environment in a typical Government primary school in Bangladesh influence children’s learning, this study aims to make a contribution to this area which has not been studied extensively.

1.4 Significance of conducting this research

This study is unique in its approach. It investigates the impact of environment on children’s learning and therefore, will critically investigate the influence of the outdoor environment on children’s learning. If the design of the outdoor environment is found to be beneficial to children’s motivation and learning, it can open up new opportunities and bridge the gaps between research and practice by contributing to the design strategies of educational institutions affecting the future development of educational architecture and policy levels. Outdoor environment is a key design component of a primary school. But generally it is not taken into consideration when the school building is designed, and the un-built area of the site is regarded as the playground. Findings of this research, therefore, may add a new perspective to philosophies of policy makers, education researchers and architects. The findings can also act as a guideline for designers and teachers to accommodate teaching and learning in the outdoor environment of primary schools.

This study addresses a group of children who are seldom researched in developing countries. This research will contribute to studies of children from middle and lower income families. In Bangladesh, research projects mainly involved children in extreme poverty and focused on social environment. Children from middle and lower income families and their physical environment are mostly out of the research focus. Developing and sustaining high quality education is a priority for developing countries (DfID & MP, 2013), in addition to

meeting children's more immediate health and nutrition needs. It is crucial that developing countries have access to high quality evidence to base decisions relevant in education, similar to the quality of evidence available to developed countries. This study aims to develop an understanding of the potential use and value of designing outdoor environments for the enhancement of children's learning and their motivation for learning. The context is crucial to this project.

As noted previously, related studies are conducted mostly in developed countries. Variables having high correlation with environment integrated learning in a developed nation may act differently in a developing country. This study aims to strengthen the prevailing theories about the relationship between children's learning and school landscape by testing them in a different culture and context — the context of Bangladesh. The outdoor environment of primary schools in Bangladesh is originally designed as a barren school ground with or without any trees. This research is preparing the ground for further study in this field. Through the design and development of the whole landscape of a primary school it aims to develop a basis for further research in educational and environmental design.

The next chapter provides an overview of the existing theories related to children's development and their environment and a critical review of the relevant literature which helped in formulation of the conceptual framework and research questions.

Chapter 2 Literature review

As mentioned in the previous chapter (Section 1.2.5.1), research on the interaction of children with the outdoor environment and its impact on their development has expanded in recent years (Nor Fadzila & Ismail, 2012; Monsoureh & Ismail, 2012) but there are still gaps. A well-conceptualised framework for carrying out research and applying it in practice from the viewpoint of an environmental designer is needed for further investigation into the relationship between attributes of the outdoor environment and children's learning.

Therefore, a rigorous review of the relevant literature has been undertaken to find out the best possible way to address the topic of children's outdoor learning environment design.

The literature review started with the aim of understanding how children learn and develop, and it therefore, looked into the theories related to child development, motivation and play. It attempted to link all these theories to the concepts and theories in ecological perceptual psychology to better understand the interplay between the environment and children's behaviour. This led to an appraisal of relevant literature focusing on the impact of outdoor environment on children in related disciplines to identify the gaps in literature and also in our understanding. Research investigating the interaction of children with their immediate surrounding was reviewed and the concepts, methods and evidence relevant to children's outdoor environment design were considered to identify the potential approaches for school ground design. The structure of the literature review section is graphically presented in Figure 2.1.

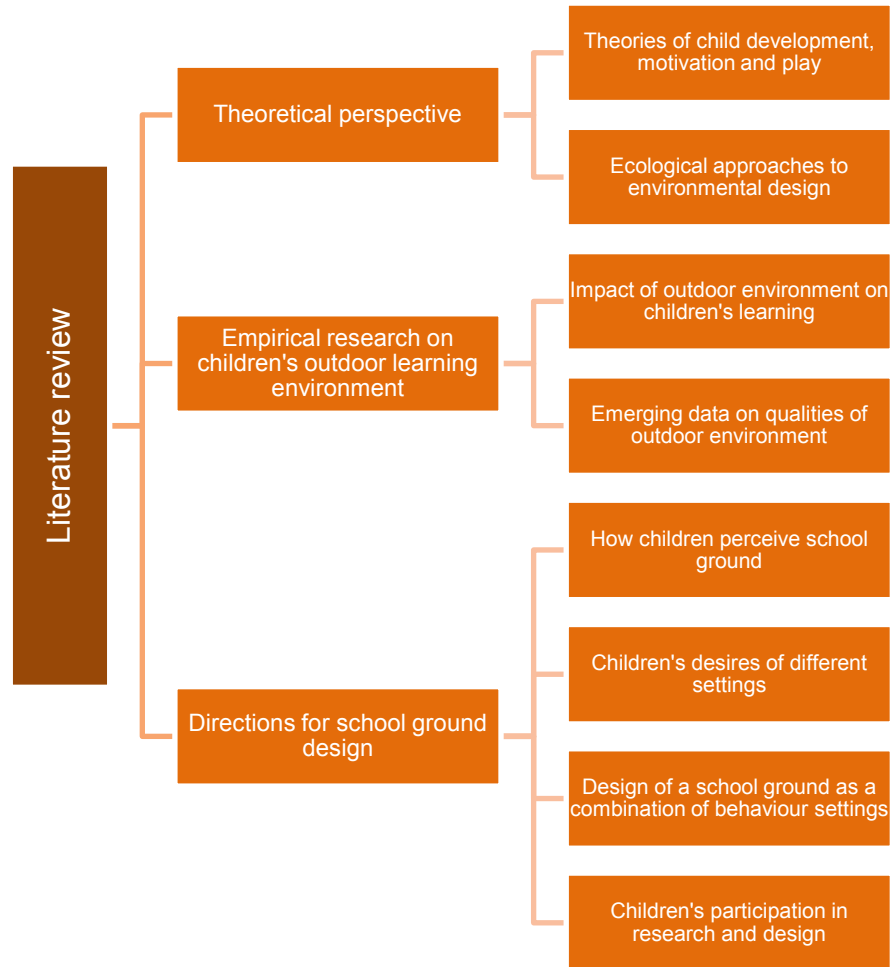


Figure 2.1: Structure of the literature review

2.1 Theoretical framework

2.1.1 Theories of child development

Children’s development is frequently categorised into three basic areas — cognitive development, physical development and socio-emotional development. Although each are distinct areas of development, there is a close relationship between children’s physical, cognitive and social-emotional functioning (Biehler & Snowman, 1982; Khan, 2009; Tai et al., 2006).

2.1.1.1 Cognitive development

Middle age children or children from six to 12 years old generally learn effectively when their learning is associated with doing (Tai et al., 2006). This stage is termed the ‘concrete operational stage’ by Jean Piaget, when children deal with concrete information that they can

perceive directly from the environment (Haq & Jahan, 1999). According to Piaget's theory of constructivism, children construct their knowledge of the world by acting upon objects in a specific space and at a particular time. They explore the surrounding environment, make their own discoveries and construct knowledge accordingly from personal experiences (Wood, 1998; Biehler & Snowman, 1982; Turner, 1984). They obtain the knowledge through the processing of information and that pattern of behaviour is known as schema. 'Assimilation' is the process of taking in new information into the previously existing schemas. When children come across new information they alter or change the existing schema which is called 'accommodation'. In the stages of cognitive development, the process of restoring balance between applying previous knowledge (assimilation) and changing behaviour to account for new knowledge (accommodation) is known as 'equilibration'. It helps explain how children are able to develop from one stage of thought into the next (Slavin, 2002).

While Piaget placed an emphasis on children as intellectual explorers who make their own discoveries, and construct knowledge independently, Lev Vygotsky, known for his theory of social constructivism, believed that learning and development occurs concurrently — when the children are active in the context of both socialisation and education. The children internalise the experience gathered from their contact with the social environment on an interpersonal level. The earlier knowledge base developed in his schema and new experiences that he comes across in his immediate surrounding 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. According to Vygotsky, the potential for cognitive development depends upon the Zone of Proximal Development (ZPD). The ZPD is the area between where the child is currently operating independently in mental development and where that child might go as a result of assistance from an adult or a more mature child (Biehler & Snowman, 1982; Slavin, 2002; Vygotsky et al., 1978). Based on Vygotsky's research it is known that children can do more in collaboration than independently. In addition, studies show that children are more motivated and engaged in studies when they learn through collaborative discussion (Wu et al., 2013).

The outdoor environment of a school can be an optimal place for development of cognition because there are many concepts that can be learnt through cooperative work with peers acting upon real objects (Wu et al., 2013; Khan, 2012) (for graphical representation see

Figure 2.2). 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 & Snowman, 1982).

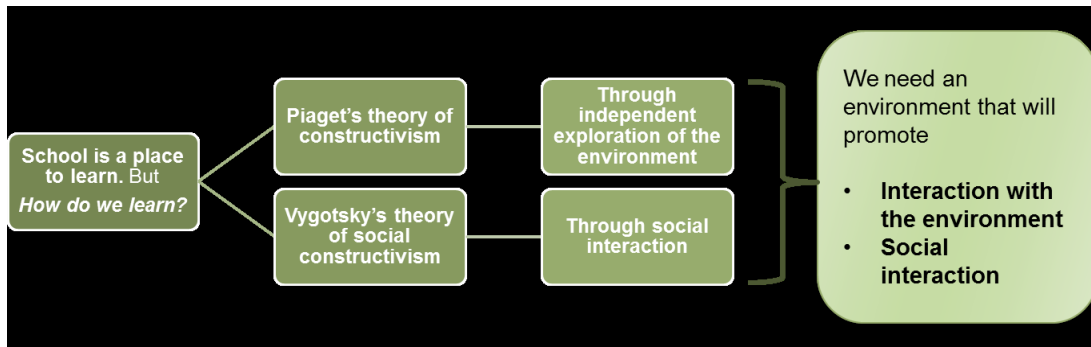


Figure 2.2: Graphical representation of the theories on how children learn

The outdoor environment provides the opportunity to connect with nature, experiencing nature at direct, indirect or vicarious levels can stimulate children's cognitive development (Kellert, 2002). This can be explored through the employment of the taxonomy of cognition developed by Bloom and colleagues (Bloom & Engelhart, 1956). 'Bloom's Taxonomy' was originally created in and for an academic context to develop a system of categories of learning behaviour to assist in the design and assessment of educational learning. This taxonomy identifies six stages of cognitive maturation which encompass more complex levels of intellectual and problem-solving capacity — knowledge, comprehension, application, analysis, synthesis and evaluation. Children explore the environment around them, discover new things and develop an understanding of that. There are studies which suggest that exploration and experience of nature can exert a positive impact upon children's cognition (Dismore & Bailey, 2005; Fiskum & Jacobsen, 2013).

2.1.1.2 Socio-emotional development

Socio-emotional development of middle age children encompasses a wide range of attributes including development of self-concept and self-esteem, motivation, personality, moral development and use of social comparison to evaluate and judge their own capabilities (Biehler & 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 how one values him or herself) (Huitt, 2011). Generally when a child enters middle age or enters school he or she

beholds intellectual curiosity and a positive attitude about his or her ability to master new ideas (Eccles, 1999). Children want the recognition of their own works (Erikson, 1995), and try to prove themselves ‘grown up’ which is characterised by independent action, co-operation with groups and performing in socially acceptable ways (Biehler & Snowman, 1982; Faupel, 2003). Children who have difficulty in school tend to develop poorer self-concepts, which might result in poor performance in upper grades (Biehler & 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.

There is evidence that hands on experience with nature while learning in the outdoor settings has a positive impact on children’s mental, emotional and social health (Maller & Townsend, 2006). Many social skills are also enhanced through outdoor educational experiences, including co-operation and communication with people, decision making, problem solving, and social competence (Swarbrick, Eastwood and Tutton, 2004, O’Brien et al., 2007, Beames, Higgins and Nicol, 2012). Nature also stimulates complex emotional development referred to by Kellert (2002) as ‘affective maturation’. Bloom and colleagues (1964) have devised a taxonomy for affective maturation. Five stages of affective development have been identified — receiving, responding, valuing, organising and characterising by a value or value complex. Bloom’s first stage of affective domain deals with children’s eagerness and desire for information and the environment. They think of nature as a different component, while they simultaneously feel attracted to it and interested in it. *“This stage in a child’s life has also been referred to as the child’s ‘earth’ period”* (Tai et al., 2006, p15). For some children, bonding with nature can be a spiritual experience, and it will have a long lasting impact on their lives. Besides, studies also suggest that exposure to green space reduces crime, increases general wellbeing and ability to focus (Tai et al., 2006; Roe & Aspinall, 2011).

In a survey of a mixed group conducted by Sebba, 96.5% of the participants stated that outdoors was the most significant environment of their childhood (Tai et al., 2006). Another study cited in Tai et al. (2006) though different to what is being investigated in this study, found that 700 of the past (those who had attended over the last 25 years) and present participants of outdoor programs (e.g. Outdoor Bound, the National Outdoor Leadership School and the Student Conservation Association) had the similar positive result. A large majority reported the experience as being one of the most important in their lives and claimed it had an impact on their personality and development (Kellert, 2002). Most further

claimed that the experience helped their self-esteem, ability to solve problems and capacity to cope, to meet challenges, and to lead their life further. Their appreciation of nature and support of conservation, as well as their future level of activity in the outdoors were all favourably influenced by that experience in nature (Kellert, 2002, Tai et al., 2006).

2.1.1.3 Physical development

Children experience many physical changes between the ages of six and 12, i.e. the development of physical skills or gross motor skills used in different physical activities and fine motor skills used in activities like different art, science or craft projects (Biehler & Snowman, 1982). The relationship between physical activity and cognition is explored by developmental theorists and can be explained by the dynamic systems theory by Thelen & Smith (1996). While Piaget (1964) theorised the creation of knowledge of the external environment in the child's internal world through individual exploration, Thelen & Smith (1996), attempted to connect these two different contexts through a dynamic systems approach and stressed on the power of movement as a means of exploration. The development of a child is not a linear process and includes an active spontaneous self-organising process leading to cognition. Young children are engaged in many activities with no apparent goals, *'however, this behaviour, commonly called play, is essential to building inventive forms of intelligence that are open to new solutions'* (Thelen & Smith 2007, p287). This is also related to the concept of affordances by Gibson (1986) (explained later in section 2.1.4.1) when a child discovers the affordances of the environment through its action and therefore develops cognition. Hence, development of action and cognition is an integral process and needs to be discussed within the same theoretical framework (illustrated in Figure 2.3).

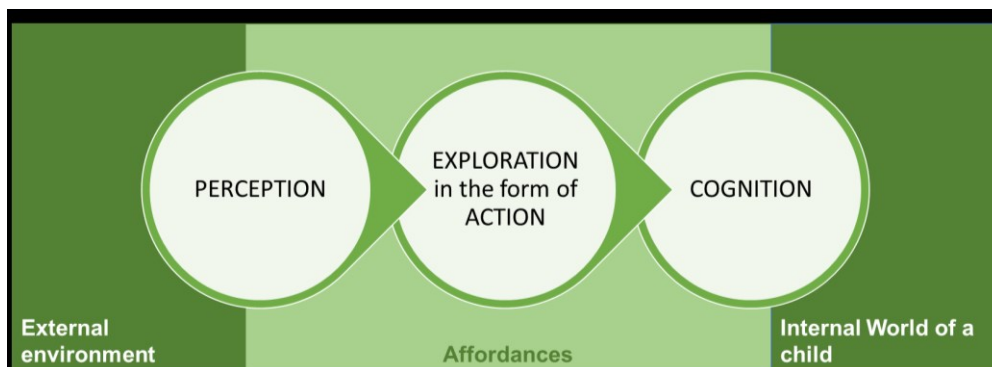


Figure 2.3: Theoretical framework: dynamic systems theories in relation to environment

The relationship between the outdoor environment and the learner has not been given as much attention as has the classroom. However, the capacity of the outdoors to contribute to the educational experience of children has been increasingly ignored (Dudek & Baumann, 2007) as a result of adherence to the ‘surplus energy theory’ (Spencer, 1855). The surplus energy theory considered to be very dominant in play theory was first proposed by the nineteenth century psychologist Herbert Spencer. It has a great influence in the design of outdoor environment of children and is found to be deeply embedded in school-culture (Malone & Tranter, 2003). Spencer believed that the main reason children play is to get rid of their excess energy and this belief is profoundly debated by many researchers and developmental theorists. People generally consider the outdoor as a place for play, games and sports and not for formal learning or educational purpose. In some countries including Bangladesh, the only use of school grounds is for physical training (PT) and sports based activity. 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 & Tranter, 2003). How outdoors can be utilised when it is a part of the formal educational curriculum is the focus of this particular study.

It is established in the literature that natural environments have an impact on children’s physical development. A growing body of studies suggests that time spent outdoors correlates with increased physical activity and fitness in children (Mygind, 2007; Davison & Lawson, 2006). Children showed higher level of physical activity while spending a day in an outdoor environment compared to a traditional school day in a study by Mygind (2007), therefore recommending a combination of indoor and outdoor teaching in the rural schools in Denmark. Children who receive additional physical education accelerate psychomotor development which helps to improve their academic skill (Shephard, 1997, Bailey et al., 2009). But there are children who are not interested in physical activities; therefore, a combination of out and indoor learning can activate those children and expose them to the natural environment. This leads to a debate as to whether physical activity itself or the physically active learning method (which can be more effectively applied outside the classroom) has a more positive impact on learning.

2.1.2 Motivation to learn

Motivation to learn and its relationships with the external environment has been a research topic for many years. Researchers have established the influence of motivation on children's academic performance (Hidi & Harackiewicz, 2000; Lepper et al., 2005; Gutman & Schoon, 2013). However, recent studies show that children's interest in learning in general decreases with age, many children lose their interest in school by the mid-elementary school years (Eccles et al., 1993). Researchers have been working on how to motivate the academically unmotivated children with the combination of external and internal motivational factors (Hidi & Harackiewicz, 2000).

'Motivation is the study of why individuals think and behave as they do' (Gutman & Schoon 2013, p12). Children have an innate interest in interacting with the environment culminating in exploration when there is sufficient diversity and variety in the environment to sustain their interest. This is defined as 'competence motivation' or 'effectance motivation' by White (1959). Woodworth (1958) regards dealing with environment as the most fundamental element in motivation (White, 1959). The motivation to explore the environment and manipulate diversified objects in the environment creates further stimuli for exploration and thus influences children's development. *'If the environment is undifferentiated or not dynamic, it becomes so familiar that behaviours may turn into reflex acts or automated tasks, at which point, development is impeded'* (Cosco, 2006, p 21). This is aligned with the basic idea of Piaget's theory — acting upon different objects in the surroundings and thereby constructing knowledge (White, 1959). However, interacting with peers in order to explore and create more interesting objects in the environment for further stimuli and knowledge is considered to be an aspect of motivation too and this is the central tenet of Vygotsky's theory. Designing the outdoor environment of primary school from this perspective, and thereby evaluating it based on children's learning and motivation can create new knowledge about how the settings in the outdoors can stimulate the motivation for exploration and learning.

Interest, often considered synonymous with motivation is a psychological state which is different from effort (Schraw, Flowerday and Lehman, 2001) and emerges from the interactive relation of an individual with certain aspects of his or her environment (e.g. objects, events, ideas) (Hidi & Harackiewicz, 2000). Individual interest is conceptualised as an enduring personal value that is activated internally and develops over time in relation to a particular topic or domain. On the other hand, situational interest is generated by certain

external conditions or stimuli in the environment that invite attention and represents affective reaction to the environment (Hidi & Harackiewicz, 2000; Schraw et al., 2001; Krapp, 1999).

Situational interest has been categorised such as emotional and cognitive interest. Emotional interest is the arousal of excitement, elation to do something related to environmental condition (Schraw, Flowerday and Lehman, 2001). However, situational interest can precede this and have a long-lasting effect on children’s learning by intriguing the individual interest and therefore the intrinsic motivation in a person (Hidi & Harackiewicz, 2000; Krapp, 1999; Schraw et al., 2001; Wu et al., 2013). It can have an impact on the creation of a ‘sense of industry’ (Erikson, 1995) in the child. For example, one day the whole class of an elementary school was taken to the school ground to be given a lesson on angles — right, acute and obtuse angles, with the help of the twigs and coloured cubes. The children measured at which angles the branches are attached to the tree. One child who had less interest in learning geometry in the classroom previously, enjoyed learning about angles in the outdoors. Classes taken in the school ground on a regular basis created a consistent interest in him which in turn surpassed his personal interest and motivated him towards learning geometry. There is evidence that children who are less motivated gradually become interested in learning and spontaneously participate in the learning activities in the outdoors where they can focus and concentrate on tasks for a longer period of time (O’Brien et al., 2007, Mygind, 2009, O’Brien, 2009). The classification of motivation and how the different types are related to each other is graphically represented in Figure 2.4.

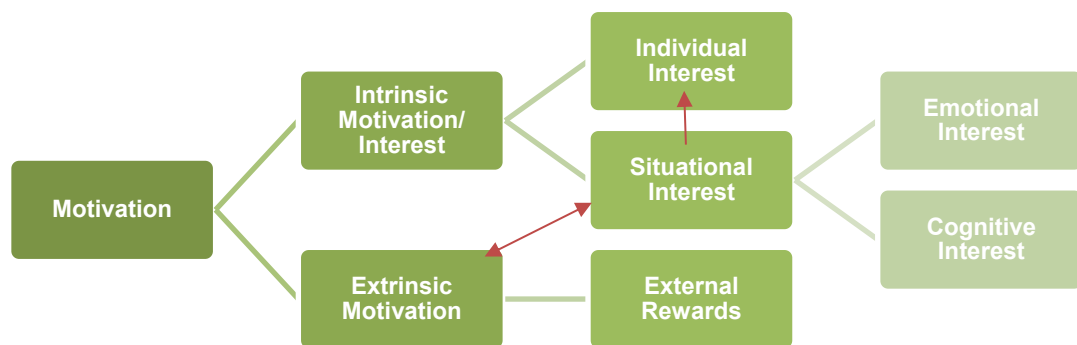


Figure 2.4: Graphical representation of classification of motivation

Individual interest has been associated with intrinsic motivation whereas researchers viewed situational interest as an externally controlled motivation or extrinsic motivation (Schraw, Flowerday and Lehman, 2001). In order to answer the query of whether children's patterns of learning in school can be categorised as intrinsic or extrinsic, researchers found three types of motivational patterns in children (Deci et al., 1991, Schraw, Flowerday and Lehman, 2001). These are that some children are externally motivated in some subject areas and internally in some others, whereas there are some children who are either extrinsic or intrinsic in all subject areas. Fifty percent of all the students' interest in learning is content and situation specific which indicates the importance of considering both intrinsic and extrinsic motivational factors in education (Hidi & Harackiewicz, 2000). It has been noted by researchers that individual interest of students can be influenced very little while situational interest can be controlled and changed by creating appropriate environmental settings for learning and teaching (Schraw et al., 2001; Hidi & Harackiewicz, 2000).

A well designed physical environment can stimulate students' learning and have an impact on their academic outcomes (Tanner, 2000, 2009) as stated earlier. It can play an important role specially for the children who lack academic motivation (Hidi & Harackiewicz, 2000). It can be related to 'integrated regulation' as defined by Deci et al. (1991) in self-determination theory, when extrinsic motivation process is fully integrated with an individual's sense of identity, needs and values. However, integrated regulation is different from intrinsic motivation as *'it is characterised by interest in the activity itself'* rather than *'by the activity's being personally important for a valued outcome'* (Deci et al. 1991, p330). In an outdoor setting children can learn through exploration of the environment and discussion with their peers (Khan & Islam, 2014; Wu et al., 2013), therefore the extent to which children are engaged in activities can be changed by creating an interest in the activity itself.

The environmental conditions can create enjoyment in children even if they do not have intrinsic motivation or personal interest in learning certain things or subjects, (Eccles et al., 1993). The value children attach to certain activities has an impact on academic achievement which can be explained by Eccles's expectancy value theory. Several components related to task value (interest in or enjoyment of an activity, perceived importance of being good at the activity, perceived usefulness of the activity and the cost of engaging in a particular activity) influence children to take certain decisions. If a child does enjoy learning science or literature in outdoor environment, he or she can develop further

interest and achieve higher marks in the exam. In an outdoor environment children learn subject matter through exploration and hands on exercises which give them an idea about the practical implication of the subject rather than a subject taught in the traditional indoor classroom (Khan 2012; Rowe & Humphries 2012). Hence, if children are engaged in the subjects they learn, they are most likely to continue studying them (Hidi & Harackiewicz, 2000). Therefore, the primary level education is critical for motivating children to learn and continue their studies later on engaging them in what they are learning in schools.

There are many studies in educational psychology on improving the contents of different subjects for the increase of situational interest in the classroom (Schraw, Flowerday and Lehman, 2001). There are some qualitative studies on how the forest schools can help in motivation and concentration of children (Swarbrick, Eastwood and Tutton, 2004, O'Brien et al., 2007). But studies exploring the relationship between the design of school ground and children's motivation to learn are scarce. This research focuses on how the physical environment of a school ground can be changed to increase motivation in children towards learning and improve their academic performance. Therefore, the study used expectancy value theory – how children attach value to their learning in different environments i.e. the classroom and the outdoors and children's expectations of success as the basis for the measurement of children's motivation to learn in those environments.

2.1.3 Theories of play

Children's development cannot be discussed without an insight into children's play as it is difficult to distinguish between work, play and learning of children (Sebba & Churchman, 1986). Play is an enjoyable activity through which children can learn, therefore it is defined as an informal learning activity (Malone & Tranter, 2003). However, it has been regarded by many as a mere physical activity to let off steam and surplus energy, and this has resulted in the design of school grounds populated with swings and roundabouts (Bell, 2008). Nevertheless, recent research suggests that play supports important aspects of children's development and different categories of play can be discussed in relation to the development of the child.

Play can be classified into three broad categories — motor play, cognitive play and social play (Bell, 2008; Malone & Tranter, 2003). *Motor play* includes the activities that help children's **physical development** such as running, jumping, crawling, swinging, climbing etc. It is necessary for the healthy growth of children's bodies. This is related to 'functional

play’ as defined by Frost (1992) in his ‘Play and Playscape’. Functional play involves games with basic movements for example — tag, chase and catch, hopscotch, skipping or racing games, playing on fixed structures and participating in structured games (Fjørtoft & Sageie, 2000).

Cognitive play occurs when children discover, explore and develop an understanding of the environment surrounding them. Through their exploration children begin to learn about patterns and systems of life, different cause and effect relationship and their connectedness with nature. Cognitive play helps in **development of cognition and aspects of behaviour** in children. It can also be termed as ‘construction play’ (Fjørtoft & Sageie, 2000; Frost, 1992) as it involves exploring materials of the environment for building dens, playing with cones, sticks or other movable things.

Social play occurs when children interact with others in different social situations. It enables children to share ideas and co-operate with others, respect others’ views and preferences and construct their own ‘identity’ (Malone & Tranter 2003) and is necessary for the **socio-emotional development** of children. Social play takes place at four different levels depending on children’s participation in the play activities, this is also related to their developmental stages (Bell 2008; Malone & Tranter 2003) —

- a) *Solitary play*: Generally, the child plays on his or her own at a distance from others. He or she is engaged in a different activity from others and pays little attention to others’ activity.
- b) *Parallel play*: The child is with other children but plays independently of them. The child may share play materials with others but they do not influence each other’s play.
- c) *Associated play*: The children are engaged in the same activity, sharing materials with others without any specific goal or sense of organization.
- d) *Co-operative play*: The children organise themselves in a group to participate in a specific activity with a common goal or purpose of the activity.

Social play also includes ‘*symbolic play*’ (socio-dramatic play which involves make-believe and imaginary situations), *role play* and *fantasy play* (such as play house, and pirates). It contributes to the development of children’s imagination, creativity and cognition.

At different ages children are engaged in different types of play. Children’s behaviour becomes more social with age. At an early age, they are more engaged in functional and construction play but with age their concentration changes. School-aged children are more interested in social play, role play and rule games as they eventually become able ‘*to organise their experiences into logical concepts*’ (Bell, 2008, p95). Children

can organise their experiences logically and be involved in *games with rules* ranging from board games to team games in the sports field. They can make their own rules or can continue playing following the original rules.

All these explorative and collaborative activities encompass many aspects of learning. The school ground needs to provide a diversity of places so that children have the maximum opportunity for interaction with others and the environment (Titman, 1994) as *'the environment dictates to a large extent what is played and how'* (Armitage & Burke, 2005, p547). *'The best play environments for children are those which are developed on the basis of children's natural play needs, taking into account the play behaviour engaged in at different developmental periods, including the social, physical and cognitive forms of play'* (Malone & Tranter, 2003, p288). These activity categories can be used in the behaviour mapping instrument for observation of children's activities during their break time in different settings of the school ground.

2.1.4 Ecological approaches to environmental design

Knowledge of the ecological environment is essential in order to study the relationships between the physical environment and human behaviour (Barker, 1968) and in this study it is important to understand the relationship between outdoor environment and children's learning. *'The ecological approach to perception has opened a new door for looking at the relationship between the individual and the environment'* (Cosco, 2006, p17). An important feature of this approach is the concept of affordance (Gibson, 1979) which focuses on the reciprocal relationship between the environment and its user. Closely related to the concept of affordances is the theory of behaviour settings first described by Barker (1976).

2.1.4.1 Concept of affordance

The concept of affordance helps researchers to describe environments from a behavioural perspective i.e. from the point of view of children's outdoor learning in the case of this study. It is important in developing the conceptual framework for research on environment-behaviour interaction as it helps to understand the impact of the physical environment on people and to identify the environmental attributes that are associated with specific behavioural responses (Gibson & Pick, 2000). The affordance of an environment is the measure of its capacity to support and complement people's development. The approach considers the relationship between the individual and the environment as reciprocal and can be understood through three concepts — affordance, information and pick up information.

Affordance: According to Gibson (1979), the *affordances* of an environment are those elements which it offers or provides for the user. In this manner, an object in the school ground can offer the opportunity for the child to climb upon it as part of a class, or it can contain the features that are manipulative or malleable for experiments in science class, or for building things in arts or craft classes. But with the change of action or behaviour of the user, the affordance of the environment does not change. It is that property of any object or environment which exists there independent of the user's capability to perceive it (Gibson, 1979). Children have to discover the affordances of the environment in order to utilise it and the teachers in primary schools can work as facilitators during their classes held in the school ground. Gibson (1986) states that affordances are the possibility or potential for action in an environment, however Withagen et al. (2012, p251) stresses '*affordances are not mere opportunities for action but they can also invite behaviour*'. These opportunities provided by affordances to act or to behave may help the designer in formulating design features with user need in mind (i.e. guidelines for designing school grounds for improving children's learning as intended in this study).

Information: The concept of *information* tells us about how the environment gives information as ambient arrays of energy and the sources of information are the objects, layout properties (surfaces, corners, holes etc.) and events (Gibson & Pick, 2000). Whether an individual will be able to perceive the property of the environment is determined by the availability of information to characterise it and also the attunement of the perceiver to that information. Whenever a child moves through a space, he or she receives information about the layout of the space, where one is and where one goes (Cosco, 2006; Gibson & Pick, 2000). This information is thus sought through active movement of the people; children move around objects, artefacts and natural elements in the school ground to seek information (to see how the plant grows, touch the soil to know the property of it) and thus build a relationship with the environment.

Pick-up information: *Information pickup* is the process through which an active perceiver obtains information and what he actually perceives. It has been classified into two general kinds — *exploratory* and *performatory*. *Exploratory* activities help children to learn about the possibilities of the environment, affordances and also the capabilities of themselves (the activity of mixing sand and water in order to see what happens); *performatory* activities are the outcome of already learnt affordances, they are performed on objects in a setting to produce certain expected results (trying to make something out of that mixture of sand and

water). Therefore *'perception and action are closely intertwined in both exploration and performance and learning is an important outcome of both types of action'* (Gibson & Pick 2000, p21). And Gibson and Pick (2000) stress that because of this close connection between perception and action, action has a central role in cognitive development.

A perceiver does not perceive light, color or texture in its abstract form, rather through the layout of the environment, the objects in the layout and the events that occur in that particular layout in relation to the pertaining objects there (Gibson & Pick, 2000). *Layout* is the arrangement of the environment surrounding the objects which move around there. It comprises the surfaces to walk on, the walls or plants that surround the objects etc. It helps children to locate themselves in space and also locate other things in relation to them. The layout also contains objects of many kinds (animate and inanimate) — people, animals, things to sit on, climb on etc. Events refer to the movements and actions that occur in the layout in relation to the objects. The notion of events is important as it is through events the properties of the layout and the objects can be learnt. These three categories together help children to locate themselves in the layout, orient themselves relating to certain objects (or landmarks) and therefore, they gain confidence to move around and find their way in the environment.

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) derived a functional taxonomy of affordances for children's outdoor play which actually worked on only the physical affordances of environments. 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). It is supported by Gibson's own statement *'An affordance is neither an objective property nor a subjective property; or it is both if you like..... It is equally a fact of the environment and a fact of behaviour. It is both physical and psychical....'* (Gibson, 1979, p125). Kyttä's affordances for sociality includes possibilities to play rule games and role play, playing home or war, being noisy and the possibility of sharing or following adults' businesses (Kyttä, 2002). Afterwards, Roe (2008) explored 'emotional affordances' in forest settings and defined it 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 internal and external environments might influence social interaction among people in the field of architecture and landscape architecture.

Children find more affordances in the outdoor environment compared to indoors (Fiskum & Jacobsen, 2013; Gaver, 1996). School grounds offer manifold affordances to children — functional (flat surface to walk on or run, sand and water to mold etc.), social (small spaces between bushes and trees offer affordances for social interaction for small groups) and emotional (natural elements or artefacts creating the feeling of happiness or displeasure). With this background, there is scope to introduce another kind of affordance of the environment — ‘cognitive affordance’ which can help in the exploration of the relationship between environment and learning. ‘Cognitive affordance’ can be defined in terms of the opportunities provided by the environment for learning. ‘Cognition’ is an innate aspect of any kind of affordance, nevertheless conscious cognition can lead to the creation of knowledge. For example, children love to play with soil and water. A simple experiment of mixing different types of soil with water help children learn the bonding character of soil. The mixing of soil with water is the physical affordance defined as ‘moldable’ but this act helps clarify different qualities of soil which children read in their environmental science book in the classroom, this can help children relate the things in the outdoor environment to the concepts they work on in the classroom (see Figure 2.5). Therefore, this thesis explores cognitive affordance in the designed school ground along with functional affordance and affordances for sociality through observation of children’s activities during formal and informal learning. Based on the findings of the research, it is further reflected on in the discussion whether the concept of cognitive affordances was helpful in this understanding and how it can be developed in future research.

2.1.4.2 Theory of behaviour setting

Closely related to the concept of affordances is the theory of behaviour settings, these are ecological units where the physical environments and behaviour are linked together in time and space (Barker, 1968). Barker (1976) described the concept based on his observation of children’s behaviour over many years. Behaviour settings have a clear structure located in time and space. They are composed of two sets of identifying characteristics — 1) a specific set of time, place and object props (tree logs, sand, rocks) and 2) a specific set of attached standing behaviour or behaviour episodes (climbing, sitting, walking, reading books) (Barker, 1968, Scott, 2005). Both of these clusters together make the behaviour setting occur (Scott, 2005). These behaviour settings are demarcated by clearly identified boundaries, their components are arranged in a functional way and are part of the whole, and their functions are independent of other adjacent eco-behavioural units (Barker, 1976).

The concept of behaviour settings is applied within the realm of design research for analysing human behaviour in different types of spaces or settings (Moore & Cosco, 2007). This has enabled identification of specific behaviour settings in the outdoor environment of schools (e.g. the nature learning area, an area for exploration with manipulative and mouldable materials and the water area) and their association with children's learning of different subjects which is essential for understanding the impact of different elements of nature on children's learning. Behaviour settings thus act as a medium for the identification of potential affordances of different type of settings.

'Behaviour settings are part of a nested group of ecological units, as any biological system where a living organism is comprised of molecules, molecules of cells, cells of atoms and so on. Likewise, a play area contains settings (e.g. sand play area), sub-settings (digger in sand area, low table for moulding, etc.) and even sub-sub-settings such as the space under the table where children enjoy hiding' (Cosco, 2006, p22). Any unit in the middle range of these nested assemblies is both whole and part, it is whole in relation to the components it contains and part in relation to the organ that it belongs to along with other components. Thus, the behaviour settings are complex entities whose characteristics are driven by the whole which contains them and they also rule the parts which compose them (Barker, 1976).

The behaviour settings are therefore rich with many interconnected elements and they regulate the behaviour episodes occurring within them (Barker, 1976). They are objective, occurring naturally in specified time-space locus and independently of any individual's perception of it (Barker, 1976, Scott, 2005). The variables of behavior settings have a stronger influence than individual difference variables i.e. children's behaviour varies less across different children within a given setting than across the same child in different settings (Barker, 1976, Ward Thompson, 2013). Certain environments or settings elicit certain kinds of behaviour and different sets of people and objects exhibit the same patterns of behaviour within the same behavior setting. These attributes of the ecological environment are important in order to understand how much an environment can influence children's behaviour.

Another very important property of a behaviour setting is the strong interdependence between the setting components — the standing patterns of behaviour or behaviour episodes and the physical milieu. Barker referred to this interdependence between physical milieu and standing patterns of behaviour as synomorphic (milieu is synomorphic to the behaviour and different parts of the milieu are also synomorphic to each other) and the physical

environment as circumjacent (surrounding, enclosing, environing) to the behaviour (Barker, 1968, Scott, 2005). This property of interdependence is the grounding for the identification and design of different behaviour settings in the outdoor environment of school. The different behaviour settings in the school ground afforded different learning behaviour and the understanding of the interdependence of these settings and learning is crucial for the design of individual behaviour settings and the whole schoolground as a combination of those settings.

2.1.5 A summary of the key theories that underpinned the research

Not one single theory guided the theoretical framework of this study. The study being multidisciplinary and comprehensive in nature, different theories contributed to the 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 learn how children construct their knowledge. Through a rigorous review of the existing theories the study adopted a constructivist approach to understand how children develop and learn. The constructivist theory by Piaget (1964) and the theory of social constructivism by Vygotsky (et al., 1978) provided the ground 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 a way that offer opportunities for such exploration and interaction. The learning that happens in such an environment can also be referred to experiential education as mentioned by Dewey (1963).

On another ground, motivation is a driving force for children to do what they do; therefore, we need to understand what would be children's motivation to come to school. The expectancy value theory by Eccles and colleagues (1993) enabled to understand what children value in their school environment and what would they expect. If children are engaged in their studies and enjoy their learning experiences in the school, they develop the interest in learning and coming to school. When children value what they learn and achieve what they expect from their learning activities, they tend to do well in their school works (Eccles, 1999). The physical environment when afford enjoyable learning experiences, can create an interest among children in exploring more and therefore can influence their intrinsic motivation to learn. This can further have an impact on their academic performance (Wigfield, 1994). Why children are motivated to learn can be potentially related to the above

theories of children's construction of knowledge, if a child actively constructs knowledge through exploration and interaction he or she will form an interest in learning more and will be motivated to coming to school.

From the above understanding of how a child constructs his or her knowledge and what motivates a child to learn, it can be inferred that the design of physical environment has potential for influencing children's learning and motivation. A school ground that can positively influence children's learning experiences and their motivation to learn can therefore be termed as a **well-designed outdoor learning environment** and that contributed to the formation of the hypothesis of this research. However, in order to investigate the hypothesis (i.e. a well-designed outdoor environment can support children's learning and motivation), a better understanding of how the environment influences children's behaviour is necessary. Theories of ecological psychology (i.e. concept of affordance and theory of behaviour settings) have been widely used in environment-behaviour research to understand the relationship between the built environment and human behaviour.

The theory of behaviour settings by Barker (1968) enabled me to understand the relationship between different settings or learning areas in the school ground and the patterns of behaviour in those areas. At the same time the concept of affordance (Gibson, 1979) provided the framework to investigate how certain features or elements of the behaviour settings afforded certain learning behaviour. Both the theories complement each other and provide a deeper understanding of why certain activities occur in certain areas of the built environment.

In this study, the theories of ecological psychology and theories of cognitive development together provided a framework for understanding how the design of a behaviour setting can afford learning. The relationship is illustrated with an example in Figure 2.5 and this framework was used to find out the properties of a well-designed outdoor environment that can enhance children's learning and therefore creates an interest in them for learning. The framework was later used to investigate how the outdoor learning environment (designed and developed during the study) influenced children's learning.

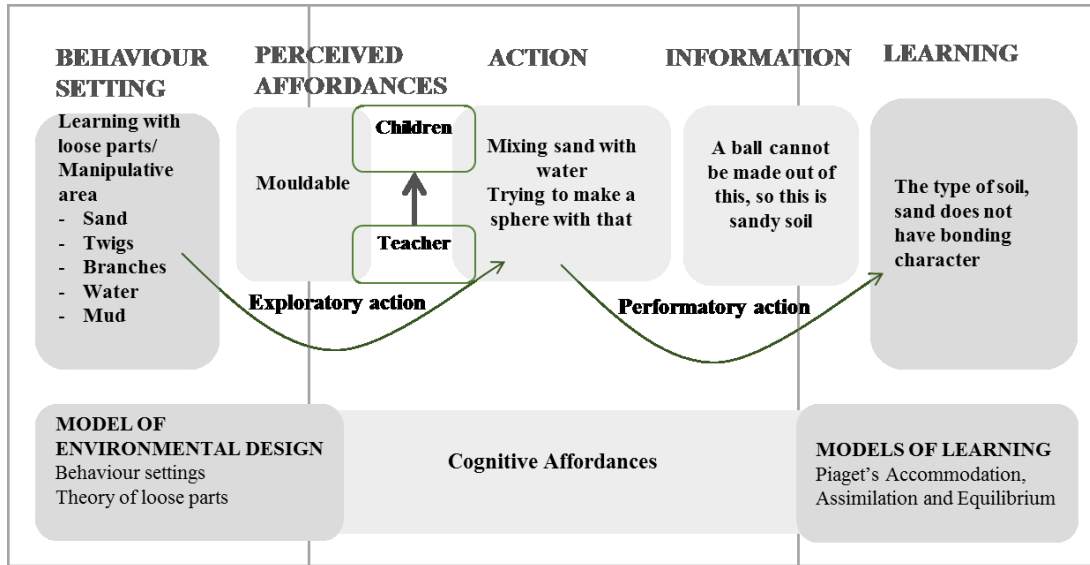


Figure 2.5: Theoretical framework: behaviour settings, affordances and learning

2.2 Empirical research on children’s outdoor learning environment

The trends of research concerning children’s outdoor environment has changed over time. Nor Fadzila & Ismail (2012) presented a synthesis of 30 empirical studies in children’s environment between 1985 and 2010 where they found play as a central topic as through this mechanism children familiarise themselves with the environment. Between 1985 and 1989, studies generally focused on specific environments for example – playgrounds and streets. During that period, research on school grounds mostly emphasised the aspect of safety and children’s developmental issues. During the next decade, studies encompassed a wider environment – the neighbourhood, public places and playgrounds and explored factors influencing children's use of environment, their experience of spaces and the impact on their development. Between 2000 and 2010, the territory increased and included the natural environment, children's outdoor environments for play and the role of design in encouraging children's activities in the outdoor environment.

The impact of the outdoor environments on children’s formal learning experience has been a much discussed topic since the end of the twentieth century. However, studies exploring that impact are not very evident as Ross et al. (2007, p171) mentioned referring to the review of research on outdoor learning by Rickinson et al. (2004, p24), ‘...not much has changed in 25 years; most studies are descriptive; there are ‘far too many poorly conceptualised, badly designed and inadequately carried out studies’ ...there is more assumption than evidence concerning lasting impacts on student attitudes.’ Empirical studies

exploring the interaction of children with elements of the environment that can guide the design of the outdoor environment facilitating teachers' use of the school ground for teaching the curriculum are even less evident.

Many factors, individual, physical and social, influence children's use of the outdoor environment. Parents' and teachers' perceived concern for children's safety guided the trend in research, which also to a great extent restrains children's freedom of use in the outdoors. Ross et al (2007) suggests that a policy change focusing on resources instead of safety and evidence of the benefits for children is needed to motivate the teachers who play a key role in taking children outdoors for teaching the curriculum. However, provision of an appropriate environment that can support teaching outside in the school ground comes late in the list in outdoor education research priorities and has not been emphasised in environment-behaviour research. This research aims to contribute to filling that vacuum, by exploring the relationship between environmental attributes and the teaching-learning process in the outdoors.

2.2.1 Impact of the outdoor environment on children's learning

A summary of the literature investigating the benefits of children's exposure to the landscape was provided in Chapter 1 Section 1.2.5.1. In this section relevant literature was discussed with a focus on its impact on children's learning (formal and informal). The literature so far researched the influence of school ground design on children's 'Learning' following two strategies — either measuring the pathway that leads to better academic performance or measuring the outcomes of learning in cognitive and affective domains (illustrated in Figure 2.6). Outcomes of learning were indicated by measuring cognitive skills or attainment tests. Children's motivation to learn was measured as 'engagement' in the affective domain of educational outcomes. Researchers in the field of education were keen to explore the relation of 'greenness'⁶ with children's environmental learning (Dyment, 2005; Lucas & Dyment, 2010; Grant & Littlejohn, 2001; Malone & Tranter, 2003), whereas research in landscape architecture, environment-behaviour studies and public health mostly investigated the impact of the playground design on children's physical activity and play (Willenberg et al., 2010, Anthamatten et al., 2011, Chawla et al., 2014, Jansson et al., 2014, Mårtensson et al., 2014). Research that combines either the path or process of how children learn and the outcomes of their learning is less evident in the present context.

⁶ The exposure to trees and vegetation

2.2.1.1 Relationship between exposure to school grounds and academic attainment

The relationship between academic performance and use of outdoor environment is complex and is explored looking into the pathways — recovery of stress that can restore the attention leading to better academic performance. Children, if exposed to green school grounds for play and learning, show positive moods, better ability to cope with ADHD and reduced stress and depression (Chawla et al., 2014). Cognitive development of children was found to be associated with the use of green school grounds through measurement of cognitive tests based on working memory and attention (Dadvand et al., 2015). Even the view of green school grounds can positively influence children’s learning through recovery of stress and attention restoration (Li & Sullivan, 2016; Matsuoka, 2010) which strengthens the importance of careful design of the school ground. Besides, there is evidence that the design of the school environment is positively associated with students’ performance. The University of Georgia’s ‘School Design and Planning Laboratory’ devised 39 patterns of school design in which movement and circulation pattern, daylight and classroom with views were found to be associated with children’s performance in certain academic aspects (Tanner, 2000, 2009).

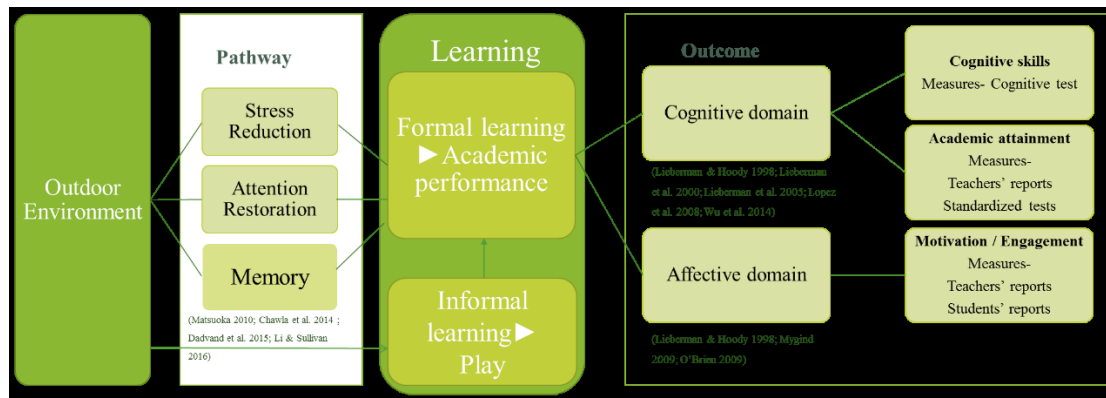


Figure 2.6: Approaches to investigate children’s learning in the outdoor environment in relevant literature

When formal learning is taken outdoors thus extending the boundaries of the classroom, the impact on children’s academic performance (measured through the assessment of tests) is notable (Khan & Islam, 2014; Lieberman & Hoody, 1998; Lieberman et al., 2000, 2005). The State Environment and Education Roundtable of the USA investigated children’s performance in cognitive and affective domains in schools where the outdoor environment was used as a context for learning and compared this to traditional schools in their study conducted in several phases. The first report ‘Closing the achievement

gap: using the environment as an integrated context for learning' (Lieberman & Hoody, 1998) is based on the study conducted in 40 schools (of which 15 were elementary schools) interviewing 403 students and 252 teachers and administrators. The students attending the EIC schools (where 'Environment' was used as an 'Integrated Context') showed higher academic achievement in reading, writing, math, science, and social studies. There were also reduced discipline and classroom management problems, increased engagement and enthusiasm for learning, and greater pride and ownership in their accomplishments compared to the students of traditional schools. The later study conducted in two phases in California assessed students based on the standardised test results of reading, mathematics, language, science and social studies and annual attendance rates. The EIC students demonstrated higher scores in 63% of the mathematics assessments and 64% of the science assessments than the traditional classroom students in phase I of the study (Lieberman, Hoody and Lieberman, 2000). The phase II of the study (Lieberman, Hoody and Lieberman, 2005) affirms the results of the phase I study and the study conducted in 1998. In an evaluative study of the renovated school grounds by Boston Schoolyard Initiative, Lopez et al. (2008) found that more students from the schools with renovated school grounds (controlling for school demographics) passed the state mandated mathematics test.

One relevant study which explored the potential of the outdoors as a learning environment in the context of developing countries was by Khan & Islam (2014) mentioned in Chapter 1, Section 1.2.3. In this study, the children of Grade IV were given lessons in an indoor classroom and the outdoor amphitheatre, afterwards a test was administered to measure the outcome of learning in these two different settings. The children, after being taught in the outdoor classroom, showed better performance than when they were taught in the indoor classroom. Children's performance in the affective domain was also measured using a questionnaire, the results indicated a higher level of engagement in the classes held outdoors. However, these studies did not further explore which features of renovated school grounds helped in the teaching-learning process. Motivation as a mediator between learning and the use of school grounds was rarely explored in the realm of environment-behaviour research for primary school children. There are studies of child-engagement and teaching motivation in the preschool settings and forest schools as mentioned earlier in Section 2.1.2. Therefore, this study adopted the approach of exploring the process of learning (through children's perceived exploration of the environment and relation with peers) in the school ground, the outcomes of the process (children's academic performance) and investigating the role of the school ground on children's motivation which can influence the outcome.

2.2.1.2 Physical activity, play and academic attainment

Recent literature explored the impact of ‘greenness’ in children’s outdoor environment — in forest schools, primary schools and child care settings on children’s play and physical activity (Dyment & O’Connell, 2013; Fjørtoft, 2004; Fjørtoft & Sageie, 2000). School grounds with access to nature were found to provide more ‘affordances’ for physical activity, play and environmental learning (Malone & Tranter, 2003; Tranter & Malone, 2004; Dyment & O’Connell, 2013). Research investigating whether a causal connection is plausible between physical activity and academic performance can also be found in sports studies (Bailey et al., 2009, Bunketorp Käll et al., 2015). In a multiyear Canadian study, students with enhanced physical education scored higher in standardised test in spite of a 13% reduction in academic teaching time (Shephard, 1997). Dwyer et al. (2001) investigated the relation of academic performance to physical activity and fitness in children in 9,000 school children between the age of seven and 15 selected from a two-stage probability sampling. Scholastic ability rated on a five-point scale both by the school authority and students (associated with each other) was found to be significantly correlated with multiple measures of physical activity. The correlations were low, which was expected as physical activity can make only a modest contribution to academic performance. Therefore, it is consistent with the hypotheses that physical activity enhances academic performance though it is difficult to determine it as a causal inference. This study will explore whether a change in the school environment focusing on children’s learning can influence children’s informal learning or play. Furthermore, in renovated school grounds more children were found to be engaged in physical activities compared to old ones (Anthamatten et al., 2011). This leads to the discussion in the next section on the qualities of primary school outdoor environments.

2.2.2 Emerging data on qualities of outdoor environments for children’s learning

Historically the principal use of a school ground has been physical education (Adams, 1993) which also guided the design of the school ground. However, in recent times the use of school grounds has extended beyond physical education and encompassed a wide range of educational activities. The outdoor environment in primary schools (i.e. school grounds), can be an important site for the development of cognitive and socio-emotional skills in young children (Khan, 2012) when designed to accommodate children’s learning. Rich and diverse outdoor environments afford more opportunities for play and learning (Moore & Wong, 1997, Cosco, 2006) whereas barren school grounds discourage children from diverse play,

social interaction, ecological experience and learning and thus create boredom and aggression (Samborski, 2010). The asphalt or tarmac playgrounds provide less opportunity for connection with nature as opposed to greener school grounds (Dyment & Bell, 2008). Outdoor environment has the potential to be just as limiting as the indoors.

There are challenges of teaching and learning outdoors, as stated earlier in Chapter 1 Section 1.2.5.3. The opportunities and barriers can vary depending on culture and climate. Knecht (2008) identified several potential obstacles of forest school outdoor learning program as perceived by 300 primary school teachers in Zurich, Switzerland. These are — bad weather, ticks, lack of discipline, lack of time, additional workload, fear of responsibility, lack of background knowledge and expertise, emotional disconnectedness to the forest and lack of proper clothing. The teachers also commented that 37% of children were somewhat distracted during the forest education. Many of these barriers can be overcome when school grounds are used for outdoor learning as asserted by Dyment (2005). However, Dyment in his study in Canada also found that poorly designed school grounds limited the amount of outdoor learning. Urban school grounds might have limited green or open spaces. Inefficient planning of the school site can create negative spaces which are less used. These neglected school grounds are open to vandalism (Broda, 2007). The barren school ground does not inherently provide places for different activities, which could be designed effectively to accommodate them. The design of school grounds determines to a large extent what children do during their break or free time in school; it might also determine the way teachers conduct their lessons in the outdoors.

Research in landscape architecture and sports science has examined the quality of outdoor environments for children's physical activity; it has mostly been investigated in preschool and forest settings (Cosco, 2006; Dyment et al., 2009; Haug et al., 2010; Mårtensson et al., 2014; Storli & Hagen, 2010). In school ground settings, most research 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 & Benedict, 1994) playground. The quality of the outdoor environment for children's curricular learning was mostly measured as availability of 'greenness' in the settings. In her masters thesis Harvey (1990) explored the relationship between children's experiences with vegetation on the school ground with their environmental learning. The author investigated four aspects of vegetation — amount, diversity, accessibility and complexity and examined their relation with botanical knowledge

(general and specific) and environmental disposition (pastoralism and human dominance). She found the complexity of environmental features to have the highest correlations with children's general botanical knowledge, pastoralism and human dominance. Students from schools with high vegetation showed higher scores for general botanical knowledge. This is also in line with recent research by Wu et al., (2014) who found an association of greenness in school surroundings with children's performance in mathematics and English language tests. However, the design of the school ground consists of both natural and man-made elements. Therefore, a comprehensive evaluation of school ground design is necessary to find the affordances of diversified elements for children's learning of the curriculum. A summary of the research concerning children's outdoor environment is given in Table 2.1.

Table 2.1: A summary of research findings concerning outdoor environments in school

Research Concerns	Findings	Authors
Relation of school landscape with children's stress recovery and attention restoration	School ground environments have an impact on children's attention restoration and stress recovery	Bagot et al., 2015; Chawla et al., 2014; Kelz et al., 2013
The relationship between school playground characteristics and children's physical activity level	While sports and playground equipment encourage vigorous physical activity, natural playgrounds attract more children for sedentary to moderate physical activity; mixed playground settings are used in a balanced way	Mårtensson et al., 2014; Anthamatten et al., 2011; Dymont et al., 2009; Fjørtoft et al., 2009; Mygind, 2007; Dymont & Bell, 2007; Pawlowski et al., 2016
The impact of school ground design on children's activity, play and environmental learning	School grounds with access to nature provide 'affordances' for more physical activity, play and environmental learning	Fjørtoft & Sageie, 2000; Herrington et al., 1998; Dowdell et al., 2011; Malone & Tranter, 2003; Dymont & O'Connell, 2013; Lucas & Dymont, 2010; Wan & Zulkiflee, 2012
School landscape and children's academic performance	School ground integrated with teaching of the curriculum positively influences children's cognitive development and academic performance	Lieberman & Hoody, 1998; Lieberman et al., 2005; Carey, 2012, Maynard et al., 2013; Dadvand et al., 2015
Using the school ground for teaching the curriculum /learning in the school ground	Learning in the school ground enhances children's botanical knowledge, science conceptions and mathematical skills	Harvey, 1990; Cronin-Jones, 2000; Maynard et al., 2013

2.3 School ground design for learning: insights from literature

School ground has generally been regarded as a ‘playground’ with swings and roundabouts and/or a plain ground for physical education and ball games (Heusser et al., 1986). Yet this notion is questioned by environment-behaviour researchers, therefore, there is a recent increase in research enquiring into the environmental quality and educational opportunity of traditional playgrounds.

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 — Berkshire, Hampshire and Surrey. Based on a three-year study from 1986 to 1989, the author advocated generating evidence for designers, managers, parents, teachers and politicians on wide use of school grounds as an educational resource and developing those to accommodate educational uses as she argues, *‘Their potential as an educational resource will not be realised unless they are developed to accommodate a wide range of educational uses’* (Adams 1990, p74). 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 physical environment — layout, sensory qualities, sense of place, differentiation of spaces, micro climate and pollution, access and circulation, landforms and soils, hard landscaping and site furniture, soft landscaping 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.

Moore & Wong’s (1997) book ‘Natural Learning’ provides an empirical account of their interdisciplinary action research in an elementary school in Washington, California which included the development of a traditional asphalt playground to a naturally diverse outdoor educational setting with the involvement of children, teachers and the community. The aim of having a biodiverse school ground with plants and animals of the local region which the authors stated as a pre-requisite for any educational reform was fulfilled to a great extent in 10 years starting in 1971. The actual use of the school ground and children’s perception of it was compared using a questionnaire, children’s drawings and behaviour mapping of the school ground during break time. The authors had an intention to make the research more extensive by conducting a quantitative assessment to support their hypothesis which indicates the necessity of comprehensive research in this field combining a range of

methods to strengthen the existing evidence of positive impact of the school ground. However, interviews with children and observations of their behaviour provided useful information on the use of the school ground for teaching the curriculum, patterns of use by boys and girls, and a decrease in children's negative behaviour. The authors provided a general guideline for planning an outdoor environment for teachers, designers and community groups based on their observations and learning through the period of rejuvenating the school ground. Later on Moore (1996) published a detailed guideline on designing outdoor settings for playing and learning in the NAMTA journal. In this article, along with providing cues for designing entrances, pathways, signage and displays, fences and game settings, stress was made on landforms and topography, vegetation, gardens, animal habitats and aquatic settings.

Following this a school ground in the UK has been changed over years initiated by the teachers particularly focusing on the learning aspects of the environment. Over years, the teachers in Coombe County Infant school adopted several strategies in order to use the environment of the school for teaching of children which they termed 'The Coombes Approach', an account of which appeared in the book with the same name by Rowe & Humphries (2012). In order to develop their teaching programme, they developed the outdoor environment with the same emphasis they had given to the development of resources in the classroom guided by the philosophy of collaborative and experiential learning. Children had tunnels, arches and shelters made with weeping willow, different kinds of vegetation and trees, ponds and wetlands, mounds and painted hard surface in the vast area of the school. All these studies indicate the benefits of changing and using a school ground as an outdoor learning environment. However, in order to design a school ground, the first step is to understand how children perceive different elements and settings in the school grounds as they are the main actors in that environment.

2.3.1 How children perceive the school ground

In order to design the school ground, it is important to have an understanding of how children perceive their surrounding spaces. Children's spaces are often designed guided by adults' perception, whereas children's perception of landscape is different from that of adults (Sebba, 1991). At an early age a child can only recognise the objects arranged against a background. He or she puts himself or herself in the centre and structures the space around — up and down, left and right and front and back (Tuan, 1974). At the age of six or seven children start defining the objects by differentiation and group geometrical objects according

to colour rather than shape. Instead of distance, size, angles and areas in topology, they observe symmetry, separation, continuity, being inside each other etc. (Shima et al., 2012). *‘Therefore children perceive places based on a sense of symmetry and centricity, paths based on a sense of continuity and intersections based on surfaces’* (Memarian, 2005 cited in Shima et al 2012, p433). Perception of aesthetics is minimal for young children. They become open to the world as they grow from infant to middle aged child and explore different meanings of the world (Tuan, 1974). An adult can see a table as a platform to work on whereas that table can be a hiding place for a child.

According to Moore (1973), children’s representations of the environment can be categorised into three distinct levels — egocentric, fixed and co-ordinated. The second level i.e. fixed level occurs at school age which is being dealt with in this study. This level of differentiated and partially co-ordinated fixed subgroups can be characterised by the presence of one or more clusters of elements corresponding to different areas. In the study of children’s experience of place by Hart (1979), this classification of different levels is found to be significantly correlated with a child’s age. During school age i.e. five to 12 years old, children gradually become capable of achieving a considerable degree of abstraction through a logical coordination of space from multiple viewpoints. Children can relate objects to each other but are not capable of appreciating the totality of the relationship between landmarks, as the landmarks are fixed in partially co-ordinated sub groups. This justifies the adoption of the theory of behaviour settings for the design of landscape for the children of this age group.

‘Children read school grounds as they read any external environment: as a set of symbols which tell them what they are supposed to ‘be’ and ‘do’ and ‘think’ and ‘feel’ in that place’ (Titman 1994, p54). Unlike adults who see the forms in the environment, children usually look for the functional properties in the environment (Heft, 2010). Instead of an artefact or an element which does not offer any activity potential, children are more attracted to the elements of the environment which afford any function — like the opportunity to sit on or to step in (Ward Thompson, 1995). As such a tree which can be a mere tree to a person might offer many affordances for a child — a place to climb on, or hide in. Therefore, instead of answering *‘What are children going to have?’* exploring *‘What are children going to do?’* might be a more appropriate approach to designing a school ground. When children were asked about different elements of the school ground in the study by Titman (1994) they judged the places by reading the elements contained by those places as signifiers: *‘Climbing trees is good if you’re bored, it makes you feel better...’* (p36) *‘The thing is about grass, well it’s*

not just grass. When you really look at it, study it, you'll find there's all sorts of other stuff there and it's really interesting....' (p34) *'Mud is brilliant fun. We do lots of things with it like making mud pies....'* (p40). Thus the school ground needs to be designed as a combination of different settings comprised of different elements, artefacts which offer children the affordances for performance of different activities rather than considering only form and aesthetics.

2.3.2 Children's desires of different settings in the school ground

While designing a school ground for children's learning, landscape architects need to focus on both what children desire in the new school ground and also how they use different areas of the school ground. What children would like to have in the school ground before intervention might or might not be congruent with how children would use the space after renovation. Few studies explored this in the context of primary schools. Studies either explored children's preferences and desires at the developmental phase or how children were using different settings or areas in the school ground. In this section, children's desires for different settings in the school ground will be discussed based on the previous research.

Christidou et al. (2013) explored children's views and preferences in a Greek primary school where most children (29 out of 36 children from Grade IV and Grade V, nine to 10 years old) suggested more green spaces, trees and plants in the school ground, the second popular suggestion (15) was a bigger playground for ball games. However, only two of the children related their desire for elements/spaces with activities like gardening and plant exploration programmes. In a project on two primary school playgrounds in Edinburgh, Ward Thompson (1995) elicited design ideas for aspects of place experiences, elements of the school ground and activities which children would like to be engaged with. In that study she found that children made their choices of places or elements based on their afforded activities. Climbing equipment/trees were found as the most desired element by children followed by running ground, places to sit and greenery. However, younger children (three-four years old) preferred less manufactured materials and equipment compared to the older children and asked for plants, rocks, trees and other organic materials in their garden in a study of a day care centre in Australia by Nedovic & Morrissey (2013).

Research results indicate that children's desires and preferences are influenced by their developmental needs, physical and social factors and gender (Shima et al. 2012; Nor Fadzila & Ismail 2012; Cohen & Trostle 1990). Children wanted areas where they would be

able to explore (Noradahl & Einarsdóttir, 2015; Malone & Tranter, 2003), be in contact with nature (Christidou et al., 2013; Noradahl & Einarsdóttir, 2015; Jansson et al., 2014; Malone & Tranter, 2003; Ghaziani, 2012), be physically active (Noradahl & Einarsdóttir, 2015; Merewether, 2015; Christidou et al., 2013; Bland & Sharma-Brymer, 2012; Ghaziani, 2012) and socialise with their friends (Merewether, 2015; Noradahl & Einarsdóttir, 2015; Clark, 2007). Younger children also preferred places where they can be engaged in imaginative or pretend play (Nedovic & Morrissey, 2013; Merewether, 2015; Clark, 2007). Nevertheless, many of these themes are interdependent and were desired at the same time for a school ground. The aesthetics or beauty of the school ground settings was also a quality desired by young children (Noradahl & Einarsdóttir, 2015).

2.3.3 Design of a school ground as a combination of 'behaviour settings'

The literature that has been explored so far reveals that in most cases the designs are mainly formulated considering the outdoor environment as only a ground for play. In some studies, considering the educational benefits of the playground authors used the term 'school ground'. In this review the term 'school ground' has been used instead of playground as the study is focused on how to design the ground for learning. This study looked into the design characteristics of children's school ground for physical activity, play and environmental learning as documented in existing literature.

2.3.3.1 'Greenness' with natural elements

Researchers stressed the presence of natural features in the outdoor environment of schools (Dutt, 2012; Fjørtoft & Sageie, 2000; Herrington et al., 1998; Kenny, 1996; Titman, 1994). In a study of two elementary schools in Australia and Canada, it has been found that though manufactured equipment is the area where vigorous physical activity takes place, the largest number of children is found to spend time in the green area (Dyment, Bell and Lucas, 2009). In a study of several primary schools in Australia, Tranter & Malone (2004) found differences at a significant level between children's cognitive play behaviour in two schools which differed in outdoor design features and educational philosophy. The Orana school grounds which had a mature pine forest and a number of flower gardens surrounded by a forest, afforded children's interaction with nature or environmental learning opportunities like constructing activities, close interaction with nature, exploring the nature. These activities were less present in the school ground of Aranda primary school because the natural environment offers diversity and a wide range of educational opportunities (Frost,

1992). Natural elements designed in an outdoor environment can support children's cognitive, social and emotional development when fundamental landscape design principles are employed (Herrington & Studtmann, 1998).

2.3.3.2 Variation and diversity with loose materials

One of the most important features of a school ground is variation and diversity in the environment (Nicholson, 1970; Sebba & Churchman, 1986; Titman, 1994; Weinstein & Pinciotti, 1988). According to Nicholson (1969 cited in Nicholson, 1970, p30) in his theory of loose parts, *'In any environment, both the degree of inventiveness and creativity, and the possibility of discovery are directly proportional to the number and kind of variables in it'*. This is also supported in the PhD research by Cosco (2006) – *'the higher the diversity, the greater the physical activity'* in the context of a child care centre in North Carolina. Variation and diversity can be created by providing loose materials which can also be interchangeably defined by 'loose parts' – a term given by Nicholson (1970). Natural and manufactured loose materials stimulated children's dramatic, exploratory and constructive play (Zamani, 2013).

Variation can also be created by variation of spaces (in terms of enclosure, size, shape and definition) or even surfaces (vertical, horizontal and inclined). Wohlwill & Heft (1987 cited in Malone & Tranter 2003) categorised the environment-child relationship in the school ground in terms of three characteristics affordances, sensory stimulation and response feedback. The school ground needs to provide responsive and malleable materials that continually respond to children's activities. These materials are open to manipulation; children can change them and build something from their imagination. This setting comprises different sub-settings or materials for example – sand, grit, mud, clay, stones, rods, canes, twigs and branches. Sensory stimulation is another property of the landscape which stimulates children through variation in colour, shape, pattern, dimension and texture (Titman, 1994; Wohlwill & Heft, 1987).

2.3.3.3 Private vs interactive place

Researchers suggest that a well-designed school ground offers the children the opportunity to interact with peers and other members of the community (Heusser et al., 1986, Weinstein & Pinciotti, 1988, Sebba & Churchman, 1986). This is also supported by the findings from previous research. Malone & Tranter (2003) found that children played mostly in small groups and preferred small places for these group activities. Research results also suggest

that school grounds should provide ‘nooks and crannies’ where children can find privacy. Children prefer to have some places as ‘their own’ where they can reflect and relax either alone or with their friends (Fjørtoft & Sageie, 2000; Khan, 2009; Noradahl & Einarsdóttir, 2015; Waller, 2006; Clark, 2007). Stine (1997) in her book ‘Landscapes for Learning’ has identified nine dimensions of landscape design for children expressed in pairs — accessible and inaccessible, active and passive, challenge and repetition, hard and soft, natural and people built, open and closed, permanent and changing, private and public and simple and complex. Both the elements are expressed as neither positive nor negative but essential in creation of space for children. This also relates to the idea of binary oppositions in *topophilia*⁷ as children perceive objects of environment by arranging them in opposite pairs (Tuan, 1974).

2.3.3.4 Playground equipment and open space

Not only do children desire places where they can interact with their friends and connect with nature in their ideal school ground (outlined in Section 2.3.2), but research results also indicate that children enjoy being in places that offer opportunities for physical movement (Fjørtoft & Sageie, 2000; Waite, 2007) and which also challenge themselves (Titman, 1994). Children in schools with more facilities like an open field with painted courts and playground equipment were found to be significantly more physically active compared to schools with fewer facilities (Haug, Torsheim and Samdal, 2008, Haug et al., 2010). School ground design focusing on environmental learning and learning of the curriculum should not ignore other developmental needs of children. Furthermore, levels of physical activity were found to be associated with children’s academic attainment (Coe et al., 2006).

2.3.3.5 Bringing all the settings together

All these design features can be grouped and arranged in different settings in the outdoor learning environment of a primary school (see Figure 2.7). Researchers suggest that a playground should be designed as a combination of separate areas for different activities (Adams, 1990), zoning of different settings can make wayfinding easier for children of primary school age (Dcsf, 2011). This can justify the idea of developing a school ground as a combination of different behaviour settings for children. Different play zones have been identified by Sanoff (1995) in his ‘Creating environments for young children’ — an

⁷ The literal meaning is ‘love of place’, Yi-fu Tuan, a human geographer refers to it as human beings’ affective ties with the material environment.

adventure play zone, a dramatic play zone, an imaginative play zone, a large muscle development zone, a manipulative play zone, a natural play zone, an open area play zone and a private play zone. The landscape elements or different sub-settings of a school ground can be grouped and brought under several settings such as natural learning area, area with loose materials, adventure play area and gardens.

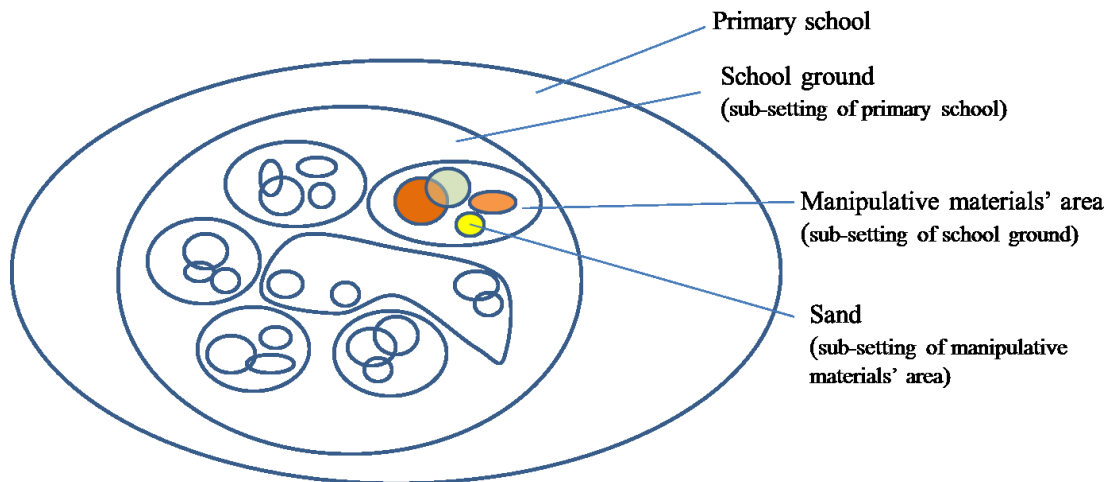


Figure 2.7: The concept of behaviour settings applied in a primary school (Adapted from Refshaug et al., 2013)

A path is needed for movement inside or between different settings. These settings can be arranged in different ways with reference to this pathway. Often the connection between different settings determines the intensity of use of those settings (Herrington et al., 1998). The school grounds can also comprise water features, features to sit on and a shelter to take refuge (Kenny, 1996; Moore & Wong, 1997; Sebba & Churchman, 1986). Water, besides being fascinating and fun to children can provide sensory and learning experiences for children (Titman, 1994, Byrd et al., 2007, Furio, 2010, Gross, 2012).

The needs of adults are generally overlooked in the design of school grounds. Stine (1997) proposed some criteria for adult needs too — observation, relaxation, community connections, learning and comfort. A school ground which can fulfil both adult and children needs can be regarded as a suitable landscape for learning.

2.3.4 Taking the curriculum outdoors

Universally the school ground has been mainly used for physical education (Adams, 1993) which determined to a great extent that the design of the school ground should be a plain area without any variety or diversity. However, in recent times, the use of the school ground

has extended from mere physical education to other educational activities. The Curriculum for Excellence (Scottish Executive, 2004) developed by the Scottish Government has encouraged the teachers of the primary schools to use the outdoors for teaching different content from the formal curriculum. In order to design the school ground that can accommodate children's learning of the curriculum, it is important to know 'what' is being taught and 'which' elements of the landscape might be useful for dissemination of that teaching. In this study, the design of landscape focuses on the learning of mathematics and science because these two subjects are directly related to different elements in the outdoors and children can benefit while teaching is conducted using those elements.

2.3.4.1 Teaching mathematics in the outdoor environment

The natural and built environment around schools provides ample opportunities for the teaching of mathematical skills in a real life context. Different manufactured and natural loose materials can be used to teach numerical theories and concepts to the primary school children of different grades. In Coombs County School in the UK, in September children brought conkers to school to explore ones, tens, hundreds and thousands. They put a conker in a large basket labelled 'singles', a bag of 10 conkers into another basket marked 'tens' placed beside the singles. After 10 bags of tens, children put bags of hundreds into another basket marked 'hundreds' and went on. By the time the children reach thousands they got an idea of the progress of the place order of numbers and could remember the left to right arrangements of the receptacles because of the hands on activities (Rowe & Humphries 2012).

An area of open ground with some pebbles or sticks can provide a context for all sorts of mathematical activities — addition, subtraction, multiplication or division. As mentioned by the same authors, *'there is something satisfying for the children (and adults) about holding a pebble in the hand, or counting out the bundles of small sticks cut from our willows or estimating the number of recently gathered pinecones in a basket'* (p138). Children enjoy the physical activity that involves collecting sticks or pebbles and love working with these (Rowe and Humphries, 2012). Number trails (one hundred square, number snake etc.) are often painted in the school ground which is used for teaching mathematics in the formal classes and children also use them during free play (Adams, 1990, Funnell et al., 1997).

