

Samarawickrama, Sumanthri, et al (eds), 2018, "Sustainability for people - envisaging multi disciplinary solution": *Proceedings of the 11th International Conference of Faculty of Architecture Research Unit (FARU), University of Moratuwa, Sri Lanka, December 08, 2018* Galle pp. 377–386. ©

IMPACT OF OUTDOOR LEARNING LANDSCAPE ON PSYCHOMOTOR SKILL OF PRIMARY SCHOOL CHILDREN

Cases from Colombo, Sri Lanka

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Abstract

Integration of landscape design elements in school environments to develop learning and skills of children is a research area of increasing interest. Development of psychomotor skills is established as vital in the overall growth of a child's brain, leading to a well-balanced adulthood. In view of this, the current study looks in to the impacts of incorporating landscape elements in outdoor learning spaces on psychomotor development of primary school students in the local context. The investigation adapted a mixed method consisting both qualitative and quantitative approaches. Critical case-study approach was used to select the schools where incorporation of landscaping elements in outdoor teaching-learning environments is critically low. Data was collected from grade 3 students of three primary boy's schools (n=10 per each school, age: 7-10) located in Colombo. Layout maps, behavioral maps and a photographic survey were used to study the factors of outdoor learning spaces while a set of pre-determined activities of movement assessment battery for children (Movement ABC assessment) was adopted to assess the level of psychomotor skills namely speed, precision, co-ordination, strength, endurance, agility and grace. The research findings affirmed that the presence of landscape elements in outdoor learning environments have significant impacts on the psychomotor skill development of primary school students. Higher the landscape elements established within school premises (Case 1-100%, Case 2- 75%, Case 3- 38%), scores higher in psychomotor scaling (Case 1- 69%, Case 2- 55%, Case 3- 51% respectively). This research recommends to incorporate the concept of learning landscape in order to accelerate the development of psychomotor skills among school children. The study suggests re-thinking of the approaches in designing contemporary landscapes associated with learning spaces in order to uplift the quality of outdoor learning to make well balanced scholars through the education system of Sri Lanka.

Keywords: *Learning Landscapes, Primary School Children, Psychomotor Skills, MABC Test*

1. Introduction

1.1. RESEARCH BACKGROUND

An effective designer uses his professional ability creatively and meaningfully to produce designs conducive for the growth and well-being of respective users. When designing for children, utmost care should be taken by the designer to assist the development of a child educationally, socially and psychologically throughout the childhood ensuring fully-fledged and well balanced adulthood. The environment in which a child is being brought up is found to have direct influence on his/her development and later outcomes in life. Children usually spend half of their day at school where they get a wide array of learning experiences that mould their future. As established through literature, the school environment should be designed in such a way that the development of a child's cognitive, affective and psychomotor domains (Bloom, 1956) are catered to.

1.2. NEED OF THE RESEARCH

Studies on nature have proven its benefits on childhood mentality (Gibson, 1979) and skill development. Due to rapid urbanization the school environment has become denser with less presence of nature decreasing opportunity for outdoor learning. Incorporating the notion of 'Biophilia'; the human's intrinsic need to affiliate with nature (Wilson 1984), the playgrounds and outdoor spaces of elementary schools in international context are now being renovated into innovative play and learning

spaces, identified as 'learning landscapes'. With the introduction of dynamic landscape designs, equipment and a range of activities, these designs help students learn through play. However, the notion of learning landscape has been rarely incorporated in to outdoor learning environment in Sri Lankan context.

1.3. RESEARCH PROBLEM

In view of this, the current investigation probes in to the importance of incorporating learning landscape design elements to positively affect a child's psychomotor skill development being the least studied domain of bloom's taxonomy (Micklich, 2011) with reference to local context.

1.4. OBJECTIVES

The study questions the factors in outdoor learning landscapes which affect the psychomotor development in primary school children. It is attempted initially to identify the established parameters which affect psychomotor skill development of children in the learning process. As the principal objective, the study focuses on identifying the landscape elements which has a conducive effect on psychomotor skill development in outdoor learning landscape environments.

1.5. SCOPE AND LIMITATIONS

This investigation was limited to the study of outdoor learning process in three selected boys' schools of Colombo District. The research was executed only during the school hours and limited to assess selected psychomotor skills and child's relationship with the environment. The sample was limited to 10 male primary school children from each class aged between 7-10 years. Sample selection was done considering equal physical attributes, socioeconomic and family background of primary school children in order to avoid other contributing factors which can have an impact on psychomotor skill development. The study was focused only on outdoor landscape elements and their impacts on psychomotor skill development of primary school children.

2. Literature review

2.1. PRIMARY SCHOOL CHILD

The age from 6 - 11 is the critical stage of a child's development where they become more appreciative of what's happening in the nearby surrounding. According to Piaget's theory of cognitive development, children at this age group are at the concrete-operational stage in which they understand through logical thinking and categories (Siegler et al., 2012). Children in middle childhood are characterized by physical, cognitive and psychosocial domains (Eccles, 1999).