Although many of these activities can be done indoors, in the outdoors the children can be engaged with this activity in a bigger and freer space. The natural learning area and

the gardens can be an enjoyable context to learn different difficult mathematical concepts. *'...A wealth of quantitative study is possible, counting, measuring and estimating, investigating size, scale, distance, volume and weight. Data banks are being developed with information on butterflies, bumble bees and the growth rates of potatoes...'* (Adams 1993, p120). In Coombs County School, during spring children can learn division and percentage in the outdoors by working on the daffodils in the garden as they work out how many flowers they can collect for a mother's day bouquet so that everybody can get an equal amount (Rowe & Humphries, 2012).

2.3.4.2 Teaching science in the outdoor environment

Science teaching is at the heart of teaching in the outdoors. It is difficult to teach science meaningfully without getting outdoors (Adams, 1990, Funnell et al., 1997, Billmore et al., 1999, Foster, 2006). Cronin-Jones (2000) investigated the effectiveness of school grounds as a context of elementary science instructions. In a pre-post experimental study, 285 students of mixed ability levels were given instruction in the traditional classroom and the school yard along with a control group given no instruction. Both the indoor and outdoor groups were given ten lessons, the outdoor lessons included field observations, outdoor lab activities and role playing activities along with lectures, demonstrations and discussions. In post hoc analysis, the school ground group performed significantly better than the classroom group in the knowledge assessment, provided there was no significant difference between the two groups before intervention.

The children can experience and explore the seasons, weather and rainfall, and natural cycles if they work outdoors throughout the year. A variety of different habitats can be designed in the school grounds that can help children learn about interdependence of animals and plants, food webs and the dependence of the living beings on the environment. Children can grow vegetables and flowers in the school ground and learn about the importance of soil and which type of soil is good for different crops. *'The children are always attracted to water in all its forms...They experiment with buoyancy using whole corks and then corks cut into sections so that they float rather than roll down....'* (Rowe & Humphries, 2012, p113). They can learn about the importance of water for living beings, the water cycle and sustainability by observing the lives in the small pond in the school ground. *'We blow into balloons and bags and do many social and cooperative exercises with parachutes and sheets to see how trapped air changes the shape of its container. Lighting a camp stove to warm air in a bin liner helps us to demonstrate the lifting power of heated*

air...’ (Rowe & Humphries, 2012, p114). Besides creating the opportunity to learn about the characteristics of air, the outdoors gives more space to explore forces, movement, sound and light, and offers practical examples of the use and properties of different materials.

2.3.5 Children’s participation in research and design

Children’s participation in research concerning themselves and the design and planning of the places that involve their interest and use have attracted increased attention of researchers (Francis & Lorenzo, 2002; Samborski, 2010). Recognising and valuing children as ‘subjects’ rather than ‘objects’ of the research ensures children’s voices are heard (Christensen & James, 2008). The changing image of children as ‘social actors’ who can have ideas and express them instead of being considered just as ‘empty vessels’ was also recognised in the United Nations Convention on the Rights of the Child in 1989. Article 12 of the convention declares, *‘State parties shall assure to the child who is capable of forming his or her own views the right to express those views freely in all matters affecting the child...’* (UNICEF, 1989, p5). These perspectives even have influences at national level policies. Article 6.13 of the National Children Policy 2011, Bangladesh concerns opinion sharing and participation of children, *‘The opinion and participation of the children in all programs shall be stressed for ensuring Child Rights and Development in the agencies/institutions which are involved with this issue’* (MoWCA, 2011, p11). Therefore, this study adopted appropriate strategy and approach to learn from children their preferences and experience of place. By engaging children in the research, this study aims to address the ethical issues concerning research with children and also to gain a deeper understanding of the mutual relationship of the environment and the children.

Children can participate at various levels in the design and planning of places. Francis and Lorenzo, (2002) identified seven realms of incorporating children’s views and opinions in the development process through an observation of 30 years’ history of children’s participation in design and planning. The romantic period dated back to the 1960s and early 1970s viewed children as planners or futurists and believed the environment would be better if only designed by kids. This approach disregarded adult input as part of the process and was found not-realistic, however, still practiced by those who search for more ‘child-generated idea of the future’.

The next realm overlapping with the romantic period is termed as advocacy which grew out of the advocacy planning movement. Adult planners (for children) became

advocates of the needs of the underprivileged, however, the outputs were not holistic and children who were advocated for were not engaged in the design process. This led to a research based approach that uses environmental psychology research to address children's needs (social science for children). The 'needs realm' contributed key findings on how children's environments can be better from interdisciplinary research of geographers, psychologists, landscape architects, planners and sociologists including Lynch & Banerjee (1976), Hart (1991, 1997), Moore & Wong (1997), Moore (1990) and Chawla (2001). This produced significant scientific articles on children's views and opinions, the benefits of open space for children, however, there always has been gap between the academia and practice unless the researchers themselves are involved in designing the places.

The next stage is 'children as learners' which identified learning as an important outcome of the participation process which creates an appraisal of the built environment and leads to learning and social change (Adams, 1990, Titman, 1994, Stine, 1997) without actual change in the environment. 'Children as citizens' is a more recent movement conforming United Nation's Convention on the Rights of the Child which viewed children as fully empowered participants. It is popular in many countries, however it is more inclined to children's social rights compared to their environmental needs. The last two realms — institutionalisation (children as adults) and proactive (participation with vision) are more common form of participation which produced numerous case studies. However, though institutionalisation regards children as adults, children only participate within boundaries set by adults. In projective approach, which combines research, participation and action, children are active participants along with adults where specially trained designers play an important role. This approach might not be possible to execute in every project, however, produced several examples in sustainable city design movement.

Adults i.e. teachers are an integral part of the school environment, as learning the formal curriculum is a two-way process where teachers play the role of the facilitator. Therefore, this research not only relies on the views and opinions of children but also includes the opinions of the teachers, parents and the community, therefore has adopted 'Participation with Vision' working at the seventh realm of children's participation. The methods are carefully designed to elicit valuable information from both the children and the teachers regarding the design and use of the outdoor environment to have a comprehensive and whole picture of how the outdoor learning environment affords children's learning.

2.4 Summary

This chapter has been concerned with reviewing and reflecting on key aspects of research that explored the relationship of children with the outdoors. A deeper understanding of how children learn and develop is necessary to explore this complex phenomenon in different contexts and disciplines. Children construct their knowledge of the world through exploration of the surroundings and interaction with other children and adults. An outdoor environment designed as a combination of different ‘behaviour settings’ can provide ‘affordances’ for these activities. This chapter also introduces ‘cognitive affordance’ which might be helpful to understand the relationship of the physical environment and children’s cognition.

There is an increasing body of research regarding children and their outdoor environment but there are still gaps. Using the school ground for the learning of the curriculum positively influences children’s academic performance (Lieberman & Hoody, 1998; Lieberman et al., 2005, 2000); and the renovated school grounds used for physical activity and play were also found to positively influence educational attainment (Lopez, Campbell and Jennings, 2008). Here arises the question — whether being physically active in the school ground alone, or informal learning along with learning of the curriculum in the outdoor environment creates the impact.

Research focusing on either physical activity or environmental learning might sometimes provide narrower exposure to what should be there in the children’s environment. Benefits from the natural environment should not rule out the necessity of elements or equipment that is needed for children’s moderate to vigorous physical activity, therefore comprehensive research is needed which explores both learning and physical play in the environment in order to gain a holistic picture of this phenomena.

Listening to children’s voices while designing places concerning them is now bound by UNESCO’s convention for the rights of children. In designing school grounds, often teachers’ needs or voices are excluded despite their playing a major role in terms of teaching outdoors. How the participation of children and teachers in the design process can influence the academic performance is also an issue to carefully consider in such research.

The critical review of the theories of cognitive development and ecogological psychology and the existing literature further leads to a definition of a well-designed learning environment. An outdoor environment that is well-designed would enhance children’s

learning and increase their motivation to learn. From an operational point of view the design of such an environment should be theoretically grounded and informed by the users and existing evidence. This would be further reflected on in the conclusion based on the findings from the research.

Alongside the physical factors (i.e. the design of the environment), multiple other factors (socio-demographic, pedagogical and individual) have an effect on children's learning and academic performance. The next chapter presents how these variables are considered within the conceptual framework to formulate the research questions and to examine the complex relation between the physical environment and children's learning.

Chapter 3 Conceptual framework and research questions

Following the lead from previous research, many questions remain unanswered or even unasked in a particular culture and context, especially in the realm of the physical environment of primary school children. In order to make a transformation in the present notion of children's learning environment, a change is necessary in national and international education policy. But empirical studies producing an evidence base supporting the relation of environmental features and children's learning are scarce in the present context. Again, this issue being multidisciplinary, architects, landscape architects and designers of children's environment will need to work alongside educationalists and developmental psychologists. The design professionals will need to interpret the developmental needs of the children in terms of space and follow specific guidelines to create outdoor learning environments that will support children's holistic development and learning. However, evidence-based design guidelines to create outdoor learning environments supporting development of 'whole' children are less evident. The present study strives to understand the complex relationship between environmental design features and children's learning and intends to inform design professionals in their decision making and therefore to influence primary education policy.

This chapter describes the conceptual base for this research which guides the formulation of research questions presented later in this chapter and the strategies and methodology to answer those questions later in the thesis. The understanding of the theories related to how children develop and learn and how the environment can support that development, combined with the rigorous review of the existing literature related to children's outdoor environment presented in Chapter 2, provides the base for the conceptual framework of the study.

3.1 Conceptual framework

The broad theoretical ground of the study is based on theories of environmental psychology which claim that human behaviour is a construct of the environment. In the conceptual level, the study seeks to establish a connection between the environment and children's behaviour — the child shapes the environment and the environment in its turn shapes the child (Björklid, 1984). Although this relationship is considered to be reciprocal, this research is intended to investigate the unidirectional relationship — the role of the environment on

children’s behaviour. Therefore, all the factors that affect learning are considered at the conceptual level and discussion of these variables also guided selection of strategies and methodological issues presented later in Chapter 4. Children’s behaviour is complex and affected by various variables; the environment is a multidimensional entity comprising physical, social, cultural and pedagogical variables. Learning (both formal and informal) is considered to be a behaviour of children and this study is concerned with physical or built environment (see Figure 3.1). The influence of the environment on children’s learning can be direct through exploration of the environment and interaction with teachers and other children based on theories by Piaget (1964) and Vygotsky (1978). Creation of appropriate environmental opportunities can also have an impact on children’s motivation or willingness to learn. This can also eventually influence children’s academic performance acting as a mediator.

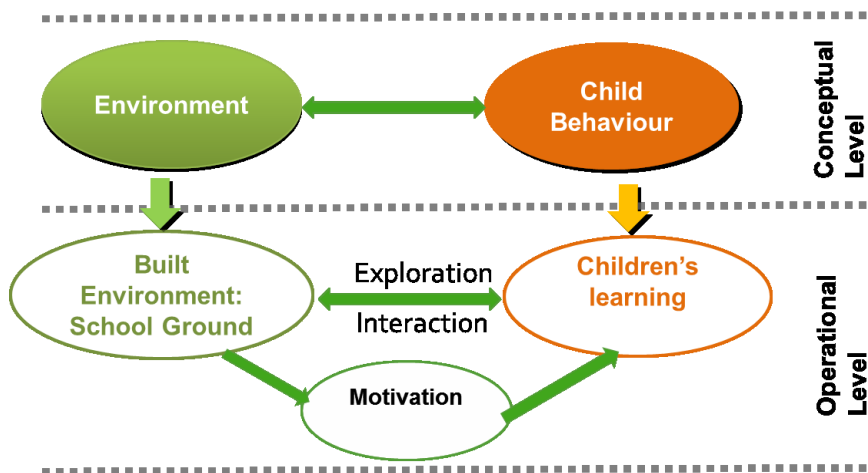


Figure 3.1: Conceptual framework of the study

Learning can be defined as a function of environmental and personal factors (Sharma, Pathak and Sinha, 2009).

$$L=f(EF*PF)$$

L= Learning, EF=Environmental Factors and PF= Personal Factors

Equation 3.1: Learning as a function of environmental and personal factors

Among the factors that influence children's learning (see Figure 3.2), personal factors comprise children's individual qualities e.g. motivation, engagement and interest which stimulate an individual towards learning whereas environmental factors are those which create the context for an individual to operate (Sharma, Pathak and Sinha, 2009). Among the demographic variables, age and gender were found to create a significant impact on children's learning (Eccles et al., 1993, Anderson, 2000, Wigfield et al., 2002). Pedagogical factors include the curriculum and teachers. This research is particularly interested in investigating the role of the physical environment on children's learning and motivation to learn. It aims to examine the impact of the environment (independent variable) on children's learning (dependent variable) by carefully taking into account the other three sets of variables.

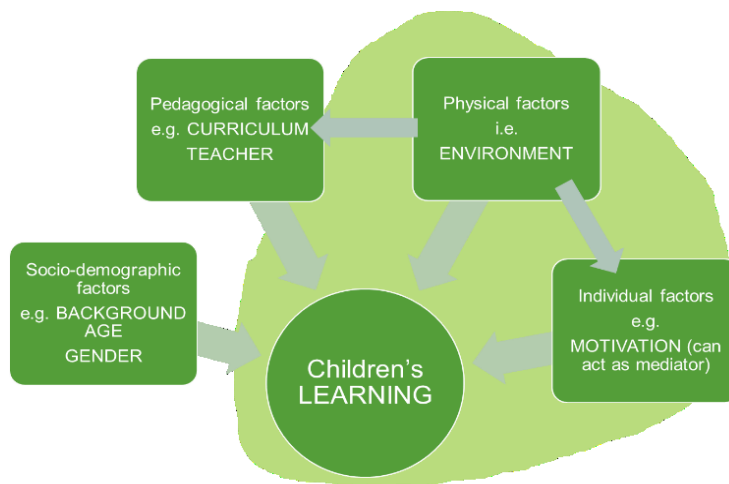


Figure 3.2: Factors that influence children's learning

The study controls the socio-demographic factors not statistically but rather by defining the age in the sample assignment and selecting the children from the similar socio-economic background. The pedagogical factors can be nullified by selecting schools that follow the same curriculum and teachers of similar competence level. Children of similar academic competence can be selected therefore neutralising the individual factors. However, pedagogical and individual factors can be influenced by the environment. Environment can offer opportunities to teachers to teach better (Lieberman, Hoody and Lieberman, 2000) and make children willing to learn (Tai et al., 2006, O'Brien, 2009). Therefore, alongside quantitatively measuring children's learning and their motivation to learn, the research aims to explore the underlying factors through adopting a qualitative approach further developed in the next part of the thesis.

3.2 Research aims

The primary aim of this research is to investigate the potential of the outdoors as an effective learning environment for primary school children. It is a study of children's behaviour from an environmental designer's perspective and aims to examine the influence of a well-designed outdoor environment (theoretically grounded and informed by the users and existing evidence) on children's learning and motivation towards learning. The broad objective of this study is to translate the findings into design guidelines which will assist the policy makers, educationalists, architects and landscape architects in policy-level decisions for the development, planning, design and proper use of primary school grounds. The study particularly focuses on the educational environment in developing countries like Bangladesh where the design of indoors is not optimal for learning. Therefore, it aims to find out whether the use of the outdoors as a learning environment can resolve the problem of absenteeism and poor academic competence of primary children.

3.3 Research questions and objectives

The study aims to compare children's learning in different environmental conditions and to identify how different elements in the outdoor built environment help support and develop children's cognitive and affective maturation. In order to identify specific variables and for the formulation of analytic procedure, a detailed research framework has been conceptualised with specific research questions, objectives and hypotheses.

Research Question 1:

To what extent does the outdoor environment influence children's learning (academic performance, and perceived exploration and peer relation)?

Objective: To compare the impact of two different types of built environment on children's academic outcome and their perceived exploration and peer relation.

Hypothesis: Children learn better or achieve more in their tests when they are taught in a well-designed outdoor environment.

Research Question 2:

To what extent does the outdoor environment influence children's motivation towards learning?

Objective: To compare the impact of two different types of built environment on children's motivation to learn.

Hypothesis: Children are more motivated to learn after being exposed to a well-designed outdoor learning environment.

Research Question 3:

To what extent do different types of built environment (traditional classroom and designed outdoor environment) influence children's motivation or interest towards learning and their willingness to come to school?

Objective: To compare the impact of two different types of built environment (classroom and the outdoors) on children's motivation towards learning and interest to come to school.

Hypothesis: Attributes of a well-designed outdoor environment can enhance children's motivation towards learning compared to a classroom.

Research Question 4:

What are the criteria that can guide the design of outdoor environment to be conducive to children's learning?

Objective: To evaluate the design of outdoor environment and find out the effective design characteristics of outdoor environment for children's learning

Hypothesis: Children's formal and informal learning activities in the school ground will be explained by the variety and diversity of different settings.

The exploratory aims are discussed in accordance with the sub-questions that will collectively answer the research question 4.

Sub-Question 1: Is there any association between school ground design and children's activities?

By comparing children's activities in the school ground before and after the intervention had taken place, this question explores the potential impact of a designed school ground on children's formal and informal learning activities.

Sub-Questions 2: How do the users respond to the individual behaviour settings of the school ground during outdoor classes and break time?

The study explores the potential for different activities of individual behaviour settings, how the affordances of different settings are being actualised by teachers and children and whether there are any missed opportunities.

Sub-Question 3: Which settings do the users prefer in their school ground and is that reflected in their behaviour?

The study explores the frequency of use in different behaviour settings in order to find out the users' preferences of different settings for various activities related to formal and informal learning.

Part II: Research strategy and methodology

The second part of the thesis comprises three chapters – Chapters 4, 5 and 6. Chapter 4 discusses why certain research strategies and methods have been chosen for the research, the development of the instruments and the ethics related to working with children. Chapter 5 focuses on the way the data have been collected and analysed, and the last chapter of this part discusses in detail how the school ground was designed and developed for the experiment i.e. the use for formal and informal learning activities.

Chapter 4 Methodology

This chapter discusses why this research applied particular methodological approaches, which methods were chosen that can answer the research questions illustrated in the previous chapter and why they were selected. The chapter also reflects on piloting these methods in Edinburgh and modifying them for implementation, and outlines the preparation for data collection in Bangladesh. The literature reveals that a large variety of methods (quantitative and/or qualitative) have been used in research studies of children. This study intends to obtain a more holistic picture of children's use of school grounds and its impact on their learning and behaviour. Therefore, it applied a range of strategies and methods that have been used before in different research but modified for use in this particular context of the study.

4.1 Research strategies

The main purpose of the study as coined in Chapter 3 is to examine critically whether changes to the primary school outdoor environment will lead to gains in children's formal and informal learning. The latest research has already established a link between outdoor environment and the health and educational benefits of children (Li & Sullivan, 2016; Lieberman et al., 2005; Matsuoka, 2010; Mårtensson et al., 2014; Roe & Aspinall, 2011; Ward, Thompson & Aspinall, 2011). However, exploration of more specific environmental attributes and characters that can influence children's behaviour and lead to these benefits is critical. This research investigates the exploration of environment and social relation (based on the theories of constructivism and social constructivism discussed in Chapter 2) as a pathway to better academic performance. It considers motivation as a driving force for such behaviour. The use of an experimental approach may help to discover the causal relationship between children's learning and different environmental conditions.

The study aims to establish a connection between environmental attributes and children's behaviour based on the framework outlined in Chapter 3. Use of a case study approach offers to investigate this *'real-life phenomenon in depth, but such understanding encompassed important contextual conditions'* (Yin, 2009, p18), for example understanding this relationship in the specific context of a developing country like Bangladesh. The concepts of behaviour settings and affordances discussed in Chapter 2 provided a useful framework to approach this paradigm of research.

4.1.1 Why experimental research?

One objective of the study is to find out the relationship or connection between certain environmental attributes and children's learning. This parallels the purpose of experimental research strategy as stated by Groat & Wang (2002): '*Experimental research seeks causal connections between two or more variables*'. The experimental research strategy is suitable when there is a treatment of an independent variable (designed outdoor environment), careful measurement of outcome measures/dependent variables (academic attainment, perceived motivation, exploration and peer relation), a specified unit of assignment (a child), the use of a control group (a comparison group in the same intervention school and a control school) and focus on causality i.e. the extent to which a designed outdoor environment causes a definitely measured learning and motivational outcome within a specified research setting. Contrasting with an artificial lab setting, the study worked on a naturalistic experiment in the changed outdoor environment setting of a primary school.

Therefore, this pre-post quasi-experimental research strategy⁸ involved design and intervention in a primary school in Bangladesh, which acted as the intervention school. The treatment was applied to the Grade IV Section B children of the school, whereas Grade IV Section A acted as a comparison group (detailed in Chapter 5, Section 5.1.2). Another school in the same area of Bangladesh worked as an additional control in order to compare the data. This can be termed as quasi-experimental action evaluation research as it sought to evaluate the utility of the treatment or the design features of the outdoor environment (Campbell and Stanley, 2015).

⁸ A quasi-experimental research, like experimental design, tests causal hypothesis but lacks the element of random assignment to treatment or control.

The research design can be diagrammed as follows:

Groups	T ₁	X	T ₂
Treatment Group	Exam Score	Exp	Exam Score
Intervention School	Questionnaire Observation and Behaviour mapping	(Intervention + Outdoor learning + Outdoor Play)	Questionnaire Survey Observation and Behaviour mapping
	T ₁	-	T ₂
Comparison Group	Exam Score	No Exp	Exam Score
Intervention School	Questionnaire Observation and Behaviour mapping	(Intervention + Outdoor Play No Outdoor Learning)	Questionnaire Survey Observation and Behaviour mapping
	T ₁	-	T ₂
Control School	Exam Score	No Exp	Exam Score
	Questionnaire	(No Intervention)	Questionnaire

Figure 4.1: Design of the experimental and the comparison groups

Design and construction of the experimental setting: The study was conducted in the context of developing countries, i.e. Bangladesh, where school grounds are generally barren and devoid of any designed natural or man-made features. Learning in the outdoors is still a new concept to be explored. Therefore, there is no ‘ready-made’ outdoor setting where the children can be taught in order to find out the desirable design features. The absence of designed outdoor environment in the primary schools necessitated the design and construction of an outdoor environment setting which worked as the **experimental setting**. The design and construction process is presented in Chapter 6 of this part of the dissertation.

The whole study was carried out in three distinct sequences – exploration, experimentation and evaluation, with the data collection executed during the exploration and evaluation phases. A detailed research design in tabular form is included in Table 4.1. The ‘**exploration**’ phase included exploration of the preferences and desires of teachers and children about the design and use of the outdoor environment. The pre-test data (exam

scores, structured questionnaire survey data and behaviour mapping and observational data) were collected from the control and intervention schools. The second phase, which was ‘**experimentation**’, included implementation of the design for the preparation of the experimental setting followed by the experiment i.e. use of the designed outdoor environment for teaching and learning. In the ‘**evaluation**’ phase, post-test data were collected and analysed to find out the effective settings for learning and also the criteria for the design of those settings.

4.1.2 Why case study research?

Along with the objective of finding a causal relationship between environmental conditions and children’s behaviour as stated in the above section, a second objective of the study is to know the underlying reasons of such a relationship and ascertain how different environmental attributes help or deter children’s formal and informal learning. A case study approach can offer ‘*important evidence to complement the experiments*’ (Yin, 2009, p16) with its ability to find the answer to ‘how’ and ‘why’ questions. In relation to landscape architecture, Francis (2001, p16) defined the case study approach as ‘*a well-documented and systematic examination of the process, decision-making and outcomes of a project, which is undertaken for the purpose of informing future practice, policy, theory and/or education*’. A case study research can be explanatory, descriptive or exploratory (Yin, 2009). However, in the present study the case study approach was applied to serve all these three purposes – to ‘explain’ the causal links in the intervention of the school ground, to ‘describe’ the intervention in the outdoor environment of a primary school and to ‘explore’ the underlying reasons for these ‘causal links’ within the intervention environment.

The case study design can be single or multiple. In this study a single case was investigated which is ‘typical’ or ‘representative’ with the objective of capturing the circumstances of an everyday situation and also observing the change in behaviour and activities of the embedded units of analysis (or children) throughout the whole study period (Yin, 2009). Multiple methods were used in the single case study for triangulation to ensure the construct validity of the research design (Francis, 2001; Yin, 2009).

Selection criteria for the case study: A Government primary school was selected for the study as Government primary schools are the highest in number among primary level institutions and the majority of children attend Government schools for primary education in Bangladesh (illustrated in Chapter 1, Section 1.2.3). As stated earlier, all the Government

primary schools and also most of the registered non-Government primary schools comply to a standard design which is prototyped across the country following some site adjustments. The selection process depended on the following criteria to ensure the highest generalisability of the study (Yin, 2009):

- 1) the school is ‘typical’ or ‘representative’ in terms of physical environment characteristics
- 2) the school is located in an average Bangladeshi village to ensure children are from typical socio-economic background, and
- 3) average academic competence of children

4.1.3 Why participatory action research?

The preparation of the experimental setting i.e. the design and development of the outdoor environment of the selected school employed a participatory action research strategy. Participatory action research strategy includes participation and action, the two key concepts from the basics of the method (Walter, 2009). The exploration is more than finding out; it implements the findings in *action* – the design of a school’s outdoor environment and implementing it. The design and implementation involve the *participation* of children, teachers and parents. Children’s role in research concerning them has changed from being ‘subjects’ or ‘objects’ to ‘participants’ (Christensen & James, 2008) which is also recognised by the national and international policies illustrated in Chapter 2, Section 2.3.5. Research studies often do not include the views of teachers and staff in the design of the school ground, which might constrain the use of the school ground for purposes of academic teaching or use by teachers, who are an integral part of children’s educational life (Stine, 1997).

The issue or problem of primary children dropping out, addressed in the research, is deeply embedded in the society. The selection of the school ensures that the problem is felt by the teachers and the school managing committee, and they are eager to improve the situation (Walter, 2009). The preferences of teachers and children, explored through different methods, were incorporated with different settings and sub-settings of the school ground identified from the relevant literature in order to achieve the final design of the outdoor setting (see Chapter 6 for the details on the development of the school ground). The construction works were executed using local masons and volunteers along with active participation of children and the community.

4.1.4 Why mixed methods research?

In-depth study of a single case involves the use of multiple methods (as stated in Section 4.1.2). Social and behavioural sciences have applied both quantitative and qualitative methods in a single piece of research. In a review of 20 studies with children in 12 different countries, Monsoureh & Ismail (2012) pointed to the adoption of mixed methods research by many researchers for obtaining more accurate results. A mixed methods research design was also employed here, as this allows quantitative and qualitative approaches to complement each other, leading to a holistic picture (Jick, 1979). The qualitative measures were used to explain the findings of quantitative measures and also for triangulation of data, leading to a better understanding of the influence of outdoor environment on children.

4.2 Research methods

The literature review so far reveals a large variety of methods used in research with children and the outdoor environment – from participant observation as conducted by Malone & Tranter (2003) to the use of a Global Positioning System by Fjørtoft et al. (2009). Often methods used in research with adults are replicated in research with children. However, Punch (2002) argued that research with children is potentially different from research with adults. Considering the benefits and drawbacks of different methods used in research with children, it is necessary to critically reflect on why and how certain methods were used (Punch, 2002, Fargas-Malet et al., 2010). Different methods were used to seek answers to different research 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 & James (2008). This section elucidates the reasons behind using certain methods, and the whole plan is graphically presented in Figure 4.2.

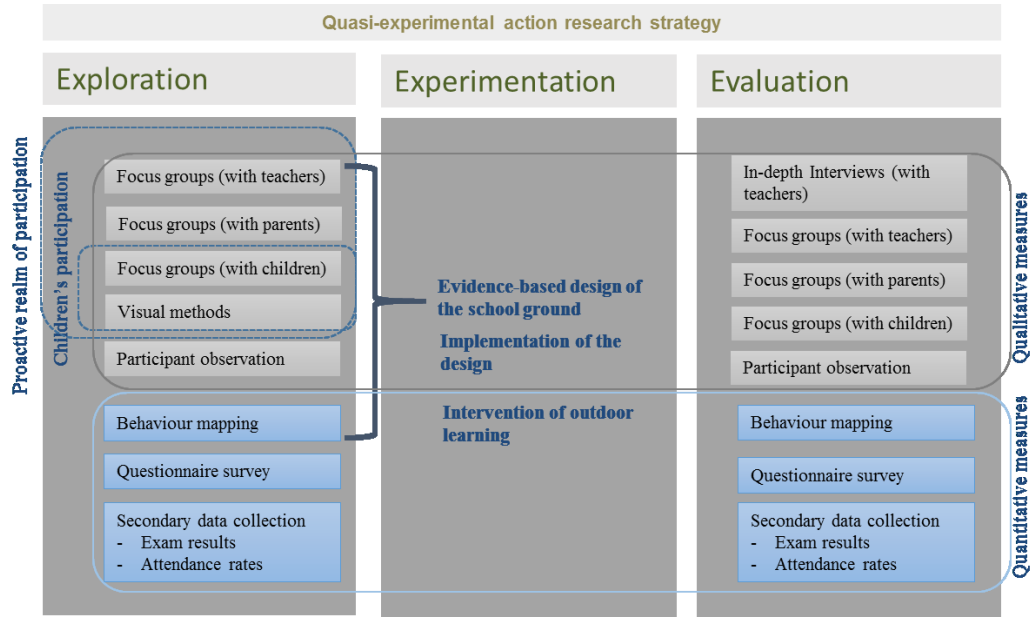


Figure 4.2: Plan of methodologies used in this research

4.2.1 Secondary data on attainment

The use of standardised tests as outcome measures is not new in this research field; however, it is not frequently applied in the field of environment behaviour research in order to find the relationship between attributes of primary school landscape and children's academic outcome in the context of developing countries. In 2010, Matsuoka investigated the association of the degree of naturalness in high schools with students' academic performance (Matsuoka, 2010). The influence of overall school architecture on students' outcome in the USA was investigated by Tanner in 2000 and 2009 using standardised tests as the outcome measures (Tanner, 2000, 2009). Most Government primary schools in Bangladesh do not use any standardised tests. However, three exams are taken at four months' interval in April, August and December, called first terminal, second terminal and annual examinations respectively. The questions for different subjects like Bangla, mathematics or science for these examinations are the same across all the schools within one sub-district or *upazila*. The questions and scoring of mathematics and science are more objective compared to the subjective or interpretive nature of other school subjects e.g. Bangla, English, Bangladesh and the world and religious studies. Therefore, the attainment scores in mathematics and science exams were used as outcome measures for learning or academic attainment of children. These were also the subjects that were taught in the outdoor environment after intervention.

4.2.2 Questionnaires

Questionnaires are considered as tools 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 this research design no single primary data collection tool was used; rather, a mix of different tools were adopted to collect data based on the suitability of the tool with that issue. The questionnaire can provide useful data when there is a well-defined problem and the major concepts are known to the researchers when they begin the study (Zeisel, 1984). The ability of children to provide reliable responses is often undermined in research (Matthews, 1985); however, Christensen & James (2008) argued that children can provide reliable answers if they find the questions meaningful to their lives. Again, with age, children become better able to realistically assess their competences (Harter, 1982).

Self-reported questionnaires have been used in research with children to compare children's 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 the forest setting. With regard to the context of this study, questionnaires were used to compare the responses of children related to their experiences in the classroom and outdoors before and after the intervention. Two sets of questionnaires were administered at the same time, asking about children's experiences in the classroom and their perceptions related to taking classes outdoors. The same questionnaire was administered in the control school. The responses of children in the experiment school were compared to that of the control school in order to measure the impact of intervention.

Questionnaire design: The questionnaire design followed the track of previous research (Harter, 1982; Harter & Pike, 1984; Faupel, 2003; Mygind, 2009) and was developed based on theories illustrated in Chapter 2 to measure specific aspects. Piaget's (1964) theory of constructivism was used to develop the part that measured children's exploration in the environment, Vygotsky's (1978) theory of social constructivism was used to measure children's relationship with peers and expectancy value theory by Eccles et al. (1993) was used to measure children's perceived motivation to learn. Some elements were extracted from the questionnaire used by Mygind (2009) and the assessment tool demonstrated by Faupel (2003) to measure the emotional literacy of children aged seven to 11 years old. According to Christensen & James (2008), visual stimuli can be useful for

primary school aged children. Emoticons have been used in the questionnaire for ease of understanding of the four-point Likert scale. The questionnaire was used to gather data to measure the above mentioned aspects both in classroom and outdoor environments (see Appendices 2A and 2B).

4.2.3 Participant observation and behaviour mapping

An ethnographic approach was adopted for an in-depth understanding of the influence of outdoor environment using participant observation, as this is considered appropriate to the participants and the social processes (Stan & Humberstone, 2011). The term ‘participant observation’ refers to the participation of the 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 look at whether behaviour in the physical environment is supported or deterred by it (Zeisel, 1984). Participant observation has been widely used in research with children as this is regarded as the most authentic impression of human behaviour (Christidou et al., 2013, p63). With this method, researchers do not only observe what is happening there, but also try to find out what is not there. They can try to uncover the silent voice of children (Greig et al., 2007). In this research, participant observation was used to look into children’s behaviour in the outdoor environment, and to find out the activities with which children were engaged before and after the intervention.

Exploration of what the school ground can offer for teaching the curriculum required careful observation of the actions in order to understand the meanings. Therefore, participant observation was used to understand the educational context to find the underlying reasons behind teachers’ use of the outdoors for teaching and ascertain how the environment helped or deterred the process of teaching and learning.

The observation of children was associated with mapping of their activities in different settings of the outdoor environment. This was carried out using the behaviour mapping approach, which is defined as an objective method to measure how spaces are used (Moore & Cosco, 2010). It can be used to record the location of the participants and their activity at the same time. It can provide useful information about the relationship between environment and behaviour and can guide design interventions (Cosco et al., 2010). Behaviour mapping has been used as the primary investigation tool in numerous research projects involving children (Cosco, 2006; Hussein, 2009). The outdoor environment was

designed based on the theory of behaviour settings and concept of affordances, which are the basis for this observational tool. Therefore, behaviour mapping was used to find out the settings and components that were heavily used by the children and the physical components that supported learning, social interaction and exploration of the environment.

4.2.4 Focus groups with children, teachers and parents

Focus group discussion was selected as a method in this research in order to gain insight into the participants' experiences, attitudes and perceptions regarding the design and use of the outdoor environment of school for learning. Focus groups have been considered a more advantageous method in research with children to gather qualitative data than interviews (Greene & 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 & 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 & 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 & Hogan, 2005; Fargas-Malet et al., 2010).

4.2.5 Visual methods to learn children's and teachers' preferences

Visual methods have been increasingly used in research in recent times as they can help in improving the degree of participation by children and even adults (Hart, 1997; Greene and Hogan, 2005; Monsoureh & Ismail, 2012). The visual method that is considered first in researching with children is drawings. Nevertheless, Hart (1997) discouraged the use of individual drawing as the primary method to listen to children's voices because children may come up with the stereotyped images they learn to draw. A pilot study in Bangladesh in 2009 also supports this, as the children of a primary school when asked to draw their dream school 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 that can stimulate further discussion or activities (Hart, 1997).

The Children's Environments Research Group has found modelling to be a *'highly effective strategy for involving children of all ages from five years and older in the design of school grounds and playgrounds'* (Hart, 1997, p109). In everyday play children communicate with each other with toys, which can be used as a medium to engage them in activities that help us to learn their desires. Even very young children can express their design preference through manipulation of their toys (Hart, 1997). 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 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 in the modelling of the school ground to give a visual form to the preferences of children.

4.2.6 Semi-structured interviews

In-depth interviews with teachers were used as a follow-up to the other data collection methods in order to achieve more in-depth data. While structured interviews are used to ensure consistency across interviews 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 along with recording the answers to the questions.

4.2.7 Research methods summary table

Table 4.1 summarises the research methods adopted in the study in correspondence with the research questions they answer.

Table 4.1: Research methods and approach to analysis

SI	Research Questions	Objectives	Hypothesis	Methods	Measures	
1	Primary RQ 1 To what extent does the outdoor environment influence children's learning (academic performance, perceived exploration and peer relation)?	To compare the impact of two different types of built environment on children's academic outcome	Children learn better or achieve more in their tests when they are taught in a well-designed outdoor environment.	1) Secondary data (exam results of students in maths and science) and 2) Questionnaire survey data **Interviews with teachers and focus groups discussions (FGDs) with children will support this	Change in children's learning	
2	Primary RQ 2 To what extent do different types of built environment (designed and barren) influence children's motivation or interest towards learning?	To compare the impact of two different types of built environment on children's motivation towards learning	Children are more motivated to learn in a well-designed outdoor learning environment.	Structured questionnaire with a 4point Likert scale to measure motivation to learn outdoors **Interviews with teachers and FGDs with children will support this	Change in children's perceived motivation to learn outdoors	
3	Secondary RQ 1 To what extent do different types of built environment (classroom and designed outdoor environment) influence children's motivation or interest towards learning?	To compare the impact of classroom and outdoor environment on children's perceived motivation towards study	Children are more motivated to learn outdoors compared to the classroom.	Structured questionnaire with a 4point Likert scale (two separate questionnaires were administered for the classroom and outdoors). **Interviews with teachers and FGDs with children will support this	Change in children's perceived motivation to study in the classroom and outdoors	
4	Primary RQ 3 What are the criteria that can guide the design of an outdoor environment conducive to children's learning?	<p>Sub-Question 1 Is there any association between school ground design and children's activities?</p> <p>Sub-Question 2 How do the users respond to the individual behaviour settings of the school ground during outdoor classes and play?</p> <p>Sub-Question 3 Which settings do the users prefer in their school ground and is that reflected in their behaviour?</p>	To compare the effect of two different school grounds (barren and designed) on children's cognitive, physical and social activities	Children's play and learning activities in the school ground will be explained by the variety and diversity of different settings.	<p>1) Behaviour mapping</p> <p>2) Observation of children in different types of settings before and after the intervention</p> <p>3) FGDs with children</p> <p>4) FGDs with teachers</p> <p>5) Interviews of teachers</p> <p>6) FGDs with parents</p> <p>7) Journal of teachers</p>	<p>Change in children's activities in the school ground</p> <hr/> <p>Children's response to individual behaviour settings and affordances of those settings</p> <hr/> <p>Children's preferences and environment's affordances that guide those preferences</p>

4.3 Piloting of research methods in Edinburgh

Teaching in the outdoors is at the core of the history of the Indian sub-continent, where the ‘*guru*’ (the teacher) used to teach the ‘*shishya*’ (the disciples) under a big tree as mentioned in Chapter 1. However, outdoor teaching is not practiced in Bangladesh except when there are not enough classrooms, and in many instances it is not regarded as proper teaching. Therefore, I had very limited exposure to the use of a designed school ground or outdoor environment for teaching and learning. Going through online and electronic sources I got some ideas about the way teaching can be done outdoors in the context of the UK. ‘The Coombes Approach’ (Rowe & Humphries, 2012) provided a vision of the way the teachers in Coombes County School in the UK introduced outdoor teaching in their school. In Scotland, the ‘Curriculum for Excellence’ (Learning and Teaching Scotland, 2010) emphasises taking children outdoors for teaching of the curriculum. Teachers in Scotland are provided with training in conference and workshops. By attending such an outdoor play and learning conference (‘Learning for Sustainability’ in Glasgow, organised by Grounds for Learning, Scotland), I was exposed to different ways of using the existing school landscape to teach some content from the curriculum. In order to have an in-depth understanding of the way different attributes of school landscapes in Scotland help or deter teaching, I contacted Education Scotland to help me choose a school where I could have an onsite experience and pilot my methods. This section gives a detailed account of the pilot study conducted in Edinburgh – selection of school, piloting the methods and implications of the pilot.

4.3.1 Selection of school

Education Scotland suggested several primary schools, which I contacted, explaining my objectives and approaches to achieve them. Two teachers from a primary school (SPS) on the outskirts of Edinburgh showed their interest in co-operating in the study. The school practices outdoor teaching, regularly taking each class to the outdoor environment once or twice a week. The study was conducted with 40 children in primary classes from P3 to P6 (eight to 12 years old), two teachers and two teaching assistants. The children of P6 were taken outdoors by their teacher once a week (every Wednesday) at 1:15pm after lunch. They were taken to a nearby woodland or, in case of bad weather, the school grounds. The children of other classes were usually taken to the school grounds for their outdoor teaching twice a week.

The school had a large and diverse ground consisting of a grassy hill, a small climbing wall, a tarmac play area with loose materials, a small woodland, some garden beds and a linear circulation area (see Figure 4.3). There was also a playground, which was closed for development at the time of the pilot study, and was therefore excluded from observations.

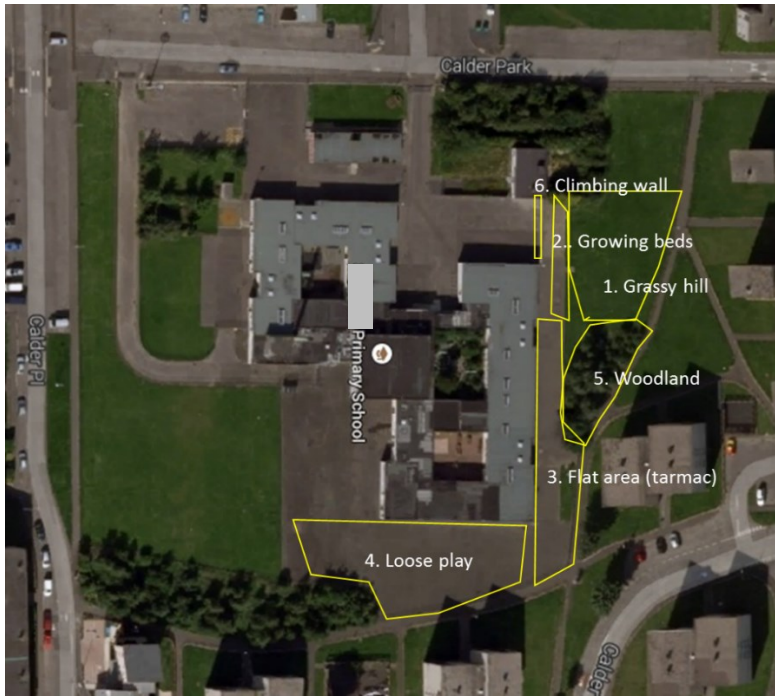


Figure 4.3: The Scottish primary school with identified behaviour settings (Map data: Google, Infoterra Ltd and Bluesky)

4.3.2 The initial approach

The initial approach was to develop an idea about the way children and teachers used different settings in the school ground for learning and play. I started accompanying the teachers and students of P6 and P3 on days when they were being taken outdoors. However, instead of observing them only during the formal teaching period and break time, I adopted an ethnographic approach for a better understanding of the phenomenon explored. Rather than measuring the outcomes of outdoor teaching, this pilot study focused on the behaviour of the participants in the school ground and their use of school spaces (Denscombe, 1983). After several visits to the school I decided to pilot some of the methods in the school before going back to Bangladesh for the field survey. The whole pilot study was undertaken from April to September 2014.

4.3.3 Piloting the methods

Piloting the instruments allows the researcher to test whether the instruments serve the purpose and also offers some practice for using them in the main study (Bryman, 2012). The context of Bangladesh and Scotland is quite different; however, piloting some of the instruments with a sample similar to Bangladesh helped to further develop and modify them before applying it in Bangladesh.

4.3.3.1 Questionnaire survey

The first pilot of the questionnaire was conducted with 40 children from P3, P5 and P6 in the primary school in Scotland. However, the data from this survey could not be used for reliability check in SPSS, as the sample size was not large enough for this analysis. Therefore, the questionnaire was piloted with a small group of children from the school following the protocols stated by Taylor-Powell (2008). Five randomly chosen children participated in the pilot; I read the questions to them one by one and observed their reactions. They completed the questionnaire afterwards in my presence while I watched for any hesitation, erasures or skipped questions. On completion I asked for verbal feedback regarding the language of the questions to make sure the children understood what they were being asked.

A version of the same questions was filled in by the teachers. The teachers were asked opinions on the language of the questions, i.e. whether the children would face difficulty in understanding any of the questions and if the questions asked clearly what they were intended to ask.

Some modifications were made to the language of two questions based on teachers' and children's feedback. Though it was surprising how quickly most children completed the questions, some of them were found to hesitate a bit at two questions and asked for clarification. I rephrased the questions to them to see whether they found that easier to understand. I noted down the exact phrases that were simpler and easier for the children and recorded the whole conversation for future reference.

I showed children two versions of the questionnaire – one with smiley faces to denote the degree of agreement with the statements and another one without the smiley faces. The children liked the use of smiley faces; however, the presence or absence of smiley faces did not matter in their understanding of the content and usually did not affect the decision-making process (Punch, 2002). As such, the questionnaire with the smiley faces

was chosen to be used in Bangladesh, as visual stimuli were found useful for pre-adolescents (Christensen & James, 2008).

The questionnaire was then translated double-blind following the recommendations by Griffiee (2001). A Bangladeshi writer and I translated the questionnaire from English to Bangla separately. These two were cross-checked and a modified version was sent to another person, who did not see the English version of the questionnaire, to translate it from Bangla to English. After some adjustments, both Bangla and English questionnaires were sent to an experienced Bangladeshi researcher (working on child development and with experience of translating and adapting questionnaires from English). Based on his opinion, some adjustments were made to two questions before piloting it in Bangladesh.

A second pilot was conducted with another small group of children and teachers in a primary school in Bangladesh with the modified and translated version of the questionnaire as it required the further validity suggested by Griffiee (2001). The pilot was conducted to ensure that the questionnaire fitted into the context and that the respondents could understand easily what it asked for. Following the same procedure carried out in Edinburgh, modifications were made to one question based on the feedback from children and teachers in the pilot study in Bangladesh for use in data collection.

4.3.3.2 Focus groups with children

Three focus groups were conducted with five children in each group from the primary school in Scotland, based around a set of questions. The situation and the context was completely different from Bangladesh, as the children had already been using the school ground for learning and there was no pre or post-intervention conditions. The focus groups were conducted to get a holistic picture of the use of the school ground and an idea of how children responded to outdoor teaching. However, some questions from the focus groups were used for an outline to generate discussion during the pre and post-intervention focus group discussion in Bangladesh.

The discussions were held in an environment familiar to children – in the courtyard of the school adjacent to the classroom (Greene & Hogan, 2005). They were asked about their favourite and least liked places in the school ground, how different settings were used for learning and play and whether they would suggest any change in the present landscape of the school. They were also asked whether there was any difference in the behaviour and attitude of children and teachers in the two environments – the classroom and the school

ground. A Google Earth image of the school ground (see Figure 4.4) was used, so that the children could easily read and point to their favourite and least liked places in that image.

The outline prepared for focus groups could generate interactive discussion among the children and with me in each session. Therefore, based on this preliminary outline, separate outlines were prepared for the pre and post-intervention sessions in Bangladesh. As the children could easily identify different settings on the Google map, I decided to use a scaled map in the post-intervention sessions in Bangladesh in order to learn children's preferences of different settings and how they were used for different purposes. As a whole, the discussion helped to provide an idea of how children felt about learning outside the classrooms, which aided in the development of the design of the school ground in Bangladesh.

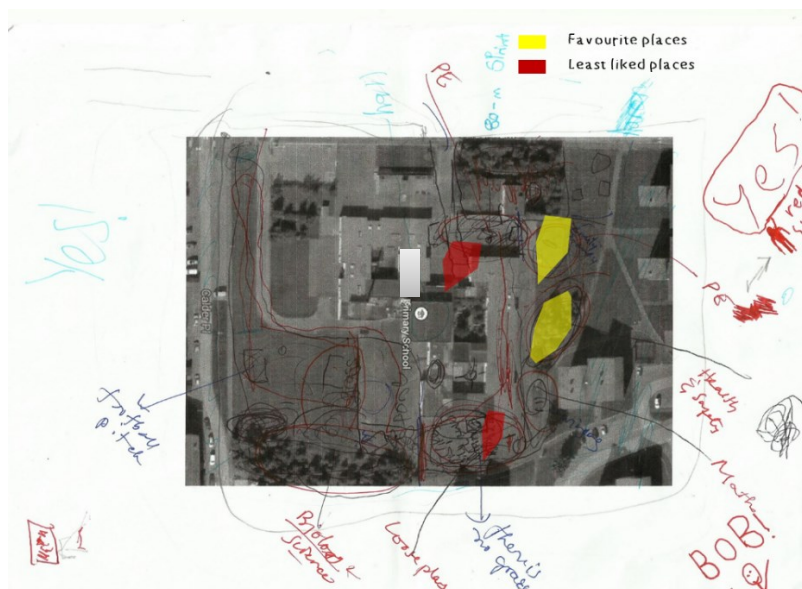


Figure 4.4: The Google Earth image used during the focus groups showing children's favourite and least liked places (Map data: Google, Infoterra Ltd and Bluesky)

4.3.3.3 Interview with the teacher

One teacher from SPS was available for the interview based on an outline of the questions developed for the pilot study. The interview session lasted for about 45 minutes and was audio-recorded with the permission of the teacher.

The questions were very specific and the interview generated useful information about the teacher's experience of teaching, teachers' and children's behaviour and attitude towards learning, how the settings helped in teaching of the curriculum and whether some settings were more useful compared to others and the teacher's suggestions for any possible

change in the design of their school ground. The teacher was asked whether she had any advice regarding the specific research I was conducting and the research methods I was using to collect information. However, some questions, though designed to seek different information, were triggering the same answers, and the teacher had to refer back to previous information she had provided. Therefore, two questions were revised and one was omitted for further use in Bangladesh. Nevertheless, the interview generated quite useful information to be kept in mind during the design of the school ground.

The interview questionnaire was translated following the same steps as outlined for the questionnaire survey. However, it was not piloted in Bangladesh as the teachers there did not have experience of using the outdoors for teaching the curriculum.

4.3.3.4 Participant observation and behaviour mapping

The children of the SPS were observed in the local woodland, during their classes and two break periods (each day) on five school days between March and September 2014. A behaviour mapping schedule based on the work of Cosco (2006) and Malone & Tranter (2003) was used to map children's activities during break time on a Google Earth map of the school. The observation included a clockwise circulation in pre-defined settings. Each observation period lasted for 30 seconds, with the first 15 seconds spent observing the children and the rest used to map children's location and note their gender, activities and the elements with which they interacted on a paper map. At the end of each break, detailed notes were written in the field note book.

The behaviour mapping schedule for break time was intended to be applied during formal teaching periods as well, for a standard format to be used across different times. No previous observation coding was prepared for mapping children's activities during the formal teaching in the outdoors, because 1) there was no 'readymade' coding guide for mapping children's activities in the school ground during formal teaching as this method had not been used before to study children's formal learning in the school ground, and 2) the coding depended on the subjects that were taught during those observational periods. Besides, the initial purpose was to have an idea about the use of school grounds for teaching the curriculum. I took detailed field notes during the observation periods.

The children were taught mathematics, science, geometry, archaeology and physical education during their classes in the school ground. Field notes were taken on the structure of the classes in the outdoors, the way the teachers were addressing different contents of the

curriculum linked to elements of the school ground or the woodland, the way they designed the tasks and the way the students were responding to those exercises. I took note of the emotions and expressions of children and teachers during outdoor classes. I had informal conversations with the teachers and teaching assistants on the way to the woodland or between the tasks about their experiences and children's behaviour and attitudes during the classes in the outdoors.

The behaviour mapping schedule used in the SPS needed a bit of modification for use in a different climatic and cultural context like Bangladesh. Though universally children like places with sufficient variety and richness (Van Anandel, 1990), their activities might differ in different cultural and climatic contexts. A generalised behaviour mapping schedule for formal teaching periods in the outdoors that might also be applicable to the context of Bangladesh was also difficult to generate. The education system is different in the two countries; the curriculum also varied. As such, I decided to take very detailed field notes. Video-tracking of children was felt necessary, as it could be further analysed and coded to generate behaviour maps at different times of the school day.

4.3.3.5 Conclusion from the pilot study

The data from the pilot study was analysed and the results were published as a *pechakucha* paper in the proceedings of the ECLAS conference in 2015 (Appendix 20B, paper no. 3). The pilot study provided useful information regarding the design and use of a school ground. The study found that rich and diverse school ground settings can offer multiple affordances to children both for their formal and informal learning (Khan et al., 2015). This is also supported by Wan & Zulkiflee (2012) who found that diverse landscape settings possess qualities that can meet children's needs for rich and stimulating environments.

The analysis of the data from the pilot study indicates that children preferred natural settings over manufactured settings; they asked for more grass and plants to be provided in the school. A large number of children were found to spend their time in the green areas, as was also found by Dymont et al. (2009). The reason is that natural or naturalistic environments provide high diversity and offer a wide range of educational opportunities (Frost, 1992). Teaching in different ways in these diverse settings makes children more engaged in their study and thus helps to increase their motivation.

The area with loose materials offers opportunities to experiment and create new things. The 'loose parts', as termed by Nicholson (1970), are materials that are open to

manipulation; children can change these and build something from their imagination. However, the area with loose materials was not clearly defined in the SPS and not separated from the flat tarmac where boys played different ball games. The children asked for more well defined settings so that they could be engaged in different activities without getting in the way of others. The playground of the school was being developed at the time to include more settings. Nevertheless, the existing settings already offered some affordances which would be considered while designing a school ground for better learning by children.

4.4 Preparation for the data collection

The first step in order to be prepared for the field work and data collection was looking for a potential sponsor who would fund the development of a school ground in Bangladesh. Some corporate organisations, organisations of volunteers and NGOs who worked for the children of Bangladesh were contacted. A presentation was made with details of what would be done, how it would be done, why it was necessary to do this work along with the amount of money that would be needed for it (see Appendix 5A). The presentation was sent to interested organisations to give them a detailed overview of the way they would be involved.

Some organisations were very eager to support the project at the first instance. One NGO offered to provide all the support needed to develop the ground of a school they nominated. But afterwards, they informed me that they would give support regarding volunteers and training and accommodation facilities but would not fund the construction. As such alternative sources were being looked into for support.

Conversations were also going on with some individuals who might be personally interested in funding the project. The alumni of the University of Edinburgh were also contacted. A voluntary organisation was contacted in Bangladesh, asking for volunteer support for the project. They were also sent a presentation and a timeline for the fieldwork in Bangladesh. Some research grants had been applied for, but the project did not fit into the relevant criteria. For partial funding of the project, EDRA's student research grant was applied for but the application was unsuccessful. At the moment that it seemed no stone remained unturned, a person came forward under the condition of anonymity and was willing to donate the construction cost for the development of the school ground.

Once the funding was confirmed, several schools in the chosen area were contacted from Edinburgh in order to ascertain the infrastructural conditions, availability of open spaces and whether they felt the need for this development. The superintendent of the local

primary training institute (PTI) was contacted for their co-operation at different levels, and enthusiastically agreed to provide all support. She was contacted again after my return to Bangladesh for fieldwork in October 2014. The research schedule is shown in the Gantt chart in Appendix 1.

4.4.1 Ethical considerations

In addition to the approval of the research proposal by the Ethics Committee of the University of Edinburgh on 3rd March 2014 (see Appendix 5B), there were some other ethical considerations that needed to be addressed throughout the research process. The ethical tensions involved in research with children (as identified by Dockett et al., 2009) are consent, representativeness of children who participate, impact of children's participation, consideration of children's spaces as sites for research and interpretive framework for data analysis. In addition to gaining consent from parents, it is important to ascertain children's assent to participate in the research (Dockett et al., 2009; Mahon et al., 1996).

During the pilot study in Scotland, the school committee was approached with a brief description of what I wanted to do during this study, requesting their permission, and parents were contacted requesting their consent. Three parents did not provide consent for their children to participate. In Scotland, in order to work with children, the researcher needs to secure him or herself with Scottish disclosure if the children are under direct guidance of the researcher in the absence of parents or teachers. However, the pilot study was done in the school ground, classroom or woodland under the direct supervision of the teachers and I worked as an observer of their usual daily activities.

Although some parents may give permission for their children to participate, some children may not want to participate, which needs to be considered and understood from different verbal and non-verbal communications with the children. Some key considerations also included in the ethics proposal were that parents or children could withdraw anytime from the research, children's identity would not be disclosed and code names would be used. In addition, no photo or personal information would be published or used for analysis without the consent of the participants. Moreover, children's desires and preferences would have been given emphasis and considered to be included in the decision-making process to ensure the positive impact of children's participation.

4.5 Summary

Quasi-experimental action evaluation research was chosen as the methodological approach for this research, as this would allow me to investigate the influence of a designed outdoor environment on children's motivation, attendance and attainment. This would generate evidence to guide design, research and policy making. A single case study typical in nature was chosen for better understanding of the phenomenon explored, which could then be generalised to similar contexts. Participatory action research strategy was applied in the development of the school ground. Mixed methods research combining qualitative and quantitative approaches was chosen and methods were carefully selected to answer the research questions, triangulate the research, complement the results of different methods and therefore expand the scope of the research to integrate different methods together.

The methods and associated instruments had been piloted in Scotland before the main field survey in order to achieve exposure to current outdoor education practices and to make any necessary modifications to the methods and the instruments. The school ground already contained a few settings that had been used by the teachers and the children for formal and informal learning. Observations of children's interactions with different elements provided useful information about the design and use of the school ground, and the instruments were modified based on feedback from children and teachers.

Many challenges were faced during the preparation for the field survey, particularly in securing the funding for the development of the school ground. Once the funding was secured, potential Bangladeshi primary schools and the nearby primary training institute were contacted from Edinburgh.

In addition to the ethical approval from the respective authorities, there are many other issues that need to be considered while researching with children. Parents' consent, children's consent, anonymity of the participants and decision-making depending on children's desires and preferences should be given emphasis in any research involving children.

Chapter 5 Data collection and analysis

The previous chapter explored the research strategies adopted to address the research problem and reflected on the choice of research methods that could provide valuable perspectives for evaluating the research questions. This chapter explains how the study employed these methods to evaluate the association of the outdoor environment characteristics and children's formal and informal learning activities. Multiple methods were applied to support comparison and triangulation and to get a holistic picture of the particular case under study. The first section of the chapter describes the process of case study selection, the second part discusses how different data were collected and the last part explains how these data were analysed. The study used the quantitative data of children's attainment scores and responses to the questionnaire to find out the influence of the redesign of the environment on children. Observation accompanied by behaviour mapping was used to record children's formal and informal activities in different settings of the outdoor environment. Additionally, the study relied on qualitative methods (focus groups and semi-structured interview) to understand the complex interaction between the outdoor environment and children. This chapter explains how the study combined a whole range of methods to elicit children's and teachers' perspectives on the design and use of the school ground.

5.1 Selection of school

The case study area was selected taking into account the generalisability of the study to a wider context (Yin, 2009). The sub-district of Raipura within the district of Narsingdi in Dhaka division was selected as the area for field survey, as it is typical of the sub-districts of rural Bangladesh (see Figure 5.1 and Figure 5.2). A population of 535,796 live in a 312.77 sq km area; 258,993 are male and 276,803 female (Bangladesh Bureau of Statistics, 2014). The main source of income is agriculture, like most other sub-districts of the country (Islam & Miah, 2012). The literacy rate is 40.5%, of which 40.9% is male and 40.1% female. There is a primary training institute in Raipura, which was considered a good source of information regarding primary education and training of the teachers.



Figure 5.1: Map of Bangladesh with the location of the school (Map data: Google)

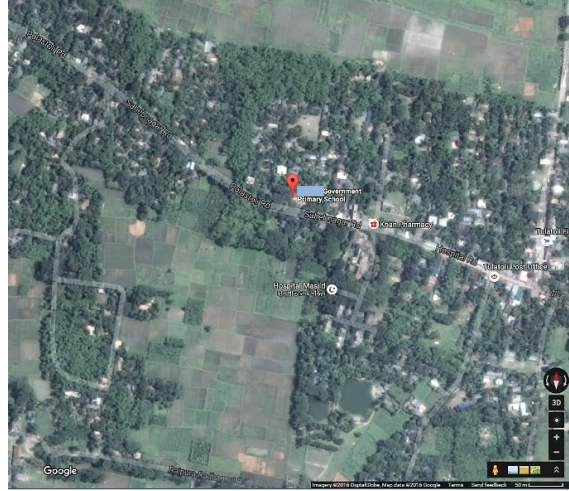


Figure 5.2: Location of the school within the village (Map data: Google, DigitalGlobe)

A Government primary school located in Raipura sub-district was selected for the study, as the majority of children attend Government schools for primary education in Bangladesh. These schools were designed based on a standard design which is prototyped across the country following some site adjustments (see Chapter 1, Section 1.2.3.3). Among the 213 Government primary schools, 10 schools were shortlisted based on several criteria:

1. Whether the schools comply with the physical environment requirement (0.33 acres of mandatory land area)
2. The demographics of the children
3. No development or pilot project taking place on site
4. The availability of the school for intervention

I visited these schools, talked with the headmaster and the assistant teachers, collected secondary data on the number of children and their scores in the previous examination. After a rigorous analysis of the above factors, the I Government primary school (IS) was selected as the intervention school for several reasons. In addition to complying with all the above requirements, the IS is a Grade B school (based on the assessment of children's academic achievement at sub-district level) that had scope for further improvement. The teachers and the headmaster expressed their interest in working in the experiment, and last but not least, the school was convenient to access for me. The whole process of the intervention school selection is summarised in Figure 5.3.

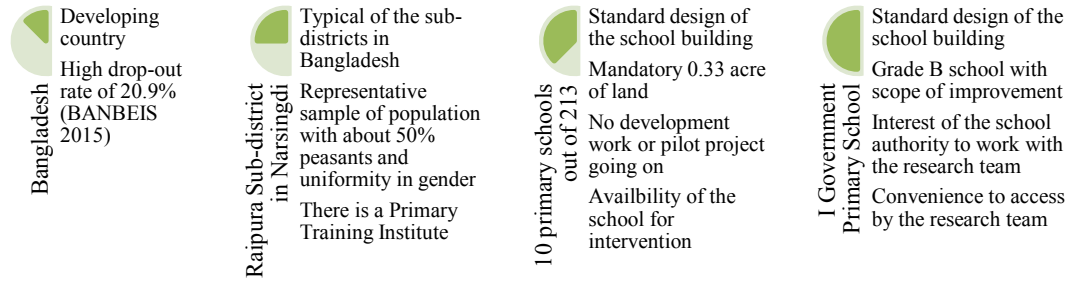


Figure 5.3: Selection of the intervention school

From the remaining nine schools, the C Government primary school (CS) was selected as the control school, cross-matching children’s demographics, academic achievement, distribution of gender and the quality of the physical environment (see Table 5.1). Both the schools were located within the same township; therefore, the children of the schools were from similar socio-economic backgrounds, making them comparable with each other. Statistical analysis of the exam scores of the shortlisted schools was conducted to find out the best matched school in the township. Both the schools were excluded from the scholarship for children programme, and no pilot project was going on at the time of the study. The design of the physical environment was better in the control school as the children were having their classes in a comparatively new *pucca*⁹ building whereas the students of the IS had their classes in a comparatively old semi-*pucca* building. However, the number of classrooms and other facilities in these two schools did not differ.

⁹ *Pucca* buildings mean dwellings made with durable materials so as to be permanent.

Table 5.1: The attributes of the intervention and the control school

<p>I Government Primary School Intervention school (IS)</p>	<ul style="list-style-type: none"> •Grade B School •Within R Township (excluded from the scholarship programme for the students) •Mandatory 0.33 acre land area •No of students — 358, Male: 186 Female: 172 (October 2014) •No of teachers — 9, Male: 1 Female: 8, Support Staff: 1, Male
<p>C Government Primary School Control school (CS)</p>	<ul style="list-style-type: none"> •Grade B School •Within the same township (excluded from the scholarship programme for the students) •Mandatory 0.33 acre land area •No of students — 325, Male: 158 Female: 167 (October 2014) •No of teachers — 9, Male: 0 Female: 9, Support Staff: 1, Male

5.1.1 School Profile

5.1.1.1 Intervention school

The I Government primary school (see Figure 5.4) is situated by the Bazar Road, which connects T Bazar to another small village. A small road to the east side connects the neighbourhood behind the school with the main road. The school has three building blocks – one block is the office room and the other two blocks are the classrooms. The main classroom block is semi-*pucca* and has a tin roof. A wash block has been recently built in the school, comprising two separate buildings – one for girls and one for boys. The open yard in front of the school building was barren, devoid of any design elements or play equipment. The boundary wall at the south side of the school had not been completed; it protected only half of the school ground. Four trees to the south of the school alongside the road gave shade to almost three-quarters of the school ground. There were another two small trees, one to the east and another to the north. The headmaster (male), eight assistant teachers (female) and one support staff (male) ran the school.



Figure 5.4: View of the I Government primary school (IS) from the road (Photo: Matluba Khan)



Figure 5.5: View of the C Government primary school (CS) from the north-east side of the school (Photo: Matluba Khan)

5.1.1.2 Control school

The C Government primary school (see Figure 5.5) is situated by the road that connects the surrounding neighbourhood to the village of Bazar. It has a two-storey building with five classrooms and an office. A separate wash block has been also built recently. The school ground was L-shaped and shaded by four large trees. There is a boundary wall separating the school from the surrounding neighbourhood. All the eight teachers and the headmaster are female, and there is one support staff member, who is male.

5.1.2 Children's profile

Children from eight to 11 years old were selected for the treatment. For this age group, learning is easier when it is associated with the use of real life objects within the

environment. They are at the middle range of ‘concrete operational stage’, benefiting most from exploration and experience of the surrounding environment (Haq & Jahan, 1999). The children of this age group attend Grade III and Grade IV in Government primary schools in Bangladesh. A major part of their curriculum links learning activities to the natural environment and prescribes taking children outdoors (NCTB, 2014).

In addition, the drop-out rate for primary children is highest at this grade, as shown in the survey conducted in all primary level institutions by BANBEIS (2014) (see Figure 5.6). As such, the children of this grade were selected for the study as they were the most vulnerable to dropping out; it was crucial to learn their preferences and views about any intervention that could potentially affect them. Furthermore, children of this age already have the level of cognition and language skills necessary to engage fully in the methods used in this study to gain information about their preferences and desires. It should be mentioned here that before the intervention the children were in Grade III; they were promoted to Grade IV in January 2015 when the school ground was ready for use.

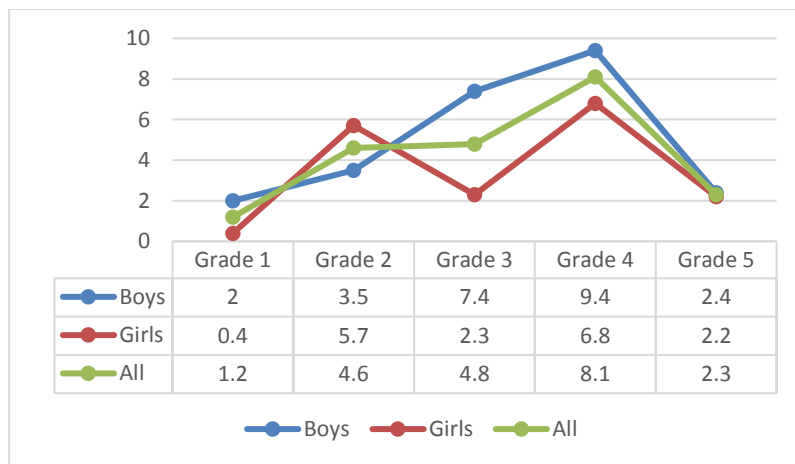


Figure 5.6: Drop-out rate by grade in primary schools (BANBEIS, 2014)

There are two sections within each grade in the intervention school, divided based on the even and odd roll numbers of the children. The roll number is based on the children’s performance in the annual exam, so the children of the two sections are comparable in terms of their academic achievement. This offered the scope for using one section as an additional comparison group. Therefore, the children of one section, Section B, worked as the treatment group who were involved in the design of the school ground, and later on they were taken outdoors for science and mathematics teaching. Section A worked as a comparison group who were not involved in the design, but they used the developed school ground for informal

learning through play. It should be noted here, I was aware of the potential contamination of the comparison group within the intervention school. Though only the children of the treatment group were involved in focus groups discussion, drawings and model making workshop during the design, the comparison children's involvement during the development of the school ground could not be fully prevented. This issue is reflected upon later in Chapter 11 Section 10.4.2.

5.1.3 Preparation for data collection – permissions and consents

In order to prepare for data collection from the schools a few things needed to be considered: 1) permission from the Department of Primary Education to work with the schools and to make changes to the school ground, 2) parents' consent forms and 3) agreed dates and times for running questionnaire surveys and focus group discussions in order to ensure the presence of most participants.

Once the schools were selected I contacted the Department of Primary Education (DPE) under the Ministry of Primary and Mass Education (MoPME) for permission to work on the project. I wrote an application to the Director General of the DPE, set a meeting with him and got the application approved as I needed to work on the site without further delay. The official permission was sent to me in January (see Appendix 5C). Letters were also sent to the District Primary Education Officer, the *Upazila* (sub-district) Education Officer and the headmasters of the respective schools, asking them to render any kind of help and services required for the project.

I met the Headmaster of the I Government primary school and gave him an invitation to participate (see Appendix 5D) to be sent to the parents of the children of Grade IV. He sent the invitation and also called for a meeting, offering me the opportunity to discuss the project with the mothers in person. I had a presentation ready to show but could not show the slides (to communicate the idea using visuals) due to the load-shedding. Rather, I took the opportunity to share a few words about what I wanted to do and how I wanted the children to be involved. The headmaster helped me by conveying the ideas in a language that was better understood by the village people. We asked for their opinions regarding the project. The members of the School Managing Committee were also present and participated in the discussion. At the end of the meeting they signed the consent form. The headmaster prepared a resolution of the meeting and kept a copy in the meeting book.

Once the consent form was signed I discussed with the teachers about the timetable for pre-intervention data collection. I took note of the holidays when the school would be closed and also the yearly updated timetable for exams and holidays. Two dates were fixed for two focus groups with the teachers beforehand, when they would be on break between classes, as I intended to cause minimum distraction to the academic routine.

5.2 Data collection

The data were gathered at different phases during the field work applying the methods explained in Chapter 4, as required by the pre-post experimental study design (see Table 5.2). The principal two data collection points were:

- 1) Pre-intervention data collected in November 2014 (T1) and
- 2) Post-intervention data collected in May 2015 (T3)

However, before intervention, attainment data were collected for the selection of the control school in October 2014 (T0). An additional questionnaire survey was conducted in the intervention school right after the construction in January 2015 (T2) in order to monitor children's change in motivation over time. Data on children's, teachers' and parents' preferences of the elements for the new school ground were only collected before intervention, and they informed the design and development of the school ground. No observational or qualitative data were collected from the control school.

Table 5.2: The schedule of data collection

Methods	Data Source	Data Collection (Time)			
		Pre data	Pre intervention data	Post construction data	Post intervention data
		T0	T1	T2	T3
Attainment scores	From both intervention and control school	Oct-14	Dec-14		May-15
Questionnaire survey			Nov-14	Jan-15	May-15
Visual methods	Only from intervention school		Oct 14 – Nov 14		
Participant observation	Only from intervention school	Oct-14			May-15
Behaviour mapping			Oct 14 - Nov 14		May-15
Focus groups	Only from intervention school		Nov-14		May-15
Interview					May-15

5.2.1 Secondary data on attainment

Children's attainment scores were collected in October, December and May where:

- October 2014 (T0) exams represented the examination held in August 2014. The exam scores were collected from the shortlisted schools in order to compare children's academic competence for selection of the control school.
- December 2014 (T1) exams were collected as the pre-intervention results from both the intervention and the control schools, after which the school ground of the intervention school was developed providing children with the scope of using the school ground for about four months.
- May 2015 (T3) exam scores were collected from both the intervention school and the control school as the post-intervention results.

Only the scores of the mathematics and science exams were used for the statistical analysis (see Chapter 4, Section 4.2.1). The examinations are held at the same time in all Government primary schools, based on the same questions. Moreover, an arrangement was made for mathematics and science exam scripts of the intervention and control schools to be

checked by the same teachers to avoid any bias relating to the marking criteria of individual teachers.

5.2.2 Questionnaire survey

The questionnaire survey was conducted three times within the data gathering period:

- November 2014 (T1) – The first questionnaire survey was conducted before the intervention in both the intervention and control schools.
- January 2015 (T2) – The second survey was conducted right after the completion of the school ground and just before children started to use the school ground for formal and informal learning. This post-construction survey was conducted only in the intervention school in order to monitor children's change over time.
- May 2015 (T3) – The post-intervention questionnaire survey was conducted in both the intervention and control schools.

The survey was conducted in the classrooms where children's classes are regularly held. At the beginning of the survey, the purpose of the questionnaire survey was explained to the children. After giving the questionnaires to the children, the process of responding to the questionnaire using the four-point Likert scale was explained. I had worked out the two sample statements with all the children and offered to read all the statements for them. Though most of the children were capable of understanding and responding without any assistance, all the statements were read one by one in order to ensure the statements were understood by all the children following the protocols used by Mygind (2007). One class teacher and one research assistant¹⁰ were present to help any child with poor literacy or if the statement was not understood. The whole survey took around 45 minutes.

5.2.3 Participant observation and behaviour mapping

Participant observational data can offer information concerning children's interaction with the outdoor environment in the primary school throughout the day. I, along with one research assistant, was present in the school before classes started until all the children left the school. I observed the children from 8:30am, 45 minutes before school started, until 5:00pm, 45 minutes after school finished, for seven days in October and November (T1). The second round of structured observation was conducted for another seven days, following the same

¹⁰ Two research assistants helped me in data collection, of which one had completed her Master of Urban Design from the University of Hong Kong and another was doing his Master of Architecture on children's environment at Bangladesh University of Engineering and Technology. Though both of them had some prior experience with working with children, before data collection they received some training on research with children.

protocol, in May (T3) after the intervention had taken place. I located myself at one corner of the school ground for easy scanning of the whole school ground on each day of the observation. Detailed observation notes were taken during the outdoor classes and the breaks.

The science class of Grade IV was held at 12:15pm and the mathematics class at 12:55pm. The duration of every class was 40 minutes and the classes were held each working day of the week from Saturday to Thursday. There was no set break time for play; the children were engaged in different playtimes before school (8:30am-9:15am), before the beginning of the second shift (11:35am-12:15pm), during lunch time (1:35pm-2:15pm) and after school finished (4:15pm-5:00pm).

Besides these pre-set observation weeks, I recorded my observation during the construction days in a journal and also in my blog (<https://matlubafrombangladesh.blogspot.co.uk/>). The children were engaged in different activities during the construction period, and in order to capture the holistic picture it was worth recording those observations. Unsystematic participant observation in the school during the whole period from January to May was conducted, which included observing the activities in the school ground and the classroom. The field journal contained a reflexive account of thoughts for the day, reasons behind children's reactions to certain situations or to us, the interactions of the children with the environment and the dialogue between me and the teachers and visitors (mostly parents and community people) to the school. The dialogue between me and my research assistant reflecting upon the data was also recorded in the field journal. Reflexivity is considered a significant feature of social research as researchers participate in the social world and eventually reflect on the products of that participation (Humberstone & Stan, 2012).

This 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. I did not intend to interrupt children in their regular activities during those observation periods, but children approached me at different times to share their experiences. Sometimes I approached them if I was unsure about the activity, and the children shared with enthusiasm what they were doing. As stated earlier I recorded those conversations in the journal too.

Behaviour Mapping Procedure: As part of the systematic observation, behaviour maps were recorded for a week which produced useful quantitative data regarding the

number and type of activities children were engaged in during outdoor classes and play. This also produced visual information about the pattern of use for different settings of the school ground. The behaviour mapping data collection involved observing 29 children of the treatment group during their formal learning in 10 observation sessions for seven days at T3 and the children of the whole school during their informal learning in 17 observation sessions each at T1 and T3. The teachers did not use the school ground for outdoor teaching. Therefore, no behaviour maps were produced at T1 for formal learning.

At T3, the teachers regularly took the children to the school ground for teaching the content of science and mathematics based on the requirement of the content and the weather conditions. Table 5.3 shows the weather condition during each day of the behaviour mapping of the outdoor classes at T3. Table 5.4 and

Table 5.5 show the weather conditions during each day of the behaviour mapping of children's activities during break time before and after intervention respectively. Temperature varied throughout the observation period ranging from 24-30°C at T1 and 23-34°C at T3. The weather condition at T1 was more comfortable with no rains, whereas it varied even during those seven days' period at T3. It was raining heavily during the morning on three days and several nights which could affect the number of children in the school ground. During that period of the year primary schools generally have fewer children present than other times. The children are also engaged in different kind of activities in different seasons based on the weather conditions, certain games are only played during the winter i.e. *dariabandha* and badminton. This issue was also reflected upon later in Chapter 8 and Chapter 9.

Table 5.3: The weather condition during behaviour map data collection of outdoor classes at T3

No	Date	Day	Time	Temp. (°C)	Humidity (%)	Weather condition
1	06/05/2015	Wednesday	Mathematics class	31	55	Sunny
	09/05/2015	Saturday	Science class	30	74	Partly cloudy
2			Mathematics class			Partly cloudy
3	10/05/2015	Sunday	Mathematics class	29	66	Raining
	11/05/2015	Monday	Science class	24	83	Partly cloudy
4			Mathematics class			Partly cloudy
	12/05/2015	Tuesday	Science class	23	88	Sunny
5			Mathematics class			Sunny
	13/05/2015	Wednesday	Science class	26	83	Sunny
6						
7	14/05/2015	Thursday	Science class	34	63	Sunny

The procedure for gathering the behaviour mapping data varied for formal and informal learning activities. There is no established protocol for collection of behaviour mapping data during formal learning and the teaching of the curriculum on a particular day depended on several factors including the topic for teaching on a particular day. During the outdoor classes, each day's task was different and the teachers were responding to the situations arising in the class, so it was not possible to prepare a behaviour mapping schedule beforehand for outdoor learning. Though the behaviour mapping data collection for informal learning or play followed the track of previous research (Cosco, 2006; Goličnik, 2005; Malone & Tranter, 2003; Zamani, 2013), it deviated a little from the established protocol. I adopted an exploratory approach for behaviour mapping during both the periods in order to best answer the research questions.

Behaviour mapping procedure for formal learning: I positioned myself at a location from where the activities were visible and the conversations between the teacher and the children were clearly heard. I had a scaled map of the school ground pasted on my field journal where I mapped the location of the children and teachers with notes of what they were doing and for how long. I also recorded interesting conversations between teachers and children. My research assistant video recorded the whole session to be used later on for any confusion or missing data. Again, the children were engaged in group activities at different settings at the same time. In those cases, I started recording in the closest setting and moved to the next setting clockwise when it was done. Not using any pre-defined coding schedule enabled me to open code children's interaction with different elements for different learning areas of the school ground. Three separate behaviour maps were produced during each outdoor teaching session in order to record children's location and movement in and between different behaviour settings. Children's locations were recorded five minutes after the class started, 20 minutes into the class, and five minutes before the class finished, following the structure of the class illustrated in the results part of the thesis. At the end of each outdoor teaching session, I wrote important points answering the questions stated above in the field journal.

Environment behaviour researchers suggest recording of answers to specific questions during 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 were

considered to make those maps meaningful. ‘*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 to make the maps useful (Zeisel, 1984).

Behaviour mapping procedure for informal learning: Behaviour mapping procedure during the breaks was developed followed the track of previous research as stated earlier. Behaviour mapping symbols (see Appendix 6A) were used to record type of user (girl or boy) and the activities of the children. I also recorded physical elements (if anything brought by the child) and interaction with adults. At T1, the whole school ground was divided into two observation zones to position in a pre-defined place for easy scanning of the behaviour settings. I positioned myself at one observation zone systematically scanned the whole school ground recording each child’s location in a scaled map of the school ground (see Figure 5.7). During that time my research assistant positioned herself in a predefined location in another observation zone to video-record the whole session. After finishing with behaviour mapping of one observation zone, I moved to the next observation zone. As the school ground was designed as a combination of different behaviour settings, at T1 all the behaviour settings were pre-defined for mapping.

Table 5.4: Weather conditions during behaviour map data collection of children’s informal learning activities at T1

No	Date	Day	Time	Temp. (°C)	Humidity (%)	Weather condition
1	20/10/2014	Monday	Lunch break	24	95	Sunny
2	27/10/2014	Monday	Before school	26	65	Overcast
			Lunch break			Overcast
3	28/10/2014	Tuesday	Before school	25	78	Sunny
			Lunch break			Sunny
			After school			Sunny
4	29/10/2014	Wednesday	Before school	26	72	Sunny
			Lunch break			Sunny
			After school			Sunny
5	30/10/2014	Thursday	Before school	27	80	Sunny
6	01/11/2014	Saturday	Before school	30	43	Partly cloudy
			Lunch break			Sunny
7	03/11/2014	Monday	Before school	30	55	Sunny
			Lunch break			Sunny

Table 5.5: Weather conditions during behaviour map data collection of children's informal learning activities at T3

No	Date	Day	Time	Temp. (°C)	Humidity (%)	Weather condition
1	06/05/2015	Wednesday	Before school	31	55	Sunny
			Lunch break			Sunny
2	09/05/2015	Saturday	Before school	30	74	Partly cloudy
			Lunch break			Partly cloudy
			After school			Overcast
3	10/05/2015	Sunday	Before school	29	66	Raining
			Lunch break			Sunny
4	11/05/2015	Monday	Before school	24	83	Raining
			Lunch break			Partly cloudy
			After school			Overcast
5	12/05/2015	Tuesday	Before school	23	88	Raining
			After school			Sunny
6	13/05/2015	Wednesday	Before school	26	83	Sunny
			Lunch break			Sunny
			After school			Sunny
7	14/05/2015	Thursday	Before school	34	63	Sunny
			After school			Sunny

As stated earlier I did not interrupt the children's actions during the observation. However, some rule games played by the children had both cognitive and social aspects and occasionally I was uncertain of some children's play behaviour. Therefore I followed the data collection protocol during behaviour mapping by Pack & Michael (1995) mentioned in Zamani (2013), I sometimes conducted a short interview following the observation. If I wanted to know about the child's actions I approached the child and asked what he or she was playing right after recording the behaviour on the map. I wrote down the explanation from the child while coding for the behaviour. The study did not apply any handheld devices to enable me to open code any behaviour that was not included in the behaviour mapping schedule

Some rural games were played using several settings and children were continually moving between the adjacent settings. For example, as part of the game '*pata pata*', children collected leaves from gardens and dug those in the open yard. In those cases, the type of activity occurred in one specific setting during the observation period was recorded and children's movements between settings were marked on the maps using dotted lines. An inventory of the folk games along with the way they were played is given in Appendix 6C.

The children’s activity was carefully observed in order to avoid any duplication or multiple appearances of the same child. On average, around 15 to 85 children were present in the school ground at any one time.

Due to limitation of time, it was not possible to train the research assistant for data gathering using behaviour mapping. Therefore, the data were collected by a single observer i.e. me, this had potential for ‘drift’ between rounds of observation at each T1 and between Ts. In order to address this and ensure the reliability of the method, all the observation sessions were video-recorded by my research assistant. The videos were used as a means of independent verification which enabled me to go back and forth between the paper maps and videos during behaviour mapping analysis for re-checking.

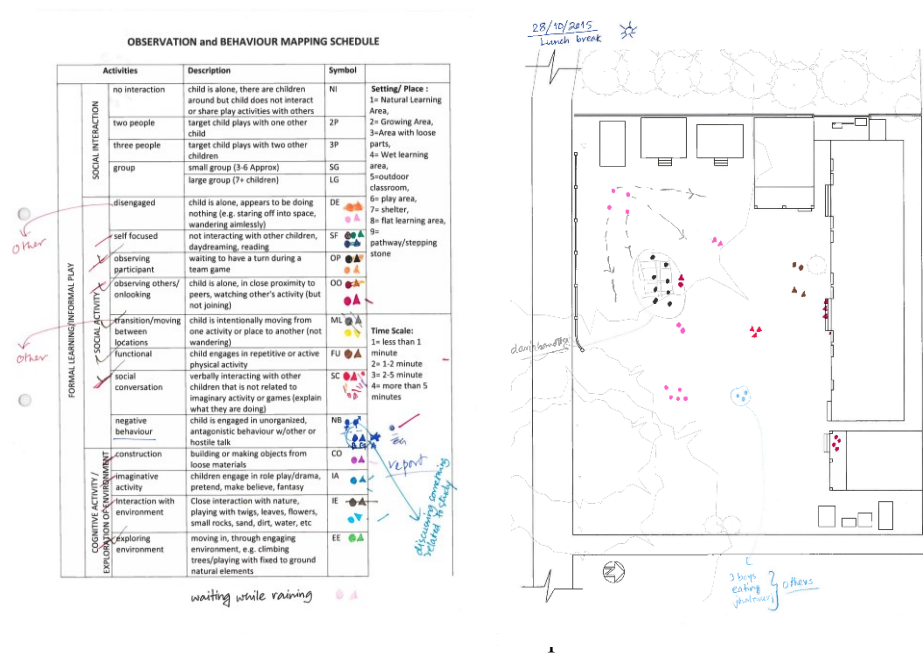


Figure 5.7: Behaviour mapping during lunch break on one observation day

5.2.4 Focus groups

Focus group discussion is a useful tool to elucidate qualitative information about the use of outdoor environment. The purpose of focus group discussion before intervention (T1) was twofold – 1) to learn how the school ground and the neighbourhood open spaces were used to complement the observational data and 2) to generate ideas regarding the design of the outdoor environment that would be conducive to learning. The focus group discussion conducted after the intervention was aimed at gathering data on children’s use of different settings for learning and play and underlying reasons for any expected change in behaviour.

Separate focus group discussions were held with children, teachers and parents. All the focus group discussions were recorded with permission from the teachers and children.

5.2.4.1 Focus groups with children

26 children from Grade III (Section B) of the intervention school participated in six focus groups in October 2014. The number of participants in each focus group varied from four to six children to ensure participation of each child in the group discussion (Krueger & Casey, 2009). The first focus group comprised an equal number of boys and girls; the purpose was to get a wide range of information from a mixture of male and female children of the same age group and same class. However, it was found that children were more comfortable working in the same sex group even though they knew each other, confirming findings from previous studies (Greene & Hogan, 2005). The remaining five focus groups consisted of single sex groups — three female and two male groups. All the discussions were audio-recorded with permission from the children, and a research assistant was present to take notes on non-verbal expression and group dynamics in order to *'enhance the understanding of the discussion'* (Greene & Hogan, 2005, p245). The focus groups were conducted outdoors in an informal setting, taking un-used benches from the classroom so that the children did not think of it as 'school work' (Darbyshire, MacDougall & Schiller, 2005, p421). The post-intervention focus groups were held in one of the huts, which provided the affordance of an intimate informal discussion.

Another six focus groups were conducted with the same group of children in the evaluation phase in May 2015 in order to gather qualitative data on the way different settings in the outdoors had been used by the participants in order to evaluate the design and come up with recommendations. However, this time three additional focus group discussions were conducted with 14 children from Section B in three groups in order to learn the views of the children who did not participate in the design but used the designed school ground for informal play during break time.

At the beginning of the focus group discussion, as an ice-breaking exercise, the children were asked to make their own badges and clip them onto their uniform. We also made a badge of our names and put it on our dresses to guide them. The second ice-breaking exercise was to say everyone's name, which was recorded and played for children to hear how they sounded. The children were excited to hear their voices on the recorder. Some children's voice could not be heard well on the recorder, so we repeated the exercise. The

children spoke louder the next time and this also made them prepared for the main discussion.

The group discussions were semi-structured around a set of questions (see Appendix 7A-F) but the questions offered openness and let the children take their time, talk and giggle. During the pre-intervention focus group sessions, the intention was to make them feel comfortable and loosen up, and to express their preferences and desires regarding their dream school ground. There was an attempt to generate interactive conversation and discussion between the participants in order to elucidate a range of ideas. The children were first asked about their favourite activities and places in the school ground and the neighbourhood, before going deeper in order to learn more about their experiences in the school ground (Fargas-Malet et al., 2010). At this point, the students were prepared for the next exercise — a combined drawing as described in Section 5.2.5.1. During the post-intervention focus groups, the children were more spontaneous and comfortable with sharing their experiences with us. However, the protocols were maintained and the same procedure was followed across all the groups both times. Based on the outcome of the pilot study I planned to use a Google Earth image of the school ground during the focus groups to stimulate the discussion. However, a clear image of the school ground was not available in the Google Earth, therefore a scaled plan of the school ground (as built) was used after the intervention. At the end of the focus groups the children were given chocolates as a token of appreciation.

5.2.4.2 Focus groups with teachers

The focus groups with the teachers were conducted in two separate sessions during lunch break on weekdays. Nine teachers participated in two focus groups. All the focus groups were conducted inside the office room. The pre-intervention focus groups were conducted in November 2014 and focused on learning teachers' preferences for places, taking classes outdoors and barriers and challenges regarding outdoor teaching. Another purpose of focus groups before intervention was to brainstorm together how the school ground could be improved, by discussing what elements were needed to conduct classes in the school ground. The semi-structured focus groups discussed an outline of questions but offered opportunities to take time, think and discuss with each other. We listed the elements mentioned by the teachers that they would have liked to have in the school grounds for teaching the curriculum. They also mentioned different playground equipment that they thought necessary to attract children to the school. After primary listing of elements, a series of

pictures was shown to the teachers in order to give them exposure to outdoor teaching practices in other countries and liberate their ideas (see Appendix 3). The teachers carefully considered those pictures and also discussed their applicability to the context of Bangladesh. In the course of the discussion, they came out with ideas suitable for teaching in the climatic and cultural context of Bangladesh.

We listed the elements and grouped them according to their qualities and characteristics. At this stage I introduced the theory of behaviour settings and, along with the teachers, organised those elements into groups based on certain settings of the school ground. This helped teachers to think about further elements. Once the elements were grouped and included within a specific setting, the settings were named. The teachers then located the settings within a scaled plan of the school.

After intervention in May 2015, only one focus group discussion was held, with seven teachers. The teachers who did not take part directly in outdoor teaching participated in the focus group discussion, while semi-structured interviews were conducted with the teachers who were teaching in the school ground. The purpose of the focus groups was to learn about their views regarding overall change in the children of the school because of the intervention and their opinions on the way the outdoor environment could be used for teaching curriculum content other than mathematics and science. The teachers were asked to evaluate the design and whether there was any scope for further improvement of the design. The same protocols were maintained across all the focus group discussions before and after the intervention.

5.2.4.3 Focus groups with parents

Before beginning my field research in the school, it was necessary to convey my research project to the parents, which would also help to attain their consent for involving their children in the research. A meeting was arranged with the mothers of the children, which was also included as a *ma-somabesh* or ‘mothers’ meet’¹¹ in the school’s meeting resolution book. This platform seemed suitable to share what I wanted to do and learn about mothers’ opinions. After the meeting I invited willing mothers to participate in a focus group discussion. Five mothers participated in one focus group, which yielded useful information

¹¹ ‘Mothers’ meet’ is a regular meet up with mothers in the school where teachers inform mothers how their children are doing and discuss on how things can be improved or how the children can be attracted to school who are irregular (this is a Government policy to engage the mothers in matters related to their children).

about children's attitudes to attending school and the potential elements in the school ground that could attract children to school.

After intervention, another meet-up was arranged with the mothers relating to the follow-up of the design and use of the school ground to see if the mothers observed any change in their children and how they felt about the whole process in May 2015. After the meetup, a focus group discussion was conducted with five parents and guardians¹² to discuss in detail what they observed in the children and what they thought were the underlying reasons behind that. The guardians were also asked how they would evaluate the design and use of the school ground and whether they had any suggestions for further improvement of the primary school grounds.

5.2.5 Visual methods

5.2.5.1 Children's drawing

At the end of each focus group the children were asked in groups of five or six to make a combined drawing of their school ground as they wanted it to be, including different elements they would like included and activities they would like to be engaged in with their peers or alone on a 20" x 30" sheet of paper. All the materials – pencils, erasers, sharpeners, crayons, markers and coloured pencils – were provided. The children were given full authority to draw whatever they would like to have in their school ground. They were also asked to include elements they thought it would be helpful to learn either from textbooks or elsewhere and the activities they would like to be engaged in with their peers or alone. While drawing, children interacted with each other, discussed what they wanted and also conveyed their desires to us. After they had finished their drawings the children were asked to explain their drawings of the dream school ground. The children were also asked whether any of the elements they wanted in the school ground had any implications for their learning of curriculum content. This collective drawing was used as a liberating exercise for mapping and modelling of the school ground and as the primary tool for creating a visual image of children's preferences regarding their school ground.

5.2.5.2 Model-making workshop

A model-making exercise was held in the school ground on 29 November 2014. The date was pre-set so that all the teachers could be present. In order to liberate the children's ideas

¹² Children's aunts and grandparents who attended the meeting in place of their parents.

and boost their confidence, two very short video clips were shown to them. In one of the videos, children were making things they liked in a pop-up playground, while another one was about a school ground where children were engaged in different activities, making things and playing. The main objective was to acquaint children with the idea that they could build things out of many different elements. Five children (three girls and two boys) were selected from the six focus groups. Each child represented a group and was selected based on their ability to translate ideas in a visual media. The children had been asked who wanted to participate in the exercise and five among the willing children were selected by me.

The children were provided with materials appropriate to the culture and context of Bangladesh to organise on a 1:50 scale base model of the school ground. Diverse materials were provided, with some materials allowing great flexibility in their meaning so that children had the scope to try different themes. I helped the children with cutting pieces or sharpening objects when they asked. Two teachers also participated in the workshop. Though the principal performers were the children, there were some negotiations between children and teachers. The modelling process was video-recorded for further analysis and for finalising the design with input from the teachers.

5.2.6 Semi-structured interviews

Two teachers who were involved in teaching science and mathematics to children in the outdoors were interviewed after the intervention in May 2015 in order to gain an in-depth insight into the influence of the designed outdoor environment. A structured questionnaire was used for interviewing the teachers (see Appendices 4A and 4B). However, I utilised the freedom to ask follow-up questions in response to any interesting or unexpected points made by the teachers.

The first part of the outline asked the teachers general information about their teaching experience, academic qualification and whether they had any training related to teaching and outdoor teaching, followed by questions that examined change in attitudes and behaviour on the part of both children and teachers after outdoor learning had been introduced in the school. This led to questions relating to teachers' preference of design features in the outdoor environment, benefits and challenges of using the outdoors as a teaching environment. The interview outline was concluded with questions about teachers' overall opinion about the project.

The teachers were interviewed inside one of the huts, from where all the settings of the school ground were visible. The huts were the only place in the school premises for any such activity other than the classrooms and office works. Interviewing participants inside a room removes them from the environment the researcher is interested in studying (Silveirinha de Oliveira, 2011). Conducting the interviews within the environment under consideration was explored in this study as a useful tool to explore different dimensions of place and examine teachers' experiences, interpretations and practices. 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). However, in this study, where the scale of the environment was small, interviewing the participants in the huts with a clear view of the school ground served the purpose. The teachers often referred to and pointed towards different settings and elements while talking about particular occurrences using those elements or in those settings.

5.3 Data analysis

The rich sets of data collected from the range of methods described above were analysed separately and presented in separate chapters. A summary of the data analysis process and the variables measured is shown in Table 5.6.

Table 5.6: Data analysis process

Methods	Variables Measured	Analysis
Exam scores	Learning (academic attainment)	Independent sample t-test, paired sample t-test, one-way ANCOVA, MANOVA
Questionnaire survey	Motivation, perceived exploration of the environment and peer relation	
Participant observation and behaviour mapping	Learning and play behaviour, place use	Descriptive statistics and sequential analysis
Visual methods	Preferences of children, teachers and parents	Content and thematic analysis
Focus groups	Learning and play behaviour, place use, place preferences, children's and teachers' behaviour, attitude and learning	Thematic analysis
Interview		

5.3.1 Analysis of data from exam scores and questionnaire survey

The quantitative data generated from the exam scores and the questionnaire survey were analysed using an SPSS program at several levels. After entering the data into the program, the normality of the data was checked to decide whether a parametric or non-parametric test would be undertaken. An independent samples t-test was undertaken to find out whether there was a significant difference between:

- 1) the treatment group and the control school
- 2) the treatment group and the comparison group (within the intervention school) and
- 3) the intervention school and the control school

before and after intervention.

Afterwards, in order to find out whether the treatment group children's responses differed for the indoor and outdoor environment, a paired samples t-test was conducted. The influence of the change in the outdoor environment on children's attainment was measured comparing the data between the above stated groups after intervention using a one-way ANCOVA, taking into consideration the scores administered prior to intervention. MANOVA was used to investigate sex differences within the treatment group because of the change in the environment. The details of the data analysis process are given in Appendix 8A.

5.3.2 Analysis of data from participant observation and behaviour mapping

The ethnographic data (field notes and photographs) and the behaviour maps produced during the participant observation were analysed separately. The behaviour maps were analysed using descriptive statistics in order to identify quantitatively the difference in the number of children in the school ground and the type of activities in which they were engaged during formal and informal learning sessions both before and after the intervention. The descriptive statistics of the behaviour mapping data were summarised in terms of frequency of children in the school ground at different times of a regular school day, percentages of different types of activities in which children were engaged and percentages of girls and boys in those activities in the whole school ground and in different settings before and after the intervention. The descriptive results for children's use of the settings for formal learning were presented as frequency of occurrences of activities rather than number of children.

The ethnographic data were analysed using an iterative process where ideas were used to find the meaning of the data and the data were used to change the ideas, considering there is no specific procedure for the analysis of ethnographic data (Hammersley, 2007). However, the results from both processes were presented together to give a whole picture of the use of the school ground before and after the intervention. The study followed Hammersley (2007) and Waddington (2004) during analysis to find the meaning of the rich data by dividing the data into elements and components to find patterns and relationships for understanding of the events and testing of hypotheses. Later on, these elements were reassembled in order to explain the structure of the classes, how different settings were used in teaching and learning in mathematics and science classes and how children used different elements and settings for different activities during lunch time and outside class hours. The data were used to complement the results from descriptive statistics and presented together to provide the whole picture of the story. A more detailed process of analysis is provided in Appendix 8B. The descriptive results for children's use of the settings during formal and informal learning are given in Appendices 9A, 9B and 9C.

5.3.3 Analysis of the data from visual methods

A quantitative analysis of children's drawings was done according to the number of different elements that were included in the drawings. *'This provided a measure of the complexity and accuracy of children's visual representations'* (Christidou et al., 2013, p63). A percentage of different elements with respect to the total number of elements in the six drawings from the six separate sessions gave an indication of the preferred elements. The analysis of the model-making exercise included a thematic analysis of children's and teachers' conversations, and a content analysis of the model prepared by the children and the teachers was conducted to find out the elements and settings and their probable locations in the school ground.

The data generated from children's conversations during the combined drawing and model-making workshop were analysed using thematic analysis in order to capture the complexities of meaning from the data gathered from a range of methods (Guest, MacQueen & Namey, 2012, p13). The data were analysed by combining the matrix and template process following the same procedure used for analysing the data from focus groups and interviews detailed in the next section.

5.3.4 Analysis of the data from focus groups and interviews

Appropriate methods should be chosen to analyse the data in any research, however particular care should be taken while interpreting children's views (Punch, 2002). The qualitative data generated from focus groups with children, teachers and parents and interviews with teachers were analysed using thematic analysis. One of the benefits of thematic analysis is the flexibility in the process; it is not theoretically bounded like grounded theory or interpretive phenomenological analysis (Braun & Clarke, 2008). The approach of analysis was twofold — confirmatory (confirmation of hypothesis i.e. change in children's motivation, behaviour and attitude) and exploratory (content driven — the underlying stories of the way the design of the school ground influenced children's and teachers' behaviour).

The thematic analysis is more recursive than following one phase to the next and involves a constant moving back and forth throughout the whole process (Braun & Clarke, 2008). This study combined the matrix and template process with the thematic analysis entailed by King (2010). The outline of the focus groups and semi-structured interview questionnaire that guided the application of the methods during the field survey, was prepared around several general themes. During the analysis these themes were used to form the headings of the preliminary matrix structure (see Appendix 10A-C). Each question under a general theme formed a sub-theme which turned into a sub-heading in the matrix structure. The empirical data from the focus groups and interview were then assessed and organised under the headings and sub-headings of that matrix structure. The extracts from the focus groups and interview data were put under those themes/headings using supporting quotations. However, the themes and subthemes in the matrix were not rigid. I redefined, added or subtracted subthemes or overarching themes based on the content throughout the analysis process.

A template was developed based on the themes from the matrix which formed the content of Chapter 10 i.e. results from focus groups and interviews. The analysis required going back and forth between the template and matrix and the findings were presented in a hierarchical way using the main themes as headings. Writing was an integral part of the analysis process from phase one — jotting down the ideas, potential coding schemes, themes or subthemes continuing right through to presentation of the results. The main themes contained various sub-themes which formed the sub-headings for the chapter. Sometimes the sub-heading also had several attributes.

5.4 Summary

IS was selected as the intervention school, as it was typical of Government primary schools in Bangladesh with children from lower middle and low-income socio-economic backgrounds. In addition, teachers from the school expressed their interest and enthusiasm in participating in the research. CS was selected as the control school, as it was comparable when cross-matched on the criteria of demographics, academic competence, age and sex. Grade IV children were selected for the study, as they had already developed the skills of expressing their preferences in a range of methods and their learning was best associated with exploration of the environment. They were also the most vulnerable to dropping out.

Once the permissions from the DPE and consent from the parents were received, data collection started, following the appropriate research protocols. The pre-intervention data were collected during October and November 2014. The findings from visual methods and focus groups, which provided ideas for design and development of the school ground (these took place in December 2014 and early January 2015), are illustrated in the next chapter. The post intervention data were collected in May 2015 after five months of the intervention. Different objects and props (e.g. visual stimuli) were used during the application of different methods to elicit valuable information from participants of different age groups.

Pre and post-intervention data from different methods were analysed in accordance with the methods. Statistical analysis of the data from exam scores and questionnaire surveys was followed by descriptive statistics and sequential analysis of the data from participant observation and behaviour mapping. The data from visual methods were analysed both quantitatively and qualitatively using content and thematic analysis respectively. The thematic analysis was also applied to the rich and complex data set produced from focus groups and semi-structured interviews.

Chapter 6 Design and construction of the school ground

While the previous two chapters of this part of the thesis presented the strategies and methods adopted and executed for this research, this chapter describes how the school ground was developed as the experimental setting for application of methods after the intervention. The design of the school ground adopted a unique approach – combining evidence from previous research (illustrated in Chapter 2, Section 2.3) with ideas from children, teachers and parents (information elicited through application of focus groups and visual methods as explained in Chapter 4 and Chapter 5) to identify a set of behaviour settings or learning areas (guided by the theoretical framework presented in Chapter 2, Section 2.1.4). The behaviour settings were termed learning areas by teachers, as certain behaviour episodes or learning activities could be held within each setting. The settings were laid out on the school ground based on specific site conditions to form the preliminary design of the school ground, leading to detailed design and construction. Teachers, children, parents, community people, a local architecture consultancy firm and architecture students participated in different phases of the development. The whole process is illustrated in Figure 6.1, which is followed by a description.

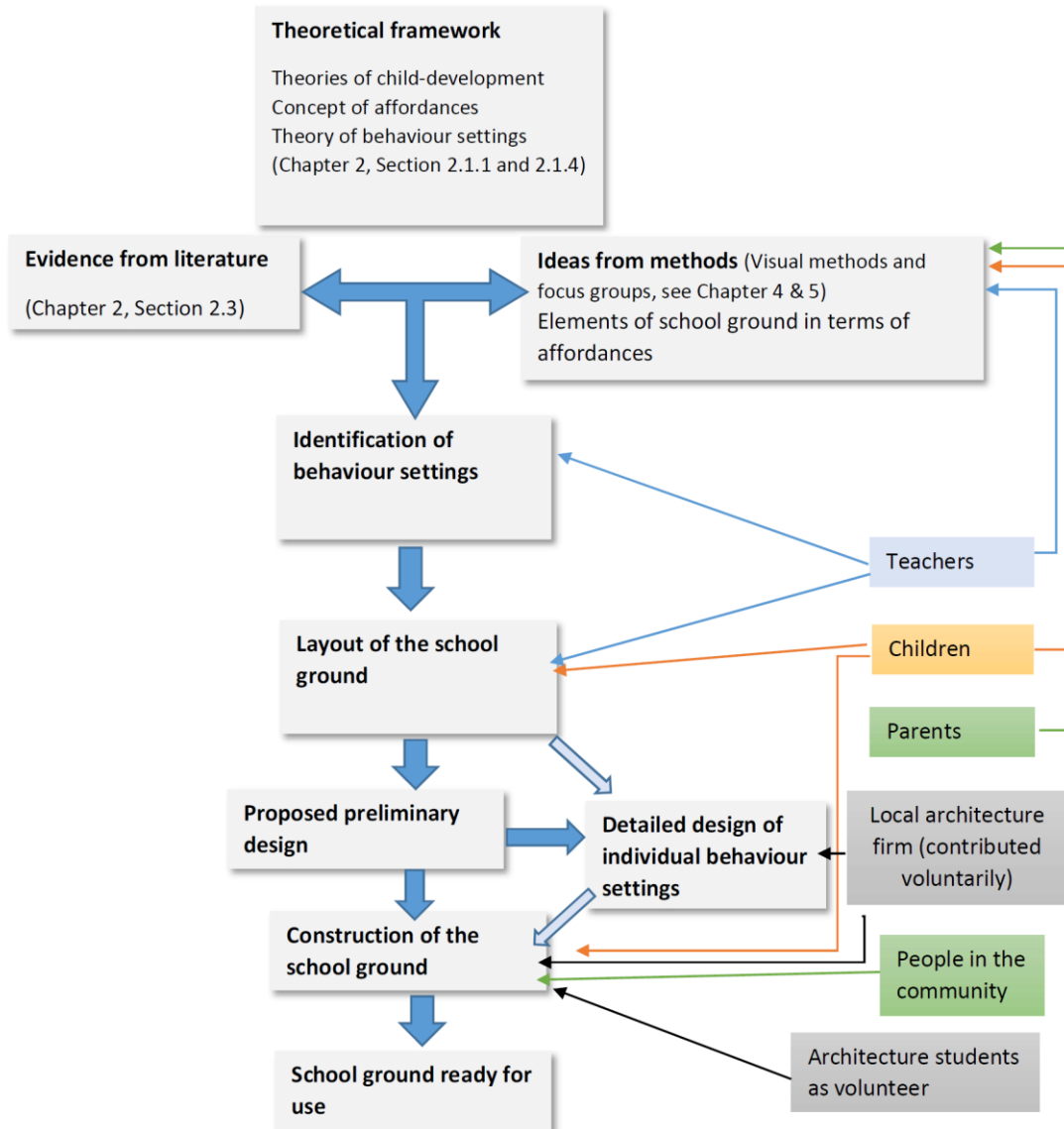


Figure 6.1: Design and development process of the school ground

6.1 Findings from the methods: ideas for an outdoor learning environment

From the analysis of focus groups with children assisted by drawings, conversation during the model-making workshop and focus groups with teachers and parents, six themes emerged. The elements (see Table 6.1) from children’s drawings can be grouped under these themes based on children’s desires or the functionality of these elements and relation with learning as indicated in children’s explanations of their drawings.

Table 6.1: Elements of school ground that appeared in children's drawings

Depicted elements	Frequency	Percentage	Explanation
Light	5 (225)	2%	Light
Natural elements (trees, plants, grass)	30 (225)	13%	Affinity with nature Exploring
Living elements from nature (birds, fish, butterflies)	16 (225)	7%	Shade/fresh air/physical comfort
Gardens	29 (225)	13%	Affinity with nature Aesthetics of the school Socialising Pretend play/dramatic play
Fixed play equipment	26 (225)	12%	Physically active
Play objects	38 (225)	17%	Rule games Socialising Physically active
Loose materials	6 (225)	3%	Pretend play
Open yard	13 (225)	6%	Rule games Socialising
Water	14 (225)	6%	Affinity with nature Pretend play Exploring
Seating area	1 (225)	0%	Socialising
Children	25 (225)	11%	Socialising Reference
Shelter	11 (225)	5%	Security Private place Socialising at intimate scale
Reference	11 (225)	5%	Sense of belonging

6.1.1 Natural learning area – to connect with nature, to explore and to learn from nature

Children's drawings of different types of trees (e.g. large trees providing shade, fruit trees, flowering plants and grass) and various living elements from nature (e.g. birds, fish and butterflies) demonstrated their desire for natural elements. Trees appeared most frequently in their drawings. 20% of the elements of their drawings included natural elements – trees and living elements from nature. Types of vegetation in children's drawings included flowering plants, trees giving fruits and trees providing shade, with total mentions of 52%, 16% and 32%. As the school ground was not large enough to have a small woodland, the teachers suggested having a green fence; the boundary with hedges and plants could be a place for

learning as well. Children wanted large trees under the shade of which they would be able to play in the fresh air. The value of natural phenomena like plants and animals in the outdoor environment to children has also been identified in previous research (Titman, 1994; Moore & Wong, 1997; Tranter & Malone, 2004; Clark, 2007). According to the teachers, in addition to giving shade, trees and plants could enhance the learning environment and were necessary for teaching science.

‘The most contents of the science curriculum are related to nature — learning about animals and plants.’ (Science teacher)

Teachers recognised natural environments’ affordances for learning science and other subjects. This opportunity, not always explored in full, has also been highlighted by other researchers in Europe and the USA (Moore & Wong, 1997; Dismore & Bailey, 2005). Children were also aware of the educational value of natural elements; they exclaimed that they could learn about different plants. A girl showed her understanding of the relationship between plants and animals by drawing a beehive and bees in one of the trees in her drawing (see Figure 6.2). Children showed preferences for plants with which they could interact — they could pluck flowers and fruits or smell the fragrance of flowers. This harmonises with findings from Noradahl & Einarsdóttir (2015) and Merewether (2015). The drawings also revealed children’s awareness of plants’ functions beyond giving shade, fruits and flowers — the capacity to attract wildlife (e.g. butterflies, birds and bees) echoing findings from Aziz’s (2014) PhD thesis.



Figure 6.2: A child’s drawing of the school ground showing interdependence of plants and animals (tree and beehive)

Further to the exploration and interaction with the natural environment and plants, children also drew rivers and ponds with fish, boats and water lilies. 8% of the school ground elements from their drawings consisted of water bodies that they wanted to explore and enjoy: *'I want to play with fishes and ducks in the water'* (Girl 2) (see Figure 6.3). According to the teachers, having a water body in the school ground would not only be enjoyable and entertaining for children, but also educational. They thought that a water body had the potential to be used to teach children the flow of water and water cycle, which was taught in upper grades.

Teacher Ms R: Children love water

Headmaster: It would be really wonderful if there was a water body in the school ground. We did not consider it before.

Mathematics Teacher: Children can learn buoyancy easily.

Headmaster: They can learn about gravity and flow of water if we can use water tubs of differing height.

Science teacher: Children themselves can put fish and plants into water and observe how fish live in water.



Figure 6.3: A drawing showing children engaged in play with natural and manufactured play equipment

6.1.2 Gardens – growing for aesthetics, imagination and agency

Children primarily associated gardening with the aesthetics of their school environment. 13% of the elements of children's drawings included flowering plants and floral patterns, and more than 50% of the plants in their drawings comprised flowering plants. Children used bright colours to draw various flowers. The teachers had the same opinion as the children, as mentioned by the science teacher: *'The beauty of the school will increase. This will not only*

enlighten the children but also enrich others. Children's fascination for aesthetics in the outdoor environment has not received much research attention; however, Billmann-Mahecha & Gebhard (2009) and Titman (1994) report in their studies that children find flowers necessary for aesthetic (beautiful), atmospheric (nice-smelling) and restorative reasons (making people happy). Alongside aesthetics, being able to explore and interact in and around the flower garden was also important to the children. While adorning themselves with flower ornaments children would like to engage in pretend play with their friends.

Girl 1: The school would be beautiful if there was a flower garden (while drawing a garden; see Figure 6.4)

Girl 2: We can come inside the garden, sit under a flower plant and have fun. We can play, we can play tag and chat with our friends. We can play with flowers. We can wear flowers in the ears.

Me: Do you think there is any educational benefit of the garden?

Girl 4: I think so. We can learn how to grow plants and take care of plants.

Their conversation indicates children's awareness about the educational benefits of having a garden in the school ground. According to the teachers, gardening or growing flowers and vegetables could bring benefits to the children in two ways. Firstly, engaging children in growing plants could create an agency in them that would make them motivated towards learning: *'The children will participate. They will have fun this way.'* (Science teacher). The parents also related the experience of gardening to creating agency and having fun; as Mrs N said:

'When we were kids we used to do gardening in school. There were more opportunities for fun in the school through different activities like this which is rare nowadays. I think that is a reason for losing children from school. There should be gardens in school.'

Secondly, the children would be able to learn through this process: *'Students can be engaged in sowing the seeds. So they can learn how plants grow from seeds.'* (Mathematics teacher). Most children in rural primary schools come from an agriculture-based background, therefore the knowledge of sowing seeds and planting is important. The affordances of gardens for learning through the participation of children in sowing seeds and growing plants in the gardens have also been researched by Graham, Beall, Lussier, McLaughlin & Zidenberg-Cherr (2005) and Passy (2014). This learning process is what Dewey (1963) defined as experiential learning, meaning learning through experience and experiment.



Figure 6.4: A child's drawing of the school ground with a fenced flower garden

6.1.3 Play area and play objects – being physically active

Children expressed their attraction for fixed playground equipment like swings, slides, see-saws and different animal figures to ride on, among which swings appeared the highest times followed by slides. 12% of their drawings included some kind of play equipment. Most of the children did not know the names of equipment like slide and see-saw and tried to explain them by their attributes, which indicates the fascination of rural children in developing countries for the playground equipment that they generally do not have in schools or parks. This was also echoed by parents, who found that Government primary schools in Bangladesh were lacking in sufficient opportunities or elements to keep children in school: *'The school lacks play equipment that can keep students there. My kid wants to go to the private school – they have slides and swings'* (Mrs T). According to the teachers, by providing playground equipment, the school could attract the children who tended to leave school during lunch break and did not come back: *'There must be something to attract children, so that they don't leave school during lunch break. The playground equipment can be there for their recreation and fun'* (Headmaster). Though pieces of playground equipment are not the best tools to demonstrate a range of learning activities, the teachers thought that they were necessary for children's physical development and school retention. Children's interest in playground equipment and different play objects demonstrates the developmental needs of this age group and the importance of both natural and built features in children's environment (Noradahl & Einarsdóttir, 2015).

17% of the elements in the drawings included play objects that were used for organised games with set rules, as well as folk games played in groups and alone. Play objects, i.e. footballs, cricket bats, cricket balls, rackets, feathers and nets indicate children's

desire to be engaged in games with set rules and also to be in contact with others, as all of these games were to be played in groups or teams. Children also drew playground markings for playing hopscotch or *dariabandha* in the open yard. Six to twelve-year-old children's interest in rule games and pretend play (Bell, 2008) demonstrates their interest in being social and interacting with friends. From further conversation with the children it was revealed that children read about different rule games and folk games in their textbooks: '*We can learn how to play different games*' (Boy 1). This indicates the cognitive aspects of different games.

6.1.4 Places to be in contact with others and also to be alone

12% of the drawing elements consisted of figures of children, which emphasises the fact that children were the principal users of the school ground and would like to be engaged in solitary play or to play in small or large groups. Children wanted to have play equipment that encouraged two or more children to play together, and their drawings of different rule games like *sotiner put* in the open yard included four or five children (see Figure 6.3). This also indicates their sense of belongingness to an environment which provides them with the opportunity to interact with their peers, leading to learning. As Vygotsky (1993, p35) states, '*Learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in co-operation with others.*'

The findings also indicate that though children mostly mentioned activities they could enjoy with friends, they also felt the need to spend some time alone or interacting with friends in an intimate place, as indicated in Girl 1's explanation: '*I want to read story books in the house*'. She further explained, '*I want to chat with my friend inside the house too.*' This was echoed in teachers' opinions; they thought it was important to have a quiet place in the school ground where a child could take refuge if he was tired or intended to be alone: '*If someone wants to be alone or to be in a quiet place [they] can go here and contemplate.*' The teachers also mentioned the necessity of places to sit down and chat: '*A place is needed for them to sit outside...There is no place in the school ground where the children can sit and chat after coming to school.*' This is in harmony with other research findings that show evidence for the necessity of intimate places in children's outdoor learning environment where children can reflect and relax either alone or with their friends (Titman, 1994; Malone & Tranter, 2003a; Waller, 2006; Clark, 2007; Noradahl & Einarsdóttir, 2015).

According to the teachers, there could be a designated gathering area where a whole class could meet: *'It would be really beneficial if there is a gathering area. Sometimes we can take a whole class there'* (Headmaster). According to the teachers, the gathering area in the form of an amphitheatre would be a platform for children to present their work to their peers and could include a blackboard for display of their work. *'This is necessary to build a leadership quality in children'* (Headmaster). The teachers also suggested that the gathering area could not only be used for teaching a whole class and giving them instructions but also for programmes like mothers' meets or the book giving ceremony.

6.1.5 Area with loose materials – imagining, building and learning by themselves

The children expressed their interest in having manufactured and natural loose materials with which they could be imaginative and engaged in pretend play. A girl wanted to have small plastic ducks and fish in the small water body in order to engage in pretend play. Pretend play is important for the development of intelligence, creativity and social skills in children (Malaguzzi, 1993). As pointed out by other researchers (Moore & Wong, 1997; Malone & Tranter, 2003), provision of natural elements and loose materials in the outdoor learning environment can increase opportunities to be imaginative and creative. These loose materials were found useful by the teachers for teaching of mathematics and science. The teachers already had a collection of different loose materials that they used in the classroom to teach numeracy at lower grades; however, they thought they should open up those loose materials in a designated area where children could be creative and build things. According to the headmaster, the area that would contain all these loose materials could be called a 'self-learning area' as *'the children can learn by themselves in this area too without the guidance of the teachers outside class time.'*

6.1.6 Bringing all themes together – rich and diverse elements to arouse curiosity

According to the teachers, most children's experience in school is barely enjoyable, without any variation and surprise: *'There is nothing new in their school experience. They come to school, have their classes in the classroom and go back home. There is nothing here that can attract them'*. The teachers emphasised that the school ground needed to be rich with diversified elements that would arouse curiosity in the children. A school ground with diverse elements and settings can make the children happy at the sight of it and willing to explore; as the mathematics teacher said, a child should feel that *'I have to come here and*

discover what these things here are.’ Thus the researchers emphasised creating a mixed nature outdoor environment that included both natural and man-made features, offering diverse affordances to children (Cosco, 2006; Noradahl & Einarsdóttir, 2015).

6.2 Identification of behaviour settings

All the elements extracted from the above findings are listed and grouped based on their functionality and landscape characteristic. We took into account the way they could fit within different sub-settings of the school ground based on the theory of behaviour settings. The landscape elements were brought under seven primary settings, namely a natural learning area, gardens, an amphitheatre, a water learning area, an area with loose materials, an open yard, huts and a play area. A pathway was necessary to connect all of these behavioural settings. A summary table (see Table 6.2) is prepared with affordances of these behaviour settings including the way they afford both formal and informal learning.

Table 6.2: Behaviour settings in the school ground with their affordances

Sl	Settings	Elements	Affordances for informal learning activities	Affordances for formal learning	Functional Taxonomy of children's outdoor environment (Heft, 1978)
1	Natural learning area	Trees Plants Grass	Shade/fresh air/physical comfort Exploring Connection with nature	Collecting leaves for counting Learning about interdependence of plants and animals Building knowledge of plants and trees	Non-rigid attached object Swinging on
2	Gardens	Garden with seasonal vegetables, medicinal and ornamental plants Compost pit Tyre garden	Connection with nature Enjoyment of beauty or aesthetics Interaction with peers Pretend play/dramatic play	Participation in the process Building knowledge on how plant grows from seed, gives flower and fruits and reproduces Knowledge of different types of plants Learning about interdependence of plants and animals	
3	Amphitheatre	Seating Platform/stage Display/blackboard	Interaction with peers and teachers Sitting on Meeting of teachers and parents/community people	Context for learning through interaction with peers and more mature adults in any area of curriculum	Attached object: Sitting on Jumping-on/over/down/from
4	Water area	Water tubs Fish Water plants	Connection with nature Pretend play/dramatic play — floating objects Exploring — swimming, diving, boating, fishing	Learning water cycle Learning life cycle of aquatic plants and animals Learning pressure and flow	Splashing, pouring Floating objects Swimming, diving, boating, fishing
5	Area with loose materials	Plastic play materials, fruits and play stuffs made of clay, marble, seeds, tennis ball, different models made	Role playing Building of things Learning by oneself (through working on objects) Lateral learning (from other kids)	Collecting loose materials and learning numeracy — addition, subtraction, multiplication and division	Graspable/detached object Drawing, scratching Throwing Hammering, batting Spearing, skewering, digging, cutting

	of wood, animal figures	playing nearby) Construction of objects Painting		Tearing, crumpling, squashing Building of structures
	A store for loose materials		Learning about different soil type	Mouldable material: dirt, sand Construction of objects (e.g. pottery) Pouring Sculpting
6 Open yard	Smooth surface Playground marking for hopscotch	Rule games Assembly/physical education Plays that use marking Physical development through running, walking, cycling	Learning numeracy from playground markings	Flat, relatively smooth surface: Walking, running Cycling, skating, skateboarding
7 Play area	Swing Slide See-saw Gymnastic ring	Physical development/exercise/mastery Sliding/passage from one place to another Swinging Attracts children to school	Informal learning	Climbable feature: Exercise/mastery Looking out from Passage from one place to another
8 Huts	Sheds Seating	Taking protection from adverse climate Refuge or contemplation Interaction in an intimate scale	Context for working in groups on curriculum contents	Microclimate Prospect/refuge Privacy
9 Pathway	Stepping stones	Movement from one place to another	Learning numeracy from inscription on stepping stone	Locomoting from one place to another Looking and listening into adjacent place

6.3 Layout of the school ground

After grouping all the elements and identification of the behaviour settings, the teachers brainstormed the probable locations of all the settings considering the site situations and use of settings for teaching purposes. A detailed account of the way teachers rationalised the location of different behaviour settings in the site and the preliminary site layout is given in Appendix 11A. Afterwards, in the student-led model-making workshop, teachers and children worked together to come up with a three-dimensional model of the school ground (see Figure 6.5). The layout of a school ground (or the location of different elements and settings in a site) depends on specific site conditions — geography and landscape characters of the site. During the model-making exercise, children and teachers negotiated their points to ensure both were satisfied with the final version of the school ground. For example, the children placed the flower garden in the middle of the school ground; however, their teacher intervened and suggested that they might want to have the fragrance of the flower in their classes. The children liked this idea and relocated their gardens near their classrooms. The children drew playground markings for hopscotch in an area shadowed by a big tree, but were guided by teachers' suggestions to create shelters in areas of the playground where there is frequently scorching sun.



Figure 6.5: Children's finished model of their dream school ground (Photo: Matluba Khan)

Analysis of the model-making exercise revealed that children were more concerned about the individual elements of the settings than the layout of the settings. While locating different elements on the scaled base of the model, children faced some difficulty in

perceiving the scale, as children of this age group can relate objects to each other but cannot do so in relation to the whole landscape (Moore, 1986), as explained earlier in the literature review. They were making play equipment, gardens, seating and shelter with care and utmost detail (see Figure 6.6); one girl even made food for the hens and ducks they wanted to have in the school ground. The details of the model-making exercise are given in Appendix 11B.



Figure 6.6: A girl making a slide with care (Photo: Matluba Khan)

6.4 Proposed preliminary design of the school ground

Based on the above findings, I brainstormed and developed the site layout of a master plan for the school ground as a combination of nine behaviour settings where the ninth setting, i.e. the pathway or stepping stones, was the setting that connected the eight other behaviour settings. All the behaviour settings were organised around the open yard, from which children could access the settings. After the master plan had been chalked out, the details of the behaviour settings were designed in several brainstorming sessions with other associates. A local architectural consultancy firm, ‘Ghorami.jon’, interested in community design and educational facilities design, voluntarily worked for the project, offering their creative insights and technical knowledge. An architecture graduate with a Masters in urban design (who also assisted in data collection) and a fresh diploma architect assisted during the construction.



Figure 6.7: Proposed preliminary design of the school ground (Source: Matluba Khan)



Figure 6.8: View from the south-west corner of the school ground (Source: Matluba Khan)



Figure 6.9: View from the office building, west part of the school ground (Source: Matluba Khan)

6.5 Construction of the school ground

The construction works began on 16 December 2014, with the aim to finish by 15 January 2015 so that the children could have their new school ground at the beginning of the new academic session. The community people were involved in the process, and children actively participated in the construction process. In order to finish the project within a month we adopted the strategy to use materials which were easily available. We tried to design the settings in a way that would take less time to build and would be easy to maintain for the school authority. The design of any space depended on individual site conditions, availability of resources, time, culture and context and intuition and aptitude of the designer. The same school ground designed as a combination of the same settings would surely look different if designed by any other designer with more time and money. Therefore, the focus of the design of the school ground was to value the views and preferences of the teachers and children and provide inexpensive but diverse elements which could offer the affordances for formal and informal learning within limited time, money and resources. An account of the construction process is given in Appendix 13.

6.5.1 Involvement of the community

The members of the community showed a positive attitude towards the intended change in the school ground and came forward to help based on their capacity. The parents who had bamboo gardens offered green bamboo needed for the roofing of the sheds and fencing of the garden, and provided thatch from their own farms at minimal price. Food and

accommodation for the volunteers working on the site were arranged by the people of the community. One of the parents, a member of the SMC, worked as the head mason of the project and rendered his services mostly free of charge. The village masons and labourers were not acquainted with this kind of landscape work. However, the novelty of the project and the thought of a beautiful school led them to accept the challenge and keep up their work. All the workers living within the neighbourhood of the school were either parents or brothers of the children studying in the school. Therefore, they felt ownership of the project, took pride working on it and treated it as if it was their own project rather than another paid job. A detailed account of the involvement of the community is given in Appendix 12.

6.5.2 Children's active participation in the construction

Children not only participated in the design process but were also actively engaged in the construction work. Though only children of the treatment group from IS participated in the focus groups, drawing and model-making, children from other grades and children from the neighbouring houses who studied in nearby private schools showed their interest in helping during construction. Children assisted in carrying and curing of bricks and prepared the garden beds themselves carrying soil and planted plants (see Figures 6.10a and 6.10b). Children themselves painted the blackboard and the boundary wall with elements of their own choice (see Figures 6.11a and 6.11b). A detailed account of children's activities, accompanied by images, is given in Appendix 14.



Figures 6.10a and 6.10b: Children preparing garden beds carrying soil and planting the first plant (Photo: Matluba Khan)



a



b

Figures 6.11a and 6.11b: Children themselves painted the boundary wall (Photo: Matluba Khan)

6.5.3 Children's activities during the construction days

The children living in the neighbourhood spent a good amount of their time in the IS, as the schools were closed at that time following the annual examination. Besides offering their help with the construction, they were engaged in different activities. They found the affordances of different construction materials, showing that children were able to discover some affordances even in the least attractive environment. The children were engaged mostly in constructing activities – building things out of the raw materials on the site.



Figure 6.12: Children making a sandcastle with fountains using sand and water (Photo: Matluba Khan)

Sand and water were the principal construction materials that the children used for building. An extensive amount of soil was excavated from the area where the water tubs were installed. Three boys were found making a sandcastle with excavated sandy soil and water flowing from the water fountains to the pool below (see Figure 6.12). The children had not been engaged in any such activity before the construction work in the school ground.

Some girls were found making layouts of houses using sand. When asked about the indoor arrangement of the house, the girls showed different spaces of the house – living room, kitchen, bedrooms and toilet. The spaces were well articulated, which demonstrates the sense of privacy in a Bangladeshi house and also their sense of place (see Figures 6.13a and 6.13b). The excavated earth for the foundation of the amphitheatre took the shape of a sloped hill, and children were found jumping from the outer wall of the amphitheatre on the hill (see Figure 6.14 and Figure 6.15).



Figures 6.13a and 6.13b: Children making houses using sand (Photo: Matluba Khan)

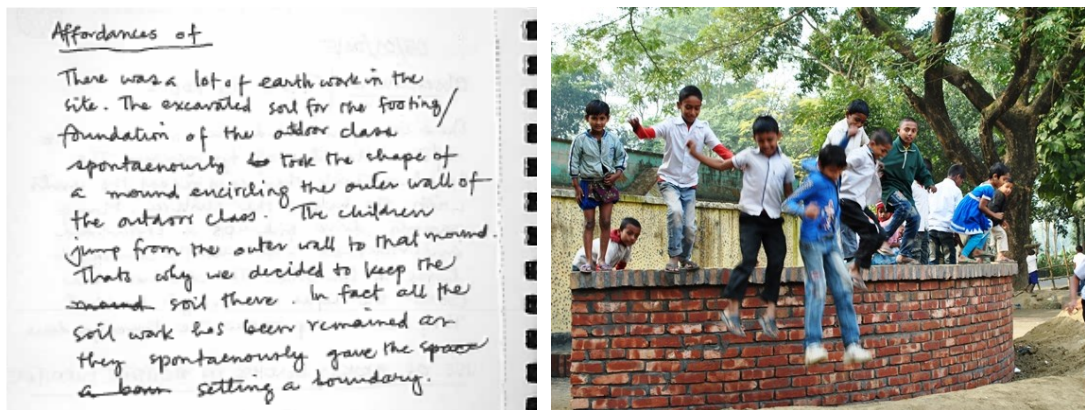


Figure 6.14: A page from the field journal (Photo: Matluba Khan)

Figure 6.15: Children jumping from the outside wall of the amphitheatre (Photo: Matluba Khan)

6.5.4 Attitude of the general villagers

During the first few days of the construction, some villagers expressed mixed feelings about the work in the school ground. They did not like the change in the regular shape of the school ground; this issue came to my knowledge from the conversation of the masons and the parents. The people presumed it was another Government project, and they thought the

Government should have spent money on new buildings rather than changing the school ground. However, nobody approached me to talk about the issue; therefore I decided to discuss it with the headmaster. The headmaster stated that after school hours, the local adolescents generally took over the school ground and did not let the small children play there. There were large fields nearby where the adolescents could go and play rather than occupying the school ground. They thought of the project as reclaiming the school ground for younger and school-aged children.

However, the attitude of the villagers changed as soon as different settings of the school ground took shape and the villagers could associate the settings with some uses. Even the parents of the children who studied in private schools expressed interest in moving their children to the Government school. Masons were found interacting with the passers-by who stopped to talk about what was going on. They were shown a postcard (an image of the amphitheatre designed as part of my Masters project, as described earlier in the literature review) published as part of the ECA Degree Show 2014 (see Appendix 15). They were discussing how this amphitheatre could be used for meetings of the villagers, and how elderly people could spend their afternoons sitting there and spending time with the children.

Some of the young day labourers working in the site had dropped out from this school and had not completed their education. During conversation with one of them, I came to learn that he dropped out as he found school boring. While he was making the blocks for stepping stones he stated that he would not have left school if the school had had these things during his time.

H: There was nothing in the school when I was here.

Me: How far did you study?

H: I did not continue studying. I did not like coming to school. There was nothing like this at that time. I felt bored. I would not have left school if all these things were here at that time.

6.6 Completion and use of the school ground

The school ground was completed in the middle of January 2015 (see Figure 6.16 and 6.17); however, since December and January are not the planting seasons, the natural learning area was not fully grown. Also, plants were not available in the nurseries at that time. However, the design of the school ground is never complete; it was designed as an ever-growing place where the areas with loose parts need refilling every now and then by the children and the teachers. Children were engaged in growing plants and vegetables in the gardens in different seasons; more plants needed to be planted during the monsoon so that the plants would grow

and give fruits and flowers. Nevertheless, children started using the school ground from the middle of January for play and learning. The science and mathematics teachers took treatment group children outdoors for formal teaching, as mentioned in the methodology chapter. I observed children's activities in the school ground throughout the whole period; after four months of intervention, in May 2015 the post-intervention data were collected. The results analysing the data collected are discussed in the next part of the thesis, Part III. It is worth mentioning here that this project is the recipient of the Great Places Award 2016 in the Place Design Category by the Environment Design Research Association (EDRA). An image of the display, presented at the 47th annual conference of EDRA in Raleigh, North Carolina, is given in Appendix 20A.



Figure 6.16: The school ground after intervention in January 2015 (Photo: Goopy Bagha productions)

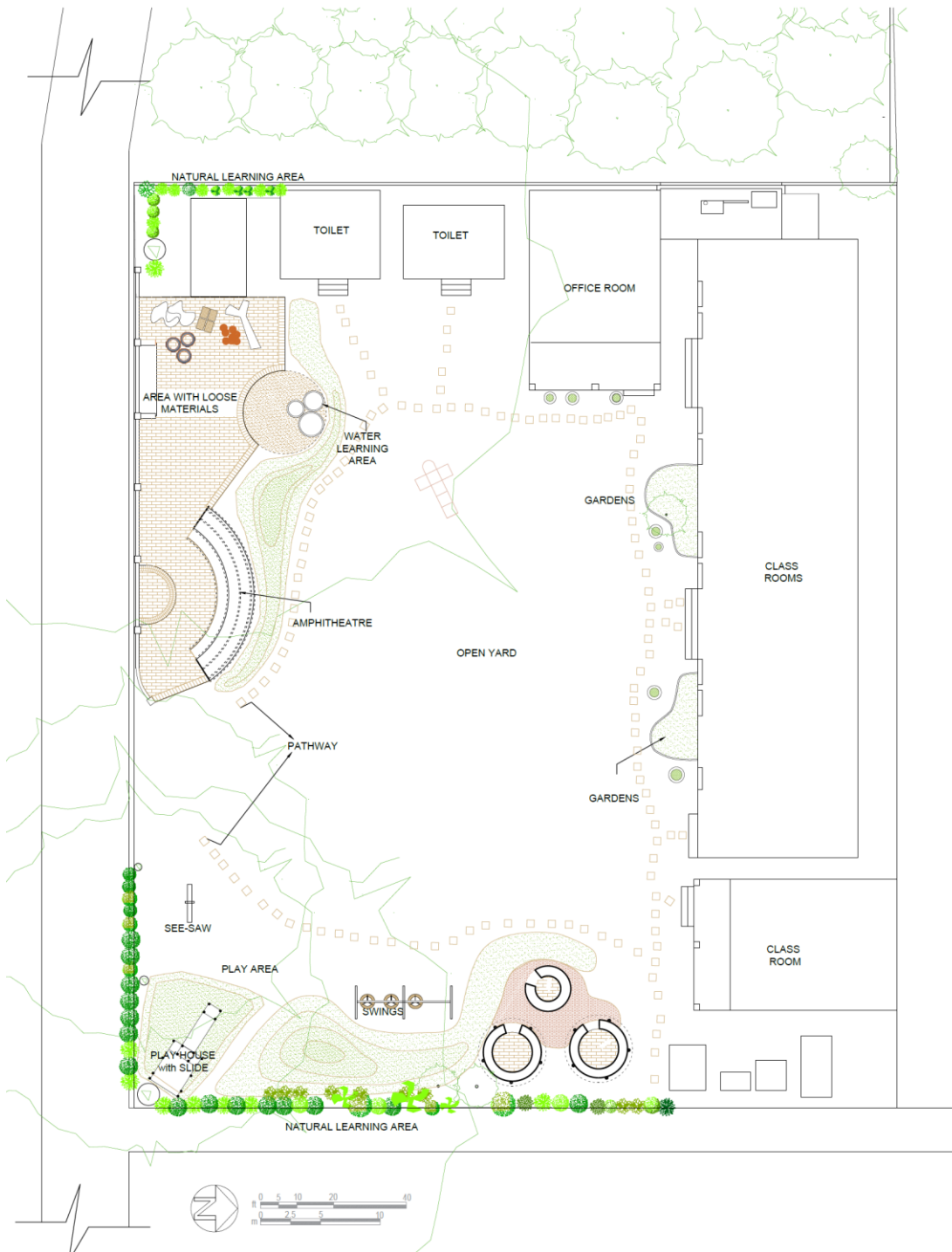


Figure 6.17: As-built drawing of the school ground (Source: Matluba Khan)

6.7 Summary

Analysis of the data elicited from children, parents and teachers revealed valuable information about their preferences for different settings in the school ground. The participants expressed their preference for natural elements for exploration and connection with nature, gardens for aesthetics and experiential learning, loose materials for building/constructing and imaginary play, sociable spaces and play ground and play objects for physical and social play. Elements extracted from the methods were combined with evidence from previous literature. These were grouped within some behaviour settings guided by theories of ecological psychology.

Findings from the model-making exercise with children and focus groups with teachers helped in formulating the layout of the school ground as a combination of several behaviour settings. A preliminary master plan was devised to set off the construction. Children and the community actively participated in the construction. *Ghorami.jon*, a Bangladeshi architecture consultancy firm, voluntarily contributed to the design and construction with their creative and technical inputs. The students from the Department of Architecture, BUET (where I worked as an Assistant Professor before coming to the UK to conduct my PhD) were invited to volunteer in the construction for dissemination of knowledge.

Neighbourhood children (including those who went to private schools) spent a considerable time in the school ground offering their help with the development works. They were also found to be engaged in different play activities with the construction raw materials. The villagers who were passing by the site, expressed their positive attitude to the change in the school ground once the behaviour settings started to take shape. The school ground was ready for use (for formal and informal learning) in the middle of January 2015. The post-intervention data were collected after four months of intervention in May 2015. A summary of the research process so far is graphically presented in Figure 6.18. The results from analysis from the pre and post-intervention data are presented in the next part of the thesis.

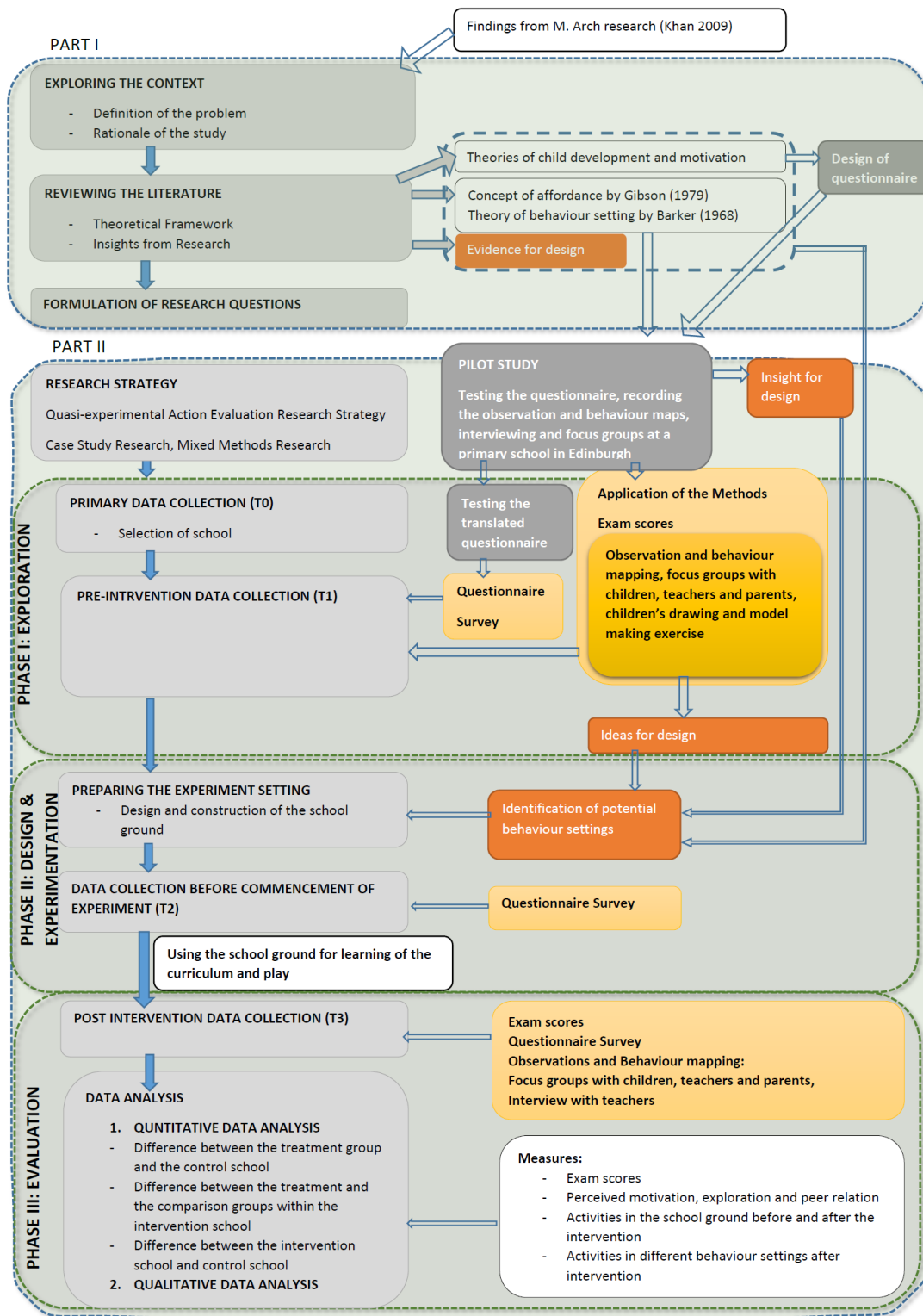


Diagram: Research stages. The research stages are on the left hand side and the research methods (in yellow boxes) are on the right in descending order

Figure 6.18: Research stages with methods

Part III: Results

Part III of the thesis comprises three chapters which present the results from analysis of data collected from exam scores and questionnaire surveys, participant observation and behaviour mapping, and focus groups and interviews consecutively.

Chapter 7 Results from exam scores and questionnaire survey data

While Chapter 6 described the process of design and development of the school ground for use as a place of outdoor learning and play, this chapter presents the results from the exam scores and questionnaire survey data. The purpose of this analysis is to find out whether the design and use of school grounds had an influence on children's academic performance. The chapter begins with a descriptive analysis of the demographics of children who participated in the study, followed by results from the analysis of methods comparison:

- 1) the treatment group (TIS) in the intervention school and the control school (CS),
- 2) the treatment (TIS) and comparison (CIS) groups within the intervention school,
- 3) the intervention school (IS) and the control school (CS), and
- 4) boys and girls within the treatment group in the intervention school.

Figure 7.1 presents the four levels of analysis graphically. The aforementioned four levels of analysis are presented chronologically by first presenting the results from the data collected before intervention (T1). This accompanies a comparison of the post-intervention (T3) results of different groups controlling the pre-intervention scores, showing the extent to which the intervention had an effect on academic attainment, on perceived motivation to learn, on perceived opportunities for exploration and on perceived peer relation while learning in different environments. Additionally, a comparison of children's perception of motivation, opportunities for exploration and peer relation in the classroom and outdoors is presented, showing the extent to which the design of the outdoor environment can have an effect on children in two different environments.

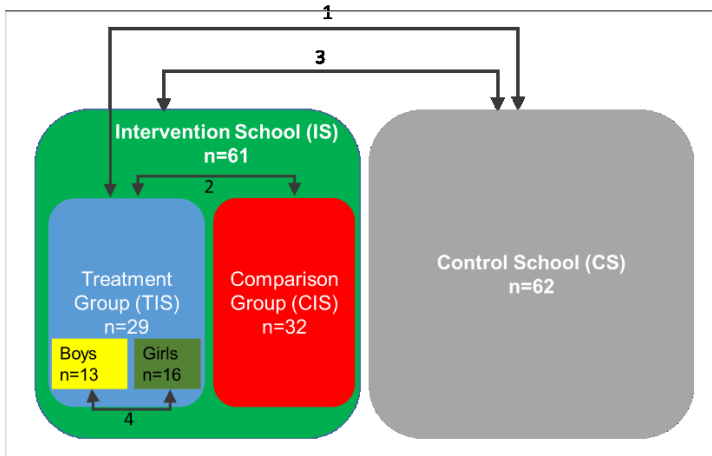


Figure 7.1: Different levels of analysis between the groups as presented in Chapter 7

7.1 Descriptive analysis

The total number of children participating in the quantitative survey was 123, of which 50% (61) were from the intervention school (IS) and the rest (62) were from the control school (CS). Within the intervention school, 48% (29) of the Grade IV children comprised the treatment group (TIS) and the rest (32) comprised the comparison group (CIS).

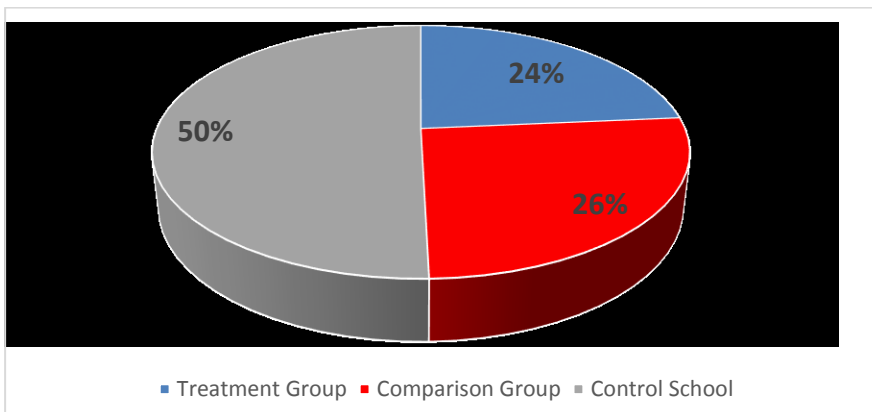


Figure 7.2: Percentages of children by groups

There was an equal distribution of boys and girls in both the IS and CS: 62 boys and 61 girls. In the TIS, the girls (55%) outnumbered the boys; the same was true for the CS girls (52%). For the CIS, the pattern was reversed, with boys comprising 59% of the total children in that group.

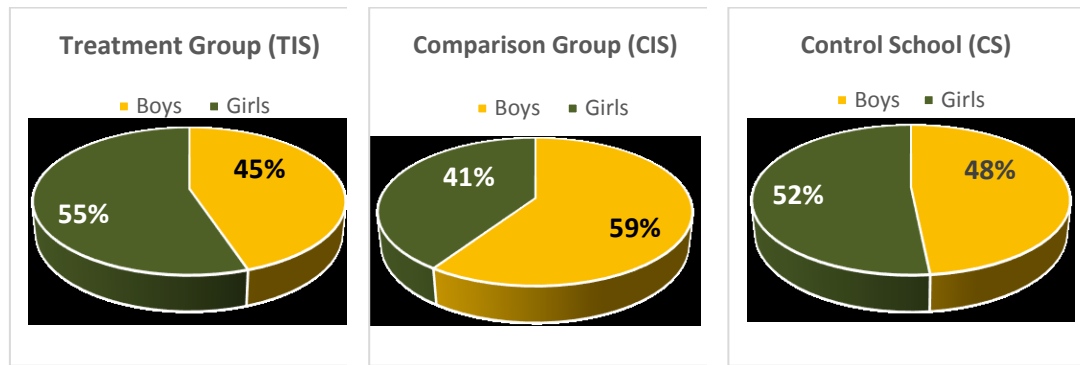


Figure 7.3: Children's gender by group

7.2 Results from exam scores data

As an exploratory screening, an independent sample t-test was conducted to compare the exam scores for different groups at T1, which is presented as the baseline measure. At T3, a one-way ANCOVA test was conducted to compare the different groups after controlling the pre-intervention scores; the purpose was to find out the extent to which the designed outdoor environment influenced children's academic performance. An independent sample t-test between different groups was also conducted at T3, the results of which are given in Appendix 17A.

7.2.1 Comparison between the treatment group (TIS) and the control school (CS)

In the independent sample t-test, no significant difference was found between the TIS and the CS in mathematics and science before intervention (see Figure 7.4).

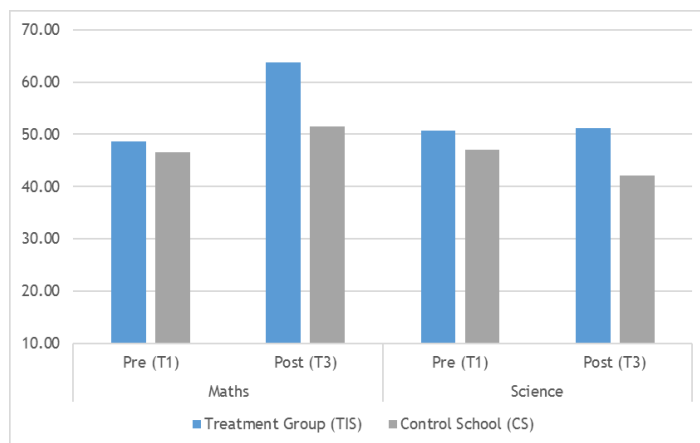


Figure 7.4: Difference in mathematics and science between the TIS and the CS at T1 and T3

In a one-way ANCOVA test to compare the TIS with the CS at T3, the TIS children showed significant improvement compared to the CS children in the following subject areas, after controlling for the scores of the exams administered prior to intervention. Significant difference was found in mathematics ($F(1, 71)=14.821, p<0.001$) and science ($F(1, 71)=12.264, p=0.001$) (see Table 7.1).

Table 7.1: One-way ANCOVA to compare the TIS and the CS in mathematics and science

Subject	Time	Treatment Group (TIS)		Control school (CS)		Significance level	Effect size
		Mean	Standard Deviation	Mean	Standard Deviation	P	η_p^2
Mathematics	T1	48.70	19.88	46.52	24.87	0.678	
	T3	64.62	22.796	51.49	20.478	0.000***	0.185
Science	T1	50.77	21.80	47.12	17.41	0.104	
	T3	52.07	15.645	42.07	16.146	0.001***	0.161

7.2.2 Comparison between the treatment group (TIS) and the comparison group (CIS) within the intervention school

An independent sample t-test was conducted to compare the exam scores for the TIS and the CIS at T1. No significant difference was observed between these two groups in mathematics and science at that time.

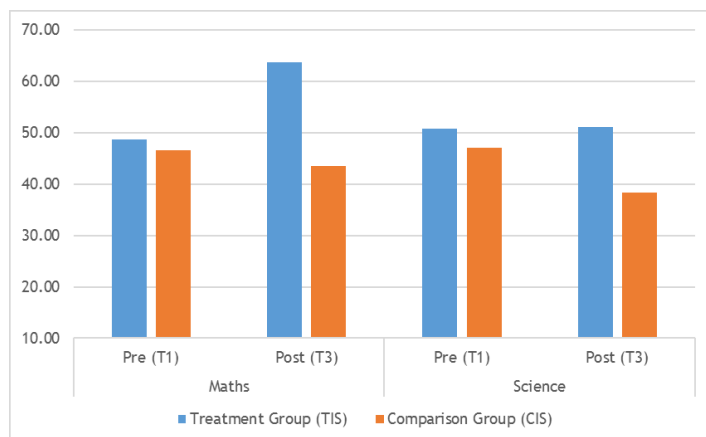


Figure 7.5: Differences between the TIS and the CIS in mathematics and science at T1 and T3

In a one-way ANCOVA test to compare these two groups at T3, taking into account their scores in the exams prior to intervention, significant difference was found in both mathematics and science. Children of the TIS showed significant improvement in mathematics ($F(1,56) = 9.016, p < 0.005$) and science ($F(1,56) = 9.094, p < 0.005$) after controlling the scores of these subjects' exams administered prior to intervention (see Table 7.2).