2.2. PSYCHOMOTOR DEVELOPMENT OF A CHILD

Bloom's (1956) taxonomy identifies three learning domains namely; cognitive, affective and psychomotor. The cognitive domain includes skills associated with remembering, recalling knowledge, thinking, problem solving and creating (Bloom et al., 1956). Affective domain deals with development of emotions and values leading to whole-person learning while the development of psychomotor domain includes acquisition of behavioral skills and executive skills (Micklich, 2011). Psychomotor development is the relationship between cognitive functions and physical movement. The adequate acquisition of fundamental motor skills (FMS) during early childhood has been considered as a crucial step in developing specialized and more complex motor skills later in life". Kokštejn, Musálek and Tufano (2018). In psychomotor learning research, attention is given to the learning of coordinated activity involving the arms, hands, fingers, and feet, while verbal processes are not emphasized. Psychomotor development comes as a sensory-perceptual-motor foundation and is an essential contributor for education and psychomotor re-education processes. As it works directly on the organization of sensation, perceptions and cognitions, it can be focused on previously planned and scheduled adaptive responses (Prado et al., 2016).

2.3. PSYCHOMOTOR ASSESSMENT METHOD

For the evaluation of psychomotor development, there are several batteries and tests, namely; the Motor Development Scale (MDS) which assesses psychomotor areas according to chronological age (CA) of the child and movement assessment battery for children (MABC). Some studies assessed psychomotor development in different clinical and social situations such as school deficiency, learning

difficulties, physical activeness, gender, age, socioeconomic status, virtual reality and obesity (Prado et al., 2016).

2.3.1 Movement assessment battery for children- MABC

The movement assessment battery for children (MABC) (Henderson, Sugden, & Barnett, 2007) is a tool highly recommended for testing the psychomotor skills of children. The M-ABC is a product oriented, norm referenced test designed to identify children aged 4–12 years with motor difficulties, clinical exploration, intervention planning, program evaluation and research (Henderson & Sugden, 1992). The M-ABC Test consists of eight items grouped in three sections namely, manual dexterity, ball skills and balance. Item content is differentiated according to the examinee's age where older the child, the more difficult the item will be. Accordingly, four types of tasks are formed corresponding to the four age groups, which the test is designed for: age group 1 (4–6 years), age group 2 (7–8 years), age group 3 (9–10 years), and age group 4 (11–12 years). The test items for age group 7-10 considered for the current investigation are presented in Table 1. According to the test manual, each child is individually tested and the testing duration is 20–40 minutes (Henderson & Sugden, 1992).

Table 1: Items of the Movement ABC test for 7-10 age group.

Tests within the particular motor components
Fine motor coordination (manual dexterity)
Placing pegs (time – seconds; averaged over hands)
Threading lace (time – seconds)
Drawing trail (number of errors)
Gross motor coordination (aiming & catching)
Catching with two hands (number of catches)
Throwing beanbag onto mat (number of hits)
Balance (static & dynamic)
One-board balance (time – seconds; averaged over legs)
Walking heel-to-toe forwards (number of steps)
Hopping on mats (number of jumps)

2.4. CHILDREN AND LEARNING LANDSCAPE

The use of landscape as a term in science is relatively new. Landscape today, refers to not only a phenomenon described and analysed by scientific methods, but also a subjective experience which has perspective, aesthetical, artistic and existential meaning (Memlük, 2012). Landscape design is the art and science of organizing and enriching outdoor spaces through the placement of plants and structures in agreeable and useful relationships with the natural environment (Zanden and Rodie, 2008 cited in Nebraska Master Gardener Handbook, 1994).

It is established that learning landscape directly or indirectly assists in the learning process of a child, providing space for leisure, interacting with landscape components, as well as outdoor lessons and revisions which in turn produces a balanced personality. Learning landscape is being applied in various countries in order to gain a positive outcome of pupils. Studies show that landscape is open-ended and intrinsic. As a matter of fact, it can speak to the physical, emotional, social, and intellectual growth of a developing child (Herrington, 1997, p. 151). There are findings that this has been done on collaboration with a child's psychology and landscape Architecture to construct which self-skills. A study done by Herath and Hettiarachchi (2018) affirmed that learning landscape has a direct impact on the growth and development of cognitive skills of pre-school children. A natural learning environment supports each child's construction of his own knowledge of the world and his place in it (Stone, 1995, p. 104). A child's primary education directly influences the future of the child. Thus, during such a scenario, the location and the learning environment become a great influence. They give much attention on physical, social, cognitive and emotional growth of the child. Tones (1997) has arrived at four assumptions regarding the learning landscape.

1. Children learn through play and play is necessary for the child's development and growth.
2. Play is not limited to younger children, it is an important concept in adults' life- cycle.