Table 7.2: One-way ANCOVA to compare the TIS and the CIS in mathematics and science

Subject	Time	Treatment Group (TIS)		Comparison Group (CIS)		Significance level	Effect size
		Mean	Standard Deviation	Mean	Standard Deviation	P	η_p^2
Mathematics	T1	48.70	19.88	46.52	18.57	0.056	
	T3	63.75	22.718	44.43	21.165	0.004**	0.145
Science	T1	50.77	21.80	47.12	17.92	0.062	
	T3	52.07	15.645	38.36	14.492	0.004**	0.146

7.2.3 Comparison between the intervention school (IS) and the control school (CS)

An independent sample t-test was conducted to compare the exam scores for the intervention school (IS) with the control school (CS) in two subject areas — mathematics and science. No significant difference was found between the two schools in mathematics and science at T1. However, the mean of the control school for these two subjects was higher than that of the intervention school before intervention (see Figure 7.6).

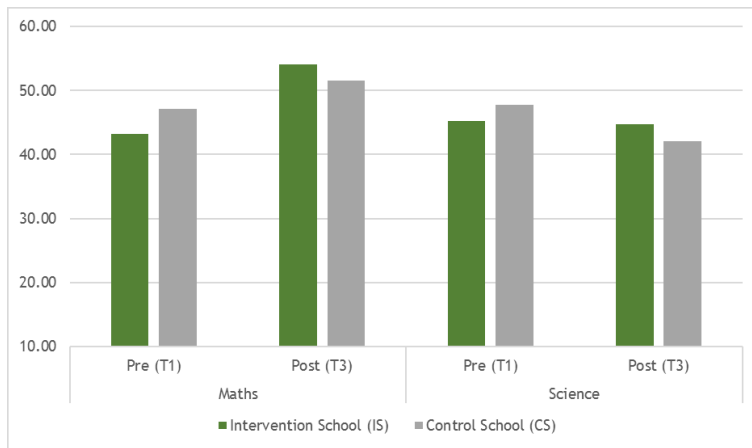


Figure 7.6: Difference between the IS and the CS in mathematics and science at T1 and T3

In a one-way ANCOVA test performed to compare the two schools after controlling the scores of the pre-test, significant difference was found in both mathematics and science. The children of the IS performed significantly better than the CS in mathematics ($F(1,99)=6.273, p<0.05$) and science ($F(1, 99)=5.756, p<0.05$) at T3 after controlling the score for the exams administered before intervention.

Table 7.3: One-way ANCOVA to compare the IS and the CS

Subject	Time	Intervention school (IS)		Control school (CS)		Significance level P	Effect size η_p^2
		Mean	Standard Deviation	Mean	Standard Deviation		
Mathematics	T1	43.24	19.22	46.52	24.87	0.459	
	T3	54.09	23.84	51.49	20.478	0.014*	.061
Science	T1	45.19	19.87	47.12	17.41	0.350	
	T3	44.75	16.02	42.07	16.146	0.018*	.057

7.2.4 Gender difference

No significant difference was found between boys and girls of the TIS in the exam scores before intervention in a MANOVA. However, the mean score of the girls was higher than those of the boys throughout all subject areas.

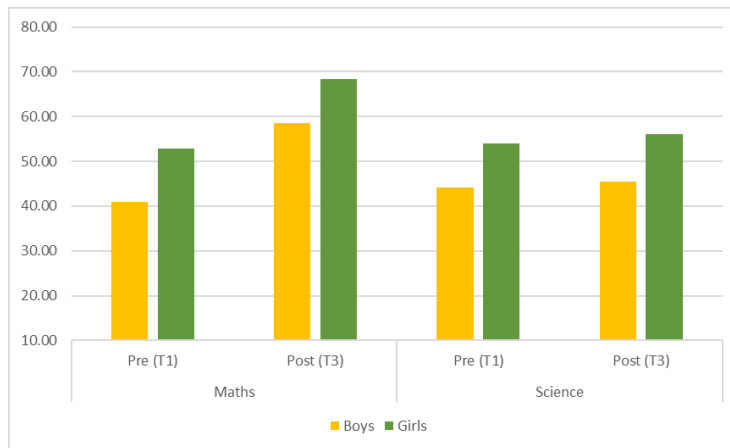


Figure 7.7: Difference between boys and girls within the TIS at T1 and T3

In a one-way ANCOVA test, no significant difference was found between boys and girls at T3 in any of the subject areas after controlling the scores for those subjects' exams administered prior to intervention.

7.3 Results from questionnaire survey data

As an exploratory screening, an independent sample t-test was conducted to compare children's perceived motivation and their reported opportunities for exploration and peer relation between different groups at T1, which is presented as the baseline measure. At T3, a one-way ANCOVA test was conducted to compare the different groups after taking into account the pre-intervention scores; the purpose was to find out the extent to which the designed outdoor environment influenced children's perceived motivation to learn and their reported opportunities for exploration and peer relation in the outdoor environment. This was followed by a paired samples t-test in order to find out the differences between the two different environments – the classroom and outdoors. Two separate questionnaires were administered with the same questions, one after another, to ascertain children's perceived motivation, exploration and peer relation in the classroom/outdoor classes, as mentioned earlier (for details on the questionnaire see Appendix 2A). A MANOVA and a one-way ANCOVA were conducted to find out the difference between boys and girls. Only the significant results are presented in this chapter; the results from the construct level measures and the independent sample t-tests between different groups at T3 are given in Appendices 17B, 17C and 17D.

7.3.1 Motivation

7.3.1.1 Comparison between the treatment group (TIS) and the control school (CS)

As an exploratory screening, an independent sample t-test was conducted to compare children's perception of their motivation to learn in the outdoor classes between the TIS and the CS at T1. There was no significant difference in children's perceived overall motivation¹³ to learn in the outdoor classes between these two groups at T1 (see Figure 7.8). However, significant difference was found in children's perceived affective motivation ($t(69)=2.336$, $p<0.05$), the children of the TIS scored higher in their perceived enjoyment of learning outdoors (for the construct measures at T1, see Table 2 in Appendix 17B).

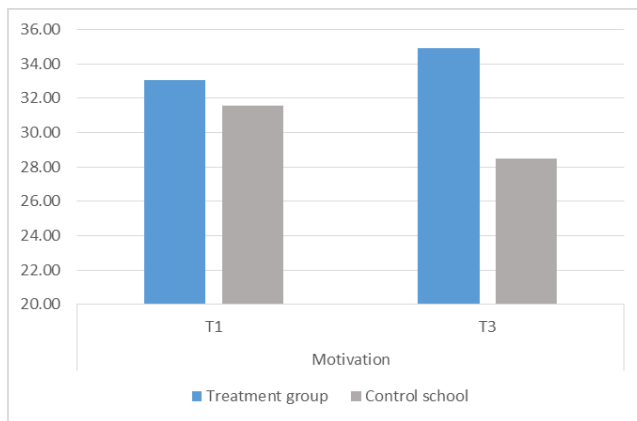


Figure 7.8: Difference in children's perceived motivation to learn in the outdoor classes between the TIS and CS at T1 and T3

In a one-way ANCOVA test, significant difference was found in children's reported motivation to learn (in both affective and behavioural motivation) in the outdoor classes between the TIS and the CS after controlling for pre-intervention scores ($F(1,49)=20.06$, $p<0.001$) (see Table 7.4). The children of the TIS scored higher in all measures than the CS. Significant difference was found between the TIS and the CS in children's perceived enjoyment ($F(1,52)=38.22$, $p<0.001$), doing well at school work ($F(1,51)=7.177$, $p<0.05$), being good at learning ($F(1,52)=14.07$, $p<0.001$), learning a lot ($F(1,52)=6.28$, $p<0.05$), hard work ($F(1,51)=16.43$, $p<0.001$) and attention ($F(1,52)=27.87$, $p<0.001$). The construct level differences are shown in a graph in Appendix 17B (Figure 42).

¹³ Motivation refers to both affective and behavioural motivation. Affective motivation is measured based on the way children value what they learn and what they expect in their learning. Behavioural motivation is measured based on the behavioural aspects of motivation i.e. hard work, perseverance, attention and ability to complete the task.

Table 7.4: One-way ANCOVA to compare children's perceived motivation to learn in the outdoor classes between the TIS and the CS at T3

Measure	Treatment group (TIS)		Control school (CS)		Level of significance comparing the two educational contexts	Effect size η_p^2
	M	SD	M	SD		
Motivation	35.14	3.41	28.26	6.26	0.000***	0.309
Affective Motivation	21.41	2.2	17.21	4.43	0.001***	0.217
Value	10.96	1.11	9.04	2.631	0.004**	0.160
Enjoyment	3.87	0.34	2.24	1.09	0.000***	0.438
Importance of what was learnt	3.61	0.66	3.38	1.08	0.361	0.017
Usefulness of what was learnt	3.48	0.66	3.43	0.96	0.794	0.001
Expectancy	10.5	1.6	8.07	2.33	0.000***	0.240
Doing well in school work	3.38	0.58	2.69	1.04	0.010*	0.130
Being good at learning	3.61	0.66	2.55	1.21	0.000***	0.223
Learning a lot	3.54	0.73	2.83	1.04	0.016*	0.114
Behavioural Motivation	13.74	1.84	11.11	2.28	0.000***	0.273
Hard work	3.22	0.74	2.25	0.8	0.000***	0.255
Perseverance	3.35	0.57	3.17	1.07	0.479	0.010
Completion of work	3.57	0.6	3.28	0.99	0.202	0.033
Attention	3.61	0.58	2.45	0.98	0.000***	0.363

7.3.1.2 Comparison between the treatment (TIS) and the comparison group (CIS)

An independent sample t-test was conducted to compare children's perceived motivation in the outdoors for TIS and CIS at T1 (before intervention). Significant difference was found in children's perceived motivation to learn in outdoor classes ($t(41)=28.849$, $p<0.001$), the scores for the TIS being higher (see Figure 7.9). Another independent sample t-test was conducted at T2; significant difference was found in children's perceived overall motivation after the intervention at T2 ($t(47.106)=3.342$, $p<0.005$). In a one-way ANCOVA test to compare these two groups after intervention, taking into account their responses to the questionnaire administered prior to intervention, no significant difference was found in any of the areas.

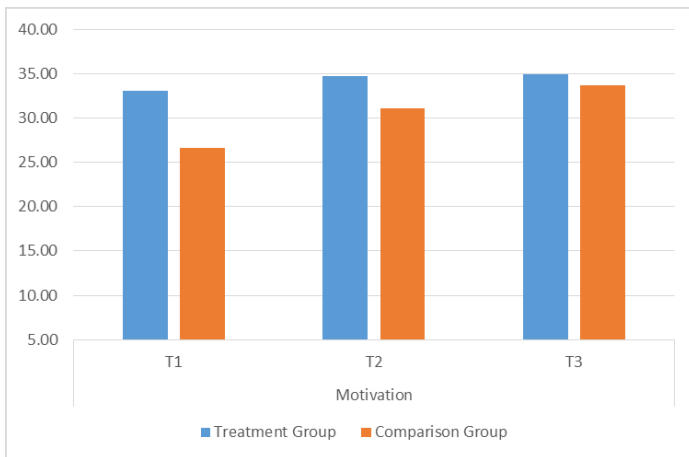


Figure 7.9: Difference in children’s perceived overall motivation in the outdoors between the TIS and CIS at T1, T2 and T3

The way children’s motivation changed over time in the TIS and the CIS can be understood from Figure 7.9. The children of both groups showed a gradual increase in motivation. However, the children of the CIS showed a very distinctive increase in all the constructs at T2 and T3. The construct level differences are provided in Appendix 17B (Figures 43-46).

7.3.1.3 Comparison between the intervention (IS) and the control school (CS)

As an exploratory screening, an independent sample t-test was conducted to compare the perception of children’s motivation for the IS and the CS. There was no significant difference in children’s perceived overall motivation to learn in the outdoor classes between the two schools.

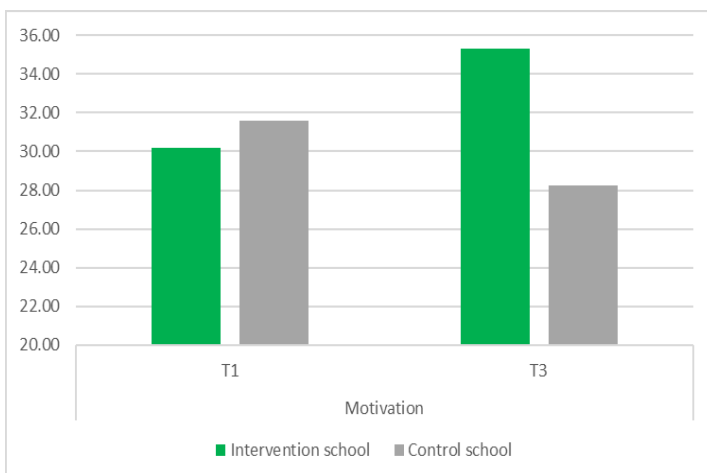


Figure 7.10: Difference in children’s perceived motivation between the intervention and the control school at T1 and T3

In a one-way ANCOVA test, significant difference was found in children’s reported motivation to learn in the outdoor class between the IS and the CS after controlling for scores administered prior to intervention ($F(1,63)=33.969, p<0.001$) (see Table 7.5). After taking into account the scores for outdoors prior to intervention, significant difference was found in enjoyment ($F(1,52)= 38.22, p<0.001$), being good at school work ($F(1,75)=8.827, p<0.005$), being good at learning ($F(1,76)=13.24, p=0.001$), learning a lot ($F(1,71)=8.712, p<0.005$), hard work ($F(1,75)=9.843, p<0.005$) and attention ($F(1, 76)=28.978, p<0.001$). The construct level differences are shown in a graph in Appendix 17B (Figure 47).

Table 7.5: One-way ANCOVA to compare indicators of motivation between the IS and the CS

Measure	Intervention school (TS)		Control school (CS)		Level of significance comparing the two educational contexts	Effect size η_p^2
	M	SD	M	SD		
Motivation	35.33	3.657	28.26	6.267	0.000***	.361
Affective Motivation	21.35	2.348	17.21	4.425	0.000***	.298
Value	10.86	1.424	9.04	2.631	0.000***	.184
Enjoyment	3.79	.508	2.24	1.091	0.000***	.484
Importance of what was learnt	3.53	.747	3.38	1.083	.366	.011
Usefulness of what was learnt	3.47	.702	3.43	.959	.883	.000
Expectancy	10.29	1.662	8.07	2.329	0.000***	.256
Doing well in school work	3.26	.681	2.69	1.039	.004**	.109
Being good at learning	3.40	.825	2.55	1.213	.001***	.154
Learning a lot	3.43	.770	2.83	1.037	.004**	.114
Behavioural Motivation	13.64	2.001	11.11	2.283	0.000***	.234
Hard work	2.98	.921	2.25	.799	.002**	.120
Perseverance	3.45	.619	3.17	1.071	.236	.019
Completion of work	3.61	.538	3.28	.996	.055	.051
Attention	3.49	.688	2.45	.985	0.000***	.284

7.3.1.4 Gender differences in motivation

A multivariate analysis of variance (MANOVA) was conducted in order to compare boys and girls in the TIS for measures of motivation at T1, at T2 (after development of the school ground) and at T3 (see Figure 7.11).

In MANOVA at T1, there was a statistically significant difference between boys and girls on the combined dependent variable i.e. motivation to study ($F(10,13)=3.064$, $p<0.05$; Wilk's Lambda=0.298). In MANOVA at T2, there was no significant difference in the perceived motivation to study between boys and girls.

In a one-way ANCOVA test at T3, no significant difference was found between boys and girls in their perceived motivation to learn outdoors after controlling children's responses prior to intervention in any of the indicators or overall motivation. The details of the construct level measures are given in Appendix 17B (Figure 48).

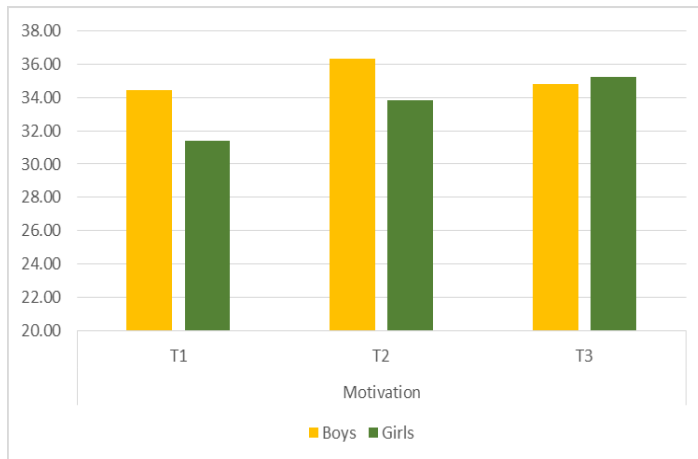


Figure 7.11: Difference in children's perceived motivation to learn in the outdoor classes between boys and girls

7.3.1.5 Difference in children's perceived motivation to learn in the classroom and outdoors

A paired sample t-test was conducted to compare children's responses to overall motivation and the constructs between the classroom and the outdoors for the three groups in the two different schools at T1 and T3 (see Figure 7.12).

TIS: No significant difference was found in the TIS children's perceived motivation to learn between the classroom and the outdoors at T1. In the paired sample t-test to compare TIS children's responses about motivation to learn between the two environments at T3, significant difference was found in overall motivation and also in the constructs between the classroom and the outdoors. The children of the TIS reported being more motivated in the outdoor classes than in the classroom at T3 ($t(25)=-3.115$, $p=0.005$). The children of the TIS reported enjoying learning more ($t(26)=-3.384$, $p<0.005$) and being better at learning ($t(26)=-4.264$, $p<0.001$) in the outdoor classes than in the classroom at T3.

CIS: Significant difference was found in the CIS children’s perceived motivation to learn in the classroom and outdoor classes at T1. The comparison group children reported being more motivated in the classroom at T1 ($t(16)=3.229, p=0.005$). The situation was reversed after the intervention. In the paired sample t-test to compare children’s responses to motivation at T3, the CIS reported they would be more motivated in the outdoors than the classroom ($t(20)=-2.804, p<0.05$).

CS: Significant difference was found in the CS for their perceived motivation in the two different environments at T1. The means were higher for the classrooms than the outdoors. In the paired sample t-test at T3, significant difference was found in CS at T3 in overall motivation and also in the key indicators of motivation, with the scores for the classroom remaining higher as with T1. The children of the control school reported being more motivated in the classroom than in the outdoors at T3 ($t(31)=4.426, p<0.001$).

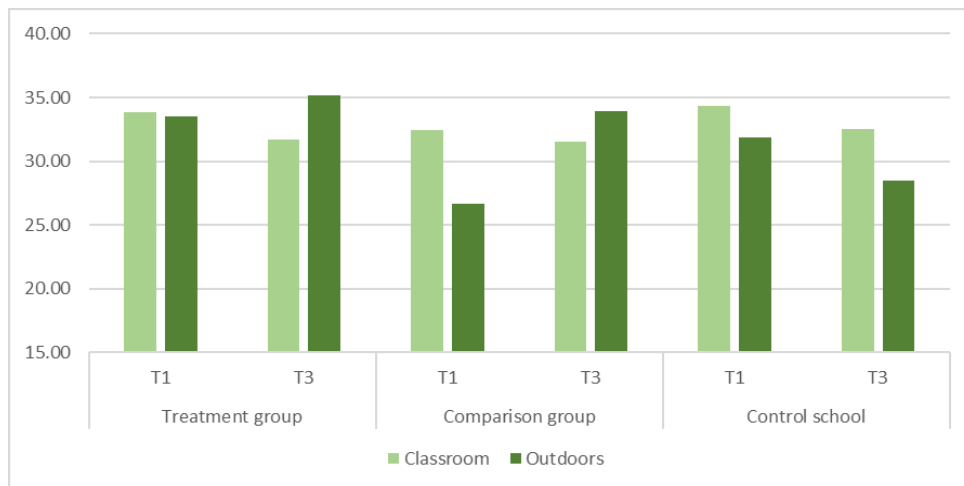


Figure 7.12: Comparison of children’s motivation to learn in the classrooms and the outdoors

From Figure 7.12, it’s evident that the motivation to learn in the outdoor classes increased among the children of the CIS too who were not taught in the outdoor environment, yet were exposed to play and other activities. However, the difference between the motivation to learn in the classroom and the outdoors remained the same among the CS children where there was no change in the school ground environment. For details of the construct measures see Appendix 17B (Figures 49-56).

7.3.2 Exploration of the environment

Children’s perceived opportunities for exploration were measured based on their reported opportunities to explore new things, learn through play, discover things and explore independently in the school ground.

7.3.2.1 Comparison between the treatment group (TIS) and the control school (CS)

As an exploratory screening, an independent sample t-test was conducted to compare children's responses about exploration of the environment in the outdoors between the TIS and the CS at T1 (see Figure 7.13). There was no significant difference in children's reported opportunities for exploration of the outdoor environment at T1 between these two groups.

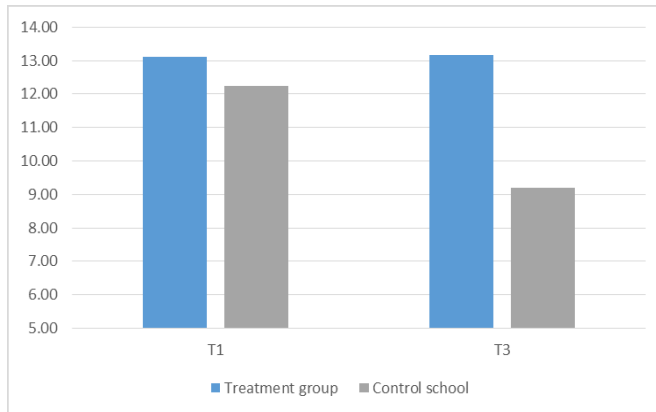


Figure 7.13: Difference in exploration of the environment between the TIS and the CS

In a one-way ANCOVA test, significant difference was found in children's reported opportunities for exploration in the school ground between the TIS and the CS after controlling the scores at T1 ($F(1,49)=51.80$, $p<0.001$) (see Table 7.6). The children of the TIS reported having more opportunities for learning through play ($F(1,52)=32.01$, $p<0.001$); independent exploration ($F(1,51)=11.64$, $p=0.001$); exploration of new things ($F(1,50)=16.38$, $p<0.001$) and discovery ($F(1,52)=13.986$, $p<0.001$) in the outdoor environment than the children of the CS after controlling the scores at T1. For a detailed account of the independent sample t-test at T2, see Appendix 17C (Figure 57).

Table 7.6: One-way ANCOVA to compare children's perceived exploration of the environment between the TIS and the CS

Elements	Treatment group (TIS)		Control school (CS)		Significance level	Effect size
	Mean	Standard Deviation	Mean	Standard Deviation	p	η_p^2
Exploration of the environment	13.38	1.830	9.07	2.159	0.000***	.530
Playfulness	3.48	.665	1.90	1.113	0.000***	.395
Independent exploration	3.22	.795	2.46	.745	0.001***	.195
Exploration of new things	3.43	.676	2.48	.911	0.000***	.258
Discovery	3.35	.714	2.31	1.039	0.000***	0.222

7.3.2.2 Comparison between the treatment (TIS) and the comparison group (CIS)

An independent sample t-test was conducted to compare children's responses about exploration of the environment for the TIS and the CIS at T1 (before intervention). There was significant difference in children's reported opportunities for exploration of the environment between these two groups at T1 ($t(46)=2.823, p<0.05$); the children of the TIS scored higher.

Another two independent sample t-tests were conducted at T2 (after development of the school ground, before teaching in the outdoors commenced) and T3 (after intervention) to compare how the children of these two groups reported their opportunities to explore in the outdoor environment at later points of the study. In a one-way ANCOVA at T3, taking into account children's responses at T1, no significant difference was found in their reported opportunities to explore in the school ground at either time. From Figure 7.14 it can be deciphered that children's reported opportunities to explore in the school ground changed over time among the TIS and the CIS. For a detailed account of this change among the two groups and to learn more about the construct level measures, please see Appendix 17C (Figures 58-61).

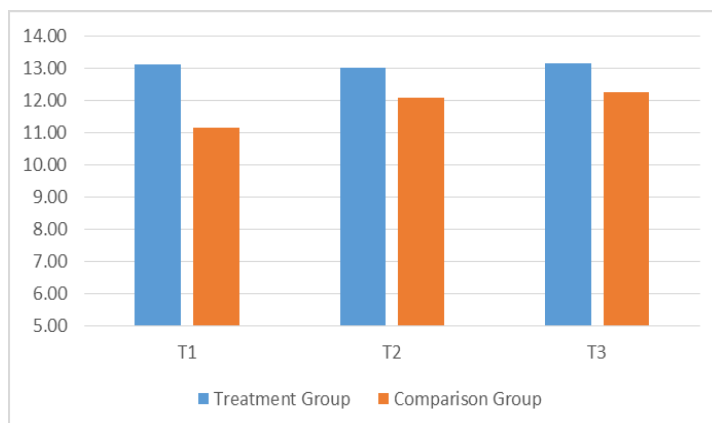


Figure 7.14: Difference in children's reports of opportunities of exploration in the outdoor environment between the TIS and the CIS

7.3.2.3 Comparison between the intervention (IS) and the control school (CS)

As an exploratory screening, an independent sample t-test was conducted to compare children's perceived exploration of the outdoor environment for the IS and the CS at T1. There was no significant difference in children's perception of opportunities for exploration between the IS and the CS at T1 (see Figure 7.15).

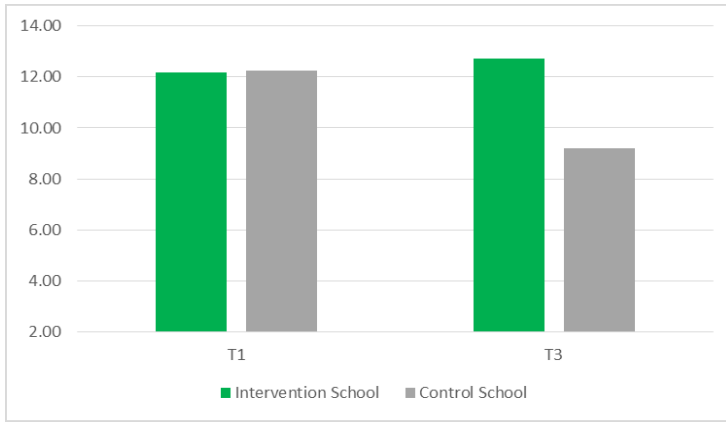


Figure 7.15: Comparison in children's perceived exploration of the environment between the intervention school and the control school at T1 and T3

In a one-way ANCOVA test at T3, taking into account children's responses at T1, significant difference was found in children's reported opportunities for exploration of the outdoor environment between the IS and the CS. Children of the IS reported more opportunities for exploration in the outdoor environment than the children of the CS ($F(1, 70)=38.821, p<0.001$). They reported having more opportunities for learning through play in the outdoor environment ($F(1,76)=29.554, p<0.001$), independent exploration ($F(1,74)=6.783, p<0.05$), exploration of new things ($F(1,81)=14.47, p<0.001$) and discovery ($F(1,75)=17.482, p<0.001$) than the CS children (see Table 7.7). For a graph showing the difference in construct level measures, please see Figure 62 in Appendix 17C.

Table 7.7: One-way ANCOVA for measures of exploration of the environment between the IS and the CS

Elements	Intervention school (IS)		Control school (CS)		Significance level p	Effect size η_p^2
	Mean	Standard Deviation	Mean	Standard Deviation		
Exploration of the environment	12.69	2.484	9.07	2.159	0.000***	.367
Playfulness	3.23	.840	1.90	1.113	0.000***	.288
Independent exploration	3.022	.9543	2.464	.7445	0.011*	.087
Exploration of new things	3.23	.841	2.48	.911	0.000***	.173
Discovery	3.26	.801	2.31	1.039	0.000***	.195

7.3.2.4 Gender differences in exploration

A multivariate analysis of variance (MANOVA) was conducted to compare children's reported opportunities for exploration in the outdoor environment between boys and girls in the TIS at T1, T2 (after development of the school ground) and T3.

In MANOVA, no significant difference was found between boys' and girls' reported opportunities for exploration at T1. No significant difference was found between boys and girls at T2 either (see Figure 7.16).

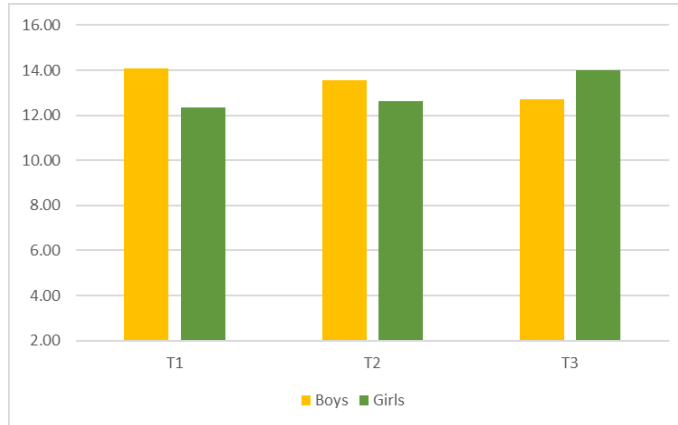


Figure 7.16: Difference between boys' and girls' reported opportunities for exploration within the TIS

In a one-way ANCOVA test, significant difference was found between boys' and girls' reported opportunities for exploration at T3 after controlling children's responses at T1. The girls of the TIS reported more opportunities for exploration than the boys in the outdoor environment at T3 ($F(1,21)=5.655, p<0.05$) (see Table 7.8). For a detailed account of the MANOVA tests at T1 and T3 see Appendix 17C, and for a graph of the difference between boys and girls at construct level measures see Figure 63 in Appendix 17C.

Table 7.8: One-way ANCOVA for indicators of exploration of the environment between boys and girls in the TIS

Subject	Boys		Girls		Significance level	Effect size
	Mean	Standard Deviation	Mean	Standard Deviation	P	η_p^2
Exploration of the environment	12.7	2.111	14.00	1.342	0.029*	0.239

7.3.2.5 *Difference in children's perceived opportunities for exploration in the classroom and the outdoors*

A paired sample t-test was conducted to compare children's responses to their perceived exploration of the environment in the classroom and outdoors for the three groups at T1 and T3. No significant difference was found between children's reported opportunities for exploration as a whole in the classroom and outdoors among the TIS and the CIS at T1.

There was significant difference in children's perceived overall exploration of the outdoor environment compared to the classroom among the TIS at T3 ($t(24)=-2.186, p<0.05$) (see Figure 7.17). The children of the TIS reported more opportunities for exploration of new things ($t(24)=-2.982, p<0.05$) and discovery ($t(26)=-2.565, p<0.05$) in the outdoor environment than in the classroom at T3. For details of the construct measures see Appendix 17C (Figures 64-71).

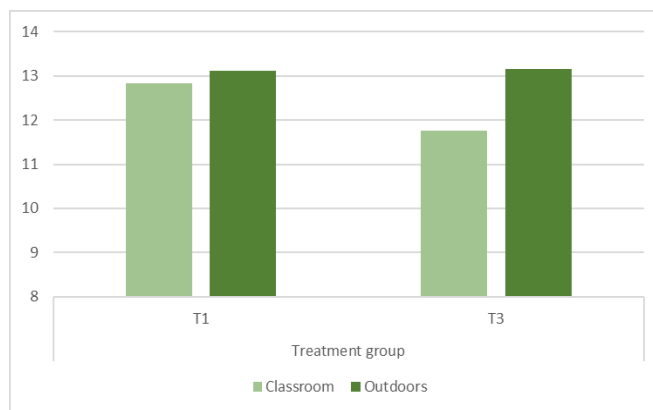


Figure 7.17: Comparison of children's perceived exploration in the classroom and outdoors

7.3.3 Peer relation

Children's perceived peer relation was measured based on their reported opportunities for support, co-operation, sharing or ideas and working in groups in the school ground. The same questions were asked to ascertain their perceived peer relation in the classroom environment.

7.3.3.1 *Comparison between the treatment group (TIS) and the control school (CS)*

As an exploratory screening, an independent sample t-test was conducted to compare children's responses about peer relation in the outdoor environment between the TIS and the CS at T1. No significant difference was found between these two groups in their perceived opportunities for peer relation when the classes were held in the school ground (see Figure 7.18).

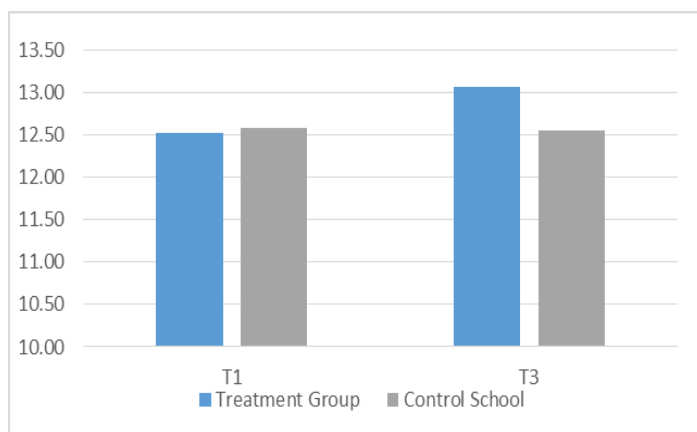


Figure 7.18: Difference in children's perceived peer relation between the TIS and the CS

In a one-way ANCOVA test, no significant difference was found in children's perceived peer relation in the school ground between the TIS and the CS at T3, after controlling their scores at T1 (see Table 7.9). But children in the TIS reported they had more opportunities for group work in the school ground than the children of the CS after controlling for the pre-intervention scores ($F(1,51)=5.863$, $p<0.05$). For a graph of the construct level measures, see Figure 72 in Appendix 17D.

Table 7.9: One-way ANCOVA at T3 for children's perceived peer relation in the school ground between the TIS and the CS

Elements	Treatment group (TIS)		Control school (CS)		Significance level P	Effect size η_p^2
	Mean	Standard Deviation	Mean	Standard Deviation		
Peer Relation	13.57	1.805	12.41	2.678	0.078	0.065
Support	3.43	0.843	3.21	1.048	0.372	0.016
Co-operation	3.61	0.583	3.52	0.829	0.658	0.004
Sharing of ideas	3.39	0.839	3.04	0.999	0.149	0.043
Group work	3.13	0.869	2.54	0.962	0.019 *	0.109

7.3.3.2 Comparison between the treatment (TIS) and the comparison group (CIS)

An independent sample t-test was conducted to compare the measures of peer relation in the outdoor environment between the TIS and CIS at T1. There was no significant difference in the way the children from these two groups reported their perceived peer relation in the outdoor environment at that time.

Another two independent sample t-tests were conducted at T2 and T3 (after intervention) to compare how the children of these two groups reported their peer relation in

the outdoor environment at later phases of the study. There was no significant difference in any of the indicators at either time (see Figure 7.19).

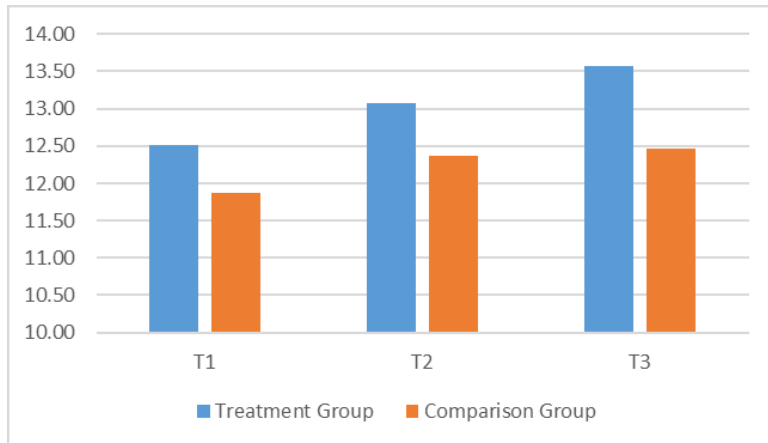


Figure 7.19: Difference in children's perceived overall peer relation in the outdoor environment between the TIS and the CIS

In a one-way ANCOVA test to compare these two groups at T3, taking into account their responses at T1, there was no significant difference in children's perceived overall peer relation between the two groups (see Table 7.10). However, significant difference was found in one of the indicators, co-operation ($F(1, 45) = 4.182, p < 0.045$). For a graph showing the differences in the construct level measures, i.e. support, co-operation, sharing of ideas and group work, please see Figure 73 in Appendix 17D.

Table 7.10: One-way ANCOVA for children's perceived peer relation between the TIS and the CIS

Elements	Treatment group (TIS)		Comparison group (CIS)		Significance level P	Effect size η_p^2
	Mean	Standard Deviation	Mean	Standard Deviation		
Peer Relation	13.57	1.805	12.47	2.435	0.133	0.057
Support	3.43	0.843	3.05	0.844	0.171	0.044
Co-operation	3.61	0.583	3.18	0.795	0.047*	0.091
Sharing of ideas	3.39	0.839	3.00	0.853	0.119	0.055
Group work	3.13	0.869	3.00	0.853	0.549	0.008

The way children's perceived peer relation changed over time in the TIS and the CIS can be deciphered from Figure 7.19. There was no significant difference between the groups; children's perceived peer relation increased over time for both. For a detailed account of the changes over time in these two groups, see Figures 74-76 in Appendix 17D.

7.3.3.3 Comparison between the intervention (IS) and the control school (CS)

As an exploratory screening, an independent sample t-test was conducted to compare children’s perceived peer relation between the IS and the CS at T1. There was no significant difference in children’s perceived overall peer relation or any of the construct level measures between these two schools before intervention (see Figure 7.20).

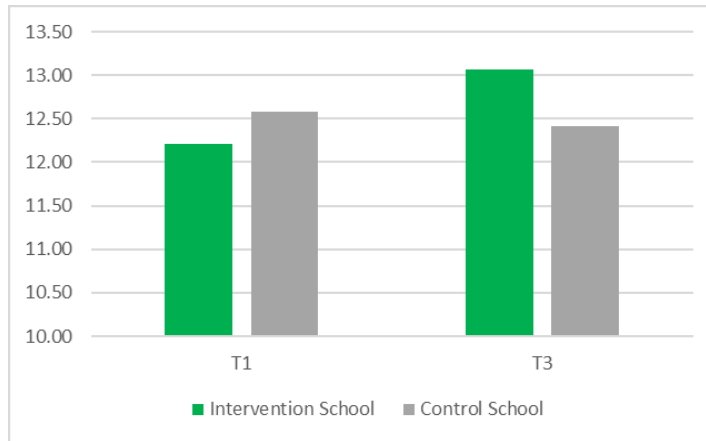


Figure 7.20: Difference in overall peer relation in the outdoor environment between the IS and the CS at T1 and T3

In a one-way ANCOVA test to compare these two groups at T3, taking into account their responses at T1, no significant difference was found in their perceived overall peer relation. Significant difference was found in one of the constructs: children’s perceived opportunities for working in groups ($F(1, 75)=9.312, p<0.005$) (see Table 7.11). For a graph showing the differences in construct level measures please see Figure 77 in Appendix D.

Table 7.11: One-way ANCOVA for children’s perceived peer relation between the IS and the CS

Elements	Intervention school (IS)		Control school (CS)		Significance level p	Effect size η_p^2
	Mean	Standard Deviation	Mean	Standard Deviation		
Peer Relation	13.07	2.157	12.41	2.678	.219	.023
Support	3.24	.857	3.21	1.048	.759	.001
Co-operation	3.40	.720	3.52	.829	.524	.006
Sharing of ideas	3.20	.859	3.04	.999	.410	.010
Group work	3.21	.931	2.54	.962	.003**	.115

7.3.3.4 Gender differences in peer relation

A multivariate analysis of variance (MANOVA) was conducted to compare boys and girls in the TIS for their perceived peer relation at T1, T2 and T3.

In MANOVA at T1, significant difference was found in children's perceived overall peer relation between boys and girls ($F(4,20)=5.813$, $p<0.005$, Wilk's lambda=0.462 and $\eta_p^2=0.538$). No significant difference was found between boys and girls at T2 and T3. The girls showed significant improvement throughout time (see Figure 7.21).

No significant difference was found between boys and girls at T3 in a one-way ANCOVA test in any of the elements of peer relation or overall peer relation after controlling the responses for those elements before intervention. For a graph showing the differences in construct level measures, please see Figure 78 in Appendix D.

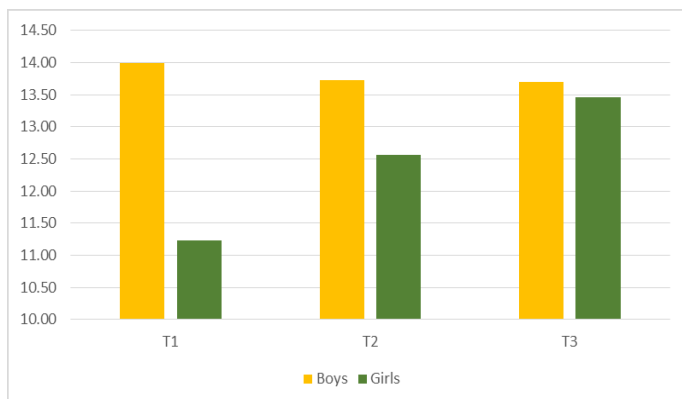


Figure 7.21: Difference in children's perceived peer relation between boys and girls in the TIS

7.3.3.5 Difference in children's perceived peer relation in the classroom and the outdoors

A paired sample t-test was conducted to compare children's responses to their perceived peer relation between the classroom and the outdoor environment for the three groups at T1 and T3. No significant difference was found in children's perceived peer relation in the classroom and outdoors in the TIS at T1. There was no significant difference in TIS children's perceived peer relation at T3 either. For a detailed account of the tests and construct level measures see Appendix D, Figures 79-86.

7.4 Summary

7.4.1 Demographic measures

Demographic measures indicate that the sample was composed of comparable groups of children in number and gender.

7.4.2 Exam scores

The children of the treatment group (TIS) showed significant improvement over the comparison group (CIS) and control school (CS) in mathematics and science after being

taught in the designed outdoor setting. No significant difference was observed between boys and girls in the TIS, with the girls performing better throughout the study. The academic performance of the IS as a whole improved after intervention compared to the CS.

7.4.3 Questionnaire survey

7.4.3.1 Motivation

The children of the TIS reported being significantly more motivated to learn outdoors than the CS after the intervention. The difference was significant in all the constructs except for importance and usefulness of what children learnt in the outdoor environment, perseverance and completion of work. There was an increase in the perceived motivation of the comparison group; therefore the children of the IS as a whole reported being significantly more motivated than the CS after intervention to learn outdoors.

Both the treatment and comparison group showed an increasing trend in motivation over time, the increase among the children of the comparison group being very distinct. This eventually yielded a ‘not significant’ difference between the treatment and comparison group after intervention in overall motivation, and the key indicators except being good at learning.

The children of the TIS reported being more motivated in the outdoor environment than in the classroom after using the designed outdoors for both formal and informal learning, whereas they had not stated any difference between the two educational contexts at T1. Both the CIS and the CS reported being more motivated in the classroom before intervention. The condition of the CS remained the same at T3, but was reversed in the case of the CIS, which reported being significantly more motivated in the outdoor environment than in the classroom after intervention. The boys of the TIS reported being more motivated in the outdoor environment than the girls, significantly differing in behavioural motivation at T1. But the motivation of the girls in the TIS increased at T3.

7.4.3.2 Exploration of the environment

The children of the TIS said that they had significantly more opportunities for exploration of the environment in the outdoor environment than the CS. They reported an increased opportunity for learning through play, exploration of new things, individual exploration and discovery. An increase of opportunity for exploration was also perceived by the CIS. Therefore, the children of the IS as a whole reported increased opportunities to explore the outdoor environment compared to the CS. They reported having more opportunities for exploration in the outdoor environment than in the classroom at T3. Whereas the TIS boys

had reported significantly more opportunities to explore at T1, the situation was reversed at T3. The opportunity of exploration for the girls significantly increased after the intervention as per their report.

7.4.3.3 Peer relation

Though there was no significant difference in children's perceived peer relation between the TIS and the other two groups, the positive impact of using the outdoors was shown by the increased opportunity for working in groups among the children of the TIS compared to the CS. The children of the CIS also reported more opportunities for working in groups at T3. They stated that they had more of these opportunities in the outdoor environment than in the classroom. There was a decrease in perceived peer relation in the classroom among the children of the CS at T3, with their perceived peer relation in the outdoor environment remaining the same. There was a gradual increase in children's perceived peer relation from T1 to T2 and T3 in the TIS and the CIS. There was significant difference between boys and girls of the TIS at T1 but no significant difference between them at T3. This indicates an increase in girls' perceived relationship with their peers.

Chapter 8 Results from participant observation and behaviour mapping

The previous chapter illustrated the influence of the intervention on children's academic achievement and their perceived motivation to learn, their exploration of the environment and their relationship with their peers. This chapter explains the influence of the design of the school ground on children's play behaviour and the relationship between design features of different behaviour settings with children's formal and informal learning. Through participant observation accompanied by behaviour mapping, rich and descriptive data were gathered about children's pattern of use at T1 and T3 and also the way they behaved in different behaviour settings during outdoor classes and outside class hours. Observation notes reflected on qualitative aspects complementing the descriptive data. Analysis of the data contributed to the interpretation of children's activities during outdoor classes and their cognitive, social and physical activities outside class hours afforded by the various behaviour settings of the school ground. In this section the results of the analysis will be explained in two parts. The first part addresses the influence of the design on children's use of the school ground through descriptive statistics in terms of observed interaction at different times and different activities at T1 and T3 (Section 8.1). The second part presents the results of evaluation of different behaviour settings in terms of their affordance for formal learning (Section 8.2) and informal learning or play (Section 8.3).

Though only the children from Grade IV (both the treatment and the comparison group) participated in the questionnaire survey and only the treatment group was taught in the outdoor environment, all the children from IS used the school ground during their free time. The total number of children in IS was 358, of which 186 were boys and 172 were girls. The following results are based on the observation of the treatment group for formal learning and the observation of the children from all grades during their free time (before school, during lunch break and after school) in the school ground. The treatment group was observed during five science classes and five mathematics classes, a total of 400 minutes of formal learning. The analysis of informal learning was done on a total of 1560 (780x2) minutes of observation for six days at T1 and six days at T3.

8.1 Comparison of pre and post intervention results

8.1.1 Comparison of observed interactions at different times

Figure 8.1 shows the average number of children at different times of a normal school day at T1 and at T3. The total number of children is equivalent to the total number of activities. The results show that most children used the school ground during lunch break both at T1 and T3. The average number of children every day at all three different times considerably increased after intervention, with after school activities being pronounced. During the observation periods at T1, on an average 12-28 children played in the school ground at one time; the rest of the children either remained in the classroom or had come to school just before the class began. The children were also found to leave school immediately after the last bell rang on most days. At T3, in contrast, children were found to be engaged in various activities after the school had finished during the observation periods. Average number of children engaged in different activities in the school ground was 52 to 69. The neighbourhood children studying in the IS, very young children who did not yet go to school and children studying in the nearby private schools were found to be engaged in different play activities after school hours and during weekends.

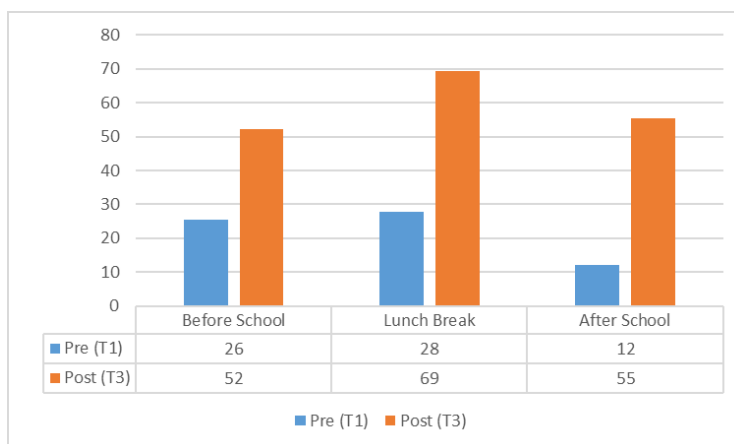


Figure 8.1: Children's interaction at different times of a usual school day on the school ground at T1 and T3

8.1.2 Comparison of different activities or play behaviours

There was considerable increase in frequency of all three kinds of activities (cognitive, social and physical)¹⁴ at T3 (see Figure 8.2). The physical activities were the most frequent,

¹⁴ Physical activities include play and games that help children's physical development e.g. running, jumping and swinging. Cognitive activities occur when children discover, explore and develop an understanding of the surrounding environment, and social activities occur when children interact with others in different social situations. For an inventory of the different activities in the school ground please see Appendix 6.

followed by the social activities, both at T1 and T3. The cognitive activities of children were negligible at T1, showing a considerable increase at T3.

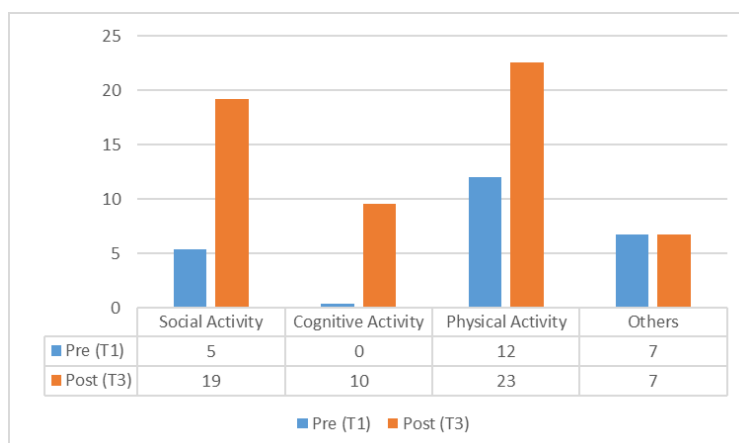


Figure 8.2: Average number of children engaged in different activities on a typical school day¹⁵

The percentage of physical and social activities was still largest at T3; however, the percentage of cognitive activities increased considerably at T3 compared to T1. A balance was therefore achieved among different types of activities. There was a decrease in the percentage of other activities which did not fall into either of these categories at T3 compared to T1. For example, many children were found wandering around aimlessly without being engaged in any of the three kinds of activities at T1. Two pie charts presenting the percentage of different activities in the school ground at T1 and T3 are given in Appendix 18A (Figure 87).

The typical daily occupancy of the children at T1 and T3 respectively shown in Figure 8.3 and Figure 8.4 gives a visual comparison of the number and spread of children in different parts of the school ground at different times during a normal school day. The cumulative maps of all the data points at T1 and T3 respectively in Figure 8.5 and Figure 8.6 show the overall spatial occupancy of the school ground. The children were mostly engaged either in ball games or in play¹⁶ that did not require any specific object to play with, e.g. *dariabandha*, hopscotch and *juta chor*. For rule games like *dariabandha* or hopscotch, they used a stick or brick chip for marking on the ground. In order to play *juta chor*, children only needed shoes from the participants. They generally used the corners of the school ground where there was shade from the trees and the space adjacent to the school building or the boundary wall.

¹⁵ Average from one regular week of observation (780 minutes) before the intervention and another regular week (780 minutes) after the intervention.

¹⁶ For the rules of different folk games played in the school ground please see Appendix 6C.

At T1 before the school started, children were found chatting, engaged in functional games like skipping or aimlessly wandering around. Sometimes the staff gave play elements like balls and skipping ropes to boys and girls respectively. At such times, the number of children in the ground immediately increased; this caused chaos, as boys entered the corner where the girls generally played. They were engaged mostly in rule games during the lunch break. The children left the school ground immediately after the last bell rang. Throughout the observation periods before intervention the children were not engaged in any kind of activity or play for long and switched games frequently.

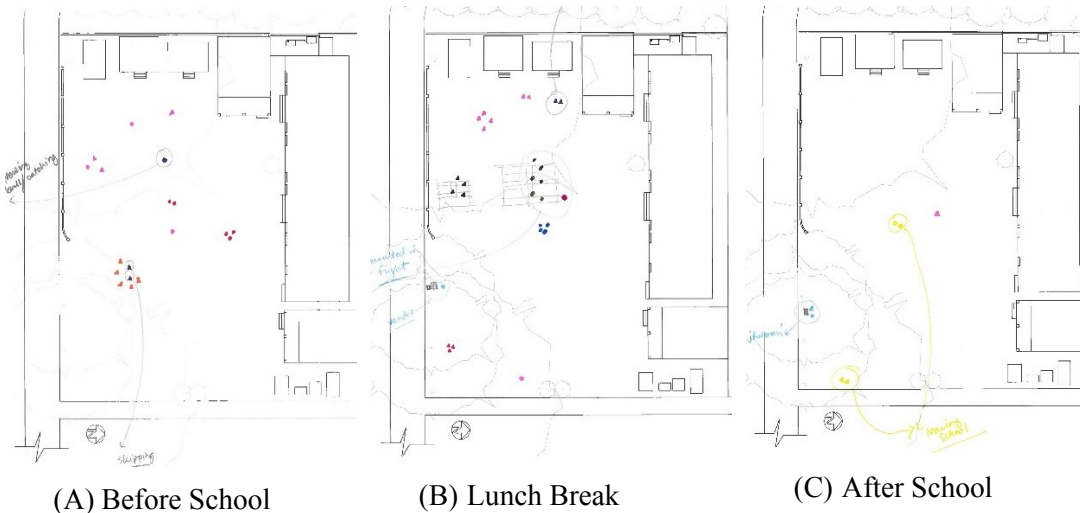


Figure 8.3: Typical daily occupancy of the school ground before intervention at three different times: (A) before school, (B) during lunch break and (C) after school¹⁷



Figure 8.4: Typical daily occupancy of the school ground after intervention at three different times: (A) before school, (B) during lunch break and (C) after school

¹⁷ For legends of the behaviour maps please see Appendix 6B.

A diverse range of play behaviours and activities was observed among the children after four months of intervention. The concentration of data points in different settings of the school ground gives an idea of the use of different behaviour settings for certain kind of activity at T3. Along with playing local rule games e.g. *dariabandha*, *hopscotch* and *juta chor*, children were found engaged in many new activities e.g. playing *pata-pata* and *mach vai*, jumping, rolling tyres, swinging, sliding, playing on the see-saw, observing life in the water tubs, cleaning the outdoor amphitheatre with brooms and taking care of the settings.

Though children were engaged in all three kind of activities throughout the day, they were found to play mostly rule games during lunch break. Most of these rule games were played in the central flat area and also in the area with loose materials. The huts were mostly used before school started; children were found to be self-focused and engaged in individual study or homework in this setting. This setting was seldom used during lunch break, as children were mostly engaged in active play or observing others. All the play equipment was occupied throughout the day; children were either active or waiting for their turns. Some activities were more prevalent in certain behaviour settings. However, others occurred in more than one setting. For example, children adopted hopscotch for playing in the amphitheatre and also in the huts, although the way they played the game was different for these two settings, resulting in a diverse range of activities performed by the children in the school ground at T3. How different settings of the school ground offered the affordance for different kind of games is explained in the second part of the chapter.



Figure 8.5: Cumulative maps of spatial occupancies at different times of the day: (A) before school, (B) during lunch break and (C) after school for the whole observation period before intervention

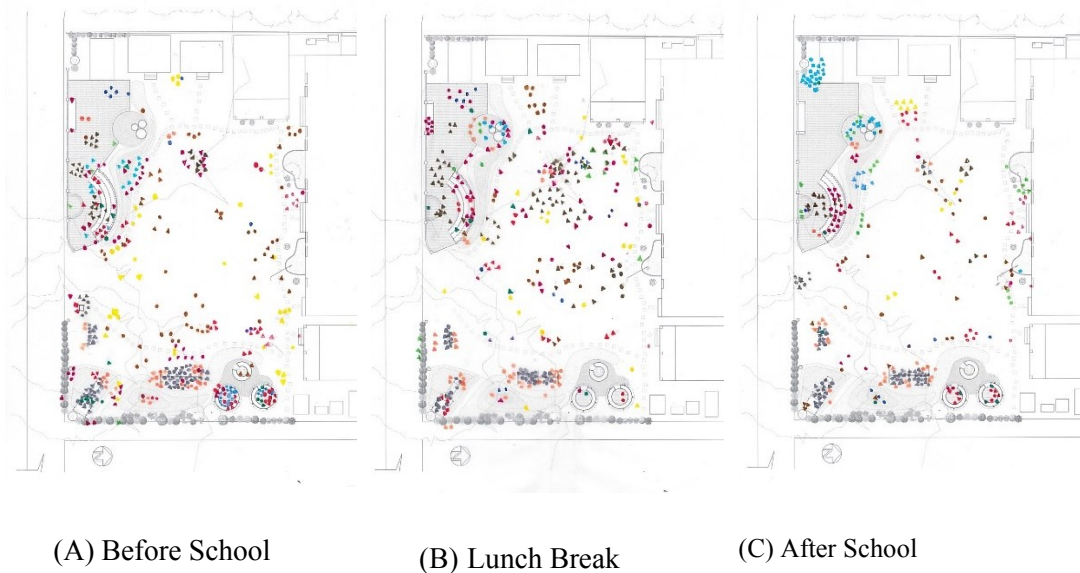


Figure 8.6: Cumulative maps of spatial occupancies at different times of the day (A) before school, (B) during lunch break and (C) after school of the whole observation period after intervention

8.1.3 Gender difference in observed interactions

Figure 8.7 shows the average number of boys and girls each school day in the school ground at T1 and T3. The behaviour mapping results indicate a considerable increase in the average number of both boys and girls in the school ground. The percentage of girls using the school ground rose from 40% to 48% at T3 (see Figure 88 in Appendix 18A).

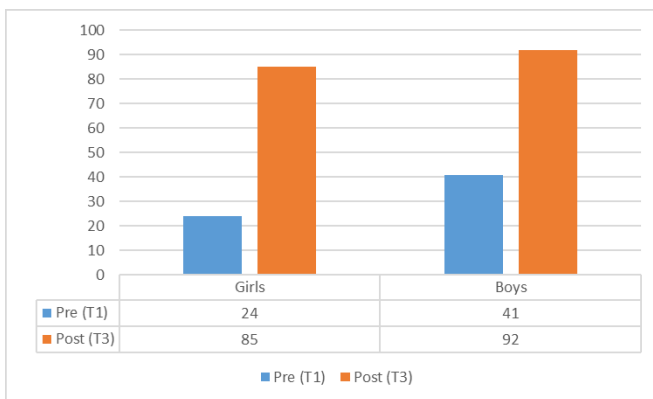


Figure 8.7: Average number of girls and boys every day in the school ground at T1 and T3

Figure 8.8 displays the average number of girls and boys at different times of the day at T1 and T3. The results show that both genders used the school ground throughout the whole day at T3, the number of the boys being higher all the time. The number of girls in the school ground increased at all times; it was even higher than the boys during lunch break.

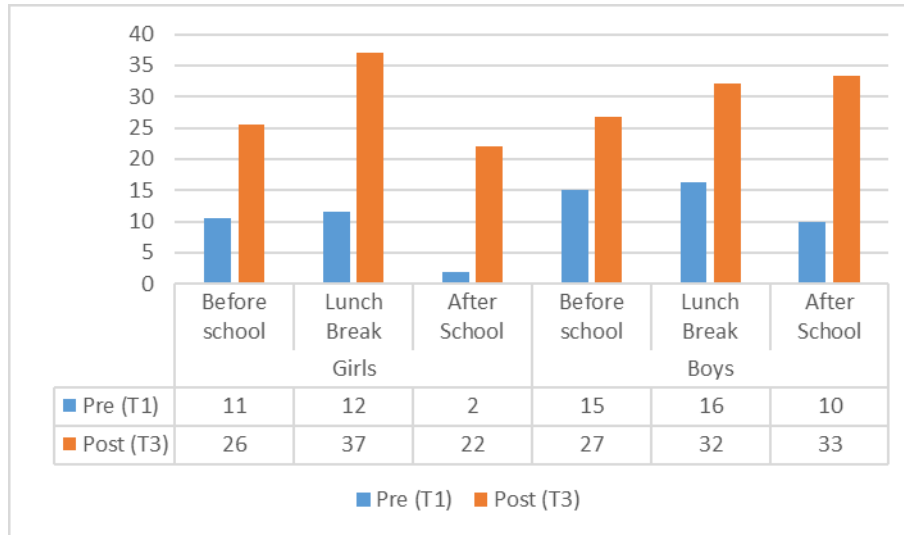


Figure 8.8: Average number of girls and boys at different playtimes every day at T1 and T3

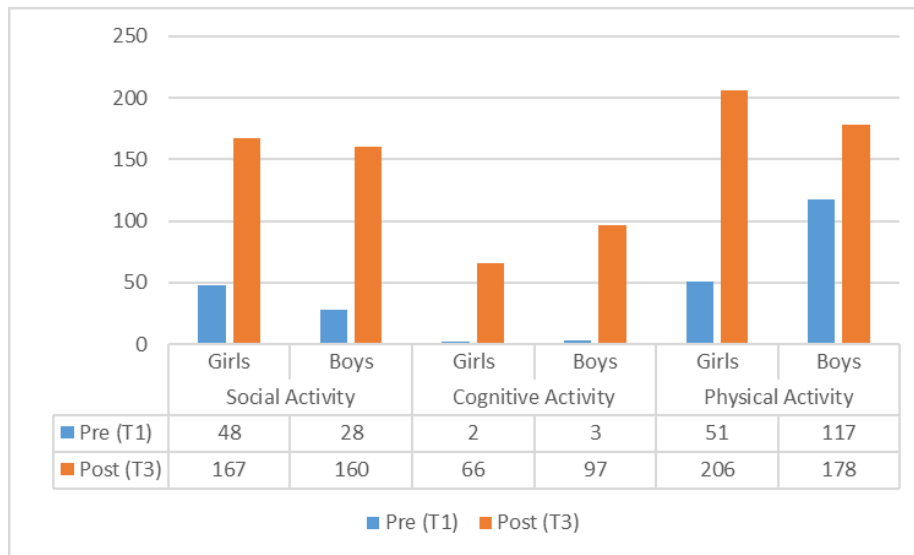


Figure 8.9: Total number of girls and boys in different activities at T1 and T3

Before intervention, girls were found to be mostly engaged in social activity, with the number being much higher than for the boys (see Figure 8.9). However, the number of boys in cognitive and physical activities was higher than for the girls. The situation is reversed in the case of physical activities. The number of social activities among boys increased considerably and was almost the same as for the girls, but the number of physical activities among the girls was even higher than the boys (for a graphical representation of the percentage of boys and girls in the school ground at different times and in different activities, see Appendix 18A, Figures 89 and 90).

8.1.4 Summary

- 1) The average number of children on the school ground considerably increased at T3.
- 2) Children were mostly engaged in physical activities during both observational periods (T1 and T3). However, the percentage of cognitive and social activities increased considerably after intervention. A balance was observed among different kinds of activities.
- 3) The children were found to be engaged in a wide and diverse range of play behaviours at T3 compared to T1. They played newer games and adapted the old games in the new settings with an added dimension.
- 4) Most children were found to be focused and engaged in specific activities in different settings, whereas previously many of them were found roaming around aimlessly in a scattered manner.
- 5) The average number of both girls and boys increased in the school ground at T3. The proportion of girls showed a distinct increase at different times of the day. It was even higher than the boys during lunch break.
- 6) Girls were mostly engaged in social activities whereas boys were engaged in cognitive and physical activities at T1. There was an increase in the percentage of boys' social activities and girls' physical activities at T3.

8.2 Observation and behaviour mapping in different behaviour settings during formal learning

In this section, the results from the analysis of observation and behaviour mapping in the outdoor class are presented in two parts. The first part reflects on the structure of the mathematics and science teaching in the classroom and in the outdoor environment, and the second part examines each behaviour setting and explains how these behaviour settings have been used for teaching the different content of mathematics and science.

8.2.1 Structure of the classroom teaching

Before intervention all classes were held in the classroom. At the beginning of the class the teacher introduced that day's lesson. Later on she discussed the concept or theory of the lesson to the whole class. The teachers discussed the topics by writing on the blackboard or reading from textbooks. Sometimes the teachers used object props prepared earlier specifically for the class. The mathematics teacher sometimes used seeds or sticks to demonstrate things on her desk; the enthusiastic, academically better students always responded and therefore were addressed, but the underachievers were generally found to sit on the back benches. After discussing the concept, the children were given tasks from the textbooks to work on individually in their exercise books. The students who finished earlier would approach the teacher and the teacher would check their exercise books. The academically better students, who sat on the front benches, generally approached the

teachers to show what they had worked on. Afterwards, the teacher concluded the day’s lesson by giving homework and sometimes an indication of what they would learn in the next class. Group activities, displays of students’ work or interactive discussions were not evident in the classroom settings. The overall structure is shown graphically in Figure 8.10 and the spatial occupancy during a mathematics class in the classroom is shown in Figure 8.11.

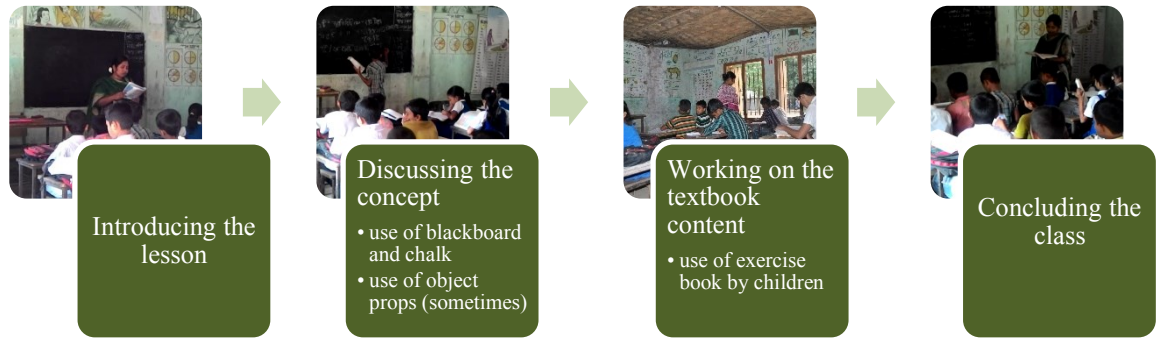


Figure 8.10: Structure of formal teaching in the classroom settings (Photo: Matluba Khan)



Figure 8.11: Spatial occupancy during mathematics class in the classroom (A) after five mins, (B) after 20 mins and (C) after 35 mins on a typical school day

8.2.2 The structure of the outdoor classes

The outdoors was seldom used for teaching of the curriculum at T1. Sometimes the children were asked to look outside the window to observe plants and trees to relate to the content in their textbook. The only outdoor activity was taking Grade II children to the school ground for learning using printed mats. The mats were rolled down on the flat area and the children learnt about different food values by jumping on the boxes drawn on the mat (see Figures

8.12a and 8.12b). However, after the intervention, teachers were teaching mathematics and science regularly in the outdoor environment. The children expressed interest in having all their classes outdoors, but only Section B, Grade IV children (TIS) were taken outdoors for teaching mathematics and science for the purpose of the experiment. Nevertheless, the other children were informed that they would all be taken outdoors for their classes after May 2015.

The mathematics and the science teacher followed a fairly similar structure in their outdoor lessons; at the beginning of the class they met all the children in the amphitheatre. The teachers introduced that day's lesson and then divided the children into groups and gave them different tasks. The children then went to different settings to work on the respective tasks. In some classes the children were given the scope to choose the setting they would like to work on or work in, and sometimes the teachers assigned them some settings or sub-settings based on the requirement of the task. At the end of the class the teachers met the children again either in the amphitheatre or the open yard and discussed that day's lesson. The last session was interactive in nature; the children presented their work in front of others and all of them participated in the discussion. Figure 8.13 shows the structure of the class graphically.



a



b

Figures 8.12a and 8.12b: The only outdoor formal learning activity before the intervention with Grade II children (Photo: Matluba Khan)

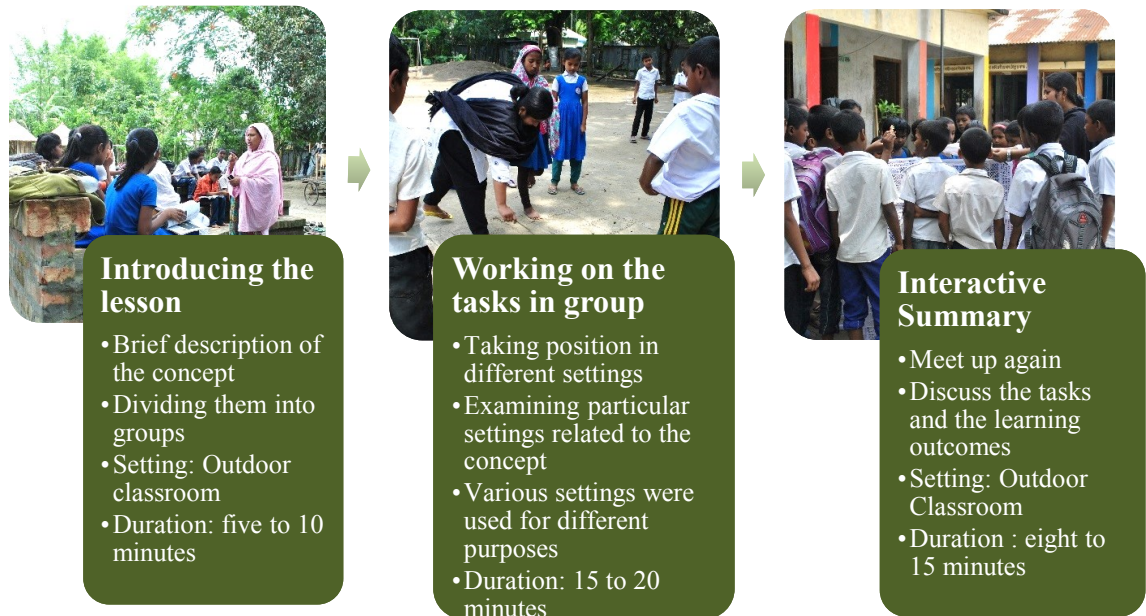


Figure 8.13: The structure of the classes in the outdoor environment

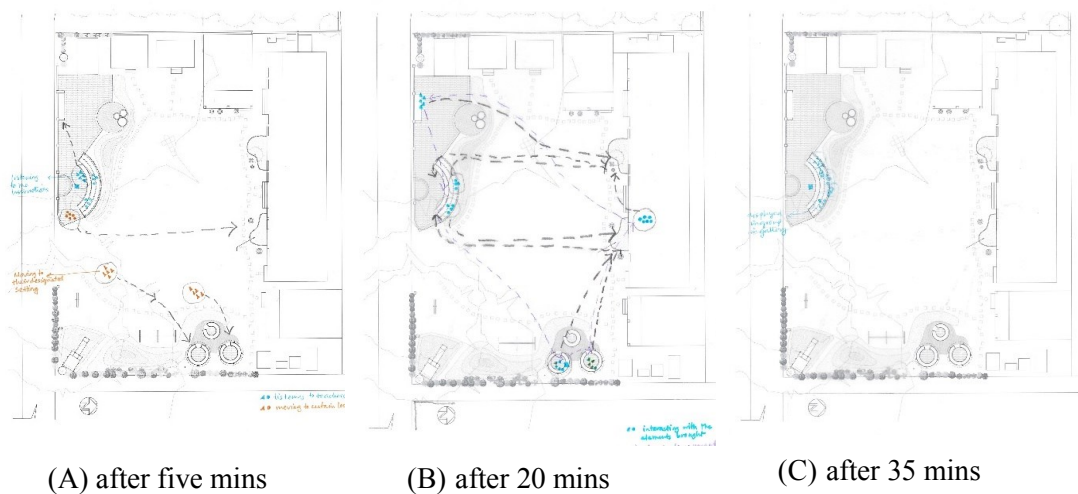


Figure 8.14: Spatial occupancy during science class (A) after five mins, (B) after 20 mins and (C) after 35 mins on 14 May 2015

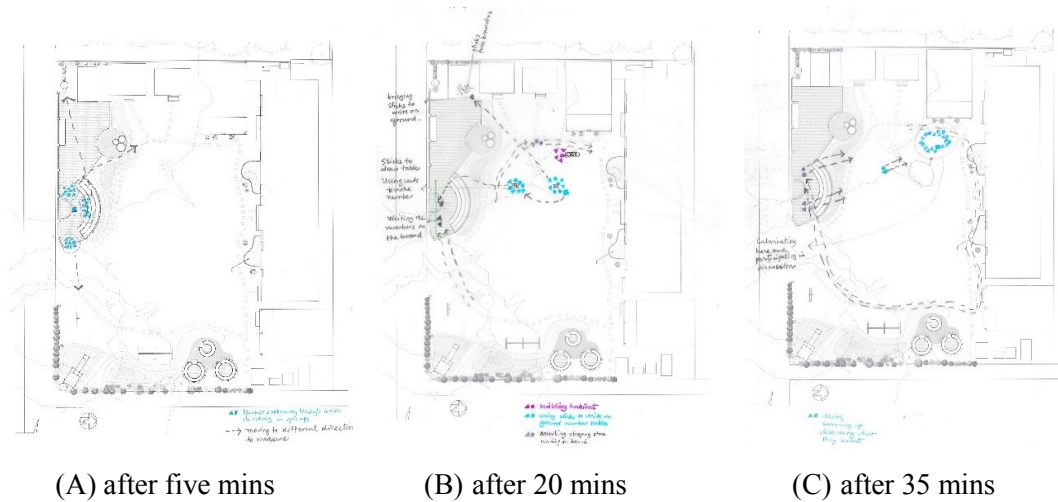


Figure 8.15: Spatial occupancy during Mathematics class (A) after five mins, (B) after 20 mins and (C) after 35 mins on 06 May 2015

The overall structure of the classes remained the same, but the mathematics and science teachers differed to some extent in their criteria of dividing the children into groups. The science teacher divided the children based on tasks; she would divide the content of a chapter into smaller tasks and then each group was assigned a task. Different groups of children looked into different aspects of a central theme or idea. Various settings were used to explore a topic from different angles, and at the end the children presented their work, which gave a complete picture of that particular topic. Sometimes after introducing the concept the teacher would lead the children to a certain setting to talk about a concept related to that particular setting (see Figure 8.16). She then divided them into groups and gave them tasks from the textbook, contextualising the content to different behaviour settings of the school ground.

The teacher then led the children to the big tree at the south-west corner of the school in the natural learning area. She asked a boy to stand beside the tree. She pushed the tree and asked the children, *'Did it move? Can the plants move on their own?'* *'Noooooo,'* the children responded together. She then gently pushed the boy, he moved a bit from his position and she asked him to walk. She asked the children, *'Can you all move? Can animals move?'* *'Yessssss!'* they again shouted together. *'So plants differ from animals, right?'* They again screamed together, *'Yesss!'* The teacher demonstrated some more differences between plants and animals... *'Every time they were finding a difference they were expressing their joy.'*

Science class

Field Journal, 27 January 2015



Figure 8.16: The teacher demonstrating the difference between plants and animals (Photo: Matluba Khan)

The mathematics teacher, meanwhile, after giving a general introduction would divide the children into groups based on their academic levels – underachievers, mid-achievers and academically good students. She then assigned the three groups certain tasks based on their levels of competence and focused on working with one group. In this way, she reduced the teacher-student ratio and could work more closely with one group on some theory of mathematics. In the next class she assigned this group certain tasks based on the lesson. She worked with the other two groups to teach number theory.

The teacher asked the students, *'Who got more than 80 in the first terminal exam?'* Three girls and one boy raised their hands. *'Today you will be free to do whatever you like. You can build house with the loose materials.'* Addressing the rest of the class, she said, *'You could have done the same if you did well in the exam. But we will work on learning numbers up to one crore again today.'* Four children who had performed very poorly in the exam were led to the stepping stones in groups of two. She asked them to step on each block, look at the number and, after a round of all the numbers, write them on the blackboard. She then divided the rest of the class into two large groups and led them to the open yard. She told them to bring some sticks from the area with loose materials in order to write on the ground. She herself carried four boxes of seeds and marbles. She gave two boxes to each group. Two children collected sticks and two others drew a table on the ground. Each of them made a number using the seeds and then one of them went to the blackboard to write the number in words. The teacher was moving between groups and helping them.

Mathematics class

Field Journal, 06 May 2015

8.2.3 Frequency of occurrences in different settings

The analysis of the observation of five mathematics and five science classes in the outdoor environment reveals that the highest number of activities took place in the amphitheatre, followed by the natural learning area and the huts (see Figure 8.17). The teacher generally met children twice in the amphitheatre during an outdoor class – first to introduce that day’s lesson and then again for an interactive summary of that day’s work. If the occurrence of activities in the amphitheatre at the beginning and the end of an outdoor class are excluded from the analysis, the percentage of occurrences in different settings did not vary much (see Figure 8.18).

The central tenet of the science curriculum of Grade IV is learning about the surrounding environment, which involves learning from observation, exploration and close interaction with nature. The natural learning area provided most of these opportunities, followed by the gardens, which accommodated the third highest number of activities after the natural learning area and huts. Most of the activities in the outdoor class were performed in groups, which triggered the use of huts. Two huts accommodated four groups of children. The teacher was found to work with children in the huts when it rained. After the gardens, the area with loose materials and the open yard were preferred for activities in the outdoor class. The rest of the time, activities took place in the pathway area, the water area and the play area.

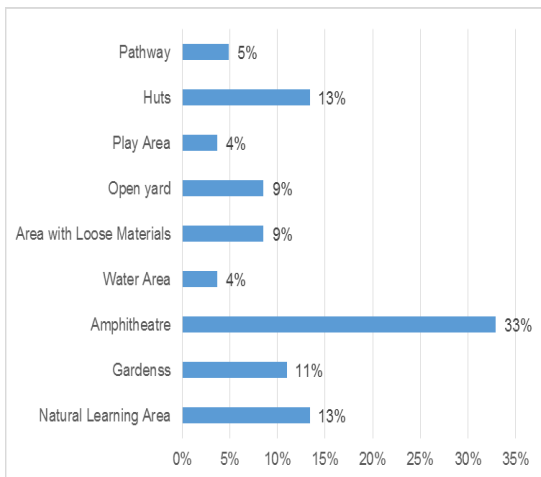


Figure 8.17: Children’s interaction with different settings during outdoor class as a whole

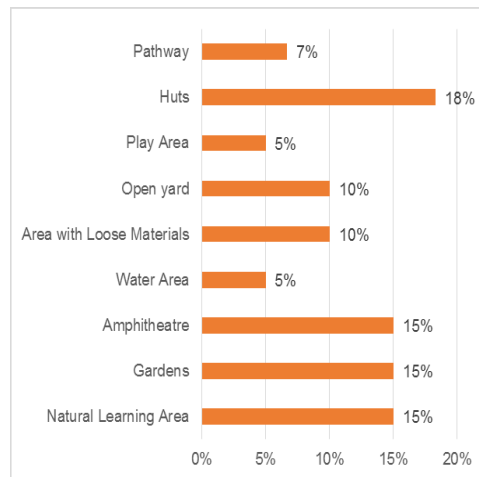


Figure 8.18: Children’s interaction with different settings during the second part of outdoor class only

8.2.4 The patterns of use of different behaviour settings

8.2.4.1 Observed interactions in the natural learning area

Figure 8.19 displays the percentage of occurrences of different activities in the natural learning area. The children used the natural learning area mostly for observing and examining plants, followed by counting, listening to the teacher and closely interacting with nature. During the observed time period the children used the natural learning area for counting different plants to relate to number theory (Figure 8.20) and measuring the circumference of a tree (Figure 8.21) in their mathematics class. In science class, the teacher directed the children to the natural learning area to explain concepts or themes related to nature. The children observed the setting (e.g. investigated the difference between plants and animals and interdependence of plants and animals and learnt about different types of plants), interacted closely with nature and made changes to it (e.g. dug a compost bin in order to make compost from rotten leaves). The most frequent activity in the natural learning area was the observation of nature. The second was counting and listening to the teacher while she explained some ideas. The activity of the children in this setting went over the time period of the class. Though children did not learn about natural fertiliser or compost until the next class, they were found working on preparing the compost bin earlier (as mentioned in Section 8.3.3.1). Sometimes children were found preparing for the next day's lesson; this was one of those occasions, as they were digging an area for a compost bin to learn about natural fertiliser the next day. They also collected natural loose materials like leaves, straws and paper from all over the school to be used in their compost bin.

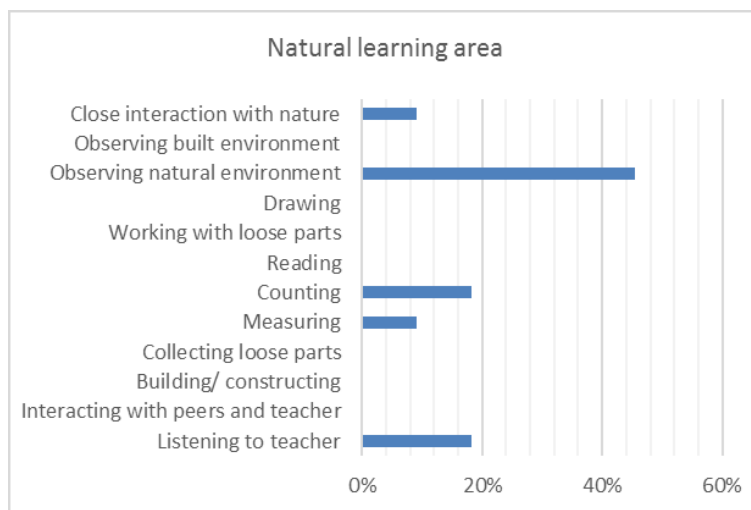


Figure 8.19: Percentage of different activities in the natural learning area



Figure 8.20: Girls counting plants in the natural learning area (Photo: Matluba Khan)



Figure 8.21: Children measuring the circumference of the tree (Photo: Matluba Khan)

8.2.4.2 Observed interactions in gardens

The most frequent activity in gardens was similar to the natural learning area, i.e. observing the natural environment (see Figure 8.22). In science class, children observed different types of plants (flowering or non-flowering), investigated gardens as a habitat of plants and insects ('A butterfly!' a girl exclaimed in joy as she saw a butterfly for the first time in the school ground) (see Figure 8.23), listed the different food produced in gardens and learnt about their food values. Children's activities in gardens during mathematics class included counting (the plants and also the bamboo sticks) and relating it to number theory (see Figure 8.24). The use of gardens for learning the curriculum was not limited to the duration of the outdoor class only. The children planted plants outside class time, watering them early in the morning and late in the evening. This way, the gardens became usable for teaching during class time.

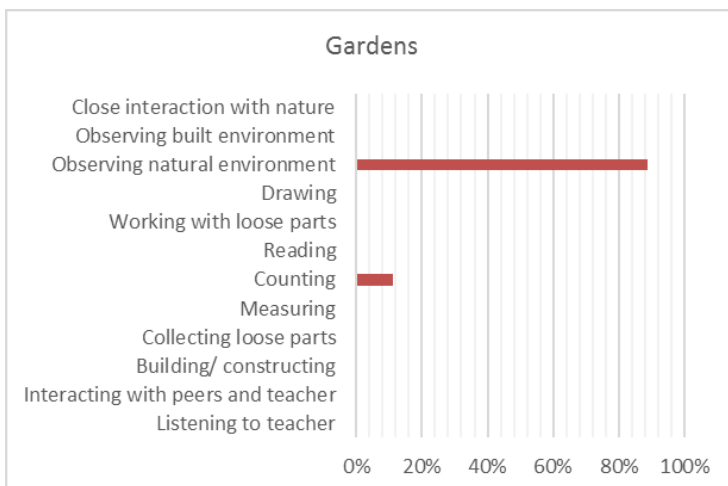


Figure 8.22: Percentage of different class activities in gardens



Figure 8.23: Girls observing gardens closely
(Photo: Matluba Khan)



Figure 8.24: Girls counting plants and bamboo pieces used in the fence of the gardens (Photo: Matluba Khan)

8.2.4.3 Observed interactions in the amphitheatre

Figure 8.25 displays the percentage of different activities in the amphitheatre during the outdoor classes. The introductory and the concluding activities of both classes mostly occurred in the amphitheatre (see Figure 8.26). This meant that listening to the teacher at the beginning of the class and interacting with peers and teachers at the end of the class to share and learn from each other were the most frequent activities that occurred in the amphitheatre. In the concluding session of the class, the children generally wrote on the blackboard (Figure 8.27) and talked about what they had worked on. Once, the children were found to display their works on the steps of the gallery (see Figure 8.28). The children were eager to present their work and overcame the shyness that had been observed during the first few days of the outdoor classes. The third most frequent activity was working with loose materials. The mathematics teacher carried such materials (e.g. seeds and marble) to the amphitheatre and used them to explain number theory to children either on the stage or on the steps of the amphitheatre. The children also measured the length of the outdoor class in one of the mathematics classes (see the journal entry of 09 May 2015).

In one of the science class projects, the children closely observed the amphitheatre setting to find out the elements that were used to build the setting and whether those elements were man-made or natural. The children also worked on soil erosion in one of the science classes. In a group of five, they had been given the task of looking for explanation of soil erosion and finding measures to protect soil from erosion. One child was looking at the mound just behind the amphitheatre and identified that rainwater had eroded the soil from the mound and washed it into the water area; as he said, *'If we could grow grass here, the soil would not have eroded.'*

“The rain ceased half an hour before the Mathematics class was due. There was water here and there on the school ground. But the children cleaned the outdoor amphitheatre with a broom. The mathematics teacher met them in the amphitheatre. She talked briefly about what they had been learning recently. She asked the children who had been working with her in the previous class about prime and composite number. Two of them responded. The teacher then repeated the definition again for the whole class. She used blackboard and chalk to show examples of prime and composite numbers. She divided the group who had worked on number theory before into four groups of two and two groups of three. Three groups were sent to different settings to count elements there and write in their exercise books whether it was a composite or prime number. She sent two groups to two corners of the natural learning area and one group to the gardens to count the plants, one group to the huts to count the bamboo poles and one group to the classroom to work with seeds. She asked them to find out whether the counted number was prime or composite. The remaining group was sent to the stepping stones from 21 to 25 and find out the prime and composite numbers there.

She worked with the rest of the group in the amphitheatre. She carried two boxes of seeds and a box of marbles. 10 children sat around her forming a circle on the stage of the amphitheatre. The children repeated the definition of prime and composite number with her. She then put six seeds on the centre of the stage. *“How many of you can get an equal number of seeds from here?”* the teacher asked, standing. Some of the children replied together,

“Six.”

“How?” Six children then picked one each from there.

“How many seeds have each of you got?”

“One”

“Now give all of the seeds to one of your friends.” They gave the seeds to one child.

“Can you distribute the seeds to three of your friends?”

“Yes, each one will get two.”

“Then, what type of number is six? You can divide the number by one and six but also two and three. Is it a prime or composite number?”

“Six is a composite number,” The children smilingly answered.

She continued with them using a different number. Children from the other groups were seen counting bamboo and plants, writing the number in the exercise book and coming back to the blackboard to write the number with the names of the group. Two boys who were working on stepping stones sat on the tyres which were there and wrote in their exercise book.

At the end of the class she gave homework to all the children from their exercise books. She concluded the class and two girls helped her carry the boxes with seeds to the office room.

Mathematics class
Field Journal, 09 May 2015

When the children in groups were given the option to choose a setting for their group work, some groups preferred the amphitheatre. They used it for drawing and also working on some science projects. Working in groups was not included as a separate code here in order to avoid duplication, as many of the activities involved group work. More than one group were found to work there on several instances.

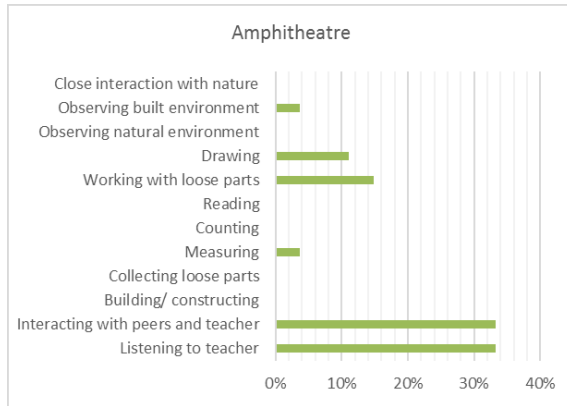


Figure 8.25: Percentage of different activities in the amphitheatre



Figure 8.26: The teacher talking about various scales of measuring at the beginning of the class (Photo: Matluba Khan)



Figure 8.27: A girl writing on the blackboard about what they worked on (Photo: Matluba Khan)



Figure 8.28: A boy explaining food values to everybody (Photo: Matluba Khan)

8.2.4.4 Observed interactions in the water area

Figure 8.29 displays the percentage of different activities in the water learning area. 67% of the activities in the water area involved close interaction with nature. The children were involved in making changes to the environment by planting water plants and putting in small fish, therefore creating a water habitat, in their science class (see Figure 8.30). Other activity in the water area included observing this water habitat and investigating the interdependence of plants and animals in an aquatic environment. During the outdoor class, one child expressed the concern: 'But madam, fish don't live long in this tub!' 'Do you know the reason?'

the teacher asked. The child seemed thoughtful. *'Think about it and we will discuss it later,'* said the teacher (Figure 8.31). The water area was not used in the mathematics class during the observation period.

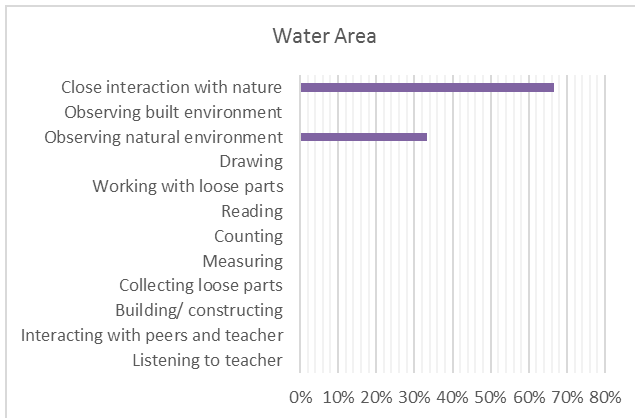


Figure 8.29: Percentage of different activities in the water learning area



Figure 8.30: Children closely interacting with water features (Photo: Matluba Khan)



Figure 8.31: Children learning about water habitat from their teacher (Photo: Matluba Khan)

8.2.4.5 Observed interactions in the area with loose materials

The most frequent activity (43%) observed in the area with loose materials was collecting loose materials for different activities (see Figure 8.32). After collecting the loose materials, children either worked in that area or moved to other settings. If they worked in that area, they were mostly engaged in building houses (see Figure 8.33). If more than one group was asked to build houses, only one group worked in this area (see Figure 8.34); the rest chose the open yard for this activity, collecting loose materials from the classroom and the area with loose materials. The children sometimes used the top of the storage shelf for group work (see Figure 8.35).

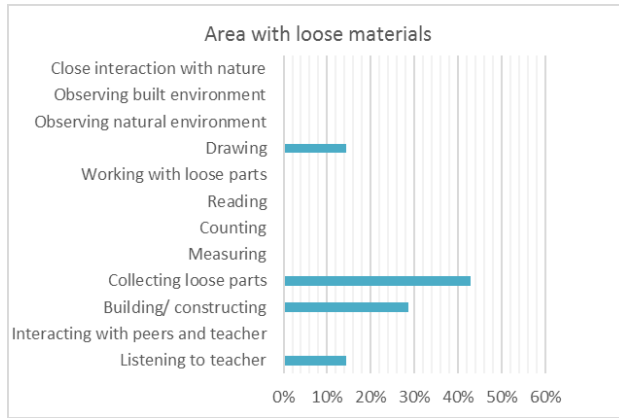


Figure 8.32: Percentage of different activities in the area with loose materials



Figure 8.33: Children collecting loose materials (Photo: Matluba Khan)



Figure 8.34: Children building a house in the area with loose materials (Photo: Matluba Khan)



Figure 8.35: Children working on different food values on top of the storage shelf in the area with loose materials (Photo: Matluba Khan)

8.2.4.6 Observed interactions in the open yard

Figure 8.36 displays the percentage of different activities in the open yard. The highest percentage of activities included working with loose materials (e.g. sticks, boxes, thatch and egg crates) (see Figure 8.37) and building/constructing (see Figure 8.38). The second highest of these activities was observing the natural environment, measuring (see Figure 8.39) and interacting with peers and teachers. Many of these activities included working in the adjacent settings (the water area and gardens) while locating themselves in the open yard. Children interacted with their peers around the houses or buildings they made with loose materials in the open yard. The only activity which occurred independently in this setting was measuring. The open yard was the only outdoor setting in the school at T1; the only use observed at that time was using learning mats for learning properties of food (explained in detail in Section 8.2.2). However, the same yard was found to be used in diverse activities at T3.

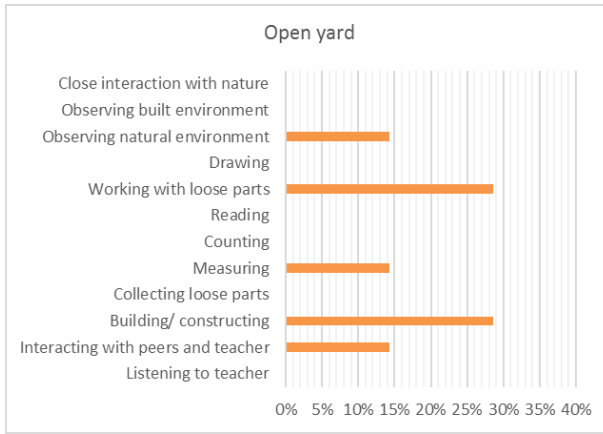


Figure 8.37: Children drawing a table to learn numbers with seeds in the open yard (Photo: Matluba Khan)

Figure 8.36: Percentage of different activities in the open yard



Figure 8.38: Children making a house in the open yard (Photo: Matluba Khan)



Figure 8.39: Children measuring the length of the open yard (Photo: Matluba Khan)

8.2.4.7 Observed interactions in the play area

The three activities that occurred in the play area shared equal percentages, as displayed in Figure 8.40. The children observed the playhouse and investigated the kind of resources that were used to build it in the science class (see journal entry on 11 May 2015). The children measured the height of the slide in their mathematics class (Figure 8.41) and were also involved in drawing. The top of the playhouse was a popular place for group activities for the children (Figure 8.42). The children would run to secure this place for their group activity if they were given a choice of setting by the teacher. They were found to slide to get down from the playhouse after finishing the activity (Figure 8.43).

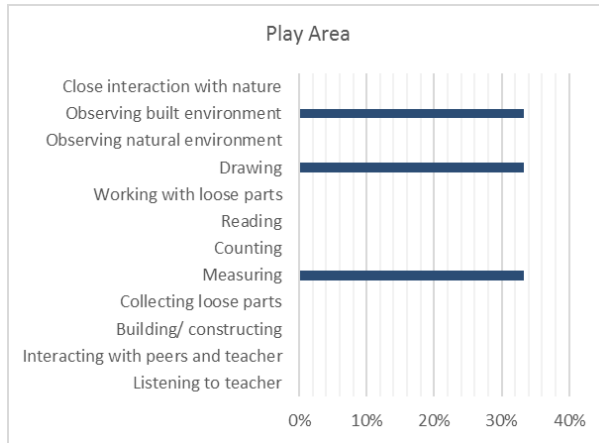


Figure 8.40: Percentage of different activities in the play area



Figure 8.41: The teacher helping with measuring in the playhouse (Photo: Matluba Khan)



Figure 8.42: Children working in a group in the playhouse (Photo: Matluba Khan)



Figure 8.43: Children sliding down the playhouse after completion of their work in a group (Photo: Matluba Khan)

8.2.4.8 Observed interactions in huts

As shown in Figure 8.44, drawing as part of science or mathematics class project occurred most frequently in the huts, followed by observation of the built environment. As part of the science class project mentioned in the previous section, children investigated the kind of resources that were used in the making of those huts (see journal entry on 11 May 2015). Other activities in this setting included counting, measuring, collecting loose materials and working with them. All of these activities were performed in groups (see Figures 8.45-8.47).

It had been raining since morning. Some of the children were worried whether they would have their classes in the outdoors today. But the rain had ceased before the class started. Today the teacher was teaching about natural and man-made resources. At the beginning of the class she met all of them in the amphitheatre. She gave a general definition of natural and man-made resources, citing an example from their textbook and also the school ground. The children seemed attentive and were responding to the teacher. The teacher requested, *'Give me an example of a natural resource that has been used in the school ground.'* Some of the children responded immediately together, *'Bamboooooo.'* The teacher smiled and then assigned them that day's task. *'Today we will learn about the man-made and natural resources that have been used in our own school ground.'* She then divided them into groups, associating each group with a certain behaviour setting. Three more children entered the class. Four groups comprised five children and one group comprised four children. The five groups were assigned to the huts, the playhouse with the slide, school building, amphitheatre and gardens. They were given 15 minutes to complete the task.

The children went to their designated settings right away. I followed one group to the playhouse. One girl was making a list of the elements in her exercise book. The other four children were telling her the names of different elements. They then discussed whether each element was man-made or natural. One child was asking, *'Do you think the slide is man-made? It's made of steel.'* *'Don't we get iron from mining? I read it in the book,'* said another child. At that point the teacher came in. She asked them about the progress, discussed some elements and helped them with their query. *'As the iron was then processed in the factory and afterwards the slide was made in the local workshop using that processed steel, we can count it as man-made for this project.'* Then she left to work with another group. The children were pleased to have come to a decision; the task seemed fun to them. After finishing, each child slid down from the playhouse.

When time was up, the teacher called the groups by group name. All the groups had finished already. They came to the outdoor classroom, where the teacher was making a table on the blackboard using chalk. She asked each group what they found in their setting. One boy entered the class at this point. He had started his journey from home after the rain ceased. She asked him to follow the class from then and then turned again to the class. *'Huts group, please tell your friends what the huts are made of.'* She then put the elements into the table, and discussed with them the confusion raised in different groups.

Afterwards the teacher gave them a task from the textbook. They were to fill in the table in the textbook. The task was to relate the lessons from the book and from real life. Some children finished within two to three minutes. The teacher checked their exercise books. Then she gave them a very brief idea of the next day's task. She wished them good day and left the outdoor class, heading towards the office room.

Science class

Field Journal, 11 May 2015

Brick chips were used as a surface material in huts to give it an identity as a setting. However, the mathematics teacher also used them in one of her classes. It was a rainy day, though the rain had ceased before the class. The children expressed their interest in having their classes outdoors, so the teacher only used the space with shelter in case it rained during

the class. She sent three groups, comprising a total of 11 children to one hut and the playhouse to draw their choice, and she worked with the remaining 13 in another hut. Instead of using her seeds this time, she asked them to collect brick chips from the setting and then they worked on the floor of the hut to learn about some aspects of number theory. The children also counted the bamboo piles of the fence to relate to number theory (Figure 8.45) and measured the diameter of the floor of the hut, which was designed as a perfect circle (Figure 8.46).

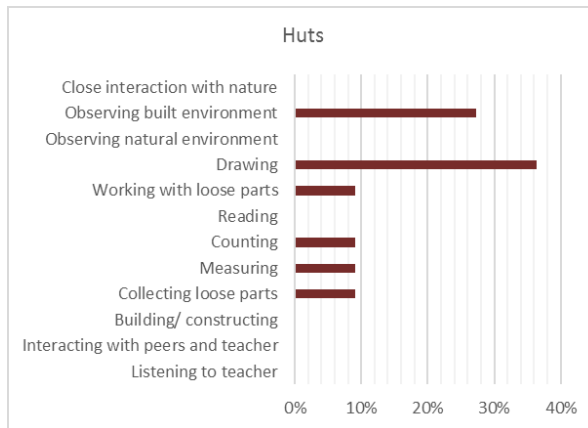


Figure 8.44: Percentage of different activities in the huts



Figure 8.45: Children counting bamboo in a hut (Photo: Matluba Khan)



Figure 8.46: Children measuring the diameter of the floor of one hut (Photo: Matluba Khan)



Figure 8.47: Children working in a group in a hut (Photo: Matluba Khan)

8.2.4.9 Observed interactions in the pathway

Figure 8.48 displays the percentage of different activities on the pathway. The most frequent activity was reading the numbers painted on the top of the stepping stones. The children used it for learning numbers from one to 100 and for making meaning of those numbers – whether it was a prime or composite number (Figure 8.49). The Grade IV children who were taught in the outdoor environment were expected to have basic knowledge of numeracy already.

Underachieving children who did not yet have a clear conception about numbers were asked to read the numbers marked on the square blocks (stepping stones) and then write them on the blackboard. The teacher used the pathway for the teaching of more advanced knowledge of mathematics to children, for example measuring, geometry and number theory (Figure 8.50).

While the children were measuring the two sides of the stepping stone the teacher appeared there to help if they needed. They measured the sides and found that all sides measured the same. *‘Let me tell you an interesting thing – when the four sides of a quadrangle are equal, it’s called a square,’* the teacher said.

Mathematics class
Field Journal, 09 May 2015

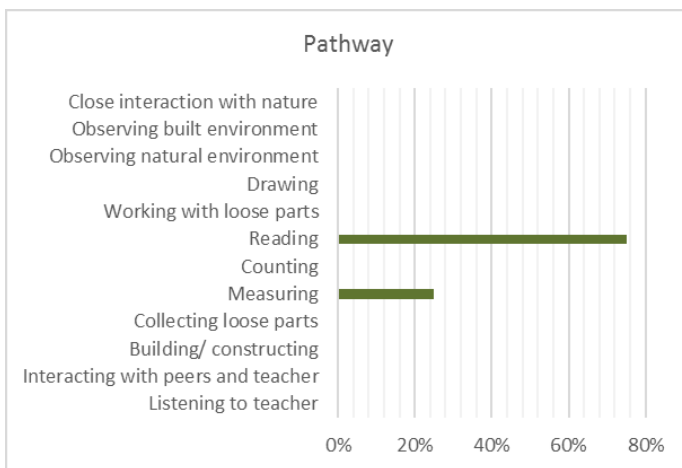


Figure 8.48: Percentage of different activities on the pathway



Figure 8.49: Prime number or composite number? (Photo: Matluba Khan)



Figure 8.50: Children measuring the length/width of a stepping stone (Photo: Matluba Khan)

8.2.5 Gender difference in observed interactions in the outdoor classes

The activities in the outdoor classes were mostly teacher directed. While children were asked to work in groups, sometimes they were free to choose group mates and sometimes the teacher formed the group. The groups formed by children were generally same sex groups.

However, when the teacher formed the groups there was a mix of boys and girls in a group. Girls and boys were found to be co-operative with each other in group work. Both genders participated actively in all tasks. Nevertheless, when the teacher asked them to answer questions, bring anything or carry the boxes to the office room, girls generally volunteered for these activities.

8.2.6 Pattern of movement

The movement pattern of children during their outdoor classes occurred at two levels – one was between different settings and another one was within the setting where they worked. When the children were given a task after the introduction of the lesson in the outdoor amphitheatre, they moved from the amphitheatre to a setting where they worked on the designated task. Different groups went to different settings based on the type of the activity or the instruction of the teacher. As part of an activity, sometimes they needed small or large materials, which they collected either from the area with loose materials or the surrounding area of the setting. At the end of the activity they generally came back to the amphitheatre again, or to some other setting where the teacher discussed their peers' work. Figure 8.51 displays the movement pattern of children and teachers in the school ground.

Working on an activity within a setting also required movement to a certain extent. In the outdoor class children worked on real life objects, touching and exploring. For example, in the mathematics class, while measuring length or working with seeds children were moving their body and using their hands. Even in science class, while creating habitats or examining plants or animals and observing nature closely, children were physically active. Tactile experience of different elements was observed as an important part of learning in the outdoor environment.

Even teachers were physically active during the outdoor classes. They moved between settings to help the children who were working in groups in different settings. When demonstrating certain concepts using real life objects like measuring or working with seeds, the teacher used her body and hands.

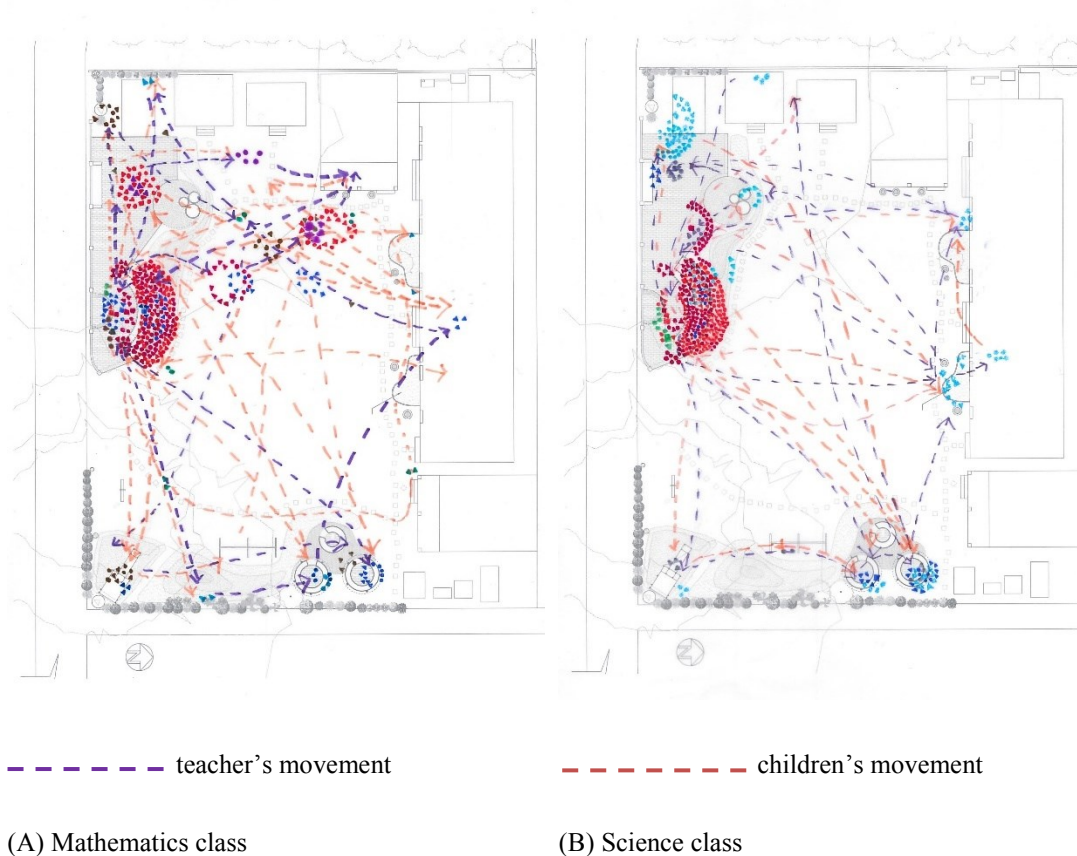


Figure 8.51: Cumulative maps of spatial occupancy and movement pattern during (A) mathematics class and (B) science class in the outdoor environment

8.2.7 Summary

- 1) The teacher met children in the amphitheatre at the beginning of each class to introduce a day's lesson and at the end to summarise the outcomes. The central activity of the class occurred in different settings, and this occupied half of the time of the total class.
- 2) Teaching in the classroom was more static – children and teachers remained in their respective locations for most or all of the time as the teaching was centred on the content of the textbook.
- 3) The highest number of occurrences took place in the amphitheatre, the natural learning area, the huts, the gardens, the open yard and the area with loose materials respectively.
- 4) A diverse range of activities were observed in the huts, the amphitheatre, the natural learning area, the area with loose materials and the open yard. The water area, the natural learning area and the gardens offered more opportunities for interaction with nature. Interaction among teachers and peers at the beginning and end of the class was mostly held in the amphitheatre and the open yard. The huts offered more opportunity for working in groups. Building or constructing activities mostly occurred in the area with loose materials and open yard (after collection of loose materials from the area with loose materials) (see Figure 8.52).

- 5) Manufactured and natural loose materials available at different settings were used to teach different concepts.
- 6) Girls volunteered comparatively more than boys in the outdoor class activities.

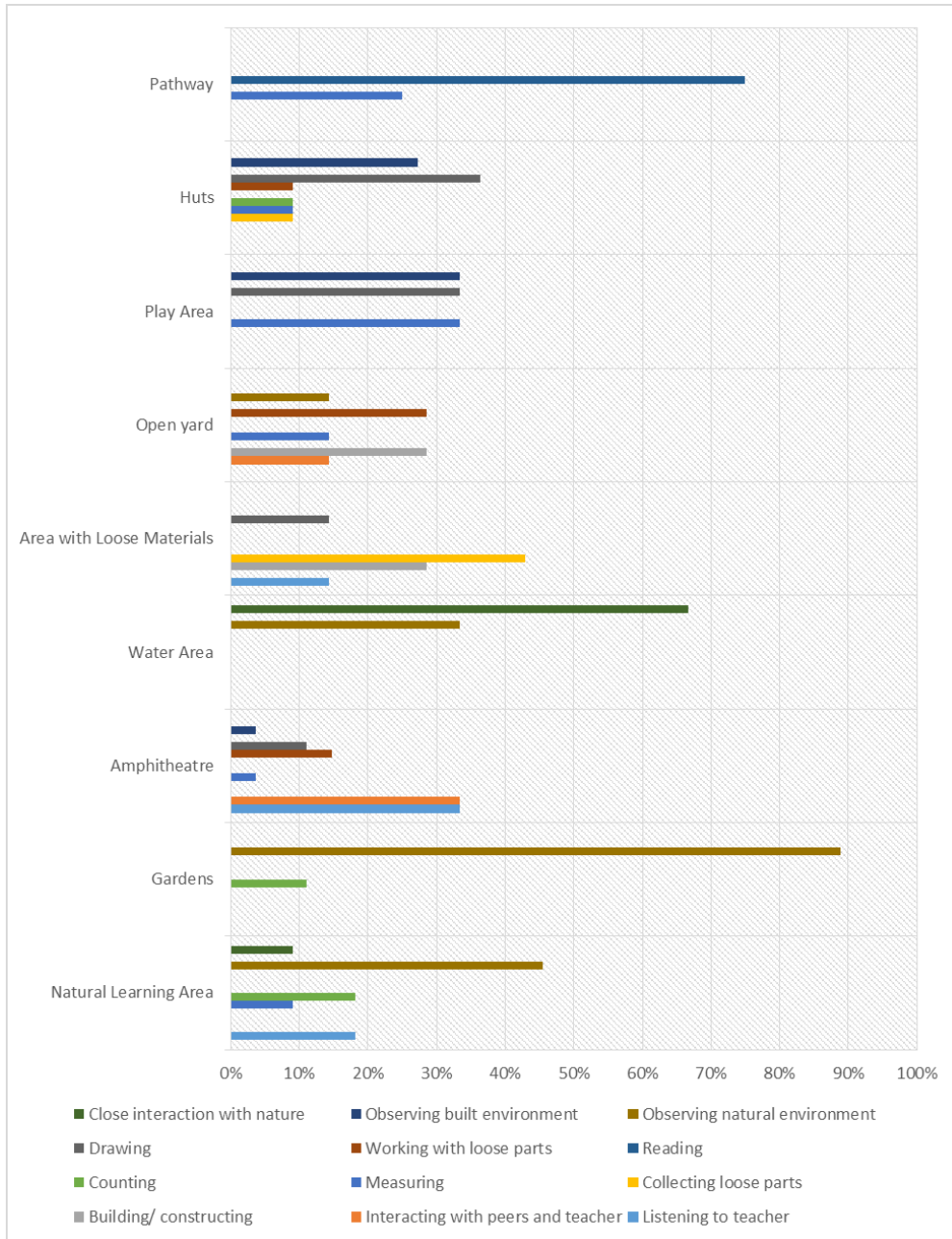


Figure 8.52: The cumulative graph of percentage of different activities in different behaviour settings

8.3 Observation and behaviour mapping in different settings during informal learning

8.3.1 Frequencies of the users and main activities in different behaviour settings

The three categories of activities – social, cognitive and physical – formed the basis for analysing the data to evaluate the behaviour settings (for a full categorisation of all activities performed in the school ground please see Appendix 6). Figure 8.53 displays the percentage of users engaged in these activities in the nine different behaviour settings of the school ground. The table shows that the open yard and the play area had the highest number of users during play time, followed by the amphitheatre. The open yard was the largest area and had the highest number of users. All the other settings were situated surrounding the open yard and were of similar size. The play area, though it was not as big as the open yard, accommodated a large number of activities. The pattern of the graph shows that the number of users did not always depend on the size of the area.

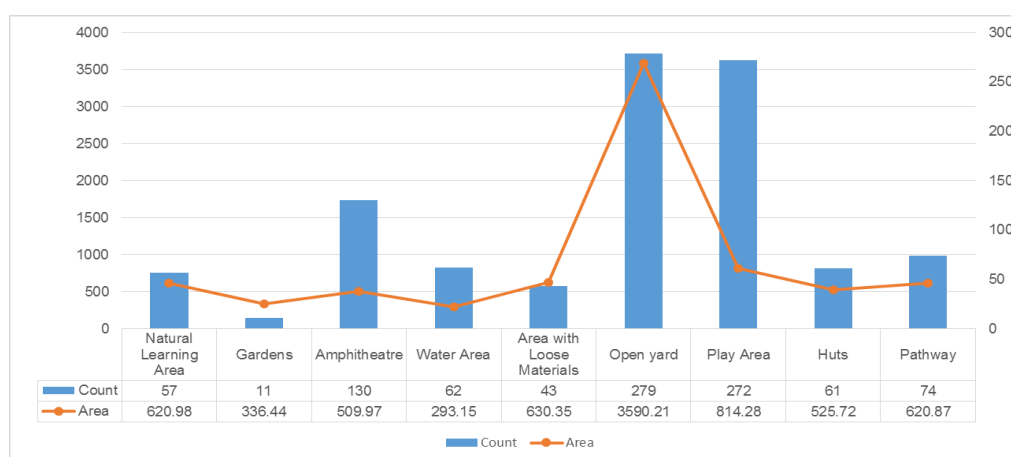


Figure 8.53: Children’s play behaviours in different settings in relation to their area during behaviour mapping

Figure 8.54 displays the frequency of the main activities in different settings. Social activities mostly took place in the play area (28%) followed by the open yard (21%), with the amphitheatre (17%) being third most used. Social activities in the play area and flat learning mostly included waiting for turns on the swings, see-saw and slide and also observing others. However, verbal interaction among the children mainly occurred in the amphitheatre and huts. The graph also shows that most cognitive activities took place in the water area (23%), followed by the natural learning area (20%) and the huts (17%). The cognitive activities in the water area and natural learning area included closely interacting with nature and taking care of the environment through making changes. The children were involved in independent

exploration in the huts. Most of the physical activities in the school ground took place in the play area (43%), the open yard (32%) and the amphitheatre (15%).

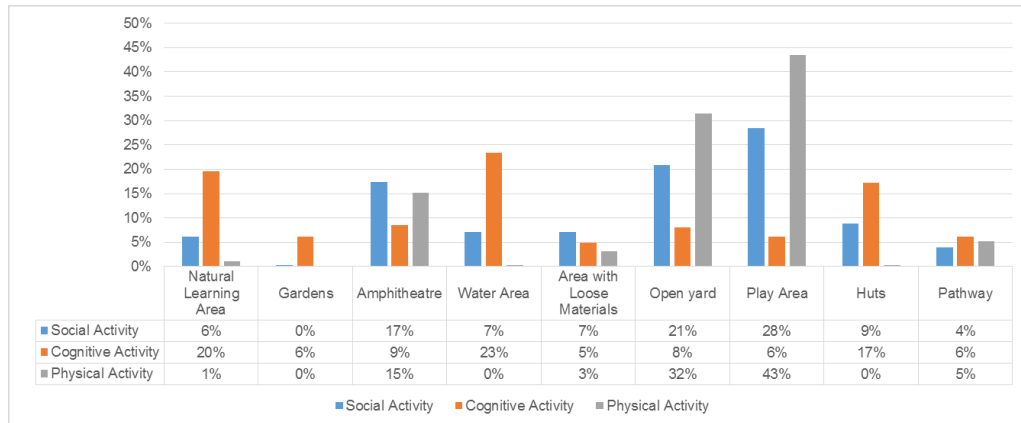


Figure 8.54: Children’s various activities in different settings during behaviour mapping

8.3.2 Gender difference in observed interactions during informal learning

Figure 8.55 displays the percentage of girls and boys in different settings of the school ground. The graphs suggest that the girls mostly used the open yard followed by the play area. The third most used setting by the girls was the amphitheatre, followed by the water area. The girls generally played *pata-pata* in the open yard, which involved picking leaves from the gardens and digging in some parts of the flat area. On the other hand, the setting most used by the boys was the play area, followed by the open yard. The third most preferred setting was the pathway, followed by the natural learning area and gardens. A healthy competition was observed in terms of ownership of the settings. When the boys occupied the play area, girls used the open yard and vice versa. However, the amphitheatre, the water area and the open yard were dominated by the girls, whereas the huts, the pathway and the natural learning area were mostly occupied by the boys.

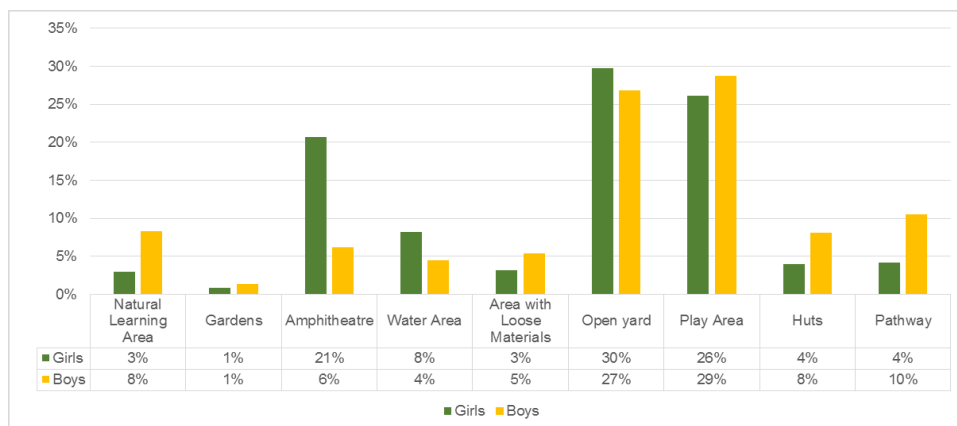


Figure 8.55: Percentage of girls and boys in different settings

8.3.3 The patterns of use of different behaviour settings

8.3.3.1 Observed interactions in the natural learning area

During playtime, the natural learning area was mostly used for cognitive activities (see Figure 8.56). The children were found to interact with nature closely, exploring the natural environment and playing with natural loose materials. The second highest use was for social activities. The children were found to observe other children in the play area from the hills and also wait for their turns in the game from this setting. Some children used the hills as a starting point to take up their position with the tyres, then rolled the tyres down towards the open yard (see Figure 8.58). The children were also found digging a compost bin in the natural learning area after school for their science class the next day, as mentioned earlier in this chapter.

Figure 8.57 shows that the natural learning area was used more by the boys than the girls, e.g. for digging and weeding. This kind of activity was stereotyped as a male activity, yet during the preparation of the gardens, girls were engaged in digging and transporting soil to the garden bed. The girls were found to use the natural learning area for local games (see Figure 8.59).

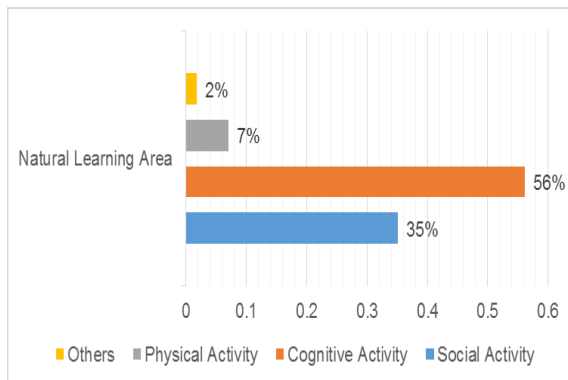


Figure 8.56: Percentage of different activities in the natural learning area

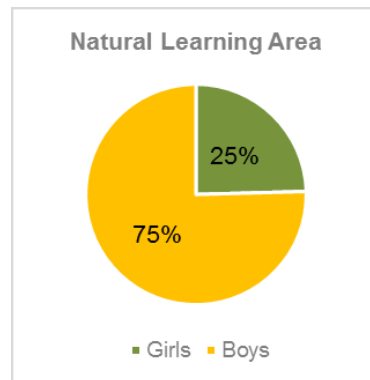


Figure 8.57: Percentage of girls and boys in the natural learning area



Figure 8.58: Two boys ready to roll the tyres down the hill in the natural learning area (Photo: Matluba Khan)



Figure 8.59: Children exploring the natural environment (Photo: Matluba Khan)

8.3.3.2 Observed interactions in the gardens

Children mostly used the gardens for cognitive activities during playtime (see Figure 8.60). They were closely interacting with the plants i.e. looking for specific plants and leaves as part of their play, taking care of gardens e.g. cleaning up the rubbish and weeds and watering the plants. During behaviour mapping, no instance of watering the plants was observed. However, informal conversation with the children revealed that they generally watered the plants in the early morning long before school started, and in the evening. The gardens were mostly used by the boys (Figure 8.61). They took care of the gardens by weeding and watering the plants, but girls mostly used the gardens as part of play (see

Figure 8.62 and Figure 8.63).

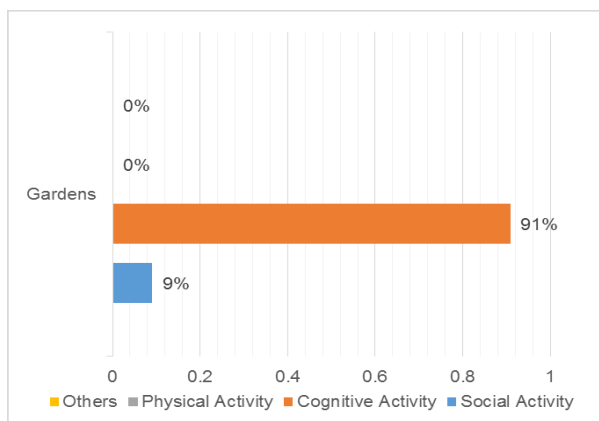


Figure 8.60: Percentage of different activities in gardens

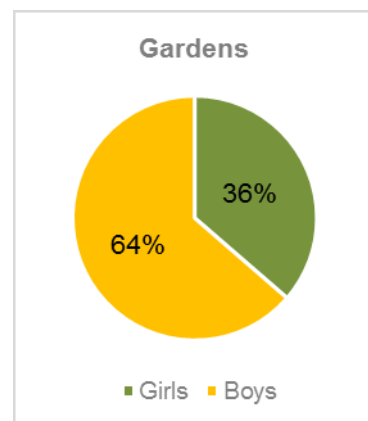


Figure 8.61: Percentage of girls and boys in the gardens



Figure 8.62: Girls picking leaves as part of the game *pata-pata* (Photo: Matluba Khan)



Figure 8.63: Two boys taking care of the gardens (Photo: Matluba Khan)

8.3.3.3 Observed interactions in the amphitheatre

During playtime the amphitheatre was mostly used for physical (45%) and social activity (44%); cognitive activity came third (11%) (see Figure 8.64). The children adopted some rule games in this setting: hopscotch and *mach vai*. Their version of hopscotch involved throwing a stone towards the steps of the amphitheatre and then chanting and hopping over the steps (see Figure 8.66). Two or more children were engaged in this game at a time. While some children played hopscotch, others used the amphitheatre for independent exploration, reading or daydreaming (see Figure 8.67). Every morning before school started, the girls were found cleaning the amphitheatre using brooms, making it ready for the class (see Figure 8.68). In addition to the girls from the treatment group, girls from other classes were also involved in this activity. The observations suggest that children were becoming aware about the protection of their environment and were also developing social skills by working together. The boys were found jumping from the outer wall (see Figure 8.69), observing others facing the open yard and sometimes writing on the blackboard. Figure 8.65 displays the percentage of boys and girls using the water area. 75% of the users of this setting were girls.

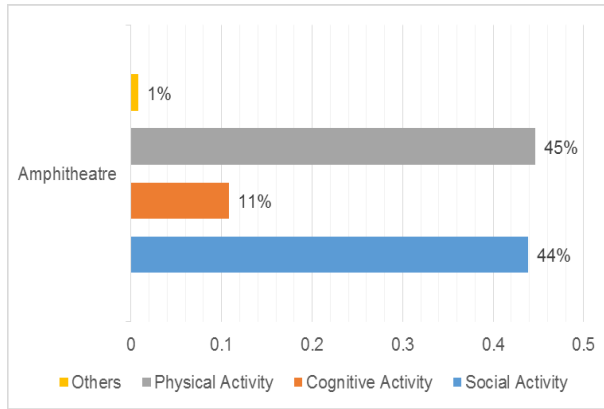


Figure 8.64: Percentage of different activities in the amphitheatre (Photo: Matluba Khan)

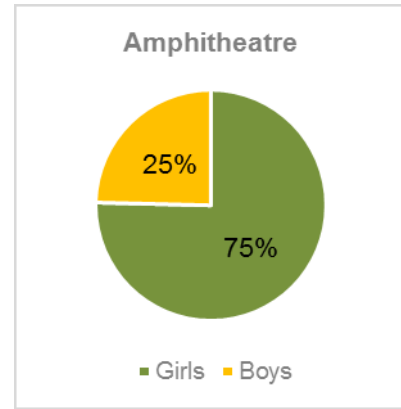


Figure 8.65: Percentage of girls and boys in the amphitheatre (Photo: Matluba Khan)



Figure 8.66: Girls playing hopscotch in the amphitheatre (Photo: Matluba Khan)



Figure 8.67: A girl enjoying reading in the amphitheatre (Photo: Matluba Khan)



Figure 8.68: Girls cleaning the amphitheatre (Photo: Matluba Khan)



Figure 8.69: Boys jumping from the outer wall of the amphitheatre (Photo: Matluba Khan)

8.3.3.4 Observed interactions in the water area

The water area was mostly used for cognitive activity, for example, making it a habitat for fish, observing the plants and animals in water and maintaining the environment (see Figure 8.70). These activities attracted quite a number of observers. Thus social activities became the second highest use of the setting. Before the observation began after four months of

intervention, due to heavy rain for a few days, the soil from the hills washed away and covered the sand of the water area. One day during lunch break, some of the older children were observed digging the area and removing the extra soil (see Figure 8.72). Some of the younger children who were observing the activity, after some moments, expressed their interests in taking part. The soil of the water learning area was used to soak the water that spilled from the water tubs. Some younger children were found playing with sand and water. Some of them were jumping 360 degrees over this sand.

Children also worked with the water habitat in one of the science classes, putting fish in the water tubs. During play time one child observed a movement in the water and was investigating the reason. She saw a fish and called her friend. Some other children who were nearby also joined them (see Figure 8.73). Any discovery in the school ground turned into a group activity. Figure 8.71 displays the percentage of boys and girls using the water area. 63% of the users of this setting were girls.

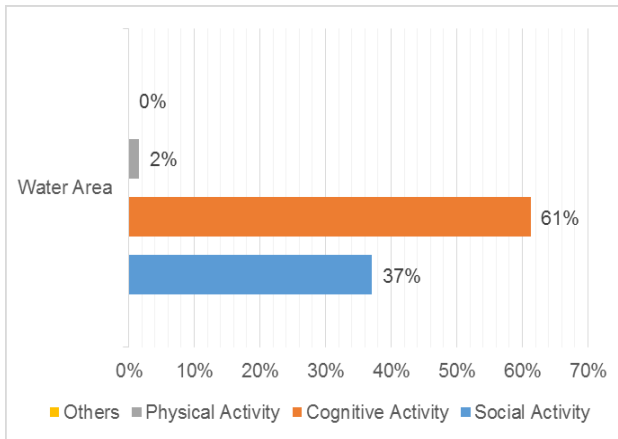


Figure 8.70: Percentage of different activities in the water learning area

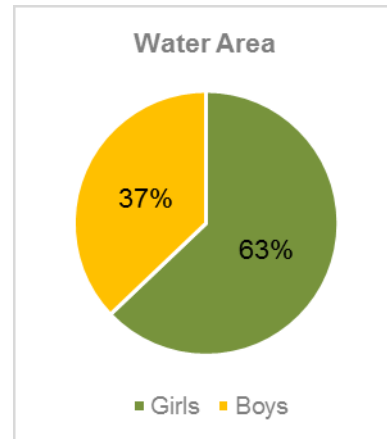


Figure 8.71: Percentage of girls and boys in the water learning area



Figure 8.72: A boy working in the water area, with some others observing (Photo: Matluba Khan)



Figure 8.73: Children observing fish in the water tub (Photo: Matluba Khan)

8.3.3.5 Observed interactions in the area with loose materials

Figure 8.74 shows the percentage of different activities in the area with loose materials. The children were found to use the area with loose materials mostly for social activity (53%) followed by physical activity (28%). The third most preferred use was cognitive activity (19%). Whenever something was happening in the adjacent settings (the water area or the amphitheatre), children were found to observe the activity from this setting. Some girls played *juta chor*. The children preferred to sit or stand on the top of the shelf, chatted among themselves and enjoyed observing their friends playing; they also enjoyed jumping from the top of the storage shelf. They also used loose parts like tyres to sit on while waiting for their turns in the game or just watching others play (Figure 8.76 and Figure 8.77).

Figure 8.75 displays the percentage of boys and girls in this setting. 65% of the users of the setting were boys. However, the girls were the more active users of the space, as boys were mostly found observing others playing. Girls and boys were observed playing separately in groups in different settings before the intervention. However, after intervention, boys expressed their interest in playing with girls, which had not been observed before in any of the play. During one observation period, one boy approached me and requested, 'Please tell them to include us in their play.' I asked the girls whether they would like to include boys in their games and soon afterwards boys and girls were observed playing *juta chor* together. *Juta chor*, which was stereotyped as a girls' game, was played by both boys and girls in the school ground.

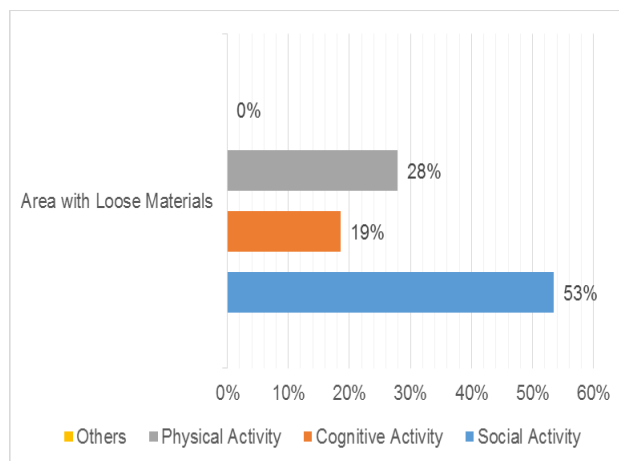


Figure 8.74: Percentage of different activities in the area with loose materials

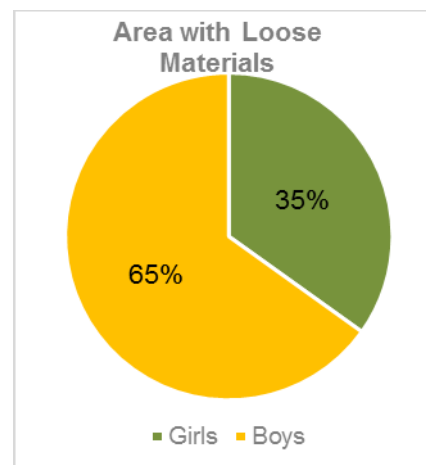


Figure 8.75: Percentage of girls and boys in the area with loose materials



Figure 8.76: The view of the area with loose materials
(Photo: Matluba Khan)



Figure 8.77: Girls interacting with each other on top of the storage
(Photo: Matluba Khan)

8.3.3.6 Observed interactions in the open yard

The most frequent activity in the open yard was physical (43%) followed by others (28%) and social activities (24%) (see Figure 8.78). The children mostly used this setting for playing rule games such as *pata-pata* (see Figure 8.80), *dariabandha*, *mach vai* and hopscotch either on the fixed playground marking or marking with sticks on the ground; functional games like chasing; and playing with loose materials like tyres (see Figure 8.81) and plastic balls. These local rule games included diverse activities, which cannot be solely termed physical activities but are coded as only one activity to avoid duplication. Some games had cognitive aspects and many of them required social skills (for example, *pata-pata*). For a detailed account of the way these games are played, please see Appendix 6C.

Other activities included using the setting to move between locations, go inside the school building and buy food from a hawker. The social activities mainly included observing others while waiting for their turn or being onlookers. Children were found to move between different locations in pairs and chat while walking. Some of the older children were found in large groups, discussing the maintenance of the school ground.

The percentage of girls and boys was almost equal, with the girls occupying the area more than the boys (see Figure 8.79). While the boys occupied the play area for swinging and sliding, the girls found the open yard free to play local games.

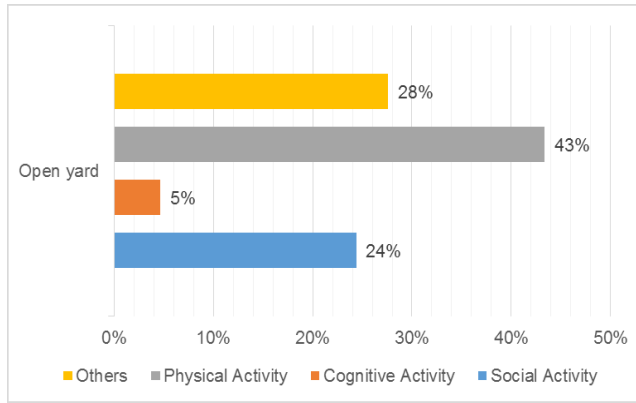


Figure 8.78: Percentage of different activities in the open yard

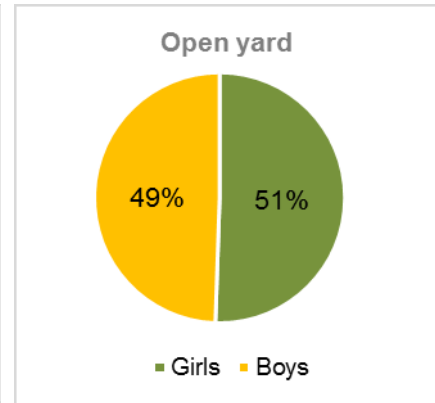


Figure 8.79: Percentage of girls and boys in the open yard



Figure 8.80: Girls playing pata-pata in the open yard (Photo: Matluba Khan)



Figure 8.81: Boys rolling tyres in the open yard (Photo: Matluba Khan)

8.3.3.7 Observed interactions in the play area

The most frequent activity in the play area was physical followed by social activity (see Figure 8.82). The children were swinging, sliding and playing on the see-saw all the time. The only time the area was devoid of children was while classes were going on in the classroom. Social activities in the play area included children observing others while waiting for their turns. Cognitive activities were mostly held in the playhouse or on the see-saw. Some children were found self-focusing or reading at one corner of the playhouse or one end of the see-saw while other children were not around.

As Figure 8.83 displays, 54% of the users were boys and the rest, 46%, were girls. Though the boys mostly occupied the setting, the percentage of girls was noticeable. The see-saw was mostly occupied by the girls, while the other two play features were used by both girls and boys depending upon availability. As three swings could only accommodate six children at a time, competition was noticeable among the children to run and occupy the

swings. However, the children used the play area in an organised way after four months of intervention (see Figure 8.85). As soon as the development works had been completed, the children used the play area heavily¹⁸ (see Figure 8.84).

The play area was also used by younger children (below five years old, who were not yet enrolled in school) from the neighbourhood out of school hours. They used the playhouse for different activities e.g. swinging from bars, climbing (see Figure 8.86) or even taking shelter under the playhouse when it rained (Figure 8.87).

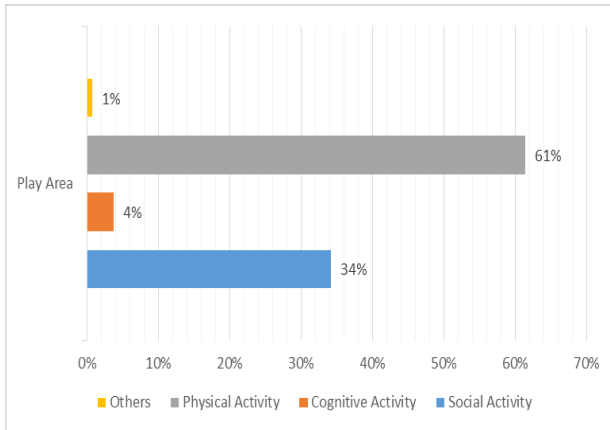


Figure 8.82: Percentage of different activities in the play area

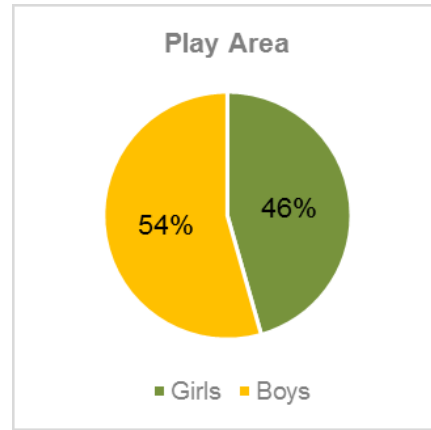


Figure 8.83: Percentage of girls and boys in the play area

¹⁸In January 2015 when the school ground was ready for use, the school authority found it difficult to control the pressure on the play equipment. All the children wanted to slide, swing and play on the see-saw. But the equipment was not designed to accommodate so many children at a time. The see-saw and a swing were broken in a short while after intervention, as more than three children were found on one swing whereas the number of users should not exceed two. However, the children eventually developed a system among themselves. Some children waited while others were swinging and after every 10 or 15 swings the children in the queue were given a chance. The same procedure was applied to the slide and see-saw.



Figure 8.84: Children on the see-saw a few days into T3 (Photo: Matluba Khan)



Figure 8.85: Usual physical activities in the play area after four months of intervention (Photo: Matluba Khan)



Figure 8.86: Younger children from the neighbourhood engaged in different functional activities in the play area (Photo: Matluba Khan)



Figure 8.87: A child taking shelter under the playhouse during the rain (Photo: Matluba Khan)

8.3.3.8 Observed interactions in huts

The children were mostly engaged in social activities in the huts, followed by cognitive activities (see Figure 8.88). Among the social activities, they were mostly found chatting with each other (Figure 8.90). Among the cognitive activities, children were engaged in individual study or independent exploration (Figure 8.91). The least frequent activities were physical ones. The girls adapted hopscotch for this setting; they threw the stone towards the seating while standing at the centre of the hut and then jumped over the bench while chanting.

Figure 8.89 shows the percentage of boys and girls using this setting. Two-thirds of the users were boys. The children defined the ownership of the two huts by themselves. The bigger shelter was allocated to the boys and the smaller one to the girls. Some teachers were also found to interact with each other in this setting in some instances before school started. It served as a waiting area for the parents of very young children. A parent was found

helping his child with homework at the end of the first shift of the school while waiting for the rain to stop (Figure 8.92).

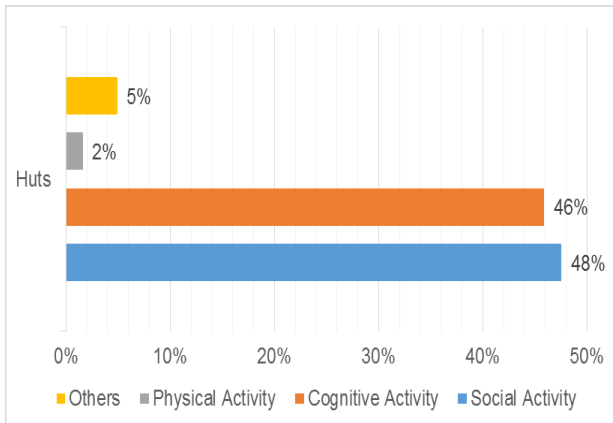


Figure 8.88: Percentage of different activities in the huts

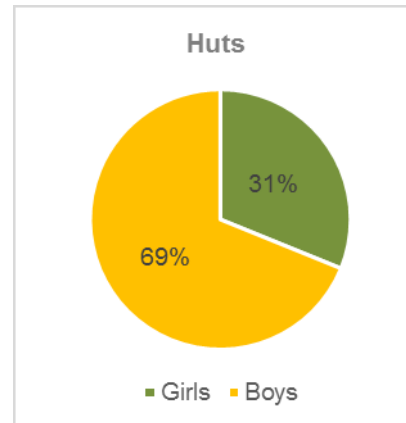


Figure 8.89: Percentage of girls and boys in the huts



Figure 8.90: Children chatting in the huts (Photo: Matluba Khan)



Figure 8.91: A child on his own in the shelter (Photo: Matluba Khan)



Figure 8.92: A parent helping his child with homework (Photo: Matluba Khan)

8.3.3.9 Observed interactions on the pathway

Figure 8.93 shows the percentage of different activities on the pathway during playtime. The most frequent activity on the pathway was moving between locations and going inside the physical environment (categorised as others) (Figure 8.97). The second most frequent activity was physical, as the children were observed jumping over the stepping stones. However, this activity had a cognitive aspect too, as the children would read the numbers while jumping over the stones. Some social activities were also observed, with children interacting with each other while standing on the square blocks. The stepping stones were useful to the children when it rained as they could avoid the rainwater and mud (Figure 8.97). Young children from the neighbourhood who were not yet attending school were observed walking over the stepping stones, trying to read the numbers (Figure 8.95). One

child was observed resting by sitting on one block and resting his legs on another (Figure 8.96).

According to Figure 8.94, stepping stones were mostly used by the boys, who mostly used them for moving between locations. However, the girls invented a jumping game¹⁹ to play on the stepping stones.

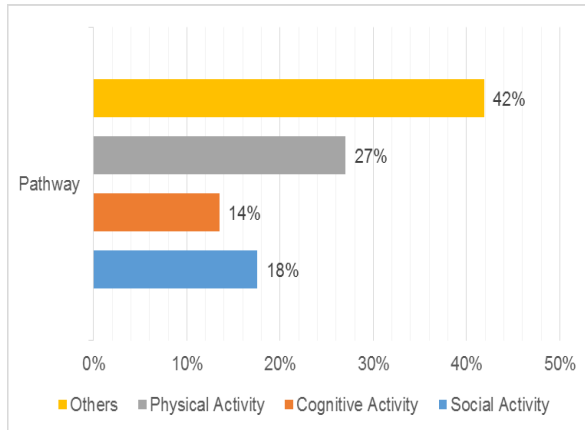


Figure 8.93: Percentage of different activities on the pathway

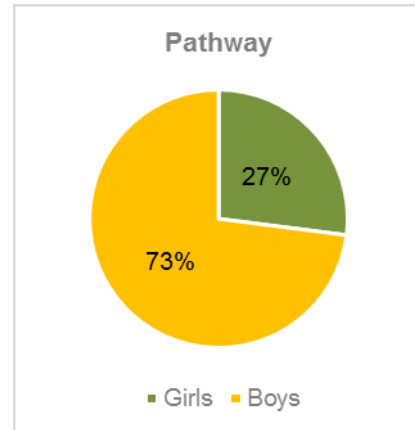


Figure 8.94: Percentage of girls and boys on the pathway



Figure 8.95: Young children reading numbers while walking (Photo: Matluba Khan)



Figure 8.96: A child resting in the middle of play (Photo: Matluba Khan)

¹⁹ The girls chanted rhymes and hopped over the stones. They had determined a number earlier where they could rest their legs (I suppose it was 10). They hopped and rested one leg on the block marked 10. And then they again chanted and jumped and rested one leg on the block marked 20. This way they encircled the whole school ground from one to 100.



Figure 8.97: Girls walking to their classroom (Photo: Matluba Khan)



Figure 8.98: Children using the pathway during the rain (Photo: Matluba Khan)

8.3.4 Pattern of movement

The children were found wandering around aimlessly and not engaged in any activity for a long time before intervention (T1). They continually changed their activities even before finishing the game. However, after intervention they were more focused. They were found to change their activity when they had to wait a long time for their turn in certain activities, mostly in the play area. While they had previously been found to fight for their places in certain activities or locations, after the intervention they could move to another setting to engage with something else or sit alone and explore.

Children's activity within a setting required some movement, for example while playing hopscotch in the amphitheatre and huts. Children also moved between settings, as they needed elements from another setting to play some games. As stated before, for playing *pata-pata* they used the open yard, the natural learning area and the gardens. Sometimes children took a tyre from the area with loose materials, rolled it up and down along the hills surrounding the amphitheatre, went to the big mound in the natural learning area and then rolled it down towards the open yard. They used four settings to play this game. While working on the water area, children dug in the water area and then transported the soil towards the part of the natural learning area close to that setting.

8.3.5 Summary

- 1) The open yard had the highest number of users in the school ground followed by the play area and the amphitheatre respectively. The number of users was not dependent on the area of the settings.

- 2) Physical activities mostly occurred in the play area followed by the open yard. The same applied to social activities, which included observing others while children were waiting for their turns on the swing, see-saw or slide. Cognitive activities mostly occurred in the water area, followed by the natural learning area and the shelter respectively.
- 3) Girls' preferred settings for their activities (in order of preference) were the open yard, the play area, the amphitheatre, the water area and the huts. Boys' preferred settings for their activities (in order of preference) were the play area, the open yard, the pathway, the huts and the natural learning area.
- 4) The settings that accommodated a wide range of activities were the area with loose materials, the amphitheatre, the natural learning area and the pathway. The gardens and the water area afforded more cognitive activities, whereas the open yard and the play area offered more opportunities for physical activities accompanied by social ones.
- 5) There was a balance in the number of boys and girls in the open yard and the play area. The huts, the pathway, the gardens and the natural learning area were dominated by boys whereas girls were more in ownership of the amphitheatre and the water area.
- 6) For one single game children used several settings.
- 7) The arrangement of different settings surrounding the open yard offered children the opportunities to engage in more activities in that setting.

Chapter 9 Results from focus groups and interviews

The previous chapter described how teachers incorporated different settings in the teaching-learning process and how children used the school ground before and after the intervention for formal and informal learning activities. This chapter aims to find the underlying reasons for different activities in the school ground from both children's and teachers' perspectives. Additionally, the chapter aims to integrate parents' perspectives in order to portray a holistic picture. A thematic analysis of the data from focus groups with children, teachers and parents and semi-structured interviews with teachers contributed to this comprehension.

Focus group discussions conducted with children in small groups generated rich qualitative data on the use of various behaviour settings for learning of the curriculum and informal learning activities, children's experiences of place and their preferences, their feelings about learning in the school ground, change in children's behaviour and attitude and their views on teachers' methods of teaching in the school ground. In-depth interviews with the science and mathematics teachers, as well as focus group discussion with other teachers, provided useful information on these aspects from teachers' perspectives. The teachers also provided additional information on the benefits and challenges of teaching in the school ground and how different settings helped or deterred them in teaching practice. Furthermore, focus groups with parents provided useful information on children's attitudinal changes because of the change in the environment. The analysis of this rich set of data is presented based on the themes, combining the responses from children, teachers and parents.

9.1 Participants

The initial decision was made to conduct the focus groups with the children from the treatment group only. In total, 29 children (13 boys and 16 girls) from the treatment group participated in six focus groups at T1. As all the children used the school ground for different activities after the intervention had taken place, the opinions of the children from the comparison group were also sought in order to learn how the design influenced them, despite the fact that they were not engaged in the design and development process. At T3, 26 children (12 boys and 14 girls) from the treatment group participated in six focus groups and 14 children (nine boys and five girls) from the comparison group participated in three focus groups.

The science and mathematics teachers were interviewed, as they were the only ones engaged in teaching in the outdoor environment. However, the remaining seven teachers from the school participated in a focus group, providing their opinions on the overall impact of the new school ground on the children. In order to seek the opinion of the parents, one focus group was conducted with the parents at T1 and T3.

9.2 Structure of the focus group discussion

The discussion was semi-structured based on a set of questions relating to six main themes as explained earlier in Part II of the thesis. These are as follows:

- children's activities in the school ground/neighbourhood
- learning in the school ground
- change in children
- change in teachers
- challenges and difficulties regarding teaching/learning in the school ground
- place experiences

I encouraged all the children to comment on and give their opinions and feedback on each of the themes. During the focus groups at T1, some children were shy, and therefore I consciously invited quieter children to speak and asked voluble members to give others a chance to speak. The scenario changed for T3, as every child was eager to voice his or her opinion and had something to say. Some aspects of the discussion (e.g. favourite activities or place) involved systematically asking each child to take a turn, whilst at other times members of the group were asked to comment on or complement what had been already said by more spontaneous group members. At the end of the discussion on each theme, if time allowed, I asked for communal thoughts or opinions.

9.3 Pre-intervention results from qualitative measures

9.3.1 Activities in the school ground before intervention (T1)

During the focus groups with children at T1, ice-breakers were used to make children comfortable as explained in Chapter 5. When the children became comfortable, the theme of events or activities was introduced by asking them, '*What do you generally do in the school ground?*' The children's responses can be divided into three broad categories: physical,

cognitive and social activities. A list of children's activities based on the discussion is provided in the later part of this chapter (see Table 9.1).

Physical activities: During the focus group discussion with children at T1, children reported being engaged mostly in physical activities. Physical activities in the school ground at T1 included mostly rule games e.g. *kanamachi*, *vai re vai* and *dariabandha*, play using free equipment such as skipping and *bombasting* (using a cricket ball) and functional play such as *laeng*. According to the teachers, the choice of games depended on seasons, e.g. children preferred to play *dariabandha* in the winter when the local adolescents made a badminton court in the school ground to play in the evening. The children used that badminton court during the day to play *dariabandha*.

Cognitive activities: The number of cognitive activities in the school ground at T1 was negligible. In one of the six focus groups, a child mentioned studying in the school ground. He did not provide any further detail about the place where he was studying or what he studied. Only one child mentioned an instance of exploring the environment: *'We climbed the tree to hang a rope, we wanted to swing.'* According to the teachers, sometimes the advanced students played games like making words and *ganer koli*²⁰. *'Sometimes word games or ganer koli... the advanced students play such games...'* (Headmaster).

Social activities: The children mentioned that they enjoyed chatting with friends in the school ground. One child also stated he observed his friends while they played because he was not able to play when the team was full: *'Sometimes I watch others play. When the team is full, I am no longer able to play, so I stand there and watch them play'* (Boy 1).

Favourite activities: In response to the question *'What is your favourite activity in the school ground?'*, almost all the children mentioned some kind of physical activity. The favourite activities cited were rule games, of which football was the most frequent (3 out of 19). *Kanamachi*, badminton, cricket, *dariabandha* and skipping were all mentioned twice. Only one child mentioned chatting with friends as her favourite activity. Children's favourite activities in the school ground did not include any cognitive activity.

Activities during the rain: The children were not allowed to play outside when it rained, as stated by Ms T: *'They are excited to play in the rain. But we don't let them as they might get cold.'* The children therefore mostly remained in the classroom when it rained. In four out of six focus groups, the children reported playing *January-February* in the

²⁰ Also known as *antakshari*, where each player sings the first verse of a song that begins with the consonant on which the previous player's song ended.

classroom. Chasing each other was a popular activity during the rain, as was mentioned in two of the focus groups. In one of the focus groups with girls, they mentioned that they enjoyed chatting with friends and reading story books while it rained outside. Sometimes boys played football and *vai re vai* in the rain.

9.3.2 Activities in the neighbourhood

In order to gain a broader idea about children's primary activities (assuming the school ground offered less opportunity, being barren), the children were asked about their activities in the neighbourhood after school time or when there was no school. Children reported being engaged in a wide range of activities in their neighbourhood.

Physical activities: The children said they were engaged in various physical activities in the neighbourhood that they did not play in the school ground. Different places in the neighbourhood offered them the opportunity to engage in games with rules, e.g. *gachkurali*, *tota ruti* and *jhi jhi poka*, which could not be played in the school ground. The children also cited different functional activities in the neighbourhood like swimming in the pond and washing clothes. Statements like '*We hang a rope in the tree in order to swing*' and '*There is a bridge over the river and we jump from the bridge into the water*' (Boy 4) clearly indicated children's physical exploration of the natural environment.

Cognitive activities: Unlike in the school ground, the children were engaged in various cognitive activities in the neighbourhood. The children explored the environment, interacted closely with nature, were engaged in dramatic play and also played using natural loose material like sticks. The statement '*I love to pluck water lilies and find the seeds inside. We eat the seeds*' (Boy 7) demonstrates children's desire to explore and discover. The children played with natural loose materials like sticks, which can also be part of a rule game called *lathi khela*. Nonetheless, one boy mentioned independent exploration of the environment: '*I like to go to the rail gate with my friends. We like to see trains.*' (Boy 8).

Social activities: The social activity in the neighbourhood frequently mentioned during the focus groups was chatting with friends. The children also liked to read story books with friends inside the house if it was raining outside.

'I like the gardens. I love to chat with my friends in the gardens.' (Girl 1).

'There is a garden and a little house. I love to chat with my friends in the house... We read story books together. There is a story of an old woman. An old woman had three dogs...' (Girl 10).

Favourite places in the neighbourhood: The children mentioned a wide range of places as their favourites in the neighbourhood. Whereas the school ground was just a flat uncovered area, the children mentioned various settings in the neighbourhood where they could engage in different kinds of activities. These places can be brought under the setting categories specified earlier in Chapter 6 (see Appendix 18B).

The place in the neighbourhood most frequently mentioned by children was the pond and canals. Girls said that they enjoyed chatting with friends on the bank of the pond, and most of the boys stated they loved swimming in the pond, plucking water lilies and jumping into the canal from the bridge.

'I go to the pond with my sisters.' (Girl 2).

'There is a pond near the railway, we swim in that pond.' (Boy 2).

The second favourite place reported was the large open field, as children were able to engage in rule games like football, cricket and *vai re vai*.

'The big field...we can play there — cricket, badminton, vai re vai.' (Boy 1).

'I go to a field near my house with my friend, he is in Section A.' (Boy 5)

The next favourite places were the flower gardens, orchard and *chowk*²¹. The children liked to socialise in the gardens and play *gachkurali* in the orchard or the woodland.

'I love to chat with friends in the gardens.' (Girl 1).

'We play gachkurali in the wood garden.' (Girl 13).

'I love to go to the south in the chowks, to play and roam around with friends.' (Boy 6).

The next most frequently mentioned places were the bamboo gardens and the bridge. The children said that they enjoyed playing cricket and some rule games in the bamboo gardens. The bridge offered them the opportunity to jump into the canal from above and also to observe others.

'...then I jump from the bridge into the canal...' (Boy 7).

'I go to the bridge with my friends. I love to see things there...' (Boy 6).

Places children liked to go with their friends: Though the children were asked *'Where do you like to go with your friends?'* the answer coincided with all the favourite places in the neighbourhood, which indicates an urge to play with friends or engage in activities

²¹ The farm lands or agricultural fields after the harvesting of crops.

with a friend rather than being alone. Children reported engaging in dramatic play with their sisters. Siblings and cousins are an important part of children's play in the neighbourhood, which is evident in statements such as *'I go to the pond with my sisters'* (Girl 2) and *'I play with my cousin-sister in the front yard, we play julavati, dolls' house'* (Girl 10).

Places least liked in the neighbourhood: The only place the children did not like was the jungle, by which they meant the dense bamboo gardens. It was mentioned in three of the six focus groups. The two reasons for not liking the jungle was darkness, dirt and also less scope for play. These were all mentioned by girls; the boys did not report any place that they did not like.

'We cannot play there...if it was not a jungle (bamboo trees) but had trees we would like to go there...' (Girl 10).

'It's dark.' (Girl 9).

'It's dirty.' (Girl 6).

Reasons for preference: According to the children, the main reason for their preference of places in the neighbourhood was the opportunity to play different games, explore and socialise with friends and peers (as mentioned above). However, children also mentioned that they preferred these places because they felt physically comfortable there. There is more fresh air and light in places like the bank of the pond, canal and large open field, which makes the children feel comfortable. Children preferred some places because of the aesthetic quality of those places; they also preferred places that were clean.

'There is more light and fresh air near the pond...we play juta chor and bou chi.' (Girl 6).

'There is fresh air...there are trees...there are fruits in the trees...we love to play there.' (Boy 6).

'I like to play in the yard because it's clean.' (Girl 2).

Can we learn from our favourite places or from using these places? Most of the children said they did not find any relationship between places or activities and what they learnt in their textbooks: *'There is nothing to learn, it's only play'* (Boy 10). However, there were three children among the 30 who stated that there were things in the open spaces from which they could learn.

'There is a story in the text book about kanamachi, we learnt about this while playing...' (Girl 1).

'Trees, there are fruits in the trees, we depend on the trees. Can't we learn it?' (Girl 2).

'We can learn if the real life elements in these places are used.' (Boy 5).

9.3.3 Use of the school ground for teaching the curriculum

In response to the question, *'Was the school ground used for teaching any of the curriculum?'* the children said that they had never been taken outdoors to be taught any of the curriculum except during their pre-primary classes, which is known as 'baby class'. However, from my previous experience of working with primary school aged children in different primary schools in this part of Bangladesh, I can state that pre-primary classes in most school are held in the outdoor environment under a tree (if there is one) where all the children sit on a mat because of lack of classrooms for holding the class indoors. In schools that have enough classrooms, like the one under study, the classes are always taken indoors. If the classroom is needed for any other purpose, for example an event or storing of books for the new academic year, the pre-primary class is taken outdoors.

The teachers in the intervention school on some rare occasions used different elements in the school ground to teach different parts of the curriculum, mostly science and mathematics. The teachers generally asked children to bring some elements of nature into the classroom, or told them to look outside through the window. However, they did not take children outdoors.

'I did not take them outdoors but asked them to look out through the window.' (Mathematics teacher).

'When I teach the chapter on 'the natural environment' I ask them to look outside from the classroom to see what elements are there in the environment.' (Ms T).

Teaching mathematics and science in the school ground: At T1, Grade I and Grade II were taught numeracy using sticks, leaves or banknotes in the classroom. Generally, no practical elements were used in the upper classes to teach mathematics. All these activities were held inside the classroom instead of taking children outdoors. According to the teachers, different contents of the mathematics and science curriculum could be easily taught outdoors using elements from nature.

'In lower grades, numeracy can be taught using elements from nature...counting trees and plants' (Ms L).

In the case of science, the teachers taught dependency of plants on water and the different parts of a plant by bringing a plant into the classroom. Sometimes, the teacher drew on the blackboard rather than taking children outdoors. Teachers also tried to relate the topic

to children's everyday experience, e.g. while teaching about technology teachers referred to a tractor which the children's parents used in farming.

'For example, I can take a plant like mustard and show the branch, root and leaves.' (Science teacher).

'One day I taught them different parts of a tree by drawing a plant on the blackboard showing them the branches, root and leaves. I drew the sun to show how plants make food by the use of sunlight.' (Ms G).

'Now I am teaching about technology. So I showed them the electric bulb, talked about the tractor that is used for farming.' (Ms G).

However, the teachers thought the children could be taken outdoors to teach different parts of the curriculum if the school ground was improved.

'We generally don't take them outdoors. Actually if the environment had things that could be used for teaching, we could have taken them outdoors. At the moment there is nothing in the school ground that we can use as an aid to teach any of the curriculum.' (Science teacher).

Teaching subjects other than mathematics and science: The headmaster only used the outdoors as a tool for teaching English once, in 2012. There is a small orchard (private property) behind the school from where the children collected leaves and counted trees.

'In 2012 when I was teaching English to class IV, in order to follow the instructions from the teachers' guidance book...to teach about a LEAF, I asked children to bring leaves from the outdoors. Some children actually brought some...and then I took children to the orchard at the back of the school and told them to count the trees...I myself did that. That's why I can remember it.' (Headmaster).

Children's perceptions of taking classes outdoors: Most children wanted to have their classes in the school ground. They said that they would feel better and improve in their studies: *'We will feel good. We would benefit if we could use the grounds for learning. Exams would be easier for us'* (Girl 1). Fresh air and ample light outside the door were the reason children wanted to have their classes outdoors. *'I feel good studying when sitting beside an open field — fresh air, it's not dark like it is in the classroom'* (Boy 1). The children also thought they could learn from real life elements outdoors: *'We can learn counting from the trees in the gardens'* (Boy 5). However, one boy thought learning should occur only in the classroom and did not want to have classes outdoors.

According to the teachers, the children would enjoy their learning experience if they were taken outdoors. The teachers thought that if children could be taught out of doors, they would be able to relate their curriculum to the real world.

'The children are always in the classroom. If they are sometimes taken outdoors, they will obviously have fun and enjoy it.' (Ms T).

9.3.4 Scope for improvement of the school ground for learning

Most of the children thought there was scope for improvement of the present school ground. At this point the children were asked to prepare a combined drawing of what they wanted in their school ground that could help them learn. In the focus groups with the teachers at this point, there was a brainstorming session to find out different elements that could be designed and provided in the school ground and would help teachers to teach the children.

According to the teachers, most children's experience in the school was not very enjoyable and contained little variation or surprise: *'There is nothing new in their school experience. They come to school, have their classes in the classroom and go back home. There is nothing here that can attract them.'* (Ms G). The teachers emphasised that the school ground needed to be rich, with diversified elements that could arouse curiosity in the children. A school ground with diverse elements and settings could make the children happy at the sight of it and willing to explore; it was thought that children should feel as though *'I have to come here and discover what these things here are.'* (Mathematics teacher).

According to the teachers, most parents in lower middle income families whose children go to Government primary schools do not pay much attention to what their children are learning. This might also act as a catalyst for children losing interest in school. During my M.Arch thesis I found that most parents of KGPS were uninterested in what was happening in their children's school. The parents had delegated the responsibility of educating their children to the primary school, and therefore were not that concerned about what their children were learning or whether they were going to school. However, with the passing of time, parents were becoming more aware about their children's education, and the meeting with mothers brought out some important points that were considered during the design of the school ground.

According to the parents, the primary schools lacked sufficient opportunities or elements to keep the students there. The children of some of the parents were interested in going to private schools that had fixed playground equipment. The children spent time in the neighbourhood playing with other children instead of going to school. One parent stated that children lost interest day by day and at some point they tended to leave school.

'The school is not attractive to the children. It is a great idea to create play opportunities in the school ground so that children want to be there rather than play in the neighbourhood.' (Mrs Ayesha).

9.4 Post-intervention results from qualitative measures

9.4.1 Children's activities in the school ground after intervention (T3)

Children's activities in the school ground after the intervention are divided into three categories — physical, social and cognitive. Based on these, a table has been prepared listing children's activities in the school ground and the neighbourhood before and after the intervention (see Table 9.1).

Physical activities: During focus groups with children at T3, the theme of events or activities in the school ground was introduced as an ice-breaker. In response to '*What do you generally do in the school ground?*' the children mentioned not only playing, but also engaging in many other activities. They stated they played many games, a considerable number of which they did not mention during the focus group discussion at T1 (see section 9.4.1). In addition to the games reported earlier, they recounted playing rule games like *juta chor*, *mangsho chor*, *high school*, *gach kurali*, *mach vai*, *gollachut* and *January-February*. They also mentioned playing with the tyre, swinging, sliding, playing on the see-saw, sitting in the amphitheatre and the huts, playing *hopscotch* in the T²², amphitheatre and seating in the huts and enjoying different functional games like running on the pathway, walking on the pathway when it rained, cycling along the terrain, walking down the terrain and doing physical training in the school ground.

Cognitive activities: The children mentioned various cognitive activities at T3 which they had not mentioned before. They reported interacting closely with nature (e.g. being engaged in activities like cleaning the gardens, planting, watering and taking care of the plants, taking care of the water learning area and cleaning the school ground), exploring the environment (e.g. counting numbers on stepping stones, observing fish, enjoying the beauty of the flowers and roaming around the natural learning area and gardens), constructing activities, fantasy or dramatic play and individual exploration.

Social activities: After the intervention, the children reported working in groups and chatting with friends in the school ground.

²² A playground marking for playing hopscotch; the children named this marking 'T', as it resembled the small t in the English alphabet.

Table 9.1: Children's activities in the school ground before and after the intervention

Activities	Before intervention (T1)		After intervention (T3)
	School ground	Neighbourhood open spaces	
Social activity	Disengaged		
	Observing participant		
	Observing others	Watch others	
	Verbal interaction	Chat with friends	Chat with friends, work in groups
	Negative behaviour		
Cognitive activity	Construction activity		Build houses
	Imaginative play		<i>Julavati</i> Who is the thief? Play with paper boats in water area
	Interaction with environment		Pluck flowers in the canal Clean the gardens, plant plants, water the plants, take care of the plants, take care of the water area, clean the school ground
	Exploring environments		Count numbers on pathway, observe fishes, enjoy the beauty of the flowers, roam around the natural learning area and gardens
	Individual study	Study	Study in the amphitheatre
	Playing with loose materials		
Physical and motor skill activity	Games with rules	<i>Kanamachi, vai re vai, football, dariabandha, jole dangay, borof pani, bou chi, hopscotch, kumir, cricket, volleyball, badminton, duodukku, icking biching, kook, kabadi</i>	<i>Vai re vai, football, dariabandha, juta chor, badminton, bou chi, duodukku, kook, kabadi, jhi jhi poka, tota ruti, gach kurali, gollachhut, January-February</i> <i>Kanamachi, vai re vai, football, dariabandha, jole dangay, borof pani, bou chi, kumir, cricket, badminton, duodukku, kook, kabadi/hadudu, juta chor, mangsho chor, high school, gach kurali, mach vai, gollachut, January-February</i>
	Free equipment	Skipping, swing, hanging ropes, <i>bombasting</i>	<i>Lathi khela</i> Playing with tyre, skipping
	Fixed elements		Swing in the trees Swing, slide, see-saw, sitting in the amphitheatre and the huts
	Functional	<i>Bombasting, laeng</i>	Swimming in the canal, hopping in the canal, washing clothes in the pond Running on stepping stones, walking on stepping stones during rain, cycling, walking down the terrain, physical training

Creation of new games and adaptation of old ones to the new settings: The children mentioned developing some new rule games after the intervention, which they played in various settings in the school ground. Some games were specific to certain settings. They explained how these were played, but had not named the games: *'On the mound one goes up then someone pushes her down then someone else goes up and again she is pushed down...someone comes to steal someone's den...then she pushes her and goes into this corner...and then again comes to steal...'* (Girl 3, CIS). They mentioned developing new games to play on the pathway, and another to play in the seating of the huts (mentioned in Section 8.3.3.9).

'We play, making six blocks in that seating (the seating without shade), we jump and buy block...' (Girl 1).

'How many people can play this game at a time?' (I).

'As many people as we wish can play...' (Girl 1).

The children reported adapting some old games to the new settings e.g. hopscotch and *bora* in the amphitheatre and the huts (also stated in Chapter 8) at T3. They also reported having the opportunity to engage in some activities in the school ground that they used to enjoy in their neighbourhood before (see Table 9.1).

'We can study and can do so many things in the amphitheatre...we can play hopscotch and bora.' (Girl 9).

'One girl throws the bora (dried stone of a mango) standing on the stage, others try to catch it...' (Girl 7).

'We did not play mangsho chor and jole dangay before in the school ground...' (Girl 7).

Favourite activities in the school ground: When asked about their favourite activities in the pre-intervention focus groups, all the children except one mentioned some kind of physical activity, mostly rule games e.g. tag and chase, football, cricket and *dariabandha*. However, after the intervention, 50% of the children mentioned more diverse physical activities — rule games such as *dariabandha*, *juta chor* and *bou chi* and functional play like swinging, sliding and playing with tyres, whereas others mentioned either social or cognitive activities as their favourites (e.g. studying outdoors or chatting with friends in the amphitheatre or huts).

Activities before and after school: Most of the children mentioned coming to school early and playing before school started on four or five days a week. The girls mentioned mostly being engaged in activities either in the amphitheatre or the huts. The boys added swinging and sliding, in addition to studying in the huts.

'We only play hopscotch in the outdoor amphitheatre and chat with friends in the huts before school starts' (Girl 1, CIS).

'We play if we can come early...children who live nearby play almost every day.' (Girl 2).

'If sometimes we come earlier, we study in those huts...' (Boy 3, CIS).

About half of the total children participating in the focus groups said they went home straight after school finished as they had to go and take tuition or their house was far away. The rest reported playing three to four days a week after school finished. The children who lived nearby played almost every day before school started or after school finished.

'Sometimes we play gollachut or practice long jump in the area with loose materials.' (Boy 11).

9.4.2 Learning in the school ground

Using the school ground for learning science and mathematics: When talking about favourite activities, children repeatedly mentioned having classes in the school ground, which generated the next theme: using the school ground for learning. The children mentioned different science and mathematics tasks that they enjoyed working on in the school ground. They talked with enthusiasm about creating the Sundarbans – a wild habitat in the school ground – and learning about the interdependence of plants and animals and different kind of food values. The children pointed to different elements of the school ground that they had measured during one mathematics class. Several themes emerged from their discussion relating to the use of school grounds for learning of the curriculum. These are:

- 1) *Opportunity to explore and experiment:* Using the school ground for formal learning offered children opportunities to learn in various ways, whereas these opportunities were very limited inside the classroom. The opportunity to explore and experiment was one of the main features of learning science and mathematics in the outdoor environment: *'In science class we can experiment with what happens to a plant with or without water in gardens, and learn about the importance of water.'* (Girl 1). The children explained how they used different settings for that purpose: *'We made the water habitat in the tubs, we put fish there...'* (Boy 2).
- 2) *Constructing activities:* The natural and manufactured materials in the loose materials area offered children the affordance for constructing activities: *'Madam lets us play and build different things.'* (Boy 1).
'We build houses in the open yard fetching materials from the area with loose materials.' (Girl 6).
- 3) *The use of loose materials:* Different loose elements were used by the teacher to teach the children different concepts and theories related to science and mathematics: *'Madam uses seeds to teach us counting, division, subtraction...'* (Boy 3). The teacher also tried using seeds inside the classroom, but: *'We can't see in the*

classroom standing if madam works with seeds...but in the amphitheatre we can all see and understand...' (Girl 4).

- 4) *Use of real life objects:* According to the children, the teacher could explain any topic from the curriculum using different settings which helped them understand easily: *'Madam explains showing trees...she explains interdependence of plants and animals...I can understand easily.'* (Boy 5).

- 5) *Working in groups:* One of the important aspects repeatedly mentioned by children and teachers was the opportunity to work in groups. The children had greater opportunities to do this outdoors than in the classroom environment. The children reported co-operating with each other while working in groups in different settings of the school ground.

'Madam tells us to work in groups, we work in groups in the huts...we work wherever we like...' (Girl 3).

'One of us tells and another one writes...' (Girl 1).

'We work in groups in the huts, playhouse and the amphitheatre, we count the bamboo pieces in mathematics class.' (Boy 3).

- 6) *Physical comfort:* the children liked to have classes in the school ground as they felt physically comfortable there. The poor physical environment of the classrooms in the primary school might be a factor in children's favouring of the amphitheatre. The classrooms are generally dark and there are no fans in most of them, which makes children uncomfortable on hot summer days.

'There is light and air outside...shade...' (Boy 6).

'It feels hot in the classroom...' (Girl 8).

Learning other subjects in the school ground: The children would love to have other classes outdoors too: *'Wouldn't it be wonderful?'* (Boy 3). The teachers mentioned topics from other subjects that could easily be taught outdoors and therefore benefit children more: *'Like Bangla, there are some lessons that are related to every behaviour setting. There is a chapter on gardens. I can bring the children outdoors to show them the gardens, what plants are there...how to take care of the gardens...children can pull up the weeds...'* (Science teacher). The mathematics teacher who also taught 'Bangladesh and the world' to another class thought that many topics in the curriculum would be better taught outdoors than in the classroom.

Bangla:

'What benefits we have from plants...there is a relation between plants and environment...children can easily write an essay on trees, can't they?' (Teacher 1).

'There is a chapter in the Bangla book for Grade III on taking care of gardens, which they are doing now...' (Teacher 4).

'Change in seasons, for example — monsoon is the season to plant plants. They can have the idea of physical industry...creating interest in them about physical industry.' (Teacher 3).

English:

'Word meaning; we not only teach about plants but also we teach shade...we have huts here...we teach bamboo, fences...we can teach comparison, there are tall things here, tall plants, short plants...they can compare...' (Headmaster).

'Stream, flow...the rain water flows down the drain...they can learn about the flow, ideas about pond, fish...' (Ms G).

'In my English lesson I needed to teach them numbers in English, from 30 to 70...I can use the pathway to teach them numeracy and also knowledge of English...' (Ms T).

Pre-primary:

'The school ground is even more suitable for teaching early years children.' (Headmaster).

'The pre-primary children can play as they wish, on the swings, on the pathway...' (Pre-primary teacher).

9.4.3 Change in children

Change in children's behaviour: improvement of their behaviour: Most of the children said that they behaved better in the outdoor classes. Some of the children said they behaved well both in the classroom and outdoors. They said the reason they behaved better in the outdoor classes was because they were happier and more engaged in their tasks. In the classroom, meanwhile, children sitting on the back benches often did not engage with what the teacher was saying and instead talked to each other. This was supported by their teacher in the interview: *'Children poke each other in the classroom while sitting in the back benches, talk to others and there are signs they are not really listening to me...but in the outdoor class...I did not observe any mischief...they are more engaged...'* (Mathematics teacher). In addition to being engaged in their tasks, the children also agreed that they co-operated with each other and helped their friends. *'The whole class is a team now and they co-operate with each other. They don't have the tendency to fight with each other anymore.'* (Science teacher).

Change in children's motivation: enjoyment and confidence: Taking classes in the outdoors had an impact on children's motivation and attitude towards learning, as mentioned by most of the children in the focus groups. The teachers also thought that children were more motivated to learn after the intervention: *'Previously the children in this section would*

not come to school regularly but now, except for two or three, most of them are present...'

(Mathematics teacher). The children reported a change in how they valued learning in the outdoors (enjoyment) and their expectancy (e.g. confidence about being good at school work and learning a lot) about having classes in the outdoors and freedom to learn.

Enjoyment: The children enjoyed the experience of learning outdoors compared to the classroom. *'We enjoy learning science in the school ground, learning this way is fun...we don't enjoy it in the classroom'* (Boy 1). The children associated this enjoyment with the opportunity to experiment and learn through exploration of the environment, constructing activities, working with loose parts and working in groups. They associated their change in interest in learning with the way their teachers taught in the outdoor class: *'The teacher only uses the blackboard and textbook in the classroom. But she uses many different things in the outdoor class, for example seeds and sticks'* (Girl 2). According to most of the children, use of different elements in the outdoor classes helped them understand easily, which made them eager to learn more.

Confidence: A considerable change in children's confidence was also observed during the focus groups. One girl, who was really shy during the pre-intervention focus groups about expressing her preferences or opinions, challenged me to test whether she had learnt more after having classes in the outdoors: *'Even you can do the test'* (Girl 3). This was mentioned by teachers too: *'Not a single child is shy. Those who are not shy can learn, they now possess the courage to ask questions'* (Science teacher).

A change in children's comprehension of the curriculum and motivation was also evident in their attitude, as indicated by the statements *'The children can understand easily in the outdoor classes — you can tell, seeing them'* (Mathematics teacher) and *'Today I asked them to write down what I have taught in the science classes for the last few days. I asked them to write in their own words wherever they learnt the concept from — either books or in my discussion, or in the outdoor settings. They said, 'Ok madam, we will try.' I did not observe this attitude before in the classroom.'* (Science teacher).

Freedom to learn: The teachers associated children's enjoyment with their freedom to learn in the outdoor environment: *'The children can learn freely, there is no hard and fast rule of learning in the outdoors, they can ask anything...'* (Science teacher). This freedom provided children with opportunities to practice some authority in their classes: *'They sometimes even guide me — let's go to that place madam, we might find something new. There is no such scope in the classroom — they only learn from books'* (Science teacher). However, freedom to choose was not restricted to children; the teachers also had the freedom to use the

whole school ground depending on their purpose and choice: *'The school ground is vast so I can use any place or setting, whereas in the classroom I can only use the table or a corner in the classroom — I can use the whole school ground according to my intention and choice...'* (Mathematics teacher).

The children in the comparison group expressed their interest in having outdoor classes. According to them, the children from Section B (TIS) had more fun in their outdoor classes and they could sit in the amphitheatre. In response to the question of why they wanted to have their classes in the outdoors, some of the children said: *'We will be able to learn by observing many things. We can improve in study'* (Girl 3, CIS). One of the children from the comparison group elaborated, *'In science class they learn by observing plants and animals — they learnt about interdependence of plants and animals'* (Girl 1, CIS). I was curious how they knew about it. The girl responded: *'I observed what they did...'* (Girl 1, CIS).

Change in children's attraction towards school: increased attendance: The children of the comparison group said that they loved to come to school now compared to before. They loved school more as: *'The school is so beautiful. I want to be here for longer...'* (Boy 1, CIS). Another child added: *'Now we have more places to play...'* (Boy 3, CIS). The opportunity to engage in more play made them motivated to come to school and stay longer. They also pointed out the change in their behaviour: *'We used to fight a lot. Now we don't. He who comes first, will sit there...'* (Girl 1, CIS).

Some children who studied in the nearby private school were interested in studying in the intervention school. The children, in one of the focus group discussions, mentioned that some children had moved to their school from the nearby private school. While parents preferred to send their children to private schools if they could afford it instead of sending them to free Government primary schools, a change in that attitude could be interpreted from children moving to the intervention school. *'Children from "A" school want to come to this school...five students have already moved to this school, three in Grade V, one in our class and one in Grade II'* (Girl 1, CIS). This was supported by teachers during the focus group discussion. They stated that the attendance had increased considerably. They also said that whereas previously less than 50% of students had attended on a day with bad weather, after the intervention it was more than 90%. An analysis of children's monthly average attendance rate was conducted, which provided the evidence for the teachers' statements (see Figure 9.2).

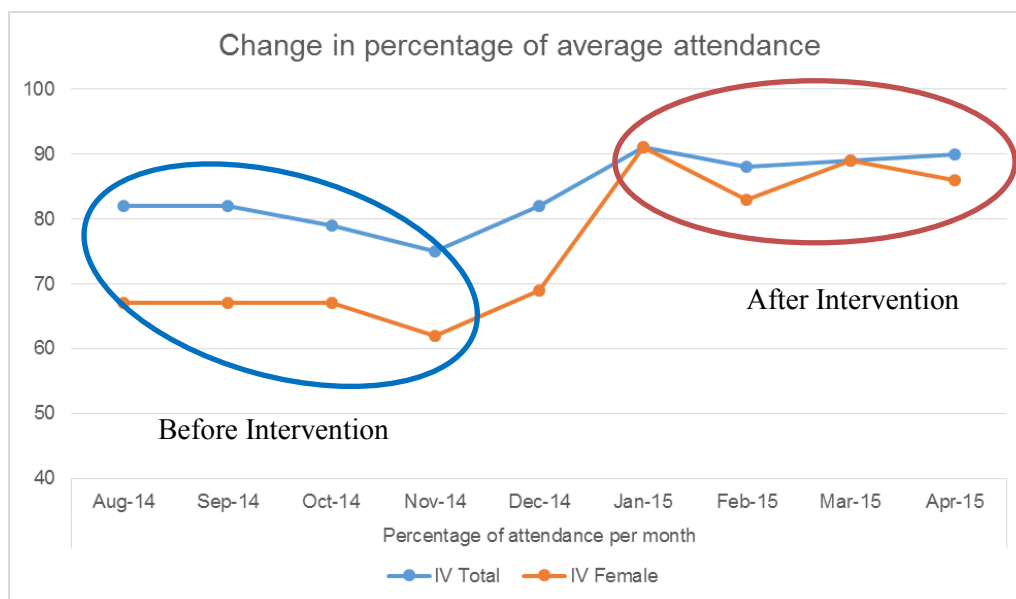


Figure 9.2: Change in percentage of children's average attendance per month

Change in under-achievers: There was a positive change in some of the under-achievers: *'They are improving gradually. They were not attentive. They were inactive. But in the outdoor classes they are spontaneous.'* (Mathematics teacher). Only the students who were better at understanding responded to teachers and paid attention in the classroom. However, in the outdoor classes, all the students benefited: *'Those who were not attentive in class have much improved, e.g. Girl 3, Girl 4 and Boy 7...Boy 1, Girl 2 and Boy 6 were good and they are now even better.'* (Science teacher).

Gender difference: The groups composed solely of girls were found to be more enthusiastic about expressing their experience in the school ground than the groups composed solely of boys. The girls in the comparison group complained about the boys, explaining how they occupied the swings and did not let the girls use them. The girls invented new games in the school ground, which were observed by the boys. One of the boys from the comparison group said:

'Girls play a strange game here...they throw a stone, then push the stone from one step to another...' (Boy 5, CIS).

'Do you want to play that game too?' (I).

'No, we don't play girls' games.' (Boy 4, CIS).

'Girls can invent more games...we can't...girls don't have that much pressure to study but we have...' (Boy 5, CIS).

However, the boys in the treatment group did not mention any such thing, and the girls in the treatment group did not make any complaints. One of them said: *'If boys are in the huts, we can play in that area...'* (Girl 3) while pointing to the open yard.

9.4.4 Change in teachers

Change in teachers' behaviour and attitude: There was a positive change in teachers' behaviour and mood too. Firstly, the diverse outdoor settings provided teachers with the opportunity to be creative in exercising different ways of engaging children, as opposed to the less rich environment of the classroom: *'In the classroom it's difficult to deal with so many students but in the outdoor class I designate different tasks to different groups of students, so I do not need to deal with too many at a time. As such I am more calm in the outdoor classes'* (Mathematics teacher). The students also found that their teachers were happier in the amphitheatre than in the classroom: *'The teacher is not angry in the amphitheatre'* (Girl 3). The teachers' behaviour in the classroom might be associated with the poor physical environment of the classroom, as suggested by the children: *'The teachers sweat in the classroom'* (Girl 5). Secondly, change in children's behaviour had an impact on teachers' behaviour too: *'The teachers get angry with us indoors as the students are naughty sometimes'* (Boy 1). However, one child said that their teacher was good both in the classroom and the outdoor class.

Change in teachers' feelings: During the first few days of teaching in the outdoors, just after the intervention had taken place, the teachers did not feel very comfortable: *'During the first few days there was a shyness. As we were used to taking classes in the classroom, there was an uneasiness about taking classes in the open field as people might observe us.'* (Mathematics teacher). With the passing of time there was a positive change in teachers' feelings, as they could use the diverse settings in their teaching. The teachers felt better about taking classes outdoors: *'I am talking about children's feelings, even I feel better teaching in the amphitheatre...there are so many settings that can be used to teach...'* (Science teacher). This was pointed out by children in the focus groups too: *'I think teachers also love to take their classes here. They can teach natural science. There are flowers, birds, the street, vehicles...'* (Boy 7).

The science teacher associated the change in children's feelings with the break in the boredom associated with the less diverse classroom environment: *'There is not much to do in the classroom. What I can do with a table and a few benches! I give them some task, they work on it and I just supervise...my time does not also pass...I get bored...but in the outdoor class they*

can present their work, write on the huge blackboard for all. Such a nice environment!’ (Science teacher).

Both the teachers and the children thought that children’s better performance in the outdoor classes had an impact on teachers’ feelings too: *‘When everyone can do the things madam asks for, madam smiles’* (Girl 3). This better performance led to an increased confidence level in children that the teacher took pride in sharing: *‘He answered my question and said I made the teacher understand’* (Science teacher). Learning in the less diverse classroom environment provided children with fewer opportunities to explore, which frustrated teachers: *‘I give them some task, they work on it and I just supervise...their learning does not last long in this way...it’s only pen, exercise book or book and nothing else’* (Mathematics teacher).

Change in teachers’ thought process: The availability of diversified elements and objects in different behaviour settings made teachers think about their teaching process: *‘Previously we did not think about using the environment, we were trained to teach in the classroom and we followed that. But now these settings make us think’* (Mathematics teacher). The designed outdoor environment helped them to think beforehand about preparing the lessons: *‘What tasks I will designate to the children or what elements can be used to teach them easily...’* (Science teacher). Thinking about the teaching became a part of their life: *‘Sometimes in bed at night I think about the lessons I will teach the next day, which processes I can follow for children’s better understanding of certain topics’* (Mathematics teacher).

Change in teachers’ way of teaching: There was a positive change in teachers’ way of teaching in terms of being able to use different elements and settings to discuss difficult theories and also in working with the children in smaller groups, reducing the teacher-student ratio. The teachers were able to use different settings to explain the difficult concepts of science and mathematics: *‘Any maths problem can be explained to them using different settings or materials in the outdoors’* (Mathematics teacher) and *‘There was no scope for using different objects or elements. So if any child could not understand anything in one way I could not tell him to try it in a different way, which I can do now in the school ground.’* (Mathematics teacher). This was supported by all the children unanimously, as they claimed that their teacher could better explain difficult concepts in the outdoor classes using different elements of nature and making things real: *‘Madam cannot explain in such a good way in the classroom’* (Girl 3) and *‘When teacher referred to different elements in nature while teaching natural science we could not see well from the classroom, but in the outdoor class the teacher can show us different things in nature’* (Boy 1). The children found it *‘easier to understand in the outdoor classes as different elements are used to explain things’* (Boy 7). They explained further: *‘She*

asks us to count how many bamboo pieces are used in the gardens, to write which plants are in the school gardens and then we count all of them' (Boy 7).

The teachers were able to deal with children in smaller groups, designate tasks based on their capability and send children to different settings to do certain tasks, which was barely possible in the classroom. The school ground, designed as a combination of different behaviour settings, provided the teachers with the opportunity to group the children in a creative way: *'In the outdoor class I designate different tasks to different groups of students. Children in groups are asked to explore different aspects of the same topic in different settings of the school ground.'* (Science teacher).

Analysis of focus groups with teachers reveals that teachers could apply Bloom's taxonomy (Bloom & Engelhart, 1956) of educational objectives in the school ground. According to the headmaster, while the classrooms provided little scope to apply different teaching approaches, the outdoors offered that opportunity. Different behaviour settings provided children with the opportunity to know, comprehend, apply, analyse, synthesise and evaluate: *'Object props are used in the classroom which the children only see and try to learn, but now with the variety of behaviour settings in the school ground the children can observe and analyse...they can follow the steps of learning.'* (Science teacher).

9.4.5 Additional benefits of outdoor teaching

Change in learning outcome and endurance of learning: According to the mathematics teacher, children were more likely to reach the target of the learning outcome she had set for a day's lesson in the outdoor classes than the classes held indoors. Meanwhile, according to the science teacher, though the target learning outcome she set was the same in the classroom and in the outdoor classes, the children remembered what they had learnt when outdoors for longer. *'They could easily learn from observation of the environment and close interaction with the environment'* (Science teacher) whereas in the classroom, *'They were more inclined to rote learning of which many of them were scared'* (Science teacher). Having classes in the outdoors helped to reduce the fear of rote learning, which led to an increased interest in learning: *'The fear of rote learning has decreased in them as they found out they could easily learn by observing...'* (Science teacher).

The association of learning with different settings and elements in the school ground helped children to remember things for longer: *'We can understand better when the teacher uses different elements. Even if we forget, we can remember when we look outside at these settings'* (Girl 3). When some of the classes were taken in the classroom, the children always

referred back to what they learnt outdoors: *'The children at that time reminded me about the class when they learnt about natural fertilizer by making compost. Maybe they would not be able to remember all this if I had taught them in the classroom'* (Science teacher).

Ripple effect of outdoor teaching: In response to the question of whether the outdoor teaching had an impact on their teaching in the classroom, both the science and mathematics teachers mentioned that they had unconsciously started adopting their outdoor teaching style when indoors. They said that although they continued to teach the children of the comparison group as before, they tried bringing elements of nature into the classroom: *'I might not reach my goal as I cannot take them outdoors. I have tried to bring as many materials as I can manage to the classroom'* (Mathematics teacher). But despite not having classes in the outdoors, using the designed school ground for play had a positive impact on the children of the comparison group: *'They are more spontaneous than before just because of the change in the environment. They think about the lifetime of the plants planted in the gardens; some children learn on their own'* (Science teacher).

However, the treatment group children took their enthusiasm about outdoor classes indoors too. When classes were taken in the classroom due to bad weather, the children tried to relate their learning to the outdoor environment: *'The children told me what could have happened if they had been taken to the outdoors to do a certain task. The children are always eager to bring loose parts and different elements to the class'* (Science teacher).

9.4.6 Challenges and difficulties of teaching in the outdoor environment

Nature alone is the barrier sometimes: Bad weather and bird droppings were regarded by the teachers as the main barrier to having classes outdoors. The teachers did not mention the noise from the street as a barrier, though one boy mentioned this when asked about the drawbacks of having classes outdoors. However, another boy tried to mitigate this, saying: *'There is noise in the classroom too, from another class'* (Boy 7). Nevertheless, during the very first days of taking classes outdoors, children tended to stare at the surroundings; this changed over time: *'During the first few days they used to look at the surrounding settings. This soon stopped and no such trait remained after a few days...'* (Science teacher).

Random observers: Random people from the nearby streets entered the school ground and observed the teachers and children. They had not seen such activities before in the school ground, which made them curious, and this made the teachers feel uneasy. However, when asked whether it had any other impact, the teacher responded with pleasure

that the teaching process being transparent made parents realise how hard the teachers worked.

'The school is not surrounded by a boundary, sometimes random people while passing by enter the school ground and look at us out of curiosity. This gives an uneasy feeling' (Mathematics teacher).

'The driver in the auto-rickshaw asked, "Madam, what is happening in the school now?" One parent said, "Madam, you are trying hard. The children need to work hard too."' (Mathematics teacher).

Teachers' training: The teachers were not used to teaching outside, as their training did not include teaching in the school ground or any other outdoor activities. Both the mathematics and science teachers thought that proper training focusing on teaching outdoors, using the resources available in a well-designed school ground, would have been helpful for them. The teachers were also eager to know how it was practised in other countries in the world; therefore, training including visuals would have been very helpful. At the beginning, the teachers might have been less confident about teaching outdoors because of the uncertainty, but they thought that proper training could make every teacher more confident.

'Training focusing on outdoor teaching would help teachers to practise teaching in the outdoor environment.' (Science teacher).

'If properly trained every teacher can do it. If given some idea teachers can think over it and gain more.' (Mathematics teacher).

'...Some videos on how the classes can be taken outdoors could help teachers.' (Mathematics teacher).

9.4.7 Place experiences

Favourite places in the school ground: Based on the data accumulated from all the focus groups with children, it was found that 41% of the time children mentioned the amphitheatre as their favourite place. They mentioned the play area 24% of the time and the huts 22% of the time. The other favourite places they mentioned were the gardens (10%), the water area (2%) and the open yard (2%). The reasons reported for favouring these places were mostly the functionality or usefulness of the settings (for a detailed account see Appendix 18C).

When the responses of the treatment group and the comparison group were analysed separately, it was found that the amphitheatre was equally favoured by both. The majority of children from both groups mentioned the amphitheatre as their favourite place 41% of the time during their separate focus group discussions. The other settings mentioned by the comparison group were the huts (36%) and the play area (32%). However, the treatment

group also mentioned the gardens (15%), water learning area (2%) and open yard (2%), in addition to the huts (15%) and play area (20%). Although the comparison group children were not engaged in the design process, their favourite places did not differ much from those of the treatment group children.

Reasons for preference: According to the children, the reasons for their preferences of settings in the school ground were their affordances for physical, social and cognitive activities and their aesthetic qualities. According to most of the children, the settings provided the affordance to play different games, socialise with their friends and to study and explore the settings. Mentioning the amphitheatre, one child said: *'We can chat with friends, study, we can be the audience of other plays...we can write in our notebooks what the teacher instructs and writes on the board'* (Boy 1). The gardens provided them with the opportunity to explore and interact with nature; as one child said: *'We planted flowers, plants grew and we take care of those...'* (Girl 3). The play area and the open yard afforded mainly physical activities. However, children thought of the huts as a place to study and socialise at the same time: *'Sometimes I bring story books and then I read them together with friends...'* (Girl 5).

The second reason for their preferences was that they found the settings beautiful. They linked this quality of aesthetics to the huts, gardens and the water area. The children liked the traditional thatch roof of the huts and named them 'huts'. They liked the gardens because of the colours of the flowers: *'Many flowers bloom. We love flowers. We love the colour of flowers...'* (Girl 4). Some of the children said that they loved to observe fish in the water area, mentioning that they found the setting beautiful when there were fish swimming in the tubs.

These qualities were not associated with individual settings. The children mentioned several qualities of a setting as a reason to like that setting. For example, one child said, *'The huts look beautiful, there is shade, we can chat...'* (Girl 1), referring to the aesthetics of the settings, the physical comfort of being there and being able to interact with friends. The children liked the school ground after the intervention had taken place: *'We like school more now as there are so many pieces of equipment for play and a place for study (amphitheatre) and a place for chit chat (huts)'* (Boy 5).

Least liked places and reasons for not liking: The children unanimously gave their opinion about all the settings of the school ground. One child did not like the back of the school. He did not like it because he thought it was dirty. The children did not like dark and dirty places, as mentioned earlier during the pre-intervention focus groups (see Section 9.3.2)

Preferred places for teaching: According to both the science and mathematics teachers, every setting is important for teaching, as different settings serve different learning purposes.

'I have used all the settings for teaching... each and every setting is necessary for teaching mathematics and science...' (Mathematics teacher).

'Every behaviour setting is suitable for teaching, e.g. the huts are good for learning in groups, the water area can be used to teach habitat. The children bring fish, make the habitat and also think about how the fish will live longer.' (Science teacher).

'Every setting is necessary, e.g. if there were no gardens I could not have explained pollination to them so easily.' (Science teacher).

'The children love the shade in the huts. They can hang their feet and work on the slide. After the slide and huts they go to the area with loose materials, climb up the shelf...' (Mathematics teacher).

Indoor vs outdoor? In response to whether they would prefer the indoor classroom or the outdoor environment, all the children instantly chose outdoors. *'We would like to have all the classes outdoors. We can have them in the classroom when it rains'* (Boy 1). Someone else added, *'We can have classes in the huts when it rains'* (Girl 3), which strengthens the notion that the children would like to have their classes outdoors. Considering they wanted to have the classes outdoors because of the poorly lit and ill-ventilated classroom environment, I asked, if the classroom had all the same facilities, where they would prefer to have their classes. The majority of the children said they would still like to have classes outdoors. The reason they gave was the opportunity to do certain things that could not be done in the classroom: *'We can work in groups and play. We created the Sundarbans in that mound yesterday'* (Boy 4). Their concern was that: *'The teachers cannot use different things to explain things in the classroom'* (Boy 7). Some of the children said they would like to have their classes both in the classroom and outdoors.

The teachers thought that certain tasks were better if conducted in the classroom and some were more suitable for taking outdoors. Activities like taking a test or tasks based solely on writing were better if conducted in the classroom, whereas outdoors was preferred for explaining a difficult concept or theory. Similarly, the teachers were asked what they would have preferred if the classrooms had been well designed and equipped with all the modern facilities. The response did not differ from that of the children, as the teachers also asserted that many parts of the curriculum would always be better taught outdoors.

'Sometimes the classes can be taken indoors, like when taking a test or some task based on writing...to give them an idea about some content or concept it's better to take them outdoors.' (Science teacher).

'Some classes are always better outdoors no matter how developed the indoor environment of the classroom is...' (Mathematics teacher).

The children from the comparison group stated that they would have felt better if the classes were taken in the outdoor environment. I was eager to learn why they wanted to have the classes outdoors, as they did not have any experience of classes outdoors. The children mentioned some qualities which were missed inside the classroom environment. In their view, those unique qualities were fresh air and closeness to nature. During one focus group, the children said: *'We can't do inside what we do outdoors...'* (Girl 1, CIS). I was curious and asked, *'Like what?'* *'It feels better to be outside...fresh air...studying in the amphitheatre and the huts is fun...'* (Girl 1, CIS). Another child added, *'There are birds...flowers...the natural scene is beautiful.'* (Girl 2, CIS).

However, this research does not aim to make the statement that children learnt better in the outdoors compared to the classroom. It looks at outdoors as a supportive environment for children's learning and addresses how a designed school ground can complement children's learning in the classroom instead of replacing it.

'It is not necessary to take all the classes outdoors, similarly all the classes should not be taken indoors.' (Headmaster).

9.4.8 Others

A small theatre out there: While I was talking with children in a focus group one day sitting in one of the huts after the school finished, the sound of singing and laughing was travelling from the outdoor amphitheatre. The children said that they used the amphitheatre once a week after school for a performance of music or dance, while the audience seated in the gallery enjoyed the performance on the small semi-circular stage. Some of them also used the outdoor amphitheatre early in the morning. *'We sometimes dance here...before school, early in the morning when we come for tuition. If we finish early then we have a gathering in the amphitheatre...'* (Girl 3).

Teachers can sit there too: When asked if the teachers used the school ground for any other purposes except teaching, the mathematics teacher smiled. They did not use any setting during the school hours, but they sometimes sat and chatted in the huts when the school was not in progress, or during early morning, i.e. when the children were not using the space. *'We can chat sometimes here, sitting in the huts. If the school is off and we have to come for some reason we sit here and chat.'* (Mathematics teacher).

The ethos of the school: The teachers had some frustration about the semi-pucca building of the school, as many schools had new one or two storeyed buildings. Both the teachers and children thought that their school was more beautiful after the intervention and that it gave the school some recognition at the sub-district level. Therefore, the change in the ethos of the school provided both the teachers and children with some sense of pride. Even the villagers who were disinterested in the school at T1 took pride in it afterwards.

'We thought that the villagers would not take care of this, rather it would be damaged some way...but actually there is some change...' (Science teacher).

Implication of the project: According to both the children and teachers, this project should be implemented in other schools throughout the country. This way, all children could benefit, which would lead to the advancement of primary education in the country as a whole. According to the teachers, the success of a project like this also depended on the awareness of the parents. Children from lower middle income or lower income group generally go to Government primary schools as they cannot afford the tuition fees in the private kindergartens and schools. Therefore, most of the parents were impersonal about their children's education in the school. If the parents had been more aware, it would have had a huge impact on the success and continuation of the project.

'If every school possessed such a well-designed outdoor environment, primary education would go far in our country...the children won't be left behind...' (Science teacher).

'If the guardians were a bit more aware and supportive, this project would have gone beyond success. We work with the children from a very root level; their parents are not interested in what the children are learning in the schools.' (Science teacher).

9.4.9 Summary of the post-intervention results

- 1) After the intervention, children's favourite activities in the school ground included some cognitive and social play e.g. chatting with friends and studying.
- 2) Alongside bringing games, they played in the neighbourhood by the school grounds, children adapted some old games in the new settings (e.g. hopscotch in the amphitheatre) and also created some new ones (e.g. jumping and chanting on the stepping stones).
- 3) Children living near the school played in the school grounds after the school finished and at the weekend on an average four to five days a week.
- 4) According to both the children and the teachers, children found learning easier because of the use of loose materials, increased opportunities for exploration and experiments and group learning activities. Teachers observed the benefits of using the school ground for underachievers.

Part IV: Discussion and conclusion

This part of the thesis consists of two chapters. Chapter 10 discusses the results from analysis of different methods in relation to research questions, discusses the new conceptualisations originating from this thesis and summarises the findings in terms of expected findings, unexpected findings and expected findings that did not emerge. Based on the discussion in Chapter 10, Chapter 11 answers the 'so what' question portraying the main contributions of this research, design, curriculum and policy implications and discusses how future line of research can be built on the findings from this research.

Chapter 10 Discussion

The previous part of the thesis presented the results obtained from the qualitative and quantitative methods applied in the study. This chapter discusses the findings from different methods with respect to the research questions, outlines the theoretical discourse based on the findings and explores the causal relationship between environment and children's learning, considering the influence of participation on children's performance. The chapter also evaluates the design of the school ground based on the intentions of the designers and the actual use of the environment, which informs the design recommendations presented in the next chapter.

10.1 Discussion of research questions

The analysis of the findings has provided evidence to support some of the initial predictions (e.g. the improvement in children's academic performance, the positive change in their perceived motivation to learn and their perceived exploration of the environment and peer relation as a result of the change in the environment). The analysis also provided supporting evidence for other findings (e.g. the benefits of the outdoor environment for underachievers and the influence on improved memory and behaviour), while also revealing some new findings (e.g. positive change in teachers). The discussion answers the research questions, combining findings from different methods with findings from relevant research.

10.1.1 Research question 1

To what extent does the outdoor environment influence children's learning (academic performance, perceived exploration and peer relations)?

The research explored children's learning in primary schools, measuring both the outcome and the process of their learning in different educational environments. Significant change in both the outcome (e.g. exam scores) and the process (e.g. perceived exploration and peer relation) after the intervention endorses the efficacy of the renovated school ground as a place for teaching and learning of the curriculum.

The analysis of children's exam scores clearly shows the improvement in the treatment group children from the intervention school who participated in learning in the redesigned school ground compared to the control school children. There was a significant difference in their academic results in mathematics and science after intervention, after controlling their pre-intervention scores. This echoes the findings of studies conducted by

Lieberman & Hoody (1998, 2000, 2004). The teachers observed and reported changes in all the students, particularly in the underachievers, according to the semi-structured interviews. While only the academically better students participated in the classroom, in the outdoor class all the students benefited. Different phenomena happening in the outdoor environment helped underachievers to relate the lessons in their textbooks to the real life context; these concepts had previously been abstract and alien to them, according to the teachers during the semi-structured interviews.

Focus group discussions with children further suggest that before intervention most children perceived their learning in the classroom as something disconnected from the real world; it was necessary but could only be learnt from the textbook. The perception of the children changed after the intervention, when they showed more confidence about what they had learnt in the outdoor environment; as one child said: *'You see these bamboo poles, we can count these and learn numbers, isn't it learning?'* This is in line with the findings of an exploratory study conducted in the UK by Singal & Swann (2011), which investigated how underachieving children perceived themselves as 'learners' inside and outside the school. Children had much less to say about the learning process in the classroom, whereas learning in the outdoor environment was perceived as more *'active, collaborative and challenging'* (Singal & Swann, 2011, p469). In another study of early years children, Maynard, Waters & Clement (2013) found that children perceived as 'underachieving' in the classroom were found to be competent in the outdoor environment, which makes 'under-achievement' subject to people, place and activity. Therefore, a place designed with purpose and positive meanings can enhance the teaching-learning process, leading to better academic achievement.

The significant difference in academic performance between the treatment group and the comparison group within the intervention school is not in line with the general conception of open space researchers that even playing in a renovated school ground can have an impact on children's academic performance (Lopez, Campbell and Jennings, 2008). Nevertheless, the significant difference between the treatment group and the comparison group was less than the difference between the treatment group and the control school. This shows weak support for the findings of Shephard (1997) and Fedewa & Ahn (2011) that change in children's physical activity can only influence academic achievement a little. Additionally, the improvement in the perception of the children from the comparison group of exploration of the environment and relation with peers in the outdoor environment indicates the positive influence of using the school ground for informal learning. The

children of the intervention school as a whole performed significantly better than the control school, which also confirms the hypotheses.

The teaching-learning process in the outdoor classes includes exploration and collaboration, as mentioned in the study done by Singal & Swann (2011). The significant difference in children's perceived exploration of the environment and peer relation between the treatment group and the control school indicates the potential cognitive and social affordances of the renovated school ground. As stated in the literature review, Cronin-Jones (2000) argued that the school ground is a more effective context for science instruction. This was based on a difference in instruction strategy in two different settings – the traditional classroom and the school ground in her study in Florida. The difference in instruction strategy can also be attributed to the differences in cognitive affordances provided by different educational environments. A dull classroom or a barren school ground provides less affordance for innovative and effective instruction strategies, whereas the teachers could use the settings in a renovated school ground for teaching difficult concepts to the children, engaging them in various activities.

The children of both schools had good social relations with their peers, which echoes the findings of Mygind (2009). Rural children studying in the same school are generally from the same neighbourhood, therefore they know each other outside school and spend time together in different activities in the neighbourhood open spaces. However, the significant difference in one of the constructs of children's perceived peer relation – 'group work' – between the treatment group and the control school children indicates that the renovated school ground offered increased opportunities for collaborative works during the outdoor classes. Collaborative discussion can make children more engaged in what they are learning (Wu et al., 2013). The teachers also found that the children showed less negative behaviour (not poking each other as they used to do in the classroom) during the outdoor classes (evidenced in semi-structured interviews and focus groups), which also resonates with Mygind's (2009) findings of less quarrelling and teasing among children in forest school settings.

The change in the outdoor environment did not produce any gender differences; the performance of the girls was similar to that of the boys. This contradicts the general conception of boys being more competent in science and numeracy and also previous research findings of boys achieving higher grades than girls in mathematics and science (Eitle, 2005). However, there are studies that have shown that girls display higher

achievement than boys regardless of the subject (Chambers & Schreiber, 2004; Kashahu, 2013). In the present study, girls outperformed boys throughout the whole study period (independent of the influence of the outdoor environment), echoing findings from the international comparison studies for reading (PIRLS), mathematics and science (TIMSS) (Martin et al., 2013).

10.1.2 Research question 2

To what extent do different types of built environment (designed and barren school ground/classroom and designed outdoor learning environment) influence children's motivation or interest towards learning?

The results from the questionnaire survey reveal that the treatment group showed a significant increase in their perceived motivation to study in the outdoor environment after intervention compared to the control school. This complements the findings of O'Brien's (2009) qualitative study in forest school settings in the UK by providing quantitative evidence. The increase in perceived motivation is not only related to children using the outdoors for learning the curriculum but also their opportunities to use it for informal learning through cognitive, social and physical activities, evidenced by the significant increase in the comparison group's perceived motivation to learn in the outdoors. Despite the fact that the children of the comparison group were not involved in the design, and also not taught in the school ground, they showed a consistent increase from T1 to T3 in their perceived motivation to study in the outdoor environment. This also resonates with another study conducted by O'Brien et al. (2007), which found that children who were not engaged during the first few classes gradually showed interest in learning in the outdoor educational setting. Indeed, the children of the intervention school (treatment and comparison group combined) outperformed the children of the control school in their perceived motivation to study in the outdoor environment after the intervention, controlling their pre-intervention scores, whereas the children of the control school reported significantly higher behavioural motivation before intervention.

The children of the treatment group valued what they learnt both in the classroom and outdoors, but significant change in the constructs of perceived motivation (i.e. enjoyment, doing well at schoolwork, being good at learning, learning a lot, attention and hard work) associated with the way they felt and its impact on their efficacy asserts the positive influence of the outdoor environment on children's motivation to learn. The extent to which children value their learning and expect to do well are strong predictors of academic achievement (Wigfield, 1994). In addition, children's intrinsic motivation is

positively correlated with their academic performance (Gottfried, 1985, 1990). The outdoor environment inarguably offers more choice to children than the classroom, as revealed by the analysis of participant observation data; providing choice can increase children's intrinsic motivation and situational interest (Schraw, Flowerday and Lehman, 2001). Besides, the outdoor environment also enabled the teachers to give the children more autonomy during the outdoor class than in the classrooms (evidenced by interview and focus group discussion results) where the teachers were more controlling. In an environment that supports autonomy, students show higher levels of intrinsic motivation, whereas the controlling environment decreases their intrinsic motivation (Deci et al., 1991). Again, children's activities also affect the way teachers act with children. When children are motivated, teachers are inclined to give them more freedom (Deci et al., 1991). Participant observation results also suggest that the same teachers designed their tasks differently while teaching in the outdoor environment, children were more engaged in their activities and, therefore, teachers supported their autonomy.

As well as influencing the way teachers taught, the designed school ground positively influenced teachers' behaviour and attitude. The children's reports of the teachers being friendlier and more fun in the amphitheatre during the focus group discussions is in harmony with the findings by Roe (2008) which revealed forest settings' positive influence on educators' behaviour. The influence of the school ground on teaching and the behaviour and attitude of teachers has rarely been explored in related studies.

Children and teachers associated the increase in motivation with the increased opportunities of exploration and experimentation, constructing new things, working with loose materials and interaction with peers in the renovated school ground. The children of the comparison group within the intervention school were exposed to these opportunities during their break time, which explains their increased motivation. This is supported by Gottfried (1986), who stated that play experiences and engagement with different play materials can produce intrinsic motivation through the creation of cognitive discrepancies, novelty, variety and complexities; and opportunities for interaction with the environment. Studies so far have investigated the association between exposure to natural elements and children's motivation; however, this study elucidates the importance of other different built environments, which offer children opportunities to explore, experiment, build and interact.

10.1.3 Research question 3

Research question 3 is answered in relation to the sub-questions outlined in Chapter 3 and in Table 4.1 in Chapter 4.

10.1.3.1 *Is there any association between school ground design and children's activities?*

The results of participant observation and behaviour mapping in the school ground before and after the intervention suggest a considerable increase in the number of children in different informal learning activities at different times of the day. This is in harmony with previous research (Colabianchi et al., 2009, Brink et al., 2010, Anthamatten et al., 2011) that found more children were engaged in activities in renovated school grounds than in un-renovated ones. Consistent with the study by Anthamatten et al. (2011), this study further found that the children who previously left the school as soon as the last bell rang were engaged in different activities in the school ground after school hours following intervention. The school ground also became a neighbourhood play space, as along with children from this school, children attending private schools in the same neighbourhood were found to be engaged in different activities there.

Behaviour mapping results also suggest that there was an increase in the number and diversity of physical, social and cognitive activities. While it was evident in the school ground before intervention that children can find affordances even in the least attractive playground, they were engaged in mostly physical activities, including rule games, running, tag and chase and hopscotch. However, the observation and behaviour mapping results show that the designed outdoor environment provided increased opportunities for cognitive and social activities, giving a boost to the percentage of these activities in the school ground, which echoes findings from previous research (Dowdell et al., 2011; Malone & Tranter, 2003). There was a decrease in the proportion of physical activities, reaching instead a balanced state of all kinds of activities in the school ground. Nevertheless, the percentage of physical activities was still the highest of all three kind of activities, followed by social. This depicts the characteristics of this age group (six to 12 years old), who, with age, increasingly engage themselves in social play, role play and games with rules (Bell, 2008). The children invented new games and also adapted for the school ground games they generally played in the neighbourhood.

The school ground was dominated before intervention by the boys, who used large areas for social games with predetermined rules; this aligns with the findings of Thomson

(2005) and Karsten (2003). However, after intervention, the proportion of girls in the school ground increased considerably, reaching 48% of the total. Generally the primary focus of boys is the activity itself, whereas the physical quality of the school ground is important for attracting girls (Blatchford, Baines and Pellegrini, 2003, Karsten, 2003). Karsten (2003) further suggested that well-designed playgrounds with challenging and good quality play objects function as a pre-requisite for bringing girls out of their classrooms, which explains the increase in girls' activities in the school ground after intervention. Consistent with Karsten's (2003) findings, girls were also engaged in more diverse activities in the school ground than boys.

Girls' games are often depicted as less complex and less competitive than boys (Lever, 1978), but the ethnographic research by Evaldsson & Corsaro (1998) subtly contradicts this, which also aligns with the present research. The boys from the comparison group found the games played by the girls complex and innovative; however, they did not want to play those games, therefore reconfirming stereotyped gendered behaviour in children's play (Blatchford, Baines and Pellegrini, 2003). The girls from the comparison group did not want to include boys in their games; they reported that boys quickly grasped the skills and invaded in their place. This supports the findings by Goodwin & Fiske (2001). However, some boys from the treatment group were found participating in games with girls and were interested to learn from them. This provides evidence for the designed school ground's influence on children's peer relation across gender. Though some level of gender segregation might be a universal feature of children's play, this might also depend on certain cultural and contextual factors (Aydin & Corsaro, 2003). Both boys and girls from the treatment group appeared to be inclusive in their games after intervention, evidenced in the observation and focus group discussion. The results from this study suggest that design and use of the school ground can change stereotyped gendered behaviour in children's play.

10.1.3.2 How do the users respond to the individual behaviour settings of the school ground during outdoor classes?

The results from observation and behaviour mapping suggest that the frequency of use of different behaviour settings is not dependent on the size of individual settings. Several factors determined which settings were used during a particular lesson, for example the content taught in different classes, the structure of the class, the way the tasks were designed by teachers and children's and teachers' perception of affordances offered by the settings. The gathering of children in the amphitheatre at the beginning for instructions on that day's lesson, and at the end for summarising the tasks, made the amphitheatre the most used area

of the school ground during outdoor classes. Tasks other than these were almost equally distributed in different settings. The children, either by their own choice or on their teachers' instructions, worked in different settings on the assigned tasks, which brought diverse aspects of the same topic together at the end of the class when they shared their work with the whole class.

Though the basic structure of the classes in classrooms and outdoors was similar, the execution differed. The way the affordances of individual settings were actualised during different lessons depended both on the perceptions and capabilities of teachers and children. Some settings offered a wide range of affordances (the amphitheatre, the natural learning area, huts and the area with loose materials) whereas activities in some other settings were more focused on one or two types (gardens, the water area, the play area and the pathway). Again, adjacency with other settings stimulated the use of some settings (the open yard). Employing the concept of behaviour settings in the design and analysis of different learning areas or settings in the school ground enabled me to interpret how the design of the settings influenced children's learning activities in the school ground. The concept of affordance helped to explain the affordances of different behaviour settings for children's formal learning activities.

Natural learning area: Significant curricular activities took place in the natural learning area, which is in line with the findings from the natural learning project by Moore & Wong (1997). A strong correlation between curricular significance and dominant perception of the natural environment was observed in the comparison of PEET (Project Environmental Education and Training) teachers' record for the locations of the most significant curricular events and perception maps in the school ground developed in Berkeley, California. The natural learning area in the designed school ground offered opportunities to learn from the science and mathematics curriculum, and the teachers found the area useful for teaching other subjects too.

Children learnt about different natural phenomena by observing natural elements and acting on those – for example, learning about the interdependence of plants and animals by observing how parasites and epiphytes grew and lived on certain trees and plants. The natural learning area creates the platform for discussion on this phenomenon, offering children new knowledge, which can be explained by applying Piaget's (1964) theory. When the teachers led children to a tree with epiphytes in the science class, an underachieving child who seldom paid attention in class, by applying his previously existing knowledge, explained how parrots bring the seeds of the epiphyte and leave them on the neem tree; the

seeds then grow and live on the tree. With the teacher's help, the child could assimilate the new broader knowledge of the interdependence of plants and animals.

Children learnt numeracy and measuring and applied their knowledge of number theories to tasks assigned by teachers in the mathematics class. The variety and diversity of different plants and trees in the natural learning area provided these opportunities. The activity of measuring the diameter of the big mango tree, or counting the number of jasmine plants to find out whether the number would be prime or composite, involved physical activity and movement. Through movement and action, children create knowledge of the external environment in their internal world or schema (Thelen & Smith, 1996). An interrelationship between gross motor skill and academic performance among children with learning disabilities was found by Westendorp et al. (2011). Davis et al. (2011) also found this interrelationship of cognitive and motor skills in typically developing children of four to 11 years old.

Gardens: The gardens afforded learning of the curriculum through close interaction with nature, along with observation and exploration of the habitat; this made the learning 'real', echoing findings by Passy (2014), who asserted gardens were an effective way of engaging children in learning. For example, in the science class, children explored the habitat of plants, insects and birds in gardens to learn about different habitats in nature; they counted the different types of plants and vegetables that they grew in gardens in relation to their knowledge of numeracy in the mathematics class. Gardening (along with outdoor learning) affects children's knowledge of science according to previous research (Berezowitz et al., 2015; Klemmer et al., 2005; Wells et al., 2015; Williams & Dixon, 2013). The use of gardens extended beyond the time duration of the outdoor classes, as children themselves were involved in gardening before and after school hours and during their break time.

Historically, school gardens have been used as a pedagogical tool and advocated in a variety of educational philosophies, including those of Montessori and Dewey (Subramaniam, 2002). The focus groups with parents also revealed that children shared their knowledge of the food value of vegetables produced in their school gardens with their parents at home. This is particularly important in the context of an agriculture based society like rural Bangladesh, where both the school and the community can learn from their mutual relationship. In peasant societies children learn about growing plants from their early years; they can bring local knowledge to school and can take back to their parents advanced knowledge on growing and taking care of plants and crops and their food values. This can

contribute to various aspects – what to cultivate, how to use modern technology and what should be on the daily menu for better health.

Amphitheatre: The meeting of teachers and children at the beginning of each outdoor lesson, the discussion of that day’s particular task and the meeting at the end of each lesson were all held in the amphitheatre. The necessity of having a meeting area in the outdoor learning environment was outlined by Rowe & Humphries (2012). In addition to these activities, children were engaged in some group work, working with loose materials collected from the adjacent setting, measuring, creating a habitat in the mound adjoining the amphitheatre and presenting their work, which demonstrates the diverse use of the semi-circular amphitheatre. The large blackboard in front of the amphitheatre was found helpful and stimulating for children; they showed enthusiasm for writing the findings from their group or individual tasks on the blackboard. This echoes the findings from the studies by Khan (2012) and Khan & Islam (2014); the students who were passive in their classroom participated actively in the class, sharing their knowledge by writing on the blackboard. Khan & Islam (2014) also provided evidence of the positive influence of the amphitheatre on children’s performance in a science test.

Focus group discussion findings show that children found the amphitheatre more comfortable than their classroom. They enjoyed learning in fresh air and under the shade of tree and could see and hear clearly what the teachers were teaching, echoing findings by Khan & Islam (2014). This also indicates the poor environmental (luminous and thermal) conditions of the classrooms in most Government primary schools in Bangladesh and highlights the necessity for improvement of the physical environment of educational institutions. This is also supported by studies on classroom environments in the field of architecture (Barrett et al., 2015; Khan, 2009; Khan, 2012).

Water area: The main learning activity in the water area was exploring the interrelationship of plants, wildlife and water in the science class, where children themselves created the habitat and learnt through practical experience, which can be referred to as experiential learning as theorised by Dewey (1963). This setting was not used during mathematics class within the period of systematic observation; however, the setting has potential for teaching numerous science and mathematics concepts, for example buoyancy, density, porosity, surface tension, displacement, geometric shapes (e.g. circle and sphere) and volume (Gross, 2012). The necessity of water features in educational environments is stressed in ‘Natural Learning’ by Moore & Wong (1997), as children can learn about pond life and aquatic plants and animals, which can contribute to their knowledge of good and bad

aspects of the environment (e.g. the way mosquito larvae can grow and spread disease). Besides, water is universally favoured by children (Titman, 1994, Korpela, 2002, Christidou et al., 2013) and adults (Korpela et al., 2001; Korpela & Ylén, 2007), and researchers are investigating the restorative potential of water environments (Ulrich, 1984, White et al., 2010), though no significant difference has yet been found between natural environments with or without water (van den Berg, Koole and van der Wulp, 2003).

Area with loose materials: Observation and behaviour mapping results indicate that children used loose materials for building and constructing houses and different structures in their mathematics class. Children worked either in the area with loose materials or the adjacent settings, i.e. the open yard and the amphitheatre, if more than one group were assigned with the task. Children also used the top of the storage shelf as a desk to work on and to display their work during mathematics and science class. A setting with varied elements can stimulate children's interest and initiate interactions between children and teachers (Waters & Maynard, 2010) which is important for learning. Consistent with previous research (Fjørtoft & Sageie, 2000; Moore & Wong, 1997; Tai et al., 2006) and Nicholson's (1970) theory of loose parts, the results of this study indicate that the loose materials afford constructive and exploratory activities. Working with loose materials to build and construct things provides the opportunity to be creative and imaginative and helps to develop communication and social skills in children (Canning, 2010, 2013, Knight, 2013). The importance of loose and manipulative materials for learning of the curriculum is not much discussed in the present research context; however, according to the teachers, the area provided opportunities for children to learn without adult guidance, which goes in line with previous research findings (Nicholson, 1970, Cosco, 2006, Zamani, 2013).

Open yard: Observation and behaviour mapping results indicate that children used the open yard for drawing on the ground, observing nature, building and constructing with loose materials, measuring and interacting with peers and teachers. Adjacency with the area with loose materials and gardens enabled most of these uses. Children brought loose materials from the area with loose materials to the open yard, and were engaged in building and constructing of houses and drawing tables for learning progression of numbers using seeds. Availability of loose materials in or surrounding a setting can also stimulate the use of a setting (Smith et al., 2014). The yard itself could only afford drawing on the surface of compact soil, digging and measuring, which are not available in the tarmac playgrounds of many primary schools in developed countries like the UK and the USA (Adams, 1990). However, a barren compact school ground without access to adjacent settings can offer

limited opportunities (as found in pre-intervention observations); barren school grounds can also encourage negative behaviour among children (Samborski, 2010).

Play area: The play area was used by the children for measuring the height and width of the playhouse in the mathematics class and for observing the setting closely to find out which natural and man-made resources were used to build this in the science class. This demonstrates how awareness of the potential of physical environment can contribute to an effective teaching-learning process (Horne-Martin, 2006). The teachers, who did not think of associating the content of a textbook with the environment before, were more aware of the educational potential of a setting that had apparently only seemed to be a place for physical activity. The children also loved to work in groups at the playhouse; the low height and cosy environment provided a sense of enclosure for working in small groups (Colwell et al., 2016; Dosen & Ostwald, 2016).

Huts: The observation and behaviour mapping results indicate that the children used huts mainly for working in groups, drawing and observing the built environment. Like the playhouse, huts provided an enclosure for small group activities, for which children preferred the area once they were given the choice to select the setting for their group work (Colwell et al., 2016). Access to loose materials like brick chips right beside the huts enabled their use for learning number theories. In addition, the mixed nature of the settings (built of both man-made and natural elements — bricks, bamboo poles and thatch) offered opportunities for various activities, for example measuring and counting in the mathematics class and observing the setting to find out the elements used for construction in the science class. The mixed nature of the school ground environment also contributes to children's increased physical activity as found by previous research (Lindholm, 1995, Cosco, 2006, Mårtensson et al., 2014); however, the present study found it stimulating for various educational activities too.

Pathway: The stepping stones were found beneficial for underachieving children in the class who did not yet have a clear conception of numbers as observed during the outdoor classes. However, the regular students were also found to explore the properties of number, measure the square pavement and learn the geometric properties guided by their teachers. It offered children the opportunity to learn by moving through the space, and movement activates brain function (Jensen, 2005, Best, 2010) as mentioned earlier in Chapter 2.

10.1.3.3 **How do the users respond to the individual behaviour settings of the school ground during informal learning?**

Like the formal learning activities, the frequency of informal learning activities in the school ground did not depend on the size of individual setting. This echoes findings by Hussein (2009), who in her PhD research found that access to the settings and their functioning stimulates the use of different settings in children's therapeutic gardens. This is also the case in the present study. Though gender is found to be a dominant factor in the playground (Blatchford, Baines and Pellegrini, 2003, Pellegrini, 2009, Zamani, 2013), both boys and girls preferred the same settings — the play area and the open yard. This section evaluates how the behaviour settings of the school ground promoted informal learning (cognitive, social and physical) activities.

Natural learning area: The principal features of the natural learning area are the trees, plants and the hill. Participant observation and behaviour mapping results suggest that children were engaged mostly in cognitive activities followed by social ones in this area. Trees and plants stimulate exploratory activities, as the girls were observed searching for particular plants and leaves to play the local game *pata pata*. The children chant folk rhymes (*ayna jhik jhik kore re, konay konay dhan gach kati re...bilai katakuta khay re...*) in many of the local games in rural Bangladesh, of which natural elements are an integral part. Many elements contributed to children's creation of play, which is theorised as 'bricolage' (Willett, 2015); the presence of natural elements in the renovated school ground stimulated folk play among girls, which involved the chanting of play-lore. Girls are the principal conservers and initiators of folklore (Meire, 2007). Trees also provide opportunities for dramatic play by providing various loose elements as play props including leaves, sticks, fruits and twigs (Moore & Wong, 1997; Moore, 1989).

Children were found to run down from the hill and roll down the tyres or rings from the hills to the open yard; previous research suggests how variation in topography can encourage sliding, rolling and running down (Fjørtoft & Sageie, 2000; Marcus & Carolyn, 1998; Moore & Wong, 1997; Zamani, 2013). Natural features like grass and the slope have been found to be associated with children's gross motor skills (Fjørtoft & Sageie, 2000). Gross motor skills are associated with academic performance (Westendorp et al., 2011) as mentioned in the previous section. The hill also offered the opportunity for looking out and observing others. The children waited on top of the hill for their turns in the play or acted as onlookers of their friends' activities. This is congruous with the findings from Merewether's (2015) research, where she found young children liked places like bridges, swings and

lighthouses from where they could have a vista of the surroundings and could watch others. This also indicates children's desire for sociality in direct or indirect forms (Noradahl & Einarsdóttir, 2015); the opportunity can be created by changing the elevation in the landscape.

Gardens: Observation and focus group findings suggest that children used the gardens mostly for cognitive activities like exploration of the environment and close interaction with nature. In addition to these, children were engaged in weeding, cleaning up the rubbish and growing and taking care of the plants (watering them in the morning and evening), which strengthens the evidence that outdoor activities in the early years can create empathy for nature among children (Tai et al., 2006; Palmberg & Kuru, 2000). Gardening is also associated with children's increased physical activity (Wells, Myers and Henderson, 2014). Children taking care of plants in the gardens attracted younger children, who were careful observers of what their older peers were engaged with. This can positively influence their social relations, as children can learn from this mutual relation at the zone of proximal development as defined by Vygotsky et al. (1978). School gardens can reduce stress (Kelz, Evans and Roderer, 2013, Chawla et al., 2014, Bagot, Allen and Toukhsati, 2015), and the view of a green landscape can influence academic performance through stress reduction and attention restoration (Li & Sullivan, 2016).

This study found a difference in the types of activities performed by boys and girls in gardens. While girls were using the leaves and flowers for folk games and watering the plants morning and evening, boys were engaged in more physical activities like weeding and cleaning up the rubbish. The difference in the activities performed by girls and boys in gardens is not evident in related research.

Amphitheatre: Children were engaged in diverse activities – physical, social and cognitive – in the amphitheatre, as revealed by the observation and behaviour mapping results. They adapted hopscotch to play on the steps of the amphitheatre, adding another dimension to the game, which is generally played on flat ground. The children were found observing their peers from the top step of the amphitheatre and jumping from there to the hill beside it. The height of the outer wall of the amphitheatre and the terrain just behind it enabled them to jump and run towards the open yard. Though there was a clear visual or physical barrier between the settings, many of them continued on to another setting. This quality of continuity from one setting to another enabled children to be fluid in their activities, extending their activities throughout the school ground. Continuity in a landscape design offers opportunities to be fluid and flexible.

According to Marcus & Carolyn (1998), a change in elevation can offer multiple play opportunities for children. The variation of height in the outdoor amphitheatre might be associated with the diverse activities occurring in the setting. Children were found to interact with their peers in the setting before and after school; the enclosed character of the setting might be associated with this affordance of sociality (Kirkby, 1989; Colwell et al., 2016; Dosen & Ostwald, 2016). Girls were found to be the principal users of this setting. While boys were occupying the play area and the open yard, many girls who might have otherwise secluded themselves in the classroom spent their time in the amphitheatre cleaning, playing, socialising and being on their own. This is in harmony with the findings by Khan (2012).

Water area: Previous studies note the manipulative and multisensory character of water offering various play opportunities (Moore & Wong, 1997; Gross, 2012; Furio, 2010). Children were engaged in role play, making paper boats and floating them in water; they also observed the dynamic relationship of plants, water and fish in water, which attracted more children to look at and celebrate the wonders and beauty of water. Water is a mysterious natural feature that arouses curiosity among children, and curiosity is a predictor of learning (Berlyne, 1978, Reio, 2004). Curiosity was also found to spread amongst children; as a movement in water attracted one child first, the number immediately increased around the water tub – the social aspect of which cannot be understated. However, *‘the most desired and the least provided element in children’s play world is water’* (Byrd et al., 2007, p44). Moore & Wong (1997), in their book ‘Natural Learning’, stress the importance of water as crucial for child development: *‘Water provides a powerful, experiential bridge between the inner life of the child and the external world, a link that represents the deeper developmental relationships between play and education’* (p49). While girls were mostly enjoying the beauty and mystery of water, the boys were taking care of the setting, cleaning the surroundings of the tubs, changing water and creating habitats.

Area with loose materials: Observation and behaviour mapping results suggest that the area with loose materials was used mainly for social activities, followed by physical and cognitive ones. However, the physical activity in the area i.e. *juta chor* (a local rule game) attracted observers, who either sat on top of the storage shelf or on tyres in order to observe others playing. Adjacency to the amphitheatre and the water area might be another reason to attract more observers in this setting. Though adjacency of settings was found to be a determinant of increased physical activity (Smith et al., 2014), it can offer opportunities for sociability too. The setting being at one corner of the school ground provided some seclusion from other settings, this made it a popular place for girls to play and to socialise. Girls prefer

places where they can be away from the crowds and be by themselves (Karsten, 2003). After intervention the boys, who previously avoided *juta chor*, regarding it as a girls' game, were found to be interested in the games played generally by girls and showed an eagerness to take part. This indicates a changed character of gender stereotyping among boys (Beeson et al., 1985), which can be attributed to the change in the school ground.

Cognitive activities in this area outside the outdoor class were the least frequent, contrary to the findings of previous research (Moore & Wong, 1997; Fjørtoft & Sageie, 2000; Tai et al., 2006; Zamani, 2013). The main reason might be the unavailability of loose materials in the area outside class time. Most loose materials were stored inside the classroom and the small ones were locked inside the storage; the children generally used these materials for constructing activities during their outdoor classes. Another reason might be the preference of this age group for social and physical play. Again, the children who were found to be messy with sand and water – building castle and water fountains during construction days and after school periods – did not engage in such activities during school days. The popular notion about being neat and tidy in the school might have contributed to this behaviour.

Open yard: Observation and behaviour mapping results indicate that children used the open yard mainly for physical activities, which is consistent with previous research that found play fields were popular for different ball games and rule games involving moderate to vigorous physical activity (Haug, Torsheim and Samdal, 2008, Haug et al., 2010, Pawlowski et al., 2016). Boys were the dominant users of the open yard before intervention due to their preference for ball games and games with rules; this is in line with the findings of Pawlowski et al. (2016). Girls remained indifferent to using places which they did not find attractive, as found in previous studies (Blatchford, Baines and Pellegrini, 2003, Karsten, 2003, Pawlowski et al., 2016). However, after the intervention, girls became equal beneficiaries of the open yard. The adjacency of the yard to the gardens offered girls opportunities to play games they generally played in the neighbourhood open spaces and could not play before in the school ground. This is consistent with the findings of the research by Smith et al. (2014) mentioned earlier while explaining the area with loose materials. Similarly, boys were engaged in chasing, rolling tyres from the hill in the natural learning area towards the open yard and circulating around it. All other settings were arranged surrounding the open yard, which made it a central place of activity for both boys and girls; an area that had offered less opportunities for focused play behaviour before the intervention became a vibrant place afterwards.

The playground marking at one corner of the open yard encouraged young girls to play hopscotch; even boys were found playing hopscotch. This is in line with previous research findings where external stimuli like playground markings were found to be associated with increased physical activity (Stratton, 2000; Stratton & Mullan, 2005; Ridgers et al., 2010, 2007). The social activities in the school ground included observing as a participant (waiting for their turn in the games) and being onlookers. However, the number of onlookers was fewer after intervention, as there were more opportunities for play.

Play area: The play area mainly hosted physical activities, being equally popular with both boys and girls. This is congruent with previous research (Anthamatten et al., 2011) that found an association between school ground renovation and increased physical activity of girls to a level similar to boys. Playground equipment encourages vigorous physical activity (Haug, Torsheim and Samdal, 2008, Dymont, Bell and Lucas, 2009, Haug et al., 2010, Anthamatten et al., 2011). Also, primary school aged children have a preference for being physically active (Noradahl & Einarsdóttir, 2015; Christidou et al., 2013). Even younger children showed a preference for challenging themselves physically in the school ground (Merewether, 2015; Noradahl & Einarsdóttir, 2015). This explains the findings from the present research, as younger children from the neighbourhood were found to use the play equipment for hanging from the bars and climbing. The swings were the most popular among play equipment for both boys and girls, echoing findings from previous research (Herrington et al., 1998, Samborski, 2010, Christidou et al., 2013, Jansson et al., 2014). Some girls were found to take refuge in the playhouse, either alone or in small groups of two or three. The cosy enclosure character of the playhouse offered girls this opportunity.

Huts: The huts encouraged verbal interaction among children and also with adults. An area for meeting and chatting in children's outdoor learning environment is stressed by researchers (Moore & Wong, 1997; Moore, 1996) as it can positively influence social relation. Besides, a shelter is necessary to protect from adverse weather (Kenny, 1996; Moore & Wong, 1997; Sebba & Churchman, 1986). Children took shelter in huts when it rained. It also became a popular place for waiting before school started. There was no place for parents in the school ground to wait for their children; however, after intervention some parents were found to wait for their children in huts, and they also helped the children with their tasks out of class time. Adults' needs are rarely considered when designing school grounds (Stine, 1997). The huts were used by teachers too, for social interaction, at times when children did not use them or were in their classes. The huts were popular with both

boys and girls; the two groups each claimed ownership of one of the two huts, the bigger one belonging to the boys.

Pathway: The stepping stones afforded functional play behaviours like moving between locations and jumping over the square blocks. The pathway was designed as a loop surrounding the open yard, providing access to all other behaviour settings. This therefore enabled children to move in a circular motion without interference, which is consistent with previous studies (Cosco et al., 2010; Moore & Cosco, 2010; Zamani, 2013). On their way along the stepping stones, they stopped if they found something interesting happening in another setting. The girls created a new game to play on the stepping stones, which involved jumping over the blocks while chanting a rhyme.

Many children, especially younger kids who were starting to learn numeracy, were found jumping on the blocks and reading the numbers on them. The painted numbers on the stepping stones were found to be very effective by teachers for teaching numeracy, as children were learning numbers without even being conscious of it. This is congruent with the observations of the teachers in Coombes County School in the UK regarding the 100 square or number snakes painted on their playground (Rowe & Humphries, 2012). Stepping stones were especially useful during heavy rains for moving between locations while avoiding the stagnant water on the ground; therefore, they can be an effective design element in schools in regions with heavy monsoon.

10.1.3.4 Which settings do the users prefer in their school ground and is that reflected in their behaviour?

What most children had desired to have in their school ground before intervention differed from the settings they actually used most and mentioned as favourites. Natural elements (23%), gardens (22%), play equipment (20%) and water features (11%) appeared most in children's drawings of their dream school ground, which is congruent with previous research (Noradahl & Einarsdóttir, 2015; Merewether, 2015; Christidou et al., 2013; Nedovic & Morrissey, 2013) that found children preferred places that are aesthetically pleasant and where they could connect with nature and their peers, be physically active and explore. In a project for designing Carlton School, Kentish Town, London, the children were involved in the design process; they were asked to draw and paint snapshots of their school on the street frontage. A new colourful entrance wall was proposed, leading to a garden full of trees, ponds, race tracks, slides, swings, movement tubes and a swimming pool, demonstrating children's love for nature and natural elements (Koralek & Mitchell 2005).

On the other hand, after intervention had taken place, the highest number of children were found to be engaged in activities in the open yard (28%), the play area (28%) and the amphitheatre (13%). The number of children in the rest of the settings were more or less equal. This suggests that the physical and social developmental needs of this age group (six to 12 years old) require engagement in activities that involve playing with friends (Bell, 2008, Shima, Mohammadjavad and Alireza, 2012). However, this contradicts the findings by Lucas & Dymont (2010). In their study of a primary school in Australia, most children were found to occupy the green area, with the second most populated place being the paved sports courts. Several factors might have contributed to children's less frequent use of the natural learning area; the area was not fully grown at the time of data collection, therefore children could only avail themselves of limited opportunities. Also, the play in the open yard was not limited to that area; some started from the adjacent natural learning area and children made frequent visits to the gardens, the natural learning area and the area with loose materials during some other play. This indicates that the central open yard might not have been as popular if it did not have the adjacent settings.

The frequency of the use of different settings during outdoor classes did not always depend on the preferences of children. Teachers designed the tasks based on the curriculum and the affordances of each setting, i.e. whether they offered the opportunity to teach certain contents from the curriculum. The amphitheatre was the most frequently used area, as the teachers met the whole class there at the beginning and the end of each lesson. However, taking into account the time when children were active in different settings simultaneously, the percentage of use of the settings was almost equal. If children were given the chance they first chose the playhouse (for the opportunity to work in a cosy shadowed space and to climb up and slide down once they finished the task) and huts (to work in shade in a cosy space), followed by the amphitheatre (to interact on an intimate scale) and the storage shelf of the area with loose materials (to sit on), which is consistent with the findings from previous research on children's preferences of use of the outdoor environment (Christidou et al., 2013; Nedovic & Morrissey, 2013; Jansson et al., 2014).

The settings that were used most frequently during playtime were not necessarily the favourite places of children, which is congruent with research findings by Mårtensson et al. (2014). In their study, children mentioned the green areas of the school ground as their favourite places but did not use them as frequently as they used the sports court. Though the amphitheatre was found to be the third most used setting in the school ground, this was mentioned as the favourite place by most children (41%). The children's choice of favourite

places was influenced not only by their use of the space during playtime but also during outdoor classes. Children enjoyed their classes in the amphitheatre in the fresh air and could socialise with their friends there, which were both mentioned as reasons for it being their favourite place. Also, the place offered opportunities to be physically active, as did the play area, which was the second most favourite place. This is congruent with the findings from previous research by Korpela et al. (2002), who found that children's favourite places were those where they could be physically active and socialise.

However, the research of Tranter & Malone (2004) in Australia suggests that children's choice of favourite places depends on the environmental opportunities they are offered. In their study in Australia, children from one school with rich green settings mentioned the forest as their favourite setting where they could be engaged with constructive activities, as opposed to the children in another school with a more grey setting who mentioned playground equipment as their favourite.

Along with the opportunity to be active and social, children also associated aesthetics with their favourite setting in the present study. Huts came third (20%) in children's list of most favourite settings in the school ground for their beautiful form and opportunity to socialise. Children also associated beauty with their preference for gardens (11%). Even very young children were found to prefer aesthetically pleasant places in a study by Merewether (2015). The prevailing theories related to children's conception of space contradicts this idea to some extent, as they reveal that unlike adults, children generally perceive place based on its functionality rather than form (Heft, 2010; Moore & Sugiyama, 2007; Tuan, 1974; Ward-Thompson, 1995). Although aesthetics appeared later in children's list of reasons for their favourite place (after the opportunity to have classes in the fresh air, being physically active and socialising), it was a strong element in their preferences for the design of the school ground and for their favourite place.

The choice of children's favourite places was found to be associated with their favourite activities to some extent. While before intervention children's favourite activities included mostly functional play and games with rules, after the intervention, about 50% of the children mentioned activities other than functional or games with rules. They mentioned social and cognitive activities, which included chatting with friends or studying in the huts or the amphitheatre. This can explain why children mentioned the amphitheatre, the play area and the huts as their favourite places. However, neither children's favourite activities nor their choice of favourite places depended on the size of the settings (see Appendix 19).

Several factors influenced children's preferences for design, use and their favourite places. Some of these preferences overlapped. Although children wanted natural elements in their school ground more than some other elements and many of their activities in the open yard included elements from the natural learning area and gardens, the natural learning area was not mentioned as their favourite place and was also used less than some other settings. This indicates that children's places should include elements from nature that can stimulate their activities in different settings. Again, rural children are exposed to natural elements in the neighbourhood open spaces outside school time, which might be a reason that the children in this study took natural elements for granted. This might be the case for the open yard too; although the open yard was the highest used space by the children, only 2% of the children mentioned it as a favourite place. The open yard independently did not offer much, except some games with rules as mentioned in the earlier sections. Some lack in design and execution and lack of access to materials can also contribute to the infrequent use of some settings, which will be discussed in detail in the next section.

10.2 Design intentions, use (actualised by children and teachers) and evaluation

The design of the school ground was guided by the views and preferences of children, teachers and parents, evidence from relevant research and 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 some other designers. To evaluate the quality of the design or physical forms based on landscape architecture quality (from adults' point of view) is not the purpose of this research. As such, rather than the quality of the physical forms of the school ground, the affordances that the newly designed school ground provided for children was the basis for evaluation of the outdoor learning environment. This section attempts to evaluate the design of the settings based on the intention of the designers (perceived as potential affordances²³ of the settings), the affordances actualised as per designers' perceptions, new affordances discovered by the users beyond designers' perceptions and the perceived affordances that were not actualised. A summary of potential, intended actualised, unintended actualised and intended not actualised affordances of different behaviour settings are listed in Table 10.1 and Table 10.2.

²³ Potential affordances are those that the designers intend to offer in the design, whereas actualised ones are those with which the users engage themselves.

The affordance of **the natural settings** for children's pretend play has been reported by previous studies (Moore & Wong, 1997; Fjørtoft & Sageie, 2000; Malone & Tranter, 2003; Moore, 1986; Tai et al., 2006; Zamani, 2013); this behaviour was not that prevalent in the present study. The natural learning area, which acted as a green fence surrounding the school, was not fully grown as we did not observe the rainy season (the planting season) during the period of the study. The school ground being small, the setting did not have adequate space for such activities, whereas the school grounds studied in previous research included a fully grown woodland or forest within the school premises or in the vicinity.

For the same reasons, **gardens** could not be designed equipped with the space for seating where children wanted to be engaged in dramatic play with their friends (as they mentioned during the pre-intervention focus groups and drawing sessions). However, these two areas offered other opportunities, e.g. sociality, games with rules, physical activity play and independent exploration which were not intended during the design phase. The presence of diverse plants in these areas allowed children to create new games and adapt the neighbourhood games in the school ground. Additionally, this also helped them with learning mathematics (counting different categories of plants and then adding, subtracting, dividing and multiplying with the numbers), which was not anticipated during design.

Loose materials in the school ground can afford children's creative play and boost their imagination, unlike fixed natural or manufactured elements (Nicholson, 1970; Cosco, 2006; Marcus & Moore, 1976; Zamani, 2013). Though children used the loose materials to build things during their mathematics class, they were not found to play with loose materials outside class time. Loose materials like boxes, crates and tyres were mostly stored in the classroom to avoid theft, and other materials like tree branches and thatches which remained on the ground started to perish day by day. These were treated as messy and were cleared by some villagers outside school time to use as fuel in clay ovens. It is necessary to consider this fact during design of an area with loose materials in rural schools. However, the availability of loose materials surrounding the huts encouraged the use of these materials during formal and informal learning activities (brick chips used as surface material afforded learning numeracy and also hopscotch in the huts).

The water area was found to be helpful in teaching science, although it was used less than other areas outside class time. Due to limitation of time and resources, the design was kept simple, which required more time for maintenance. Children, both alone and under instruction from teachers, and staff took care of the setting; however, the headmaster said the

children had feared people would steal the fish. According to the teachers, some mechanical intervention in the design of this setting (which might be expensive) and/or teachers' involvement and thoughts on maintenance and use of it could make the setting vibrant. Besides, children might have felt the need for approval from parents and teachers to be messy with sand, water and loose materials during class and school time.

The open yard, which had been kept flat for ball games and physical education became a vibrant place with games and play that had not been played there before. Having all other settings surrounding the open yard (because of the scarcity of space) turned out to be useful for a range of activities. Though the stepping stones formed a **pathway**, the open yard itself also became a pathway giving access to individual settings, which enabled particular behaviour. This is new knowledge from the design point of view, which landscape architects can consider when designing small school grounds where there might be limited opportunities for designing a well-defined pathway to connect individual settings. This goes along with what Hussein (2010) suggested in her thesis for designing the pathway as a 'sensory trail' (which in one sense becomes a garden) with access to different behaviour settings in a sensory garden for disabled children. The adjacency of different settings to the open yard also afforded diverse activities with more movement using several settings. This is congruent with earlier research findings (Smith et al., 2014) as mentioned in the previous section.

Access to natural elements from built settings and having natural features within a built environment afforded observation and exploration during science classes. **The outdoor amphitheatre** and **the huts**, mainly designed for the purpose of seating and meeting with peers and teachers, were found to afford diverse activities: building/constructing with loose materials and recreating the Sundarbans in the adjacent hills. While the activities in the settings that included either natural or built elements were more focused, the settings of mixed nature (having both natural and built features within it) and/or access to natural elements afforded more diverse activities beyond designers' perceptions of potential affordances. The diverse affordances of mixed settings were also found in studies of pre-school children by Cosco (2006) and Zamani (2013).

The physical features of some settings afforded certain physical activities. The steps in the outdoor amphitheatre and the seating in huts (mentioned in the discussion of individual settings in previous section) offered opportunities that were not intended while designing these settings. Besides, the vertical bamboo poles used as sheathing materials for

huts became an effective tool for teaching numeracy. The small bamboo poles of the garden fences and small plants in rows in the natural learning area served the same purpose, which demonstrates the usability of vertical repetitive elements in the school ground. Pure geometric shapes were intentionally used in the design of huts, water tubs and stepping stones, which turned out to be effective in teaching concepts of geometry. When measuring a square shaped pavement, a child discovered all the sides were equal and at the same time learnt about geometrical shapes with the help of teachers. These findings are useful for the designers of educational settings, particularly in designing pre-primary and primary schools.

The design of the behaviour settings was fluid rather than overly defined and walled. All the behaviour settings were identifiable for their surface materials and physical features; however, the features created to give them identity and separation from the surrounding settings became a link between the two and flowed between settings. The mound formed with the soil dug from the foundation of the outdoor amphitheatre started from the area with loose materials and flowed along the periphery of three settings, separating the settings from the open yard. It stimulated active play like rolling tyres and jumping. Also, the continuity of the hills from the natural learning area towards the open yard through the play area afforded rolling tyres and running down. Fluidity of space is particularly important for designing small school grounds.

Table 10.1: Potential (perceived by designers) and actualised affordances of different behaviour settings during formal learning in outdoor classes

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 interdependence of plants and animals Building knowledge of plants and trees	Learning 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, give 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, give flower and fruit and reproduce Knowledge of different types of plants Learning about interdependence of plants and animals	Counting Working in groups	
Amphitheatre	Context for learning through interaction with peers and more mature adults in any area of curriculum	Learning through interaction with peers and more mature adults in any area of curriculum	Observing built and natural environment Working with loose materials Measuring Drawing Working in groups	
Water area	Learning water cycle Learning 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
Area with loose materials	Collecting loose materials and learning numeracy: addition, subtraction, multiplication and division Building/constructing	Collecting loose materials and learning numeracy Building/constructing Working with loose materials	Drawing Working in groups	
Open yard	Learning about different soil type Gathering with peers and teachers	Gathering with peers and teachers	Observing natural environment Working with loose materials Measuring Building /constructing	Learning about different soil type
Play area	Learning in groups in playhouse Learning numeracy	Working in groups	Measuring Observing built environment Drawing	
Huts	Learning in groups Measuring Drawing/reading	Learning in groups Measuring Drawing/reading	Counting Using loose materials to learn number theories Observing built environment	
Pathway	Learning numeracy from inscription on stepping stone Learning geometric shapes Measuring	Reading numbers Learning geometric shapes Measuring		

Table 10.2: Potential (perceived by designers) and actualised affordances of different behaviour settings during informal learning

Behaviour settings	Design intentions (potential affordances as perceived by designers)	Actualised affordances	Unintended actualised affordances	Intended not actualised
Natural learning area	Shade/fresh air Connection with nature Playing with natural loose materials Running down Role play Swinging Exploring environment	Exploring environment Connection with nature Playing with natural loose materials Functional play: running down	Sociality: observing participant and onlooker Independent exploration Rolling tyres Games with rules (collecting leaves for <i>pata pata</i>) Taking care of plants	Swinging Role play
Gardens	Connection with nature Enjoyment of beauty or aesthetics Interaction with peers Pretend play/dramatic play	Sociality: observing others Connection with nature Exploring the environment Enjoyment of beauty and aesthetics		Pretend play/dramatic play
Amphitheatre	Interaction with peers and teachers Sitting on Meeting of teachers and parents/community people	Sitting on Sociality: verbal interaction Exploring the environment Independent exploration	Games with rules Functional play Moving between locations Role play/drama	
Water area	Connection with nature Pretend play/dramatic play Swimming, diving, boating, fishing	Connection with nature Exploring environment: creating habitat Independent exploration	Sociality: observing participant and onlooker Pretend play: floating boats	
Area with loose materials	Role play Building of things Construction of objects	Sociality: observing participant and onlooker Exploring the environment Independent exploration Playing with natural loose materials	Games with rules Functional play	Building/constructing
Open yard	Rule games Assembly/physical education Plays that use marking Physical development through running, walking, cycling	Games with rules Playing with free equipment Functional play: running, walking, cycling Playing using playground marking Assembly/physical education	Sociality: observing others, onlooking and chatting Exploring the environment Independent exploration Playing with loose materials	
Play area	Physical development/exercise/mastery Sliding/passage from one place to another Swinging Looking out from	Games with rules Playing in fixed equipment: sliding/passage from one place to another, swinging, climbing	Sociality: observing others, onlooking and chatting Playing with loose materials Independent exploration: daydreaming Taking shelter/refuge	
Huts	Taking protection from adverse climate Refuge or contemplation Interaction in an intimate scale Privacy	Taking shelter/refuge Independent exploration/contemplation Sociality: intimate interaction	Games with rules (adapted hopscotch) Moving between locations Reading Sociality: observing others	
Pathway	Movement from one place to another Reading Looking out from	Functional play Moving between locations Reading Looking out from	Sociality: observing others, onlooking and chatting Exploring the environment Games with rules	

10.3 Towards a definition of cognitive affordance – a potential new conceptualisation

This study used the affordance perspective to find out the relationship between the physical environment and pedagogy. ‘Cognitive affordance’, as introduced in Chapter 2, Section 2.1.4.1, was found useful for analysing the participant observation and behaviour mapping data in order to improve the understanding of this relationship. The school ground, designed bearing in mind the potential affordances for learning the curriculum (see Table 6.2 in Chapter 6) influenced the teaching-learning process; therefore, it had an impact on children’s academic performance. Some of these affordances were actualised, some remained undiscovered and some new affordances emerged as outlined in Table 10.1, evidenced by the participant observation and behaviour mapping data. The data also reveal a sub-set of cognitive affordances of the designed school ground as actualised during formal and informal learning. The scope of developing a taxonomy of ‘cognitive affordances’ of children’s environments based on a single case study research is limited; however, a definition of this new conceptualisation can be developed referring to related theories.

‘Cognitive affordance’ can be defined as that quality of the environment that affords cognition (in different forms of environmental, formal or informal learning) in people. Cognition can happen when the environment offers information about the properties inherent in that particular environment. This either creates *knowledge of the environment* or can be used to develop cognition of other phenomenon related to that environment, therefore creating *knowledge about the environment*. The knowledge of the environment (what Gibson referred to as a form of awareness – direct perceptual cognition) can lead to environmental learning or informal learning in children’s environment. Gibson also mentioned another form of awareness: indirect, symbolic and transmitted cognition, which ‘*expands and confirms information*’ perceived through direct cognition (Kyttä, 2003, p41). This extended cognition can explain the teaching-learning process during formal learning in the outdoor classes in the present study.

According to ecological perceptual psychology, cognition involves a psychological process where information is received from the environment either by perceiving the existing environment or remembering an earlier environment (Kyttä, 2003). However, Gibson himself rejects the division between perception and memory, present and past. Therefore, cognitive affordance of the environment cannot only be seen as the direct perception of the environment; rather it is a mental process where information perceived in contact with the

environment creates knowledge. The mental process can occur independently in a person with or without the influence of other people.

In an informal educational setting, for example while children are engaged in play in the school ground during break time, cognition can happen through individual exploration of the environment, processing the information gained through direct perception. A child on their own can learn the properties of a leaf or a box through sensory experience, leading to knowledge of the environment. This can also happen in a social context when a child is engaged in play in small or large groups. Direct perceptual cognition during informal learning is similar to Kyttä's (2002) illustration of various affordance levels adapted in Figure 10.1.

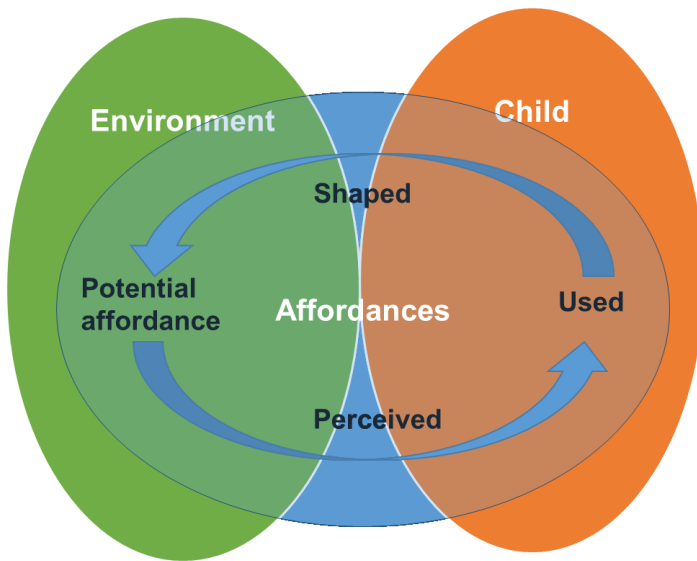


Figure 10.1: Affordances of various levels identified as existing between environment and child (adapted from Kyttä, 2002)

When children learn in a formal educational setting, the process can include both individual exploration and interaction with peers (see Chapter 2, Section 2.1.1.1) guided by a more mature adult or teacher. *'Any form of direction or guidance from adults is not invasion of individual freedom, rather this can require...more multiplied and intimate contacts between the mature and the immature (Dewey, 1963, p20).* A teacher can influence the development of cognition relating to that environment and therefore can change the way a child perceives, utilises and shapes the affordances of the environment. A child might perceive a tree as a feature to climb on or look out from on their own, which is categorised as functional affordance by Heft (1988). However, a tree has other embodied or situational cognition (it

does not move whereas animals move) that a child can discover when guided by a teacher to learn the difference between plants and animals in a formal educational setting (see research journal entry in Chapter 8). Therefore, the actualisation of the cognitive affordance by children also depends on the way the teacher perceives that affordance and uses it in designing the task to impart that particular lesson on the difference between plants and animals. It can also be inferred; a well-designed outdoor learning environment offers cognitive affordance for both teachers and children and this activates the teaching-learning process illustrated in Figure 10.2.

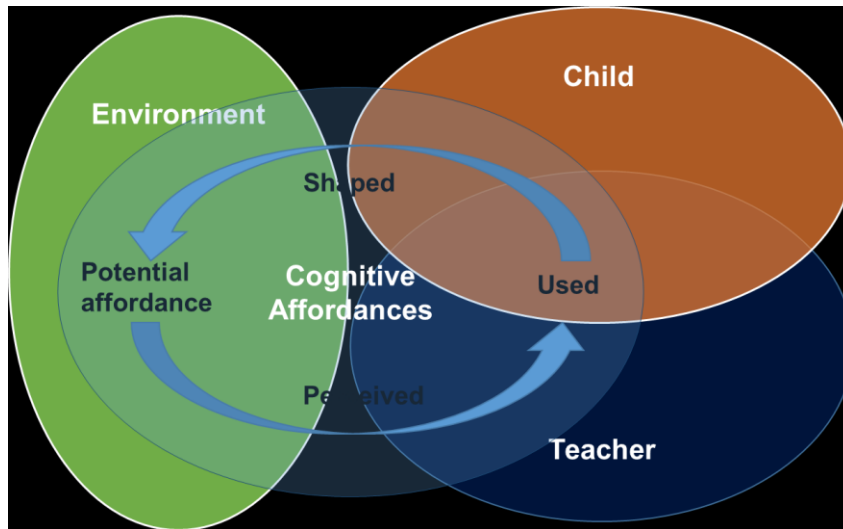


Figure 10.2: Cognitive affordances existing between environment and child-teacher interaction within a formal educational setting

Potential cognitive affordance like physical, social or emotional affordance is embodied in the environment independent of a person's ability to perceive it. Gibson himself explains the individual difference in perception of affordance as dependent on: 1) understanding of environmental information, 2) approach of exploration or investigation and 3) individual bodily abilities. This might lead to the general preconception of individual ability of teachers making the difference in children's cognition and learning. However, in this study, the fact that the same teacher imparted the same lesson to the comparison group and the treatment group in two different environments and produced a significant difference in academic performance indicates the difference in cognitive efficacy of those two environments.

The interview findings suggest that teachers were exhausted and bored in the classroom environment, where they were not able to do much in terms of designing tasks or

explaining concepts in different ways. On the other hand, in the outdoor environment (after intervention), the teachers discovered new (cognitive) affordances, some of which they actualised in designing and delivering the tasks. Focus groups with teachers after the intervention also revealed that there were more potential (cognitive) affordances embodied in the designed school ground waiting to be perceived and actualised in future lessons within a formal educational context.

Kyttä (2003) discussed children's ability to perceive affordances within the socio-cultural dimensions of the affordances offered by children's environments. In Kyttä's (2003) view, social and cultural factors control, or in many ways restrain, the actualisation of affordances. Many socio-cultural factors can influence children's learning (as discussed earlier in Chapter 3); having controlled those variables in this study it was found that within a designed outdoor environment, the teaching-learning process afforded by the environmental attributes helped children perform better in the exams. As suggested by observation and behaviour mapping, focus groups and interviews, a well-designed outdoor environment can offer more 'cognitive affordances' to both teachers and children than the classroom. This confirms better cognitive efficacy of the school grounds when designed with its potential for use as a context and tool for teaching in mind.

10.4 How much of the changes in children's learning can be attributed to the design of the environment?

As illustrated in Chapter 3 of this thesis, several factors contribute to children's learning, e.g. socio-demographic (e.g. age, gender and family background), environmental (e.g. social, political, physical and psychical) and pedagogical factors (e.g. teachers and the curriculum). The present study attempted to control other independent variables considering the research design, through careful selection of the intervention and the control school and the samples (treatment, comparison and control group children) in order to understand the relationship between the physical environment and children's learning (and their motivation to learn). However, the study also acknowledges that in real life experiments there might be other poorly-identified variables which could have an influence on children's learning. This section discusses how these variables have been considered in the study and could also be taken into consideration in future research.

10.4.1 The influence of the environment on pedagogy

The pedagogical variables influencing children's learning were considered in the experiment by choosing schools of the same grades (Grade B) within the sub-district (meaning teachers'

level of competence is the same). Within the intervention school, the same teachers taught both in the classroom and outdoors, therefore ensuring a further control on this variable. However, it is evident from focus group discussions with teachers and children and in-depth interviews with the teachers involved in outdoor teaching that the outdoor environment influenced the pedagogy itself. There was a difference in the same teachers' way of teaching, and in their behaviour and attitude in the two different environments. According to the children, they could understand better in the outdoor environment as their learning was made easier by the use of real life elements in teaching. This clearly demonstrates that improved quality teaching can influence children's better understanding of the subject content, which can lead to better academic performance. The same teachers' better quality teaching in the outdoor environment compared to the classroom demonstrates more affordances of the outdoor environment for teaching subjects like mathematics and science. So the improvement in children's academic performance, if credited to the better quality of teaching, can be attributed to the design of the outdoor learning environment.

There is a reciprocal relationship between academic attainment and children's self-concept (Marsh & O'Mara, 2008). Children's improved performance can influence their positive attitude/motivation towards study and vice versa. This can also positively influence teachers' behaviour and attitude; as one child said: *'When we can do our tasks in the outdoor class, the teacher smiles.'* Children's better performance in the outdoor class motivated the teachers to explore further how learning could be made easier using different settings in the school ground: *'I can understand from children's body language in the outdoor class that they can understand things better...If some of them can't, I think there might be some lacking in my teaching...I think how I can make their learning easier, which settings I can use to explain certain concepts.'* (Mathematics teacher). Therefore, the whole teaching-learning process acted as a virtuous cycle, which was kindled by the design of the outdoor learning environment (see Figure 10.3).

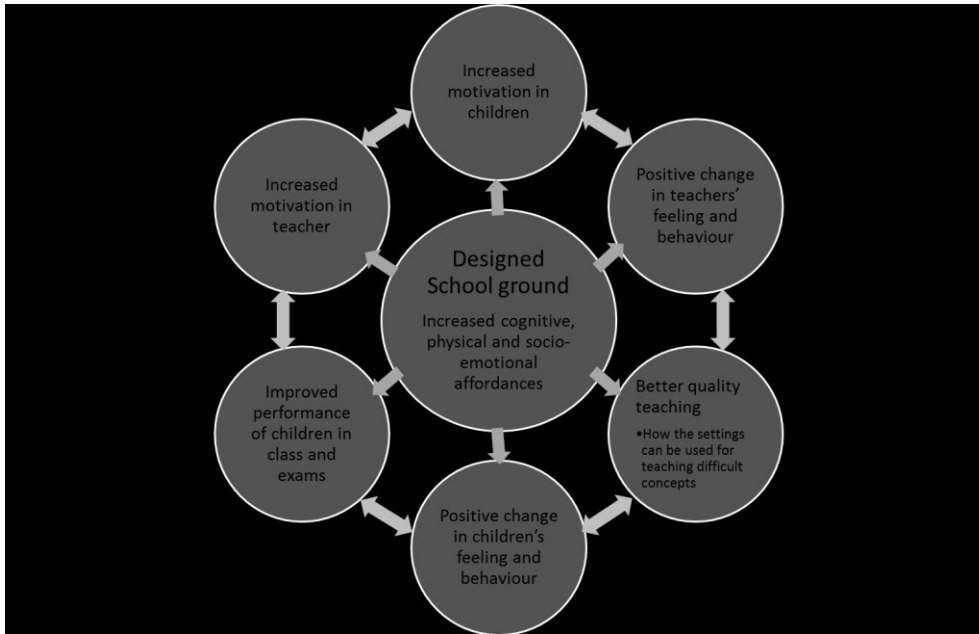


Figure 10.3: The relationship of the designed school ground and children's increased motivation and academic performance

10.4.2 The influence of children's participation

Participation in the design and development of the school ground can create agency (Hart, 1997; Lozanovska & Xu, 2013), which can influence children's motivation to learn, leading to better academic performance (Chawla & Heft, 2002). Therefore, can we say there is a causal relationship between the design of the outdoor environment and children's learning? Appropriate measures have been taken to control this, i.e. the use of a comparison group within the intervention school who did not utilise the school ground for learning the curriculum. Only the treatment group participated in the design decision-making; however, children from the whole school, and even children from the neighbourhood who did not attend that school, participated in the development process to some extent (by offering some help e.g. carrying thatch to the school ground and curing bricks). Therefore, the significant difference in academic attainment of the treatment and the comparison group demonstrates the influence of learning in the school ground. It might be too limiting to distinguish whether the design of the school ground itself or the teaching intervention in the outdoor environment had influenced learning, as the study provides evidence that the design of a school ground can influence pedagogy. However, some other questions also arise from the study. Would the school ground if designed differently or without the input from the users have had a similar impact on children's learning? A future line of research can be based on these grounds and will be further discussed in the limitations section.

10.5 Summary of findings

The discussion above demonstrates the confirmation of the 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 relation between the design of the environment and children’s learning is more complex (see Figure 10.4). The design of the outdoor environment was found to influence pedagogy and teachers’ motivation to teach, which might have had an impact on children’s academic performance. Also, children’s use of the school ground for different activities during free play, though it had no impact on their academic performance, positively influenced their motivation. Table 10.3 summarises the main research findings from different methods exploring the causal relationship. This study provides some evidence for the relationship between the motivation of children and teachers and children’s academic performance; however, this topic can further be researched in future to generate stronger evidence, which is why the arrows showing these relationships are accompanied by question marks. Table 10.4 summarises the evaluation of the design in terms of affordances offered by different settings.

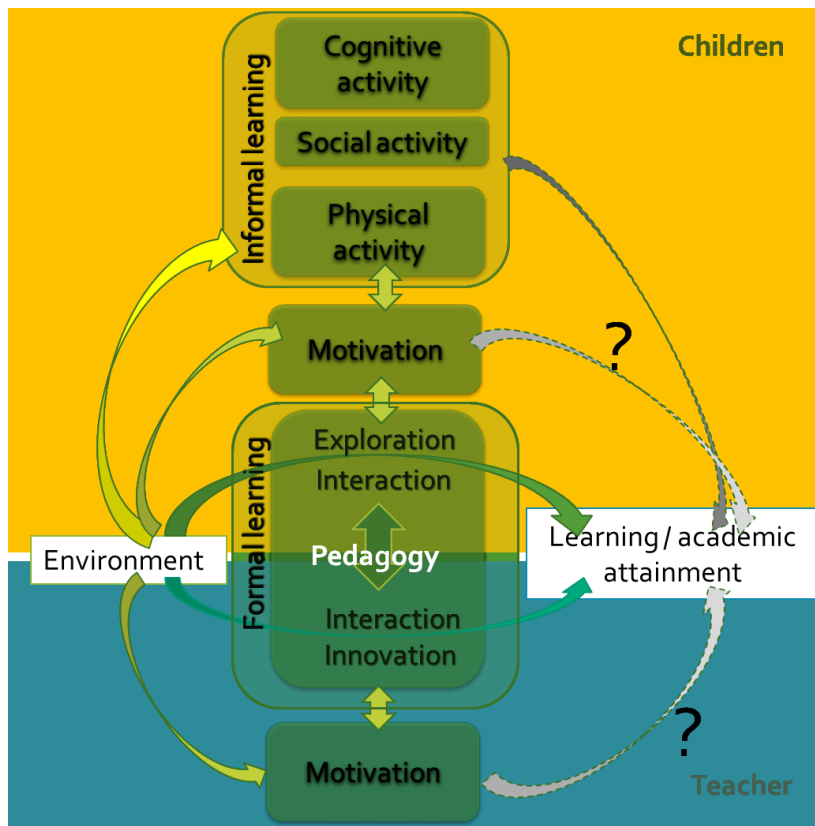


Figure 10.4: The relationship between environment and children’s learning

Table 10.3: Summary of findings from different methods

Expected findings	New findings that were not expected	Expected findings that did not emerge
<ul style="list-style-type: none"> • Positive influence of the outdoor environment on children's academic performance, perceived exploration and peer relation (1, 2, 3, 4) • Children's increased motivation to learn in the outdoor environment (2, 3, 4) • Positive change in children's perceived enjoyment, ability to do well in schoolwork, being good at learning, hard work and attention and no change in how children valued learning in the classroom and outdoors (2, 3, 4). • Positive change in children's perceived motivation, exploration and peer relation in the outdoor environment compared to the classroom after intervention (2, 3, 4). • Children's inclination to games with rules and physically active play (3, 5). • Benefits of outdoor learning environment for underachievers (4, 5) • Children's improved memory and active and spontaneous participation in outdoor classes (3, 4) • Outdoor environments' affordances for group work and interactive discussion with teachers and peers (3, 4, 5) • Decreased negative behaviour among children (4, 5) • Increase in number of children in the renovated school ground engaged in different activities than before (5, 6) • Children's engagement in more diverse activities in the renovated school ground than before (3,5) 	<ul style="list-style-type: none"> • Affordances of the new school for innovative teaching practices (4, 5) • Increased motivation of teachers (3, 4) • Positive change in teachers' behaviour (3, 4) • Positive relationship between children of different grades (3) • Affordances of neighbourhood open spaces for diverse activities compared to school ground before intervention (3) • Attraction of the neighbourhood children to the renovated school ground who did not study in this school (3, 5, 6) • Increased attendance and enrolment of new students in the school after intervention (3, 4, 6) • Increased motivation, positive influence on perceived exploration and peer relation in children who did not participate in the design process but used the changed school ground for informal learning (2, 3) • Change in boys' stereotypical idea of gendered games (3, 5). • Improved peer relation between boys and girls (3, 5). • Increased number of both genders in the school ground reaching a balance, especially girls who were creating new games and finding newer affordances of the school ground • More spontaneous behaviour from girls than boys in the outdoor class activities (5, 6). • Development of outdoor environment as a platform for discussion for underachiever who talked observing natural phenomena in the outdoor class (4,5) • Environmental awareness/caring for the school ground — a sense of ownership developed in the children (3, 5) 	<ul style="list-style-type: none"> • The influence of outdoor environment on children's perceived peer relation was not as significant as expected (2). <p>Legends for different methods:</p> <ul style="list-style-type: none"> • Exam score data = 1 • Questionnaire survey data = 2 • Focus group discussions = 3 • Semi-structured interviews = 4 • Observation and behaviour mapping = 5 • Attendance data = 6 <p>The bold numbers indicate the principal methods for these findings and the rest are methods that supported those findings.</p>

Table 10.4: Summary of findings evaluating the design of the outdoor learning environment

Expected findings	New findings that were not expected	Expected findings that did not emerge
<ul style="list-style-type: none"> • Different settings offered different affordances for formal and informal learning. Some settings offered more diverse opportunities whereas some others afforded more focused activities (4, 5) • Learning in the classroom was static and textbook-centred whereas learning in the outdoor environment was more dynamic, using movement and action (4, 5) • Most used settings by both boys and girls were those which offered opportunities to be physically active (5) • Settings of mixed nature or adjacent to settings offering connection with natural elements afford diverse activities (5) 	<ul style="list-style-type: none"> • Adjacency of the settings offered opportunities to play games using several settings and more movement (5) • Availability of loose materials within or surrounding any setting encouraged the use of those materials in formal and informal learning activities (5) • Preference of settings did not differ much between girls and boys; however, boys dominated in some settings, girls in some others (5) • Natural settings like the water area and gardens created a sense of mystery and curiosity among children (5) 	<ul style="list-style-type: none"> • Area with loose materials were not used much by children during informal learning (5) • Natural learning area and garden were not identified as favourite places after the intervention (3) <p>Legends for different methods:</p> <ul style="list-style-type: none"> • Exam score data = 1 • Questionnaire survey data = 2 • Focus group discussions = 3 • Semi-structure interviews = 4 • Observation and behaviour mapping = 5 • Attendance data = 6 <p>The bold numbers indicate the principal methods for these findings and the rest are methods that supported those findings.</p>

Chapter 11 Conclusion and design recommendations

The thesis originated from concerns related to the lack of understanding of the influence of the physical environment on children's behaviour and learning resulting from the poor physical environment of schools, particularly very poor ones in the developing countries. There is even less understanding about the influence of outdoor environment which resulted in barren unsurfaced and tarmac primary school grounds. World problems like high drop-out rates in primary schools and the poor academic competence are being discussed in relevant literature in relation to what children are being taught and which socio-economic background they are from but not in relation to where they are being taught. The study wanted to address this issue from the perspective of an environmental designer, through addressing the gap between application of environment-behaviour studies and design, as well as the gap between designers' perceived notions of the use of the environment and the actual use and impact. Along with the gap between academia and practice, it also addresses the distance between different academic disciplines. Accordingly, it argues that though there are published resources on the design and use of school environment, there is a lack of appropriate knowledge and information based on empirical research. Advocates of outdoor learning in Scotland (where outdoor learning is encouraged in policy and curriculum) are acknowledging the lack of empirical knowledge to convince teachers to take children outdoors for teaching the curriculum (Higgins, 2016). The problem, once identified, can lead towards understanding the necessity of such inquiry, methods for conducting it, measured outcomes and the applicability of it for policymakers, designers and educationalists.

While multiple theories of child development helped in the understanding of how children learn through exploration, interaction and movement, theories of ecological psychology provided the framework for understanding the relationship between the environment and education. The concept of 'cognitive affordances' was introduced in this thesis as an extension of Gibson's theory of affordances adding to Heft's (1988) functional affordances and Kytta's (2002) affordances for sociality. This new conceptualization was found useful in identifying the potential behaviour settings within the primary school premises which could accommodate formal learning activities.

The research has portrayed a detailed account of how intervention in a barren unsurfaced school ground can influence children's behaviour and learning. The study also provided a detailed picture of how the school ground was designed and developed involving

children, teachers and parents based on the evidence from previous research and information elicited from the participants regarding their preferences. The elements extracted from these two sources were grouped using the framework provided by the theory of behaviour settings which helped to identify those properties of the environment which offered different activities – cognitive, social and physical activities. This can have practical implications in design and education, meaning that designers ought to consider ‘cognitive affordances’ of different elements, and at the same time teachers need to be aware of the environment’s affordances to effectively utilise it as a place and tool for teaching.

The quasi-experimental action research was conducted in a school typical of Government primary schools in Bangladesh in terms of physical environmental quality and participants’ profile and this made the research findings generalisable to other schools in similar contexts. Mixed methods research combining quantitative (e.g. exam scores, a questionnaire survey on motivation, exploration and peer relation and behaviour mapping), and qualitative measures (e.g. participant observation, focus groups and interviews) has been established as a tool to portray the holistic picture of the influence of physical environments on children. This also generated empirical evidence measuring the outcomes quantitatively.

The findings strongly suggest that the academic performance of children can be intentionally improved by participation in design and outdoor learning. The significant improvement in the academic score of the treatment group and the intervention school compared to the control school (with no change in the environment) demonstrates the importance of outdoor environments in children’s learning. Therefore, policies regarding academic competence should consider the development of school grounds, encouraging the participation of children, teachers and the community.

Education policies in many countries emphasise the outcomes, and therefore disregard children’s engagement in education. The findings from the study reveal that children were more engaged in what they were doing while learning in the school grounds and enjoyed the learning experience. This also influenced their attendance rates while conventional classroom teaching deterred them from coming to school. Developing the school grounds was found effective as a strategy to attract children to school making them intrinsically motivated in their studies. This has implications not only in other primary schools in Bangladesh, but also in other developing nations, and among the disadvantaged communities in developed countries where the drop-out rate is very high.

With regard to children's education and engagement, the school ground designed as a combination of diverse behaviour settings was found effective as it offered opportunities for experiential and collaborative learning. Different settings offered different affordances for informal learning activities (e.g. the play area afforded physical activities and the natural learning area afforded cognitive ones), on the other hand during formal learning almost all the settings were found to offer some kind of affordances (e.g. every setting afforded measuring in the mathematics class and learning about natural and manmade resources in the science class). However, the amphitheatre was the most frequently used setting during outdoor classes, it afforded giving lectures and interaction between the teachers and peers at the beginning and the end of each class. The richer the school ground with diverse behaviour settings, the more 'cognitive affordances' can be found by teachers and children for learning the curriculum and informal learning activities.

This study also reveals the discrepancy between children's favourite places and their most frequently used settings with what they wanted to have in their school ground. However, neither the favourite activities nor the frequency of use depended on the size of the settings. Although the open yard accommodated the highest number of activities or children, the use was stimulated by the affordances provided by the adjacent settings e.g. gardens and the area with loose materials. Nevertheless, the children while using the settings in line with the expected use during design, they failed to discover some inherent affordances but found unexpected new affordances. Therefore, understanding of affordances is crucial for designers while designing children's environments. Evaluation of existing school grounds in terms of affordances can help identify what worked for children, what did not and what can be improved in future design, this framework can be used by architects and landscape architects. Additionally, the designers need to consider age and gender difference in the use of school grounds as evidenced in the study.

The study further provides evidence of the positive influence of the new school ground on teachers' motivation, quality of teaching, thought process, feelings, behaviour and attitude. Teachers who had exhausted all the affordances provided by the classroom were inspired to explore innovative ways of teaching by the provision of diverse settings of the school ground. While an increment in the salary is always regarded as an effective strategy, this study reveals that providing appropriate environment for teaching can also motivate the teachers. Teachers who are aware of the role of the environments can use their surroundings for children's education and can discover newer affordances for their teaching.

Finally, the study suggests that improvements in children's education and engagement was influenced by multiple factors. Participation in design, increased opportunities for exploration and peer relation, better quality teaching and teachers' motivation, all contributed to these changes. However, all these are related to the design and use of the outdoor environment and an understanding of this complex relationship between environment and children is crucial for policy, planning and design decisions.

11.1 Contributions to knowledge

The study makes significant contributions in a number of areas in the field of landscape architecture, environmental psychology and education.

11.1.1 Methodological contribution

This study has combined practice (participatory design and development of a school ground) and research (evaluation of the impact of that school ground) within the same study giving design research a new dimension which has not been used in PhD research before. Research investigating the influence of renovated school grounds on children's academic performance is evident in the present context (Weinstein & Pinciotti, 1988; Andersen et al., 2015; Brink et al., 2010; Lopez et al., 2008), however, research making a physical change in real life involving the participants and afterwards investigating the influence of that change is rare in the context of developing countries. The only other similar study that can be referred to is the school ground developed by Moore & Wong (1997) in California in the USA. This research, unlike other PhD thesis by design, adopted social research design but used design activities as a means of creating the experimental setting for conducting the research to produce new knowledge that can inform better design criteria. Though the use of children's drawings as a method to elicit information on their desires is not new in the realm of research and design, however there is doubt how much of this information actually informed the final design. This study listened to children's preferences, took their voices into consideration in design and involved them in the development process.

11.1.2 Contribution to environment-behaviour research

This study contributes to environment-behaviour research by providing evidence to support the argument that the physical environment (design of the outdoor environment of a primary school) can influence human behaviour (children's learning and motivation and teachers' behaviour and attitude). There is a growing knowledge base exploring the relationship between the design of outdoor environments and children's physical activity play (and/or

environmental learning). However, research looking into the relationship of the design of school environment and children's learning is rare (Armitage & Burke, 2005; Barrett et al., 2015; Horne-Martin, 2006). Empirical studies on the relationship between physical environmental variables and teachers' motivation and teaching are even scarce (Monsur, 2015). This study addressed this gap in the realm of environment behaviour research, exploring how the design of outdoor environment can influence teaching-learning behaviour.

11.1.3 Contribution to educational research

Understanding of the pedagogical process is necessary for designers and the researchers in the field of design who are involved in educational environments design and research. Similarly, teachers need to be aware of the potential of the physical environment for teaching. A well designed physical environment can have an unrecognised influence on how teachers and children are using it. However, directed and deliberate use of the physical setting can support an innovative teaching-learning process (Horne-Martin, 2006). Therefore, teachers' understanding of the environmental influences is important for children's educational outcomes. Some teachers might see the potential of the environment, but many teachers think of the classroom as only a place or context for teaching and disregard its potential as an effective tool for pedagogy. If not informed teachers might miss those opportunities provided by the environment. This study contributes to this understanding of the relationship between the environment and pedagogy, explaining how the teachers used different settings of the school ground for teaching of the curriculum. This approach might be used by educational researchers exploring innovative pedagogical processes in various educational settings. This can further contribute to addressing the isolated research practices in closely linked yet different disciplines within academia, and encourage collaborative research on educational environments.

11.1.4 Contribution to environmental psychology – a new conceptualization of Gibson's affordances

The affordances of the environment for learning of the curriculum and cognitive activities have rarely been explored in environment behaviour research. 'Cognitive affordance', a term generally used in human-computer interaction research, has been introduced in this thesis in relation to physical environments. This provided the framework for understanding the relationship between environment and education. The school ground, designed as a combination of diverse behaviour settings, provided multiple cognitive affordances for teaching and learning (e.g. counting, measuring and growing plants). The concept can further

be developed in future research and can also be applied by the designers in design of educational settings.

11.1.5 A comprehensive view of the educational setting

The study is also innovative in its approach to getting a holistic picture of the impact of the school ground on children's learning. Related research on the impact of the school ground on children's behaviour explored either academic performance, or play or physical activity. This might give detailed information on a single aspect, however, it might provide only a very narrow view of the influence of physical environment. This study investigated the influence of the renovated school ground on both formal and informal learning, therefore giving a comprehensive view of the school ground setting. The results suggest that children used different settings for various activities; some settings which were heavily used during the informal play sessions did not have that many users during outdoor classes (e.g. the swings and the see-saw in the play area). Again almost all the settings had more or less equal number of users during outdoor classes. Therefore, the implication based on studies emphasising only one aspect, might limit children's activities in other areas. This study makes the case for better design criteria, drawing upon the holistic picture of the educational setting, and how children are using the environment for different activities.

In addition, relevant studies on children's educational environments did not consider teachers' views, behaviour and attitude concurrently with the needs of children. Research studies focusing on either children or teachers may not give a comprehensive picture. In order to better understand how the physical environment influences children's learning, it is necessary to investigate the teaching-learning mechanism at both ends – from the viewpoint of both children and teachers (Monsur, 2015). The role of the outdoor learning environment on children's learning can be best explained by investigating how the environment is being utilised by both teachers and children. For example, the science teacher designed a task using the water area and gardens to teach different types of habitats, and then the children created the habitats by themselves in the class to learn how plants and animals live. This study explains the process from both ends therefore contributing to knowledge by providing a comprehensive picture.

11.1.6 Direct design implications

The study aims to inform design criteria for the outdoor learning environment. It not only provides information based on statistical findings and observations, but it also presents a real life model based on the existing evidence, guided by theories of pedagogy and

environmental psychology and informed by the participants. However, the study acknowledges possible design limitations of the model itself and therefore, evaluated the design based on the use and opinions of the users. The research and design fed into each other which makes the design recommendations (see Section 11.4) more comprehensible and applicable in the contexts.

11.1.7 Evidence for policy level decisions and implementations

The evidence of the positive impact of a designed outdoor environment on children's physical activity and play might not be enough to convince teachers to take children outdoors for imparting curriculum lessons. Policies in some countries, though very few, encourage taking children outdoors, however it is important to convince the teachers to do so who are one of the key players. There is very little evidence on whether actually using the school ground for teaching the curriculum can influence children's academic performance and their motivation for learning. Natalie White, Outdoor Learning Development Officer of Education Scotland in her presentation to an Outdoor and Environmental Education Seminar in April 2016, reflecting upon her experience of working with teachers and policy makers, stressed the importance of more empirical research evidence to convince teachers. This research contributes to addressing this knowledge gap by providing statistical evidence for the positive influence of teaching in a well-developed school ground (informed by theories, previous research and its users) on children's learning and motivation.

11.1.8 Contribution to research in a unique context

Relevant research on the relationship between the physical environment and play can be found in developed contexts, while research on children in developing countries mainly focuses on socio-cultural and economic factors. Research in the field of education exploring the reasons for children's drop-out and poor academic competence rarely considered the physical environment as a variable. Therefore, there is a huge gap in knowledge-base in this field in the context of developing countries. This research addresses this gap by providing evidence on how development of a school ground and use of it as a context and tool for teaching can attract children to school, reducing absenteeism therefore contributing to their increased motivation to study and improved academic attainment.

11.2 Limitations of the study

Several limitations to the study have been identified which are discussed below-

11.2.1 Limitations related to methods and data collection

In a pre-post study design, the post study should be ideally conducted after one year. In the present study, it was conducted after four months due to the limitation of time and resources within the period of a PhD research. However, post studies after 3 months are evident in landscape architecture research (Silveirinha de Oliveira et al., 2013). In a tropical climate, the outdoors is generally more used during autumn and winter (September-December) than in spring and summer (April-July), therefore the number of children was supposed to be fewer after intervention compared to the pre-intervention period. Again, according to the teachers, the attendance rate is generally poor during May which is the harvesting season, when the children are generally expected by the parents to help in their agricultural activities. During October and November with the annual exam approaching, children were less absent in the school. This is the period when the pre-intervention data were collected. In spite of these factors which could have resulted in less attendance during post intervention data collection period, the attendance rate increased. Therefore, in spite of the limitation of time gap in pre-post design along with other contextual factors, the influence of the change in the outdoor environment on children's attendance rate is evident.

The behaviour mapping was done for a short period of time – seven days during each data collection period which might not give the whole picture of how outdoors could be used for different activities during formal and informal learning by children and teachers. Formal learning activities in the outdoor environment depend on the contents that are taught outside, hence the maps might not have included all the affordances of the outdoor environment for teaching the curriculum. The teachers also said that they were yet to find all the affordances of the designed environment and the more they would be engaged in teaching outdoors, the more they would be able to find innovative ways of relating their contents with the outdoor environment. Furthermore, children were engaged in different kinds of activities in different seasons. For example, the children played *dariabandha* in winter which they generally do not play in summer. Consequently, the behaviour maps after the intervention might not have showed all the affordances of the environment for children's informal learning activities.

The questionnaire collected information on children's perceived motivation to study in the classroom and outdoors. The instrument was created based on theories related to

children's development and motivation, however, the statistical reliability could not be tested beforehand due to small sample size of the pilot study. This instrument can be further developed in future to be used in primary school settings. Also, the sample size of the teachers was too small to generalise the results for other teachers. However, this also has potential to be researched in more detail in future.

11.2.2 The dual role of designing and evaluating the design

Being the co-designer as well as the researcher who evaluated the design and use of the school ground, I was aware of the possible biases related to that joint role. However, the trend is not new and was used previously by researchers and professionals (Herrington et al., 1998; Moore & Cosco, 2010; Refshauge et al., 2013). As a PhD student I had to work mostly alone on collecting and evaluating the data. Embracing the role of a designer, stepping out from the role of a researcher, can provide perspectives and findings otherwise unattainable and *'add significantly to the overall quality and the relevance of design research'* (Fallman 2008, p17). Moreover, in order to evaluate the evidence-based design (EBD), the observer needs to know the intentions of the designer (Refshauge et al., 2013), the design intentions are best known by the researcher who is also involved in the design. Another approach of research by design that could have been followed here is the workshop-based method, *'where researcher is the facilitator who feeds the designers with research-based knowledge and methods but otherwise leaves all design decisions to them'* (Backhaus et al. 2012 cited in Refshauge et al. 2013, p18). However, though the risk related to the aforementioned bias might be reduced in this method, the researcher is not fully aware of the design intentions.

11.2.3 The design was specific to this site

The design of the school ground is very specific to this particular site. How this school ground was designed cannot be said the only option for this site, nevertheless this was the best possible solution with the given budget and time. Another landscape architect could have designed the same behaviour settings on this site in different ways with more time and less budgetary constraints. Again, the design and organisation of the same behaviour settings can be different in another site. Therefore, derivation of design guidelines based on the design of only one school ground might not be appropriate. This is also discussed later in future directions of research (Section 11.5).

11.2.4 Novelty of the environment

Any new environment attracts users who might lose interest after sometime. The impact of intervention can decline after a certain period of time. This is also evident in the present study as during the first month after intervention, the children used some settings heavily, for example the see-saw broke being unable to bear the load of so many children at a time. In order to eliminate the impact of novelty on children's activities and use of different behaviour settings, observation and behaviour map data were collected after four months of intervention in May 2015.

The teachers in the primary schools in Bangladesh neither have any training on how they can use the outdoor environment for teaching nor do they have any practice in outdoor teaching. The teachers of the intervention school participated in the design process which provided them with some idea of how they could use certain elements, however, using a redesigned environment for teaching is different from brainstorming on the design of a school ground. Consequently, the teachers were not fully aware of all the affordances an outdoor learning environment can offer for teaching the curriculum as depicted in the headmaster's words, *'Our teachers are new to this environment and the practice of outdoor teaching. They are yet to discover all the opportunities the new school ground can offer for teaching.'* Further conversations with teachers during the focus group discussions revealed that the teachers could not yet fully utilise all the potential affordances of the environment and they thought with passing time they would discover new potentials of different settings for teaching and their teaching would get even better.

11.2.5 What about new students who did not participate?

The present study considers that there is only one opportunity to be engaged in the design of the school ground. The new students enrolling every year will not be getting the opportunity for designing the school ground. The new teachers might not get the opportunity of the brainstorming exercise liberating their ideas about how the outdoors can be used for teaching. However, unlike the static character of the classroom environment, the design of the outdoor environment can be flexible and offer opportunities for change, therefore creating novelty and opportunities for participation every now and then. Again, outdoor learning itself is a participatory process as in this study children and teachers were found creating water habitats, gardening, making compost bins and engaging in many other activities.

The flexibility to change and create was considered during the design of the school ground by making it 'living'. The area with loose materials has been designed considering that it can be refilled every now and then by the teachers and the children bringing recyclable or unused inexpensive items from their household. The gardens are a constantly changing element of the school ground offering novelty and opportunities for participation, so is the water area and the natural learning area. When the tyre gardens were installed, the teachers liked the concept and thought they could easily create new tyre gardens, as one of the teachers exclaimed, *'Even the children can do it bringing damaged tires from home whose parents are auto-drivers.'*

11.3 Implications for policy and curriculum

Given how much of their waking time children spend in an educational institution, children's experiences in this environment should be a major consideration of the public policy at both national and international levels. International bodies like UNESCO and UNICEF aim for all children to have access to education (United Nations agenda of Education for All by 2015) and to achieve standard academic competence after completion of primary level education. National policies of the countries affiliated with the United Nations share the same goals. The key findings of the present study have implications for policy makers and planners of the curriculum intending to address crucial problems like drop-out and poor academic competence and to encourage active, engaging educational experiences in school.

Different international bodies, along with the Governments of respective countries, are applying different measures in order to attract children to school such as providing food, money and school uniforms (UNESCO, 2015). However, these rewards or extrinsic motivational incentives which are instrumental in nature do not help in keeping children at schools or engaging them in learning activities (Ryan & Deci, 2000), as such these rewards do not have an impact on the academic achievement of children (Lepper et al., 2005). In these circumstances, the present study has huge implications for Governments and donors when they are prompted to rethink their policies regarding children's academic attainment. Building more and more classrooms is the main parameter for infrastructure development in primary education sector of Bangladesh under PEDP3²⁴ whereas these classrooms do not

²⁴ The third Primary Education Development Program implemented by the Directorate of Primary Education under the Ministry of Primary and Mass Education of the People's Republic of Bangladesh from July 2011 over a period of five years funded jointly by the Government of Bangladesh's own resources and nine development partners (including Department for International Development of the UK)

function properly and need technical adjustments (Kalra, Khan and Rehman, 2014). The cost for building one classroom for 50 children is approximately £27,000²⁵ whereas a school ground can be developed spending only approximately £10,000²⁶ which can be used by children of all grades for learning the curriculum and informal learning during their break time and also outside school hours.

The present study suggests that children having their classes in a well-designed outdoor learning environment are significantly more motivated to learn, and perform significantly better compared to children having their classes in a traditional classroom setting. Learning in a designed outdoor environment specifically benefitted the underachievers who actively participated in the outdoor class. Therefore, development of the outdoor learning environment should be given priority in national and international policies. Children who received their learning in the developed school ground performed significantly better than the children who did not within the same intervention school, this evidence suggests prescription of outdoor learning within the curriculum. This has implications for the disadvantaged population in developed countries, for example it is a challenge for the states and school authorities in the USA to attract children from less advantaged population of the country (Digest, 2013).

The newly designed outdoor learning environment not only engaged children in learning during their classes, but also offered multiple opportunities for diverse play and informal learning activities during breaks, before and after school time. Most rural children who loved to play truant and despised spending time in school found the school environment more attractive after intervention. Unlike most other extrinsic motivational factors which cannot keep children in school, play materials and play experiences have intrinsic features where the activity itself can keep children engaged (Gottfried, 1986). Therefore, development of the outdoor environment which can offer diverse opportunities for play should be considered as a strategy to not only attract children in school, but also to keep them there.

The developed school ground can also be a community place after school time where children of different age groups can interact within themselves and also with the older members of the community. This can have a positive impact on enrolment too as in a village

²⁵ The cost for building one classroom was calculated based on the study by Kalra et al. (2014)

²⁶ The cost for developing a school ground was calculated based on the development work in the intervention school.

in Afghanistan, the enrolment increased by 42% in community schools in 2007 (UNESCO, 2015). In the present study children, teachers and parents worked together for the development of an effective outdoor learning environment. Involvement of the community and active participation of the members of the School Managing Committee are advised in research reports by the Ministry of Primary and Mass Education (2015, p53), however, participation of all the stakeholders in the development of their environment should be included in the policy.

From a review of the research reports on Education for All by groups from individual to international level, no evidence is found on these national and international policies' decisions on measures to attract children to schools being based on research exploring children's own voices (UNESCO Institute for Statistics, 2012; UNESCO Institute for Statistics & UNICEF, 2015; DPE, 2014, 2012). Though participation of children is established by the UN Conventions for the Rights of the Children, their views and preferences are seldom taken into consideration in the design of places, curriculum and policies. There is also very little research in the context of developing countries on children's learning environment which can feed the policy in the decision making. Therefore, the necessity of research and policy making based on empirical evidence should be established within the policy (Unterhalter, Ross and Alam, 2003). It is also necessary to address the disparities between policies and implementation, the policies being clear about where and how children can be engaged in the decision making process.

This study also has implications for developed nations, for example Scotland. Scottish Educational Policy encourages outdoor learning by adopting the Curriculum for Excellence, although the barriers to taking children outdoors are yet to be removed (Higgins, 2016). Taking children to an external outdoor setting other than the school ground can be time consuming and not very cost effective whereas the school grounds if improved can accommodate outdoor learning fulfilling the Curriculum for Excellence. Hence, the development of the school ground for commencing outdoor learning, involving all the stakeholders, more importantly the teachers (which will encourage them to take children to the outdoors) should be given priority in policies.

Relevant studies rarely considered teachers' views and preference in the design and development of school ground and rarely explored the relationship of the outdoor environment and teachers' motivation. The present study provides evidence that the outdoor environment positively influences teachers' motivation and engaging them in the design of

school grounds might be the first step to encourage the teachers to take children outdoors. This is also supported by Carey's (2012) study where she compared three potential solutions — altering the school ground, engaging with one teacher, a teacher training program based on reach, time and cost and she opted for the development of the school ground.

The present study also provides evidence for the positive impact of the outdoor learning environment on the teaching-learning process, teachers' behaviour and attitude and their well-being. In order to ensure the quality of education, UNESCO (2015) emphasises investing in teachers in terms of housing, financial benefits, accelerated promotions, raising social status and local recruitment. Though these are necessary, research shows increment in salary has little to do with increasing teachers' motivation (Sylvia, 1985). Teachers are more motivated in a supporting environment with challenges, and they find their jobs rewarding when children are motivated and learning. In the present study, the teachers who were bored in the classroom with limited opportunities, found teaching in the outdoor class challenging which had an impact on their thought processes and motivated them to think more on how they could have utilised the environment for teaching. This finding is important as not only the outdoor environment, but the whole physical environment of the school should be improved for better learning outcomes. The established design that has been implemented by the LGED in Bangladesh should be rethought, the development of new infrastructure should be evidence based, participatory and involving appropriate professionals.

The present study also suggests that teachers, if aware of the role of physical environment on children's learning, can utilise the relationship between the physical environment and children's actions as a tool for designing their tasks while teaching the curriculum. If they are not informed, teachers might miss the opportunities provided by the environment for innovative teaching-learning process. However, this lack of awareness can be removed by providing training to the teachers in issues concerning the design and role of the physical environment (Horne-Martin, 2006). Educational policies should reinforce teachers' training, educating them about the role of the physical environment and also how the outdoors can be used as an effective context and tool for teaching.

Last but not the least the findings from the present study have implications for curriculum reform. The curriculum in most countries is designed at the top level, leaving fewer opportunities for teachers to contribute to it (UNESCO, 2015). The Education for All

monitoring team also suggests a curriculum reform. The findings from this study suggest implications for place based learning. The agricultural lands in rural areas and the parks and open spaces in urban areas can be ideal settings for teaching the curriculum, as this study suggests that a natural learning area with fixed and loose natural elements provides affordances for exploration, close interaction with nature and sociality. The curriculum should prescribe outdoor learning within it and also give autonomy to teachers to contribute to it from their experiences of teaching in the outdoor learning environment. For a summary of the implications in relation to the findings please see Table 11.1.

Table 11.1: Implications for policy and curriculum in relation to findings

Findings		Implications for Policy and Curriculum
A well-designed outdoor environment and children's learning	<ul style="list-style-type: none"> - Learning in a well-designed school ground can improve children's academic performance. - Underachievers benefit from outdoor learning. - A well designed outdoor learning environment can positively influence children's motivation to study. - Children are more motivated in outdoor classes compared to the classroom. 	<ul style="list-style-type: none"> - Development of the school ground should be given priority to address the problem of drop-out and poor academic attainment. - Outdoor learning should be included in the policy and prescribed within the curriculum.
A well designed outdoor environment and children's informal learning	<ul style="list-style-type: none"> - More children are engaged in diverse activities in the school ground outside class time. - Children who left school during lunch break or when the last bell rang before, brought lunch boxes to school for increased opportunities of play after intervention. - Children from the neighbourhood going to private schools played in the school ground with children from this school after school time and during weekends. - Amphitheatre was recognised as a potential place for meetings of elderly people, young adolescents also spent their time in the school ground after school. 	<ul style="list-style-type: none"> - Design and development of the school ground based on evidence should be established by policies to attract more children towards school reducing absenteeism. - School grounds can be developed as a community place to create bonding between children, young adolescents and the elderly people of the neighbourhood therefore a sense of community can grow which can be further utilised for maintenance of the school ground.
Outdoor learning environment and teachers' teaching, behaviour and attitude	<ul style="list-style-type: none"> - Teachers teach better (using real life objects), feel better and are more fun during outdoor classes. - Outdoor environment influences teachers' teaching which can influence children's improved academic performance. - Teachers can practice innovative ways of teaching. They can reduce student-teacher ratio by sending students of different capabilities to work in different behaviour 	<ul style="list-style-type: none"> - Relevant studies did not explore the relationship between the design of the outdoor environment and teachers' teaching of the curriculum which can be researched more rigorously in future studies. - Measures to increase teachers' motivation and well-being should be established within the policy and curriculum.

	settings when they can focus on working with the underachievers, explaining difficult concepts.	- Teachers' innovative ways of teaching outdoors have implications for the curriculum and policy in terms of reducing teacher-student ratio and addressing underachieving. Teachers should be encouraged by getting more autonomy to contribute to the curriculum.
Participation of children, teachers and the community people in the design and development of the school ground	<ul style="list-style-type: none"> - Participation of teachers and children might create agency for teaching and learning. - Participation in the design process focusing on teaching of the curriculum can help teachers think about different ways of teaching the same subjects. 	<ul style="list-style-type: none"> - In the annual report from Ministry of Primary and Mass education, community participation is encouraged and active participation of the SMC members is advised which is not much evident in the field. Participation in the design and development of the school ground can be a way to engage the community. - Any development in the physical environment of the educational setting must abide by the preferences of both teachers and children and take into consideration of the needs of the users. This needs to be established within the policy. - Participation of teachers is necessary to encourage the teachers
Teachers' awareness of the role of environment in teaching	<ul style="list-style-type: none"> - Use of different behaviour settings and learning areas in the outdoor environment make learning easier and more enjoyable for children. Teachers when conscious of the role of physical environment can effectively utilise the settings for teaching. - Teaching using 'real life objects' in the outdoors make learning easier for children. 	<ul style="list-style-type: none"> - Teachers should be supported with training for outdoor teaching. Training focusing on the role of environment in teaching and how teaching can be done outdoors can support teachers and make them more confident in delivering lessons in outdoor classes. - The findings have implications for place based learning. Where the school ground is small, the opportunity to take children to nearby green spaces and agricultural land needs to be established within policy.

11.4 Recommendations for a well-designed learning environment

Based on the findings from the application of different methods and evaluation of the design of the school ground, this thesis provides an operational definition of a well-designed school ground. As stated earlier a well-designed outdoor environment would be theoretically grounded, informed by the existing evidence and co-designed with the users i.e. children, teachers and the community. The findings from the research further suggest that an outdoor learning environment should be a combination of several behaviour settings surrounding an open yard (in a small school ground) or a continuous pathway (in case of a bigger school ground) and should provide access to both natural and manufactured elements. In addition, the outdoor learning environment should be designed as an organism offering flexibility and growth, connectivity between settings and adjacency to natural settings or elements; provision of loose materials, provision for small and large group activities and repetition, variety and diversity are crucial to the design.

This thesis has produced a set of design recommendations for landscape architects to consider while designing primary school grounds. These recommendations are applicable to the renovation of the old or the designing of new primary school grounds in the context of Bangladesh and can also go beyond the geographical territory and might be considered in countries with similar climatic and geographical conditions. The first thing to be considered is any change in the school ground should be made involving all the key players — children, teachers, parents and the community. Landscape architects should learn and value children's and teachers' preferences for different elements, settings and artefacts and accommodate them in the school ground. The following recommendations can help landscape architects in articulating their ideas along with those of the children and teachers, in physical forms of the school landscape.

11.4.1 Spatial layout and location in relation to the site

- The school ground should be designed as a combination of different behaviour settings. At the initial planning stage, elements and objects can be grouped based on the behavioural opportunities they offer, however this should not mean that each individual setting will only conform to one kind of behaviour.
- The behaviour settings should include but might not be limited to a natural area, a water area, gardens, a play area, an amphitheatre (and a blackboard), a shelter, an open yard and an area with loose materials. The provision of all of the settings can provide multiple affordances for both formal and informal learning.
- The larger the school ground, the richer it can be with more behaviour settings. In the case of smaller school grounds, prioritising can be done based on the preferences

and use by teachers and children. Rather than eliminating some settings to make room for others, several behaviour settings should be combined to form one.

- The gardens should be located near the classrooms thus offering fragrance and view from the classroom.

11.4.2 Accessibility and connectivity of the settings

- All the behaviour settings need to be connected using a continuous pathway or a network of pathways which itself can become a behaviour setting. In the case of smaller school grounds, the individual settings should be arranged surrounding the open yard with access from and to it as this can stimulate diverse activities in the open yard.
- The related but different behaviour settings should be located adjacent to each other, with connectivity between these settings. This can stimulate movement between settings and also activities using diverse materials available in different settings.
- Changing the elevation at different places or modelling the terrain are effective ways to create variation (which can stimulate activities like running or rolling down) and to offer views.
- One way of designing a pathway is to use stepping stones which can stimulate physical activity and movement; alphabets, numbers or other patterns painted or engraved on the stones can help to learn literacy, numeracy and other contents from the curriculum.

11.4.3 Design of natural settings

- Natural settings should be incorporated in children's outdoor learning environments which offer diverse opportunities. Natural settings include natural fixed elements such as trees which can also offer natural loose materials like leaves, branches and twigs for cognitive play opportunities. In urban settings, natural elements can be added to the existing site respecting the local ecological system.
- Gardens, an important natural setting should be in a school ground where children can interact closely with nature by digging, sowing seeds, growing vegetables and watering the plants. There should be space for composting too, where children themselves can produce natural fertiliser for their gardens.
- Water, whenever possible, should also be included in the design. Waterbodies can be of different sizes based on the size of the school ground, and their shapes should be designed in accordance with the overall concept. In the case of very small school grounds, alternative ways of incorporating water should be thought of.

11.4.4 Behaviour settings of mixed nature

- In addition to having natural settings, wherever possible behaviour settings can be designed combining both natural and man-made features. In the intervention school in this study, huts and the playhouse which combined built (e.g. bricks, concrete and MS pipes) and natural materials (e.g. bamboo, thatches and wood) offered multiple opportunities for learning mathematics and science.

- The manufactured settings can be located near a natural setting, or trees and plants can be incorporated around the setting. Adjacency with settings having natural elements can create opportunities for activities that include cognitive aspects (Smith et al., 2014). For example, adjacency to the gardens and the natural learning area offered the opportunity to play *pata pata* in the open yard.

11.4.5 Provision for large and small group activities

- There should be provision for large and small group activities in the school ground. There can be an area where the teachers and all children of the class can gather for communal discussion and the introduction or closing of a lesson, e.g. the amphitheatre in this project provided that opportunity. There should be a blackboard or display board which can assist the teachers and children to discuss certain topics or concepts.
- There should be spaces for small group activities which foster peer relations. These spaces should provide some sense of enclosure, e.g. the huts in this study afforded small group activities in a cosy enclosed space.

11.4.6 Provision of loose materials

- There should be provision of loose materials in the school ground and the materials should be available for use even outside school and class-time. If there is fear of theft and displacement, there can be accessible wheeled storages for large materials that are easy to move between the classroom and outdoors.
- The loose materials can include easily available recyclable and reusable materials like damaged tyres, empty bottles and jars, pieces of wood from broken benches and tables from the classrooms, egg crates and seeds. All of these materials need to comply with child safety. These materials can be easily replaced by children and teachers with minimum expense.
- Along with having a distinct area with loose materials, these materials can also be provided within the behaviour settings which can stimulate learning. For example, use of brick chips as a surface material surrounding the huts afforded working with those inside the huts to learn number theories.

11.4.7 Repetition of elements and variety of shapes

- School grounds should comply to repetition of elements which is a principle of design. Repetition of elements particularly the vertical ones were found helpful in teaching numeracy. Repetition can be created in various ways. For example, plants planted in a row in the natural learning area as a green fence and the bamboo poles of the huts were useful for learning addition, subtraction, division and multiplication.
- Landscape architects can consider using different shapes — organic and geometric — in the design not only for aesthetics but also for the learning opportunities these can provide. Measuring can be done in any setting, however settings that contain pure geometric shapes enable children to go beyond measuring and learn about the properties of shapes. Square shaped stepping stones, the circular shape of the huts, circular water tubs and also the semi-circular outdoor amphitheatre provided these

opportunities. Organic shapes can be used for teaching geography and other parts of the curriculum.

11.4.8 Variation and Diversity

- A school ground designed as a combination of different behaviour settings offers diversity and variety. Diversity and variety can also be created within a behaviour setting by different means, e.g. variation in topography in the natural learning area.
- Variation can be created with different trees and plants in the woodland and gardens which can help in learning mathematics and geometry. This can also be created based on the colour of flowers, the size and shape of plants, or even based on the food value of the plants. This can support eco-systems and attract creatures which not only afford exploratory play but can also be used in the teaching of science.

11.4.9 Determination of size and elements of behaviour settings

- The size of individual behaviour setting and the elements it consists of are not constant and will depend on the size of the school ground and availability of different elements locally. However, the landscape architect should try to provide as many settings as possible while not making the school ground over crowded, yet having variety and diversity. For example, the water area in a small school ground can be designed as only several drums or big tubs of water. These tubs can be designed adjacent to the sand play area where the sand can soak up the water which overflows from the tubs and can offer children play using sand and water.
- Use of local materials is environment friendly and can equip the children with local knowledge and wisdom.

11.4.10 Flexibility and growth

- The design of the school ground should be 'living'. The plants grow, mature, give flowers and fruits and then die; they need care to live and grow. As such, settings containing natural elements and loose materials (e.g. gardens, area with loose materials and water area) by default offer opportunities for participation. These opportunities should be maximised by design and construction e.g. the area with loose materials should include materials that can be easily replaced if damaged, without consulting the landscape architect.
- The design of the school ground should be flexible enough so that it can accommodate change and growth made by both children and teachers. For example, we designed and installed tyre gardens during the intervention, the children and teachers can repeat these tyre gardens in their school ground later on.

11.4.11 Designing for age and gender

- While designing school grounds, landscape architects should keep in mind the developmental needs of different age groups and gender. The same settings can be used differently by boys and girls, and by young children and a bit older children. The design can influence these activities, e.g. while the older children were sliding

from the playhouse and used the shed above, the younger ones found a nook under the playhouse and were found hanging from the rods (as steps) under it.

- Large open yards are necessary for structured games with rules and ball games. Boys generally are more inclined to these games with growing age, however, the design of the school ground can influence the activities performed by boys and girls as evidenced in the present study where the boys were engaged in more social activities than before. Therefore, a school ground, which offers opportunities for all despite the differences, would be an ideal one and the most effective.

11.5 Future research directions

The study has answered its original research questions, however, during the course of the study and analysis many other questions arose which could be explored in future research.

- This study finds that the design of an outdoor environment can positively influence teachers' motivation. However, the sample size is too small for generalisation of the data for a larger context, as mentioned in the limitations of the study. There is little research in the present context exploring the relationship between outdoor environmental features and teachers' ways of teaching and their motivation. Further research can be executed in this area to explore this relationship.
- The design was implemented in only one selected school. If the design can be implemented in several schools and the environment-behaviour relationship studied, preparation of a detailed design guideline for primary school outdoor learning environment would be possible.
- Trial and error research experimenting the effectiveness of different design features and/or behaviour settings for pedagogy is worthy of further exploration. This research, interdisciplinary in nature should be conducted in communication with landscape architects, educationalists and psychologists.
- The study explored what affordances the designed school ground can offer for teaching mathematics and science for Grade IV children. However, the findings suggest that the school ground can be used for teaching other parts of the curriculum too. Future studies could investigate the school grounds' efficacy for different parts of the curriculum and also for different grades or age groups.
- The study was conducted in a rural primary school. What worked for rural areas might not work in the same way for urban primary schools. Therefore, future research can look into the difference between rural and urban, public and private schools within the same context and in other contexts.
- The study findings contribute to the understanding of the environment's affordances for learning, leading to a potential new theoretical conception which can be further explored. A taxonomy of cognitive affordances can be developed, this might help in analysis of data in future research in order to find out the cognitive affordances provided by a formal, informal or non-formal educational setting.
- The findings can have implications for the design of classrooms too. How children interact with elements in a classroom designed and organised as a combination of

different behaviour settings, and how this design can influence the teaching-learning process can be explored in future research.

- The evaluation of a designed school ground's efficacy for pedagogy and children's development are different from post occupancy evaluation of an environment. Currently there is no established scale for such evaluation which can be further researched and developed.
- Due to the limited time scale of a PhD research, a follow up study was not possible. Whether children's academic performance, motivation and the use of the school ground, and teachers' motivation and way of teaching would change after a year of the intervention and onwards is worthy of exploration in future research.

The research initially focused on children's interactions with outdoor learning environment in a primary school before and after intervention. The research findings show that the topic is much more complex and the influence of the environment if studied with narrowed focus might not give the whole picture and miss out the tangential and interdisciplinary issues attached to it. For this reason, this study can be a base for future more robust interdisciplinary research. Longitudinal multiple case study experimental action evaluation research can provide much stronger evidence and create a much larger impact on children and society.

11.6 Dissemination of the knowledge

Dissemination of the knowledge generated from this study can be done in several ways. In addition to presenting the findings in conferences and publishing articles in leading journals, the research findings can be shared through conducting innovative events and workshops. Teachers, head teachers, landscape architects and policy makers can participate in such workshops, and these workshops can also work as a platform for knowledge exchange between people at different sectors. In Bangladesh, the teachers who were involved in this study can play an important role by sharing their experiences with their colleagues in training sessions and workshops. Landscape architects will benefit from a continuing professional development (CPD) course that can be produced based on the findings of the project and this will equip them with the professional knowledge to design school grounds keeping in mind the mutual relation between physical environment and pedagogy.

In March 2015, I co-organised a workshop on '*The role of the school environment and surroundings on children's education*' for primary school teachers in association with Bangladesh University of Engineering and Technology and the University of Edinburgh following the intervention. Three teachers from the intervention school, two teachers from KGPS (the school where my Masters project was conducted) and 25 trainee teachers from R

Primary Training Institute participated in the workshop. The purpose of the workshop was to inform teachers of the relationship between physical environments and to show how different features of classrooms and outdoor environments can be used for teaching the curriculum. The teachers also visited the newly designed outdoor learning environment in the intervention school. Afterwards the teachers designed primary school grounds in groups and brainstormed how the surroundings could be used for teaching and learning in their groups. A detailed account of the workshop can be found in Appendix 16. More of these workshops can be organised at district levels in Bangladesh involving the primary school teachers and also the trainee teachers from primary training institutes and teacher training colleges.

11.7 A final word: have the research objectives been met?

Design of the physical environment is a neglected aspect of educational research which has resulted in poor design of classrooms and school grounds globally. Having considered the benefits of outdoor environments for humans of all ages, particularly children, this study set out to explore the relationship between the quality of outdoor environments and children's learning in primary schools. This exploration was non-linear unearthing the complex and multifaceted relationship between the outdoor environment and children's learning.

Referring back to the research questions, I will now review to what extent its objectives have been achieved.

The first research question was — *to what extent does the outdoor environment influence children's learning?* This study found that children's academic performance significantly improved when they had been taught in the designed outdoor environment compared to the children taught in their traditional classrooms. Therefore, this study adds to the limited evidence generated from empirical research on the influence of outdoor environment design on children's learning outcomes. The close relation between education and engagement influenced the formulation of the second research question — *to what extent does the design of outdoor environments influence children's motivation towards learning?* The hypothesis here was that children were more motivated to learn after being exposed to a well-designed outdoor environment. This study provides strong evidence in support of this hypothesis. Children who were exposed to the designed outdoor environment reported a significant increase in their motivation to learn compared to children who did not have a designed school ground.

The third research question asked to further investigate *whether children's perceived motivation to learn varied in two different environments (the classroom and outdoors)*. This study found that although children valued what they learnt both in the classroom and the outdoor class, they enjoyed their learning more and learnt better in the outdoor environment. The children also reported improved performance and productivity with a higher degree of attentiveness when taught outdoors. The fourth and the final research question asked, *what are the criteria that can guide the design of primary school outdoor environments to enhance children's learning?* This study answered this question by addressing the three related sub-questions — *the association between children's activities and the school ground design, the users' responses to the behaviour settings during formal and informal learning and users' preferences of settings*.

The number and diversity of activities children performed in the school ground increased considerably after the intervention, as found in participant observation and behaviour mapping. The children played games, which they used to play before in the neighbourhood, in the designed school ground; they adapted some games for the new settings and also invented new games. Different settings were used for different activities during outdoor classes and outside class time. Though children's use of settings was not congruent with what they desired before the intervention and reported as their favourite afterwards, a mix of natural and manufactured settings in the school ground was found useful for teaching the curriculum and also for informal learning.

A school ground if designed as a combination of different behaviour settings, can afford multiple learning opportunities for children. The settings can include

- a natural learning area,
- a water area,
- an area with loose materials, gardens,
- a play area,
- a flat ground, and
- areas for large and small group activities (with a blackboard for the display of children's activities).

They can be connected by a pathway or accessed from an open yard. Such a school ground also offers opportunities for innovative teaching practices by teachers. Based on the findings evidenced here, this study defined 'cognitive affordances' as those qualities of the

environment which afford ‘cognition’ in people. The knowledge of ‘cognitive affordances’ offered by the physical environment is beneficial for educators while teaching, and also for designers when designing educational environments.

In addition to answering the above stated research questions, this study also yielded some surprising findings. It found that the intervention in the school ground positively influenced teachers’ motivation and their way of teaching, which to some extent influenced the learning outcomes and motivation of children. The study suggests that teachers’ awareness of the role of physical environment is crucial for the pedagogical process. Therefore, improving the outdoor environment of schools and the consequential learning and motivational outcomes cannot be solely achieved by the designer or the educator, coordinated participation of all the parties is necessary for achieving such outcomes. Children’s participation at every stage, from design to execution and use, is particularly crucial for better educational and motivational outcomes.

This study opens a doorway for new approaches to built-environment research and suggests interdisciplinary approaches to investigate a broader range of concerns related to children’s environments. By demonstrating the reciprocity between research and practice, the study heralds the way for informed practices and collaborations among environmental designers, educators and policy makers in order to enhance the quality and effectiveness of learning environments for both children and teachers.

References

- Adams, E. (1990) Learning through landscapes : a report on the use, design, management and development of school grounds. Winchester : Learning Through Landscapes Trust, 1990.
- Adams, E. (1993) School's Out!: New Initiatives for British School Grounds. Children's Environments. (2), p.180.
- Ahmed, S. G., Rahman, M. M. and Pal, M., eds. (2010) Dropout Rate in Secondary Level Education in Bangladesh. First. Dhaka: The University Press Limited.
- Altman, I. (2012) Children and the environment. Springer Science & Business Media.
- Van Andel, J. (1990) Places children like, dislike, and fear. Children's Environments Quarterly. pp.24–31.
- Andersen, H. B., Pawlowski, C. S., Scheller, H. B., Troelsen, J., Toftager, M. and Schipperijn, J. (2015) Activating schoolyards: study design of a quasi-experimental schoolyard intervention study. BMC public health. Vol.15 (1), p.523.
- Anderson, J. B. (2000) Factors affecting learning of Mexican primary school children. Estudios económicos. pp.117–152.
- Anthamatten, P., Brink, L., Lampe, S., Greenwood, E., Kingston, B. and Nigg, C. (2011) An assessment of schoolyard renovation strategies to encourage children's physical activity. International Journal of Behavioral Nutrition and Physical Activity.
- Ardt, K., Hastings, C., Hopkins, K., Knebel, R., Loh, J. and Woods, R. (2005) Report on primary education in bangladesh: Challenges and successes. Bangladesh Bureau of Education Information and Statistics (BANBEIS)/Bangladesh Ministry of Women and Children Affairs (MWCA).
- Armitage, M. and Burke, C. (2005) The influence of school architecture and design on the outdoor play experience within the primary school (English). Paedagogica historica. Vol.41 (4–5), pp.535–553.
- Asadullah, M. N. and Chaudhury, N. (2013) Primary Schooling, Student Learning, and School Quality in Rural Bangladesh [Online]. Available: <http://www.cgdev.org/publication/primary-schooling-student-learning-and-school-quality-rural-bangladesh-working-paper-349>.
- Aydt, H. and Corsaro, W. A. (2003) Differences in children's construction of gender across culture an interpretive approach. American Behavioral Scientist. Vol.46 (10), pp.1306–1325.
- Ayvaci, H. S. and Devecioğlu, Y. (2010) Place arrangements and motivation methods of preschool teachers use in science and nature activities. Procedia - Social and Behavioral Sciences. Vol.2 (2), pp.1977–1981.
- Aziz, N. F. B. (2014) Affordances of School Grounds for Children's Outdoor Play and Environmental Learning (January).
- Backhaus, A., Dam, T. and Jensen, M. B. (2012) Stormwater management challenges as revealed through a design experiment with professional landscape architects. Urban Water Journal. Vol.9 (1), pp.29–43.
- Bagot, K. L., Allen, F. C. L. and Toukhsati, S. (2015) Perceived restorativeness of children's school playground environments: Nature, playground features and play period experiences. Journal of Environmental Psychology. Vol.41, pp.1–9.
- Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R. and Group, B. P. E. and S. P. S. I. (2009) The educational benefits claimed for physical education and school sport: an academic review. Research Papers in Education. [Online] Vol.24 (1), pp.1–27. Available: <http://dx.doi.org/10.1080/02671520701809817>.
- BANBEIS (2014) Basic Education Statistics 2014.
- BANBEIS (2015) Bangladesh Education Statistics 2014.
- Bangladesh Bureau of Statistics (2014) Population & Housing Census-2011.
- Barker, R. G. (1968) Ecological psychology : concepts and methods for studying the environment of human behavior. Stanford, Calif. : Stanford University Press.
- Barker, R. G. (1976) On the Nature of the Environment. In: Proshansky, H. M., Ittelson, W. H., and Rivlin, R. G. (eds.). Environmental psychology : people and their physical settings. New York: Holt, Rinehart and Winston, pp.12–26.
- Barrett, P., Davies, F., Zhang, Y. and Barrett, L. (2015) The impact of classroom design on pupils'

- learning: Final results of a holistic, multi-level analysis. Building and Environment. Vol.89, pp.118–133.
- Beames, S., Higgins, P. J. and Nicol, R. (2012) Learning outside the classroom: theory and guidelines for practice. New York ; London: Routledge.
- Beeson, B. S., Williams, R. A., Frost, J. L. and Sunderlin, S. (1985) The persistence of sex differences in the play of young children. When children play. pp.39–42.
- Bell, S. (2008) Design for outdoor recreation [electronic resource] / Simon Bell. New York : Taylor & Francis, 2008. 2nd ed.
- Berezowitz, C. K., Bontrager Yoder, A. B. and Schoeller, D. A. (2015) School Gardens Enhance Academic Performance and Dietary Outcomes in Children. Journal of School Health. Vol.85 (8), pp.508–518.
- van den Berg, A. E., Koole, S. L. and van der Wulp, N. Y. (2003) Environmental preference and restoration: (How) are they related? Journal of Environmental Psychology. [Online] Vol.23 (2), pp.135–146. Available: <http://www.sciencedirect.com/science/article/pii/S0272494402001111> [Accessed 3 Mar 2016].
- Berlyne, D. E. (1971) Aesthetics and psychobiology. JSTOR.
- Berlyne, D. E. (1978) Curiosity and learning. Motivation and Emotion. Vol.2 (2), pp.97–175.
- Best, J. R. (2010) Effects of Physical Activity on Children’s Executive Function: Contributions of Experimental Research on Aerobic Exercise. Developmental Review : DR. Vol.30 (4), pp.331–551.
- Biehler, R. F. and Snowman, J. (1982) Psychology applied to teaching / Robert F. Biehler, Jack Snowman. Boston : Houghton Mifflin Co., [1982], ©1982. Fourth edition.
- Billmann-Mahecha, E. and Gebhard, U. (2009) ‘ If we had no flowers...’ Children, Nature, and Aesthetics. The Journal of Developmental Processes. Vol.4 (1), pp.24–42.
- Billmore, B., Brooke, J., Booth, R., Funnell, K. and Bubb, M. (1999) The Outdoor Classroom: Educational Use, Landscape Design, & Management of School Grounds. Building Bulletin 71. ERIC.
- Björklid, P. (1984) Environmental diversity in housing estates as a factor in child development on JSTOR. Children’s Environments Quarterly. Vol.1 (4), pp.6–13.
- Bland, D. and Sharma-Brymer, V. (2012) Imagination in school children’s choice of their learning environment: An Australian study. International Journal of Educational Research. Vol.56, pp.75–88.
- Blatchford, P., Baines, E. and Pellegrini, A. (2003) The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior school. British Journal of Developmental Psychology. Vol.21 (4), pp.481–505.
- Bloom, B. S. and Engelhart, M. D. (1956) The classification of educational goals : handbook. 1. Cognitive domain ; by a committee of college and university examiners ; edited by Benjamin S. Bloom and Max D. Engelhart ... [et al.]. Taxonomy of educational objectives. New York : McKay, 1956.
- Bloom, B. S., Krathwohl, D. R. and Masia, B. B. (1964) Taxonomy of educational objectives : the classification of educational goals. Handbook 2, Affective domain ; by David R. Krathwohl, Benjamin S. Bloom, Bertram B. Masia. London : Longman Group Ltd., 1964. [First edition].
- Braun, V. and Clarke, V. (2008) Using thematic analysis in psychology. Qualitative Research in Psychology.
- Brink, L. A., Nigg, C. R., Lampe, S. M. R., Kingston, B. A., Mootz, A. L. and van Vliet, W. (2010) Influence of schoolyard renovations on children’s physical activity: the Learning Landscapes Program. American journal of public health. [Online] Vol.100 (9), pp.1672–8. Available: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2920958&tool=pmcentrez&rendertype=abstract> [Accessed 4 Apr 2016].
- Broda, H. W. (2007) Schoolyard-enhanced learning. Portland, Maine: Stenhouse Publishers.
- Bryman, A. (2012) Social research methods / Alan Bryman. Oxford, [England] ; New York, N.Y. : Oxford University Press, 2012. Fourth edition.
- Bunketorp Käll, L., Malmgren, H., Olsson, E., Lindén, T. and Nilsson, M. (2015) Effects of a Curricular Physical Activity Intervention on Children’s School Performance, Wellness, and Brain Development. The Journal of school health. Vol.85 (10), p.704.
- Byrd, R. K., Haque, M. T., Tai, L., McLellan, G. K. and Knight, E. J. (2007) Designing a Children’s Water Garden as an Outdoor Learning Lab for Environmental Education. Applied Environmental Education and Communication. Vol.6 (1), pp.39–47.

- Campbell, D. T. and Stanley, J. C. (2015) Experimental and quasi-experimental designs for research. Ravenio Books.
- Canning, N. (2010) The influence of the outdoor environment: den- making in three different contexts. European Early Childhood Education Research Journal. Vol.18 (4), pp.555–566.
- Canning, N. (2013) ‘Where’s the bear? Over there!’ – creative thinking and imagination in den making. Early Child Development & Care. Vol.183 (8), pp.1042–1053.
- Carey, L. A. (2012) Little classroom on the playground: increasing student academic achievement through integrating the playground into academics.
- Carpiano, R. M. (2009) Come take a walk with me: the ‘go-along’ interview as a novel method for studying the implications of place for health and well-being. Health & place. Vol.15 (1), pp.263–72.
- Chambers*, E. A. and Schreiber, J. B. (2004) Girls’ academic achievement: Varying associations of extracurricular activities. Gender and Education. Vol.16 (3), pp.327–346.
- Chawla, L. (1992) Place Attachment. In: Altman, I. and Low, S. M. (eds.). Human Behaviour and Environment. Boston, MA: Springer US, pp.63–86.
- Chawla, L., ed. (2001) Growing up in an urbanizing world. London: Earthscan Publications.
- Chawla, L. and Heft, H. (2002) Children’s Competence and the Ecology of Communities: a Functional Approach To the Evaluation of Participation. Journal of Environmental Psychology. Vol.22 (1–2), pp.201–216.
- Chawla, L., Keena, K., Pevec, I. and Stanley, E. (2014) Green schoolyards as havens from stress and resources for resilience in childhood and adolescence. Health & place. Vol.28, pp.1–13.
- Cheskey, E. (1995) How Schoolyards Influence Behaviour. Green Teacher.
- Choudhury, M. K. and Obaidullah, A. K. M. (1980) Outdoor Primary Education in Bangladesh. International Bureau of Education.
- Chowdhury, J. H., Chowdhury, D. K., Hoque, M. S., Ahmad, S. and Sultana, T. (2009) Participatory evaluation: causes of primary school drop-out. [Online]. Available: http://www.mopme.gov.bd/index.php?option=com_content&task=view&id=481&Itemid=515.
- Christensen, P. and James, A. (2008) Research with children: Perspectives and practices. Routledge.
- Christidou, V., Tsevreni, I., Epitropou, M. and Kittas, C. (2013) Exploring Primary Children’s Views and Experiences of the School Ground: The Case of a Greek School. International Journal of Environmental and Science Education. Vol.8 (1), pp.59–83.
- Clark, A. (2007) Views from inside the shed: young children’s perspectives of the outdoor environment. Education 3-13. Vol.35 (4), pp.349–363.
- Coe, D. P., Pivarnik, J. M., Womack, C. J., Reeves, M. J. and Malina, R. M. (2006) Effect of Physical Education and Activity Levels on Academic Achievement in Children. Medicine & Science in Sports & Exercise.
- Cohen, S. and Trostle, S. L. (1990) Young Children’s Preferences for School-Related Physical-Environmental Setting Characteristics. Environment and Behavior. Vol.22 (6), pp.753–766.
- Colabianchi, N., Kinsella, A. E., Coulton, C. J. and Moore, S. M. (2009) Utilization and physical activity levels at renovated and unrenovated school playgrounds. Preventive medicine. Vol.48 (2), pp.140–3.
- Collins, J. W. (2006) Texas Safety Standards.
- Colwell, M. J., Gaines, K., Pearson, M., Corson, K., Wright, H. D. and Logan, B. J. (2016) Space, Place, and Privacy: Preschool Children’s Secret Hiding Places. Family and Consumer Sciences Research Journal. Vol.44 (4), pp.412–421.
- Cosco, N. G. (2006) Motivation to move : physical activity affordances in preschool play areas. 2006.
- Cosco, N. G., Moore, R. C. and Islam, M. Z. (2010) Behavior mapping: a method for linking preschool physical activity and outdoor design. Medicine & Science in Sports & Exercise. Vol.42 (3), pp.513–519.
- Cronin-Jones, L. L. (2000) The Effectiveness of Schoolyards as Sites for Elementary Science Instruction. School Science and Mathematics. Vol.100 (4), pp.203–211.
- Dadvand, P., Nieuwenhuijsen, M. J., Esnaola, M., Forn, J., Basagaña, X., Alvarez-Pedrerol, M., Rivas, I., López-Vicente, M., De Castro Pascual, M., Su, J., Jerrett, M., Querol, X. and Sunyer, J. (2015) Green spaces and cognitive development in primary schoolchildren. Proceedings of the National Academy of Sciences. Vol.112 (26), p.201503402.
- Darbyshire, P., MacDougall, C. and Schiller, W. (2005) Multiple methods in qualitative research with children: more insight or just more? Qualitative research. Vol.5 (4), pp.417–436.
- Davis, B., Rea, T. and Waite, S. (2006) The special nature of the outdoors: its contribution to the

- education of children aged 3-11. Australian Journal of Outdoor Education. (2), p.3.
- Davis, E. E., Pitchford, N. J. and Limback, E. (2011) The interrelation between cognitive and motor development in typically developing children aged 4-11 years is underpinned by visual processing and fine manual control. British Journal of Psychology. Vol.102 (3), pp.569–584.
- Davison, K. K. and Lawson, C. T. (2006) Do attributes in the physical environment influence children's physical activity? A review of the literature. The international journal of behavioral nutrition and physical activity. [Online] Vol.3 (1), p.19. Available: <http://ijbnpa.biomedcentral.com/articles/10.1186/1479-5868-3-19> [Accessed 4 May 2016].
- Dcsf (2011) Building Bulletin 102: Designing for disabled children and children with special educational needs.
- Deci, E. L., Vallerand, R. J., Pelletier, L. G. and Ryan, R. M. (1991) Motivation and Education: The Self-Determination Perspective. Educational Psychologist. Vol.26 (3–4), pp.325–346.
- Denscombe, M. (1983) Interviews, accounts and ethnographic research on teachers. The ethnography of schooling. pp.107–128.
- Dewey, J. (1963) Experience and education. New York: New York : Collier Books.
- Digest, of E. S. (2013) Percentage of high school dropouts among persons 16 through 24 years old (status dropout rate), by sex and race/ethnicity: Selected years, 1960 through 2012. [Online]. Available: http://nces.ed.gov/programs/digest/d13/tables/dt13_219.70.asp.
- Dillon, J., Rickinson, M., Teamey, K., Morris, M., Choi, M. Y., Sanders, D. and Benefield, P. (2006) The value of outdoor learning: evidence from research in the UK and elsewhere. School science review. Vol.87 (320), p.107.
- Disinger, J. F. (1990) Needs and mechanisms for environmental learning in schools. Educational Horizons. Vol.69 (1), pp.28–36.
- Dismore, H. and Bailey, R. (2005) 'If only': Outdoor and adventurous activities and generalised academic development. Journal of Adventure Education & Outdoor Learning. Vol.5 (1), pp.9–19.
- Domjan, M. (2014) The principles of learning and behavior. Cengage Learning.
- Dosen, A. S. and Ostwald, M. J. (2016) Evidence for prospect-refuge theory : a meta-analysis of the findings of environmental preference research. City, Territory and Architecture. pp.1–14.
- Dowdell, K., Gray, T. and Malone, K. (2011) Nature and Its Influence on Children's Outdoor Play. Australian Journal of Outdoor Education. Vol.15 (2), pp.24–35.
- DPE (2009) Bangladesh Primary Education Annual Sector Performance Report 2009. Education.
- DPE (2012) Activities of DPE: Steps taken to increase enrolment and resuce dropout rates since 1991.
- DPE (2014) Bangladesh Primary Education Annual Sector Performance Report - 2014.
- Dudek, M. and Baumann, D. (2007) Schools and kindergartens [electronic resource] : a design manual /Mark Dudek ; contributions by Dorothea Baumann [and others]. Basel ; Boston : Birkhäuser, [2007], ©2007.
- Dutt, I. (2012) School Design and Students' Relationships with the Natural World. Children, Youth and Environments. (1), p.198.
- Dwyer, T., Sallis, J. F., Blizzard, L., Lazarus, R. and Dean, K. (2001) Relation of academic performance to physical activity and fitness in children. Pediatric Exercise Science. Vol.13 (3), pp.225–237.
- Dyment, J. E. (2005) Green School Grounds as Sites for Outdoor Learning: Barriers and Opportunities. International Research in Geographical and Environmental Education. Vol.14 (1), pp.28–45.
- Dyment, J. E. and Bell, A. C. (2008) Grounds for movement: Green school grounds as sites for promoting physical activity. Health Education Research. Vol.23 (6), pp.952–962.
- Dyment, J. E., Bell, A. C. and Lucas, A. J. (2009) The relationship between school ground design and intensity of physical activity. Children's Geographies. Vol.7 (3), pp.261–276.
- Dyment, J. and O'Connell, T. S. (2013) The impact of playground design on play choices and behaviors of pre-school children. Children's Geographies.
- Eccles, J. S. (1999) The development of children ages 6 to 14. The future of children. pp.30–44.
- Eccles, J., Wigfield, A., Harold, R. D. and Blumenfeld, P. (1993) Age and gender differences in children's self- and task perceptions during elementary school. Child Development. Vol.64 (3), pp.830–847.
- Eitle, T. M. (2005) Do gender and race matter? Explaining the relationship between sports participation and achievement. Sociological Spectrum. Vol.25 (2), pp.177–195.
- Erikson, E. H. (1995) Childhood and society. London : Vintage, 1995. Revised edition.

- Eshach, H. (2007) Bridging In-School and Out-of-School Learning: Formal, Non-Formal, and Informal Education (2), p.171.
- Evaldsson, A.-C. and Corsaro, W. A. (1998) Play and Games in the Peer Cultures of Preschool and Preadolescent Children An Interpretative Approach. Childhood. Vol.5 (4), pp.377–402.
- Fallman, D. (2008) The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration. Design Issues. Vol.24 (3), pp.4–18.
- Fargas-Malet, M., McSherry, D., Larkin, E. and Robinson, C. (2010) Research with Children: Methodological Issues and Innovative Techniques. Journal of Early Childhood Research. Vol.8 (2), pp.175–192.
- Faupel, A. S. P. S. (2003) Emotional literacy : assessment and intervention : ages 7 to 11. London: NferNelson.
- Fedewa, A. L. and Ahn, S. (2011) The Effects of Physical Activity and Physical Fitness on Children’s Achievement and Cognitive Outcomes. Research Quarterly For Exercise And Sport. Vol.82 (3), pp.521–535.
- Fiskum, T. A. and Jacobsen, K. (2013) Outdoor education gives fewer demands for action regulation and an increased variability of affordances. Journal of Adventure Education & Outdoor Learning. Vol.13 (1), pp.76–99.
- Fjørtoft, I. (2004) Landscape as Playscape: The Effects of Natural Environments on Children’s Play and Motor Development. Children, Youth and Environments. Vol.14 (2), pp.21–44.
- Fjørtoft, I. and Sageie, J. (2000) The natural environment as a playground for children landscape description and analyses of a natural playscape (English). Landscape and Urban Planning. Vol.48 (1–2), pp.83–97.
- Foster, A. (2006) Schools for the Future: Designing School Grounds. The Stationery Office.
- Francis, M. (2001) A case study method for landscape architecture. Landscape Journal. Vol.20 (1), pp.15–29.
- Francis, M. and Lorenzo, R. (2002) Seven realms of children’s participation. Journal of Environmental Psychology. Vol.22 (1–2), pp.157–169.
- Frost, J. L. (1992) Play and playscapes. Delmar.
- Funnell, K., Alford, V., Denegri, D., Johns, S., Young, B., Lucas, B., Titman, W., Wood, J., Department for, E., Employment, L. A. and Building, B. (1997) School Grounds: A Guide to Good Practice. Building Bulletin 85.
- Furio, J. (2010) Better than any fountain: a Bay Area school gets a water feature that teaches a real-life lesson in sustainability. Landscape architecture. Vol.100 (12), pp.70–77.
- Gambino, A., Davis, J. and Rowntree, N. (2009) Young children learning for the environment: researching a forest adventure.(Report). Australian Journal of Environmental Education. p.83.
- Gaver, W. W. (1996) Situating action II: Affordances for interaction: The social is material for design. Ecological Psychology. Vol.8 (2), pp.111–129.
- Ghaziani, R. (2012) An Emerging Framework for School Design Based on Children’s Voices. Children Youth and Environments. Vol.22 (1), pp.125–144.
- Gibson, E. J. and Pick, A. D. (2000) An ecological approach to perceptual learning and development. Oxford Univ. Press.
- Gibson, J. J. (1979) The ecological approach to visual perception. Boston : Houghton Mifflin.
- Goličnik, B. (2005) People in place : a configuration of physical form and the dynamic patterns of spatial occupancy in urban open public space. Thesis (PhD)--Heriot-Watt University, 2005.
- Goodwin, S. A. and Fiske, S. T. (2001) Power and gender: The double-edged sword of ambivalence. Handbook of the psychology of women and gender. pp.358–366.
- Gottfried, A. E. (1985) Academic intrinsic motivation in elementary and junior high school students. Journal of educational psychology. Vol.77 (6), p.631.
- Gottfried, A. E. (1986) Intrinsic motivational aspects of play experiences and play materials. Play interactions. pp.81–99.
- Gottfried, A. E. (1990) Academic intrinsic motivation in young elementary school children. Journal of Educational psychology. Vol.82 (3), p.525.
- Graham, H., Beall, D. L., Lussier, M., McLaughlin, P. and Zidenberg-Cherr, S. (2005) Use of School Gardens in Academic Instruction. Journal of Nutrition Education and Behavior. Vol.37 (3), pp.147–151.
- Grant, T. and Littlejohn, G. (2001) Greening school grounds: Creating habitats for learning. New society.
- Greene, S. and Hogan, D. (2005) Researching children’s experience : methods and approaches. Sage.

- Griffie, D. (2001) Questionnaire Translation and Questionnaire Validation: Are They the Same?. [Online]. Available: <http://eric.ed.gov/?id=ED458800> [Accessed 30 Mar 2016].
- Groat, L. N. and Wang, D. (2002) Architectural Research Methods [Online]. John Wiley & Sons. Available: https://books.google.co.uk/books/about/Architectural_Research_Methods.html?id=21Uz_E0HN R4C&pgis=1 [Accessed 16 Feb 2016].
- Gross, C. M. (2012) Science Concepts Young Children Learn Through Water Play. Dimensions of Early Childhood. Vol.40 (2).
- Guest, G., MacQueen, K. M. and Namey, E. E. (2012) Introduction to Applied Thematic Analysis. Applied Thematic Analysis. SAGE Publications, Inc.
- Gutman, L. M. and Schoon, I. (2013) The impact of non-cognitive skills on outcomes for young people. Education Endowment Foundation. Available at: http://educationendowmentfoundation.org.uk/uploads/pdf/Non-cognitive_skills_literature_review.pdf.
- Hammersley, M. (2007) Ethnography principles in practice. Third edit. Milton Park, Abingdon, Oxon.
- Haq, N. and Jahan, M. (1999) Shishur Gyan Bikasher Dhara: Piaget tatta (Children's Cognitive Development: Piaget theory). Dhaka: Bangla Academy.
- Hart, R. (1979) Children's experience of place. Irvington.
- Hart, R. A. (1997) Children's participation: The theory and practice of involving young citizens in community development and environmental care. London : Earthscan.
- Hart, R., Iltus, S. and Katz, C. (1991) The participatory design of two community elementary schoolyards in Harlem. Children's Environments Research Group.
- Harter, S. (1982) The Perceived Competence Scale for Children. Child Development. Vol.53 (1), p.87.
- Harter, S. and Pike, R. (1984) The pictorial scale of perceived competence and social acceptance for young children. Child Development. Vol.55 (6), p.1969.
- Harvey, M. R. (1990) The relationship between children's experiences with vegetation on school grounds and their environmental attitudes. The Journal of Environmental Education. Vol.21 (2), pp.9–15.
- Haug, E., Torsheim, T., Sallis, J. F. and Samdal, O. (2010) The characteristics of the outdoor school environment associated with physical activity. Health education research. Vol.25 (2), pp.248–256.
- Haug, E., Torsheim, T. and Samdal, O. (2008) Physical environmental characteristics and individual interests as correlates of physical activity in Norwegian secondary schools: the health behaviour in school-aged children study. The international journal of behavioral nutrition and physical activity. Vol.5, p.47.
- Heft, H. (1988) Affordances of Children's Environments: A Functional Approach to Environmental Description. Children's Environments Quarterly. (3), p.29.
- Heft, H. (2010) Affordances in the perception of landscape: an enquiry into environmental perception and aesthetics. In: Ward Thompson, C., Aspinall, P., and Bell, S. (eds.). Innovative approaches to researching landscape and health : open space: people space 2. New York : Routledge, pp.9–32.
- Herrington, S., Studtmann, K., Rodiek, J. E. and Steiner, F. (1998) Landscape interventions : new directions for the design of children's outdoor play environments (English). Landscape and Urban Planning. Vol.42 (2–4), pp.191–205.
- Hidi, S. and Harackiewicz, J. M. (2000) Motivating the academically unmotivated: A critical issue for the 21st century. Review of educational research. Vol.70 (2), pp.151–179.
- Higgins, P. (2016) Outdoor Education and Policy. In: Outdoor and Environmental Education Seminar.
- Horne-Martin, S. (2006) The classroom environment and children's performance – is there a relationship? In: Spencer, C. and Blades, M. (eds.). Children and their Environments: Learning, Using and Designing Spaces. Cambridge: Cambridge University Press, pp.1–10.
- Huitt, W. (2011) Self and self-views. Educational Psychology Interactive. [Online]. Available: <http://www.edpsycinteractive.org/topics/self/self.html>.
- Humberstone, B. and Stan, I. (2012) Nature and well-being in outdoor learning: authenticity or performativity. Journal of Adventure Education & Outdoor Learning. Vol.12 (3), pp.183–197.
- Hussein, H. (2009) Therapeutic Intervention: Using Sensory Gardens to Enhance the Quality of Life for Children with Special Needs. University of Edinburgh.
- Hussein, H. (2010) Using the Sensory Garden as a Tool to Enhance the Educational Development and

- Social Interaction of Children with Special Needs. Support for Learning. Vol.25 (1), pp.25–31.
- Inhelder, B. and Piaget, J. (1969) The psychology of the child. New York: Basic Books.
- Islam, S. and Miah, S. (2012) Raipura Upazila - Banglapedia. National Encyclopedia of Bangladesh. [Online]. Available: http://en.banglapedia.org/index.php?title=Raipura_Upazila [Accessed 28 Mar 2016].
- Jansson, M., Gunnarsson, A., Mårtensson, F. and Andersson, S. (2014) Children's perspectives on vegetation establishment: Implications for school ground greening. Urban Forestry & Urban Greening. Vol.13 (1), pp.166–174.
- Jensen, E. (2005) Teaching with the brain in mind. 2nd ed. ASCD.
- Jick, T. D. (1979) Mixing Qualitative and Quantitative Methods: Triangulation in Action. Administrative Science Quarterly. Vol.24 (4), pp.602–611.
- Kail, R. V (2015) Children and their development. Pearson Higher Ed.
- Kalra, R., Khan, I. and Rehman, O. (2014) Final Report : Efficiency Analysis of Classroom Infrastructure for Primary Education in Bangladesh.
- Karsten, L. (2003) Children's Use of Public Space The Gendered World of the Playground. Childhood. Vol.10 (4), pp.457–473.
- Kashahu, L. (2013) The impact of gender, some demographic characteristics and parent-teacher relationship on adolescent academic achievement. In: . Albania International Conference on Education.
- Kellert, S. R. (2002) Experiencing nature: Affective, cognitive, and evaluative development in children. In: Kahn, P. and Kellert, S. (eds.). Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations.. Cambridge: MIT press, pp.117–151.
- Kelz, C., Evans, G. W. and Roderer, K. (2013) The Restorative Effects of Redesigning the Schoolyard: A Multi-Methodological, Quasi-Experimental Study in Rural Austrian Middle Schools. Environment and Behavior.
- Kenny, K. (1996) Grounds for learning : a celebration of school site developments in Scotland. Winchester : Learning Through Landscapes, [1996], ©1996.
- Khan, M. (2009) Rethinking learning spaces for child development: Primary Schools at Raipura, Narsingdi. Architecture. Bangladesh University of Engineering and Technology, Bangladesh.
- Khan, M. (2012a) Outdoor as learning environment for children at a government primary school in Bangladesh.
- Khan, M. (2012b) Design by Research: Using Lighting Simulation Software in a small study on Luminous Environment of a Primary School. In: International Seminar on Architecture: Education, Practice and Research. Department of Architecture, BUET, pp.413–422.
- Khan, M., Bell, S., Oliveira, E. de S. and McGeown, S. (2015) Outdoor Environments for Primary School Teaching and Learning - An Exploratory Study. In: ECLAS Conference, Tartu. pp.215–218.
- Khan, M. and Islam, Z. (2014) Outdoor as Learning Environment for Children at a Primary School of Bangladesh. In: 45th Annual Conference of the Environmental Design Research Association. Environmental Design Research Association, pp.112–119.
- King, N. (2010) Interviews in qualitative research. Los Angeles : SAGE.
- Kirkby, M. (1989) Nature as refuge in children's environments. Children's Environments Quarterly. Vol.6 (1), pp.7–12.
- Klemmer, C. D., Waliczek, T. M. and Zajicek, J. M. (2005) Growing minds: The effect of a school gardening program on the science achievement of elementary students. HortTechnology. Vol.15 (3), pp.448–452.
- Knecht, S. (2008) Benefits and Challenges of Forest Education in Primary Schools in the Canton of Zurich , Switzerland.
- Knight, S. (2013) Forest school and outdoor learning in the early years. Sage.
- Korpela, K. (2002) Children's environment. Handbook of environmental psychology.
- Korpela, K., Kyttä, M. and Hartig, T. (2002) Restorative experience, self-regulation and children's place experiences. Journal of Environmental Psychology. Vol.22 (4), pp.387–398.
- Korpela, K. M., Hartig, T., Kaiser, F. G. and Fuhrer, U. (2001) Restorative Experience and Self-Regulation in Favorite Places. Environment and Behavior. Vol.33 (4), pp.572–589.
- Korpela, K. M. and Ylén, M. (2007) Perceived health is associated with visiting natural favourite places in the vicinity. Health & place. Vol.13 (1), pp.138–51.
- Krapp, A. (1999) Interest, motivation and learning: An educational-psychological perspective. European Journal of Psychology of Education. Vol.14 (1), pp.23–40.

- Krueger, R. and Casey, M. (2009) Focus Groups: A Practical Guide for Applied Research.
- Kusenbach, M. (2003) Street phenomenology: The go-along as ethnographic research tool. Ethnography. Vol.4 (3), pp.455–485.
- Kytta, M. (2002) Affordances of children’s environments in the context of cities, small towns, suburbs and rural villages in Finland and Belarus. Journal of Environmental Psychology. Vol.24 (2), p.20.
- Kytta, M. (2004) The extent of children’s independent mobility and the number of actualized affordances as criteria for child-friendly environments. Journal of Environmental Psychology. p.15.
- Kyttä, M. (2002) Affordances of children’s environments in the context of cities, small towns, suburbs and rural villages in Finland and Belarus. Journal of environmental psychology. Vol.22 (1), pp.109–123.
- Kyttä, M. (2003) Children in outdoor contexts: affordances and independent mobility in the assessment of environmental child friendliness.
- Learning and Teaching Scotland (2010) Curriculum for Excellence through outdoor learning.
- Lepper, M. R., Corpus, J. H. and Iyengar, S. S. (2005) Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. Journal of educational psychology. Vol.97 (2), p.184.
- Lever, J. (1978) Sex Differences in the Complexity of Children’s Play and Games. American Sociological Review. Vol.43 (4), pp.471–483.
- Li, D. and Sullivan, W. C. (2016) Impact of views to school landscapes on recovery from stress and mental fatigue. Landscape and Urban Planning. [Online] Vol.148, pp.149–158. Available: <http://www.sciencedirect.com/science/article/pii/S0169204615002571> [Accessed 1 Feb 2016].
- Lieberman, G. A. and Hoody, L. L. (1998) Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning. Results of a Nationwide Study.
- Lieberman, G. A., Hoody, L. L. and Lieberman, G. M. (2005) California student assessment project phase two: The effects of environment-based education on student achievement. State Education and Environment Roundtable.
- Lieberman, G. A., Hoody, L. and Lieberman, G. M. (2000) California student assessment project-The effects of environment-based education on student achievement. State Education & Environmental Roundtable.
- Lindholm, G. (1995) Schoolyards: The Significance of Place Properties to Outdoor Activities in Schools. Environment and Behavior. Vol.27 (3), pp.259–293.
- Lopez, R., Campbell, R. and Jennings, J. (2008) Schoolyard Improvements and Standardized Test Scores: An Ecological Analysis. Gastón Institute Publications.
- Lozanovska, M. and Xu, L. (2013) Children and university architecture students working together: a pedagogical model of children s participation in architectural design. CoDesign. [Online] Vol.9 (4), pp.209–229. Available: <http://dx.doi.org/10.1080/15710882.2012.693187>.
- Lucas, A. J. and Dymont, J. E. (2010) Where do children choose to play on the school ground? The influence of green design. Education 3-13. Vol.38 (2), pp.177–189.
- Lynch, K. and Banerjee, T. (1976) Growing up in cities. New society. Vol.37 (722), pp.281–284.
- Malaguzzi, L. (1993) For an Education Based on Relationships. Young Children. Vol.49 (1), pp.9–12.
- Maller, C. and Townsend, M. (2006) Children’s mental health and wellbeing and hands-on contact with nature. International journal of learning. Vol.12 (4), pp.359–372.
- Malone, K. and Tranter, P. J. (2003a) Children’s Environmental Learning and the Use, Design and Management of Schoolgrounds. Children, Youth and Environments. Vol.13 (2), p.87.
- Malone, K. and Tranter, P. J. (2003b) School Grounds as Sites for Learning: making the most of environmental opportunities. Environmental Education Research. Vol.9 (3).
- Marcus, C. C. and Carolyn, F. (1998) People Places: Design guidelines for urban open space. New York.
- Marcus, C. C. and Moore, R. C. (1976) Children and Their Environments: A Review of Research 1955-1975: And a Discussion of Why the Findings have Largely Been Ignored. Journal of Architectural Education. Vol.29 (4), pp.22–25.
- Marsh, H. W. and O’Mara, A. (2008) Reciprocal Effects Between Academic Self-Concept, Self-Esteem, Achievement, and Attainment Over Seven Adolescent Years: Unidimensional and Multidimensional Perspectives of Self-Concept. Personality and Social Psychology Bulletin. Vol.34 (4), pp.542–552.
- Mårtensson, F., Jansson, M., Johansson, M., Raustorp, A., Kylin, M. and Boldemann, C. (2014) The

- role of greenery for physical activity play at school grounds. Urban Forestry & Urban Greening. Vol.13 (1), pp.103–113.
- Martin, M. O., Foy, P., Mullis, I. V. S. and O'Dwyer, L. M. (2013) Effective Schools in Reading, Mathematics, and Science at the Fourth Grade. In: Martin, M. O. and Mullis, I. V. S. (eds.). TIMSS and PIRLS 2011: relationships among reading, mathematics, and science achievement at the fourth grade—implications for early learning. TIMSS & PIRLS International Study Center Lynch School of Education, Boston College International Association for the Evaluation of Educational Achievement (IEA).
- Matsuoka, R. H. (2010) Student performance and high school landscapes: Examining the links. Landscape and Urban Planning. Vol.97 (4), pp.273–282.
- Matthews, M. H. (1985) Young children's representations of the environment: A comparison of techniques. Journal of Environmental Psychology. Vol.5 (3), pp.261–278.
- Maynard, T., Waters, J. and Clement, J. (2013) Child-initiated learning, the outdoor environment and the 'underachieving' child. Early Years. Vol.33 (3), pp.212–225.
- Meire, J. (2007) Qualitative research on children's play: A review of recent literature. Several Perspectives on Children's Play. pp.29–78.
- Merewether, J. (2015) Young children's perspectives of outdoor learning spaces: what matters? Australasian Journal of Early Childhood. Vol.40 (1), p.99.
- Monsoureh, R. and Ismail, S. (2012) Methods for Evaluating Responses of Children with Outdoor Environments. Procedia - Social and Behavioral Sciences. Vol.49, pp.39–46.
- Monsur, M. (2015) Does Childcare Architecture Matter? Investigating how Indoor-Outdoor Spatial Relations Influence Child Engagement and Teacher Motivation. North Carolina State University.
- Moore, G. T. (1973) Developmental differences in environmental cognition. In: Preisser, W. (ed.). Environmental Design Research. Stroudsburg, PA,: Dowden, Hutchinson, and Ross.
- Moore, G. T. (1986a) Effects of the spatial definition of behavior settings on children's behavior: A quasi-experimental field study. Journal of Environmental Psychology. Vol.6 (3), pp.205–231.
- Moore, G. T. and Sugiyama, T. (2007) The Children's Physical Environment Rating Scale (CPERS): Reliability and Validity for Assessing the Physical Environment of Early Childhood Educational Facilities. Children, Youth & Environments. Vol.17 (4), pp.24–53.
- Moore, R. C. (1986b) The power of nature: Orientations of girls and boys toward biotic and abiotic play settings on a reconstructed schoolyard. Children's Environments Quarterly. Vol.3 (3), pp.52–69.
- Moore, R. C. (1989) Plants as play props. Children's environments Quarterly. Vol.6 (1), pp.3–6.
- Moore, R. C. (1990) Childhood's domain: play and place in child development. Childhood's domain: play and place in child development.
- Moore, R. C. (1996) Outdoor Settings for Playing and Learning: Designing School Grounds to Meet the Needs of the Whole Child and Whole Curriculum. NAMTA Journal. Vol.21 (3), pp.97–120.
- Moore, R. C. and Cosco, N. G. (2007) What makes a park inclusive and universally designed?- a multi-method approach. In: Ward Thompson, C. and Travlou, P. (eds.). Open space : people space. London ; New York : Taylor and Francis.
- Moore, R. C. and Wong, H. H. (1997) Natural learning : the life history of an environmental schoolyard : creating environments for rediscovering nature's way of teaching. Berkeley, Calif. : MIG Communications.
- Moore, R. and Cosco, N. (2010) Using behaviour mapping to investigate healthy outdoor environments for children and families: conceptual framework, procedures, and applications. Innovative Approaches to Research Excellence in Landscape and Health. London (UK): Taylor and Francis.
- Moore N. G., R. C. and Cosco (2010) Using behaviour mapping to investigate healthy outdoor environments for children and families: conceptual framework, procedures and applications. In: Ward Thompson, C., Aspinall, P., and Bell, S. (eds.). Innovative approaches to researching landscape and health : open space: people space 2. New York : Routledge, 2010.
- MoPME (2015) Education for all 2015 National Review-Bangladesh [Online]. Unesco. Available: <http://unesdoc.unesco.org/images/0023/002305/230507e.pdf>.
- Mygind, E. (2007) A Comparison between Children's Physical Activity Levels at School and Learning in an Outdoor Environment. Journal of Adventure Education and Outdoor Learning. Vol.7 (2), pp.161–176.
- Mygind, E. (2009) A comparison of childrens' statements about social relations and teaching in the

- classroom and in the outdoor environment. Journal of Adventure Education & Outdoor Learning. Vol.9 (2), pp.151–169.
- NCTB (2014) Primary Curriculum.
- Nedovic, S. and Morrissey, A.-M. (2013) Calm active and focused: Children's responses to an organic outdoor learning environment. Learning Environments Research. Vol.16 (2), pp.281–295.
- Nicholson, S. (1970) How not to cheat children: The theory of loose parts. Landscape architecture. Vol.62 (1), pp.30–34.
- Nicol, R., Higgins, P., Ross, H. and Mannion, G. (2007) Outdoor Education in Scotland : a Summary of Recent Research. Perth: Scottish Natural Heritage.
- Noradahl, K. and Einarsdóttir, J. (2015) Children's views and preferences regarding their outdoor environment. Journal of Adventure Education and Outdoor Learning : JAEOL. Vol.15 (2), p.152.
- Nor Fadzila, A. and Ismail, S. (2012) The Trends and Influential Factors of Children's Use of Outdoor Environments: A Review. Procedia - Social and Behavioral Sciences. Vol.38, pp.204–212.
- O'Brien, L. (2009) Learning outdoors: the Forest School approach. Education 3-13. Vol.37 (1), pp.45–60.
- O'Brien, L., Murray, R., Liz, O. and Richard, M. (2007) Forest School and its impacts on young children: Case studies in Britain. Urban Forestry & Urban Greening. Vol.6 (4), pp.249–265.
- Pack, A. R. and Michael, W. B. (1995) A Comparison of Two Methods of Data Collection in Analyzing Social and Cognitive Play Behavior. [Online]. Available: <http://eric.ed.gov/?id=ED387506> [Accessed 7 Mar 2016].
- Palmberg, I. E. and Kuru, J. (2000) Outdoor Activities as a Basis for Environmental Responsibility. The Journal of Environmental Education. [Online] Vol.31 (4), pp.32–36. Available: <http://www.tandfonline.com.ezproxy.is.ed.ac.uk/doi/abs/10.1080/00958960009598649> [Accessed 8 Mar 2016].
- Passy, R. (2014) School gardens: teaching and learning outside the front door. Education 3-13. Vol.42 (1), pp.23–38.
- Pawlowski, C. S., Andersen, H. B., Troelsen, J. and Schipperijn, J. (2016) Children's Physical Activity Behavior during School Recess: A Pilot Study Using GPS, Accelerometer, Participant Observation, and Go-Along Interview. PLoS ONE. Vol.11 (2).
- Pearsall, J. and Hanks, P. (1998) The new Oxford dictionary of English. Clarendon Press.
- Pellegrini, A. D. (2009) Research and Policy on Children's Play. Child Development Perspectives. Vol.3 (2), pp.131–136.
- Pellegrini, A. D., Blatchford, P., Kato, K. and Baines, E. (2004) A Short-term Longitudinal Study of Children's Playground Games in Primary School: Implications for Adjustment to School and Social Adjustment in the USA and the UK. Social Development. Vol.13 (1), pp.107–123.
- Perkins, L. B. and Cocking, W. D. (1949) Schools. Reinhold.
- Piaget, J. (1964) Development and Learning. In: Ripple, R. E. and Rockcastle, V. N. (eds.). Piaget rediscovered. Cornell University, pp.7–20.
- Price, A. (2013) Improving school attendance: can participation in outdoor learning influence attendance for young people with social, emotional and behavioural difficulties? Journal of Adventure Education & Outdoor Learning. pp.1–13.
- Punch, S. (2002) Research with children: The same or different from research with adults? Childhood. Vol.9 (3), pp.321–341.
- Rabbi, A. F. M. F. (2005) Viability of Achieving Millennium Development Goals Primary Education in Bangladesh : pp.1–86.
- Rasmussen, K. (2004) Places for Children – Children's Places. Childhood. Vol.11 (2), pp.155–173.
- Refshauge, A. D., Stigsdotter, U. K., Lamm, B. and Thorleifsdottir, K. (2013) Evidence-Based Playground Design: Lessons Learned from Theory to Practice. Landscape Research. pp.1–21.
- Reio, T. G. (2004) Prior knowledge, self-directed learning readiness, and curiosity: Antecedents to classroom learning performance. International Journal of Self-directed learning. Vol.1 (1), pp.18–25.
- Rickinson, M., Dillon, J., Teamey, K., Morris, M., Young Choi, M., Sanders, D. and Benefield, P. (2004) A review of research on outdoor learning (Shrewsbury, UK, Field Studies Council).
- Ridgers, N. D., Fairclough, S. J. and Stratton, G. (2010) Twelve-month effects of a playground intervention on children's morning and lunchtime recess physical activity levels. Journal of physical activity & health. Vol.7 (2), pp.167–175.
- Ridgers, N. D., Stratton, G., Fairclough, S. J. and Twisk, J. W. R. (2007) Children's physical activity

- levels during school recess: a quasi-experimental intervention study. The international journal of behavioral nutrition and physical activity. Vol.4 (1), p.19.
- Roe, J. (2008) The restorative power of natural and built environments. Heriot-Watt University.
- Roe, J. and Aspinall, P. (2011a) The Emotional Affordances of Forest Settings: An Investigation in Boys with Extreme Behavioural Problems. Landscape Research. Vol.36 (5), pp.535–552.
- Roe, J. and Aspinall, P. (2011b) The restorative outcomes of forest school and conventional school in young people with good and poor behaviour. Urban Forestry and Urban Greening. Vol.10.
- Ross, H., Nicol, R. and Higgins, P. (2007) Outdoor study of nature: teachers' motivations and contexts. Scottish Educational Review. Vol.39 (2), pp.160–172.
- Rowe, S. and Humphries, S. (2012) The Coombes Approach: Learning Through an Experiential and Outdoor Curriculum. Bloomsbury Publishing.
- Rubin, H. J. and Rubin, I. S. (2011) Qualitative Interviewing: The Art of Hearing Data [Online]. SAGE Publications. Available: https://books.google.com/books?hl=en&lr=&id=bgekGK_xpYsC&pgis=1 [Accessed 29 Mar 2016].
- Ryan, R. and Deci, E. (2000) Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. Contemporary educational psychology. Vol.25 (1), pp.54–67.
- Saint, A. (1987) Towards a social architecture: The role of school-building in post-war England. Yale University Press.
- Samborski, S. (2010) Biodiverse or barren school grounds: Their effects on children. Children Youth and Environments. Vol.20 (2), pp.67–115.
- Sanoff, H. (1995) Creating Environments for Young Children.
- Sanoff, H. (2015) Foreward. In: Schools for the Future: Design Proposals from Architectural Psychology. Springer, pp.vii–ix.
- Schraw, G., Flowerday, T. and Lehman, S. (2001) Increasing Situational Interest in the Classroom. Educational Psychology Review. Vol.13 (3), pp.211–224.
- Scott, M. M. (2005) A Powerful Theory and a Paradox: Ecological Psychologists after Barker. Environment and Behavior. Vol.37 (3), pp.295–329.
- Scottish Executive (2004) A curriculum for excellence.
- Sebba, R. (1991) The Landscapes of Childhood: The Reflection of Childhood's Environment in Adult Memories and in Children's Attitudes. Environment and Behavior. Vol.23 (4), p.28.
- Sebba, R. and Churchman, A. (1986) Schoolyard design as an expression of educational principles. Children's Environments Quarterly. pp.70–76.
- Sharma, C. B., Pathak, A. and Sinha, A. (2009) Factors affecting learning-1. eGyankosh.
- Shephard, R. J. (1997) Curricular Physical Activity and Academic Performance. Pediatric Exercise Science. Vol.9 (2), p.113.
- Shima, O., Mohammadjavad, M. and Alireza, N. (2012) Evaluation of Outdoor Environment from the Viewpoint of Children. Procedia - Social and Behavioral Sciences. Vol.35, pp.431–439.
- Silveirinha de Oliveira, E. (Eva M. (2011) Immigrants and public open spaces : attitudes, preferences and uses. Thesis (Ph.D.)--University of Edinburgh, 2012.
- Silveirinha de Oliveira, E., Aspinall, P., Briggs, A., Cummins, S., Leyland, A. H., Mitchell, R., Roe, J. and Ward Thompson, C. (2013) How effective is the Forestry Commission Scotland's woodland improvement programme--'Woods In and Around Towns' (WIAT)--at improving psychological well-being in deprived urban communities? A quasi-experimental study. BMJ open. Vol.3 (8), p.e003648.
- Singal, N. and Swann, M. (2011) Children's perceptions of themselves as learner inside and outside school. Research Papers in Education. [Online] Vol.26 (4), pp.469–484. Available: <http://www.tandfonline.com.ezproxy.is.ed.ac.uk/doi/abs/10.1080/02671520903281617> [Accessed 4 Apr 2016].
- Slavin, R. E. (2002) Educational psychology : theory and practice / Robert E. Slavin. Boston : Allyn and Bacon, [2002], ©2003. Seventh edition.
- Smith, W. R., Moore, R., Cosco, N., Wesoloski, J., Danninger, T., Ward, D. S., Trost, S. G. and Ries, N. (2014) Increasing Physical Activity in Childcare Outdoor Learning Environments: The Effect of Setting Adjacency Relative to Other Built Environment and Social Factors. Environment and Behavior. p.0013916514551048-.
- Spencer, H. (1855) The principles of psychology. London : Longman, Brown, Green and Longmans.
- Stan, I. and Humberstone, B. (2011) An Ethnography of the Outdoor Classroom--How Teachers Manage Risk in the Outdoors. Ethnography and Education. Vol.6 (2), pp.213–228.

- Stine, S. (1997) Landscapes for learning: Creating outdoor environments for children and youth. John Wiley & Sons.
- Storli, R. and Hagen, T. L. (2010) Affordances in Outdoor Environments and Children's Physically Active Play in Pre-School. European Early Childhood Education Research Journal. Vol.18 (4), pp.445–456.
- Stratton, G. (2000) Promoting children's physical activity in primary school: an intervention study using playground markings. Ergonomics. [Online] Vol.43 (10), pp.1538–46. Available: <http://www.tandfonline.com/doi/abs/10.1080/001401300750003961> [Accessed 4 Apr 2016].
- Stratton, G. and Mullan, E. (2005) The effect of multicolor playground markings on children's physical activity level during recess. Preventive medicine. Vol.41 (5–6), pp.828–33.
- Subramaniam, A. (2002) Garden-based learning in basic education: A historical review. Monograph, Centre for Youth Development, University of California.
- Susa, A. M. and Benedict, J. O. (1994) The Effects of Playground Design on Pretend Play and Divergent Thinking. Environment and Behavior. Vol.26 (4), p.560.
- Swarbrick, N., Eastwood, G. and Tutton, K. (2004) Self-esteem and successful interaction as part of the forest school project. Support for Learning. Vol.19 (3), pp.142–146.
- Sylvia, R. D. (1985) What Makes Ms. Johnson Teach? A Study of Teacher Motivation. Human Relations. Vol.38 (9), pp.841–856.
- Tagore, R. (1945) Shiksha.
- Tai, L., Haque, M. T., McLellan, G. K. and Knight, E. J. (2006) Designing Outdoor Environments for Children: Landscaping School Yards, Gardens and Playgrounds. McGraw-Hill.
- Tanner (2000) The influence of school architecture on academic achievement. Journal of Educational Administration. Vol.38 (4), p.309.
- Tanner, C. K. (2009) Effects of school design on student outcomes. Journal of Educational Administration. Vol.47 (3), pp.381–399.
- Taylor-Powell, E. (2008) Pilot test your questionnaire [Online]. University of Wisconsin-Extension. Available: <http://www.uwex.edu/ces/4h/evaluation/documents/Pilottestyourquestionnaire.pdf> [Accessed 1 Apr 2016].
- Thelen, E. and Smith, L. B. (1996) A Dynamic Systems Approach to the Development of Cognition and Action. MIT Press.
- Thelen, E. and Smith, L. B. (2007) Dynamic Systems Theories. In: Handbook of Child Psychology. John Wiley & Sons, Inc.
- Thomson, S. (2005) 'Territorialising' the primary school playground: Deconstructing the geography of playtime. Children's Geographies. Vol.3 (1), pp.63–78.
- Titman, W. (1994) Special places, special people: the hidden agenda of school grounds. Surrey, U.K.
- Tranter, P. J. and Malone, K. (2004) Geographies of environmental learning: an exploration of children's use of school grounds. Children's Geographies. Vol.2 (1), pp.131–155.
- Tuan, Y.-F. (1974) Topophilia: A study of environmental perception, attitudes, and values. Columbia University Press.
- Turner, J. (1984) Cognitive development and education / Johanna Turner. New essential psychology. London ; New York : Methuen, 1984.
- Uduku, O. (2015) Spaces for 21ST-Century Learning. In: Routledge Handbook of International Education and Development. pp.196–209.
- Ulrich, R. S. (1984) View through a window may influence recovery from surgery. Science (New York, N.Y.). Vol.224 (4647), pp.420–421.
- UNESCO (2014) EFA Global Monitoring Report Regional Overview-Monitoring the Education for All goals:Sub-saharan Africa.
- UNESCO (2015) Education For All 2000-2015: Achievements and Challenges. EFA Global Monitoring Report.
- UNESCO Institute for Statistics (2012) Global Education Digest 2012.
- UNESCO Institute for Statistics (2015) A Growing Number of Children and Adolescents are out of School as Aid Fails to Meet the Mark [Online]. Education for All Global Monitoring Report. Available: <http://unesdoc.unesco.org/images/0023/002336/233610e.pdf>.
- UNESCO Institute for Statistics and UNICEF (2015) Fixing the Broken Promise of Education for All.
- UNICEF (1989) Convention on the Rights of the Child.
- Unterhalter, E., Ross, J. and Alam, M. (2003) A Fragile Dialogue? Research and Primary Education Policy Formation in Bangladesh, 1971-2001. Compare: A Journal of Comparative and International Education. Vol.33 (1), pp.85–99.

- Vygotsky, L. (1993) Interaction between learning and development. In: Gauvain, M. and Cole, M. (eds.). Readings on the development of children. New York : Scientific American Books, pp.29–36.
- Vygotsky, L. S., Cole, M., John-Steiner, V., Scribner, S. and Souberman, E. (1978) Mind in society. Cambridge, MA: Harvard University Press.
- Waddington, D. (2004) Participant Observation. In: Essential Guide to Qualitative Methods in Organizational Research.
- Waite, S. (2007) ‘Memories are made of this’: some reflections on outdoor learning and recall. Education 3-13. Vol.35 (4), pp.333–347.
- Waller, T. (2006) ‘Don’t Come Too Close To My Octopus Tree’: Recording and Evaluating Young Children’s Perspectives on Outdoor Learning. Children, Youth and Environments. Vol.16 (2), pp.75–104.
- Walter, M. (2009) Participatory action research. Social research methods. Vol.2, pp.1–8.
- Wan, A. and Zulkiflee, A. S. (2012) A Pilot Study: The Impact of Outdoor Play Spaces on Kindergarten Children. Procedia - Social and Behavioral Sciences. Vol.38, pp.275–283.
- Ward-Thompson, C. (1995) School playground design: a projective approach with pupils and staff. Landscape Research. Vol.20 (3), pp.124–140.
- Ward Thompson, C. (1995) School playground design: a projective approach with pupils and staff. Landscape Research. Vol.20 (3).
- Ward Thompson, C. (2013) Activity, exercise and the planning and design of outdoor spaces. Journal of Environmental Psychology. Vol.34, p.79.
- Ward Thompson, C. and Aspinall, P. A. (2011) Natural Environments and their Impact on Activity, Health, and Quality of Life. Applied Psychology: Health & Well-Being. Vol.3 (3), pp.230–260.
- Waters, J. and Maynard, T. (2010) What’s so interesting outside? A study of child- initiated interaction with teachers in the natural outdoor environment. European Early Childhood Education Research Journal. Vol.18 (4), pp.473–483.
- Weinstein, C. S. and Pinciotti, P. (1988) Changing a schoolyard: intentions, design decisions, and behavioral outcomes. Environment and Behavior. Vol.20 (3), pp.345–371.
- Wells, N. M., Myers, B. M. and Henderson, C. R. (2014) School gardens and physical activity: A randomized controlled trial of low-income elementary schools. Preventive medicine. Vol.69, pp.S27–S33.
- Wells, N. M., Myers, B. M., Todd, L. E., Barale, K., Gaolach, B., Ferenz, G., Aitken, M., Henderson, C. R., Tse, C., Pattison, K. O., Taylor, C., Connerly, L., Carson, J. B., Gensemer, A. Z., Franz, N. K. and Falk, E. (2015) The Effects of School Gardens on Children’s Science Knowledge: A randomized controlled trial of low-income elementary schools. International Journal of Science Education. [Online] Vol.37 (17), pp.2858–2878. Available: <http://dx.doi.org/10.1080/09500693.2015.1112048>.
- Westendorp, M., Hartman, E., Houwen, S., Smith, J. and Visscher, C. (2011) The relationship between gross motor skills and academic achievement in children with learning disabilities. Research in Developmental Disabilities. Vol.32 (6), pp.2773–2779.
- White, M., Smith, A., Humphryes, K., Pahl, S., Snelling, D. and Depledge, M. (2010) Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes. Journal of Environmental Psychology. Vol.30 (4), pp.482–493.
- White, R. W. (1959) Motivation reconsidered: the concept of competence. Psychological Review. Vol.66, pp.297–333.
- Wigfield, A. (1994) Expectancy-value theory of achievement motivation: A developmental perspective. Educational Psychology Review. Vol.6 (1), pp.49–78.
- Wigfield, A., Battle, A., Keller, L. B. and Eccles, J. S. (2002) Sex differences in motivation, self-concept, career aspiration, and career choice: Implications for cognitive development. Biology, society, and behavior: The development of sex differences in cognition. pp.93–124.
- Willenberg, L. J., Ashbolt, R., Holland, D., Gibbs, L., MacDougall, C., Garrard, J., Green, J. B. and Waters, E. (2010) Increasing school playground physical activity: a mixed methods study combining environmental measures and children’s perspectives. Journal of science and medicine in sport / Sports Medicine Australia. [Online] Vol.13 (2), pp.210–6. Available: <http://www.sciencedirect.com/science/article/pii/S1440244009000930> [Accessed 7 Mar 2016].
- Willett, R. (2015) Everyday game design on a school playground: children as bricoleurs. International Journal of Play. Vol.4 (1), pp.32–44.
- Williams, D. R. and Dixon, P. S. (2013) Impact of Garden-Based Learning on Academic Outcomes in

- Schools: Synthesis of Research Between 1990 and 2010. Review of Educational Research. Vol.83 (2), pp.211–235.
- Withagen, R., de Poel, H. J., Araújo, D. and Pepping, G.-J. (2012) Affordances can invite behavior: Reconsidering the relationship between affordances and agency. New Ideas in Psychology. Vol.30 (2), pp.250–258.
- Wohlwill, J. F. and Heft, H. (1987) The physical environment and the development of the child. Handbook of environmental psychology. Vol.1, pp.281–328.
- Wood, D. (1998) How children think and learn : the social contexts of cognitive development / David Wood. Understanding children’s worlds. Oxford : Blackwell, 1998. Second edition.
- Woodgate, R. L. and Skarlato, O. (2015) ‘It is about being outside’: Canadian youth’s perspectives of good health and the environment. Health & place. Vol.31, pp.100–110.
- Woodworth, R. S. (1958) Dynamics of behavior.
- Wu, C.-D., McNeely, E., Cedeño-Laurent, J. G., Pan, W.-C., Adamkiewicz, G., Dominici, F., Lung, S.-C. C., Su, H.-J. and Spengler, J. D. (2014) Linking Student Performance in Massachusetts Elementary Schools with the ‘Greenness’ of School Surroundings Using Remote Sensing. PLoS ONE.
- Wu, X., Anderson, R. C., Nguyen-Jahiel, K. and Miller, B. (2013) Enhancing motivation and engagement through collaborative discussion. Journal of educational psychology. Vol.105 (3), pp.622–632.
- Yin, R. K. (2009) Case study research: Design and methods. Fourth. Sage publications.
- Zamani, Z. (2013) Affordance of Cognitive Play by Natural and Manufactured Elements and Settings in Preschool Outdoor Learning Environments.
- Zeisel, J. (1984) Inquiry by design : tools for environment-behaviour research. Cambridge University Press.

Appendices

Appendix 1: Research Schedule

Appendix 2A: Questionnaire with themes

Appendix 2B: Questionnaire in Bangla

Appendix 3: Images used during focus groups

Appendix 4A: Outline for semi-structured Interview with teachers

Appendix 4B: Outline for semi-structured Interview with teachers: Bangla

Appendix 5A: Presentation for Sponsors

Appendix 5B: Ethics Approval

Appendix 5C: Permission form Department of Primary Education

Appendix 5D: Letter to the parents asking for their consent

Appendix 6A: Coding for Behaviour Maps

Appendix 6B: Legends of the behaviour maps in the school ground

Appendix 6C: Rules of folk games played in the school ground and the neighbourhood

Appendix 7A: Outline for focus group discussion with children

Appendix 7B: Outline for Pre-Intervention Focus groups discussion with children: Bangla

Appendix 7C: Outline for Pre-Intervention Focus groups discussion with teachers

Appendix 7D: Outline for Pre-Intervention Focus groups discussion with teachers: Bangla

Appendix 7E: Outline for Post-Intervention Focus groups discussion with children: English

Appendix 7F: Outline for Post-Intervention Focus groups discussion with children: Bangla

Appendix 8A: Analysis of data from exam scores and questionnaire survey

Appendix 8B: Analysis of the data from participant observation and behaviour mapping

Appendix 9A: Behaviour mapping in the school ground before intervention

Appendix 9B: Behaviour mapping in the school ground after intervention

Appendix 9C: Behaviour mapping in the school ground after intervention during formal learning

Appendix 10A: Matrix of the Pre-intervention focus groups with children

Appendix 10B: Matrix of the post-intervention focus groups with children

Appendix 10C: Matrix of the interview with teachers

Appendix 11A: Layout of the school ground - brainstorming with teachers

Appendix 11B: Model making workshop with children and teachers

Appendix 12: Involvement of the community

Appendix 13: Development of the school ground

Appendix 14: Children's active participation in the construction

Appendix 15: Image in the post card

Appendix 16: Workshop on the use of school environment for children's learning

Appendix 17A: Results of the exam Scores

Appendix 17B: Results of the questionnaire survey — Motivation

Appendix 17C: Results of the questionnaire survey — exploration of the environment

Appendix 17D: Results of the questionnaire survey — peer relation

Appendix 18A: Percentage of different activities in the school ground before and after the intervention

Appendix 18B: Children's favourite places in the neighbourhood

Appendix 18C: Children's preferences of settings

Appendix 19: Children's preference for design, use and their favourite places

Appendix 20A: Display of the 'Place Design Award 2016'

Appendix 20B: Publications