3. To play outside is an important need because it offers opportunities not found anywhere else.
4. Play environments are educational areas

Campbell (2013) has identified six key components of learning landscape which facilitate a wide range of actions and reactions from children namely; active space, gathering space, experimental space, individual spaces and ecological space. Outdoor class rooms and gathering areas have found to improve children's recognition, problem solving, cooperation, communication and socialization.

3. Theoretical Framework

Theoretical framework forms the basis for the research design and analysis to assess the impact of landscape elements on psychomotor skill development in primary school children. Theoretical framework was derived from the established theories and the findings from scholarly research done on the connotation between outdoor learning landscape and skill development of primary children.

Table 2: Five key components of learning landscape - Campbell (2013)

Theme spaces	Associated skill development	Design components/areas
1. Individual	Self-discipline Creativity	Natural elements
2. Experimental	Questioning, Curiosity Observation, Empathy Creativity, Expression	Water wall, sound wall, exploration areas, rainwater harvesting system, habitat gardens,
3. Ecological	Nature, experience Perceptual Recognition Problem solving	Edible places, plant information box, thematic garden seasonal garden, wooded areas,
4. Active	Fine and gross motor Fitness Reduce stresses Balance Self-confidence	Dramatic Balancing and climbing logs, climbing wall, different topographical surfaces areas, running paths, adventure trail, maps and paths, cycling road, activity wall
5. Gathering	Cooperation and sharing Communication skills Socialization Problem Solving Sense of self experience	Dramatic play area, activity areas, mounds and hills, outdoor classroom, planting areas, nature trips camp grounds

The research being run totally based on local context, caused limitations in the landscape elements present, outdoor learning activities provided, time frame in hand and the research scope. For instance, some of the activities suggested by Campbell (2013) was found as unrealistic in the local context, thus neglected. It was attempted to extract suggested theme spaces which can be adapted to the local situation by examining the landscape elements present in the selected cases. Based on the Blooms taxonomy which defines the psychomotor skills to be developed, it was attempted to test selected motor skills which can be locally assessed namely; strength, endurance, coordination, precision, dexterity and grace. In deriving the theoretical framework, psychomotor skills related with the child activities were extracted from the MABC model.

Below table 3 shows the relationship with the selected activities from MABC, psychomotor skills derived from the blooms taxonomy and the landscape elements related with the motor skills which were filtered from the research done by chambell (2013).

Table 3 Derived theoretical framework from the literature

Activities - MABC	Measurement	Landscape element
Activity-1 Catching ball	Speed Precision Coordination	Clear distance, Topographical changes, Variety of materials, Scale
Activity-2 Throwing bean bag on to mat	Precision Coordination	Soft and hard landscape,

Activity-3 On board balance	Strength Endurance	Climbing wall, Topographical changes, Dramatic garden
Activity-4 Walking heel to toe forward	Speed Agility Grace	Clear distance, Topographical changes, Presence of a variety of materials, Scale, Tree log, Rock boulders

4. Research Methodology and Data Collection

Adopting a critical case-study approach, three local cases were selected where incorporation of landscape elements in outdoor teaching-learning environment is critically low. The case studies selected were from Colombo, representing a tight urban context characterized by relatively poor outdoor spaces, quality of landscape and similarity in cultural and educational backgrounds of the students. Primary children selected for the research were in ages 7-10 and with equal physical and socioeconomic attributes (10 boys from each school) namely; height, weight, health conditions, economic and family background. Psychomotor skills of primary children were assessed based on movement assessment battery for children (MABC) incorporating tests designed for 7-10 age group (Henderson & Sugden, 1992). Since research was based on landscape related activities, the tests adopted were limited to landscape related situations. The students were instructed to perform the given tasks as elaborated below and their performance was assessed through MABC.

Activity one - Catching ball: 5 attempts were given for each student to throw a ball towards a wall with the distance of 1.8m and their ability to catch the ball with or without any bounce was observed.

Activity two - Throwing bean bag on mat: Each child was given 10 attempts to throw a bean bag on a mat with the distance of 1.8m and their ability to aim at the target was observed.

Activity three - One Board Balance: Children were given 30 seconds to stand on one leg. Both legs were observed to check their psychomotor skills.

Activity four- Walking heel to toe forward: Each child was asked to walk on a line and their walking speed and associated psychomotor skills were tested.



Fig1: Activities were executed in order to discuss different psychomotor skills

4.1. CASE STUDY ONE

Children of this school are normally taken outside the classroom for co-curricular activities. As they were allowed to play with soil, plants and water, they automatically have built up close contacts with nature. They were allowed to perform a range of activities within and away from the classroom. The school comprises with spaces which are surrounded by trees and valleys which provide spaces for them to play. A large playground is located within the play area. Moreover, a colourful play area could be observed nearby. Accordingly, the children are given opportunity to play alone and in groups. They have made the surrounding a child friendly environment.



Figure 2: layout map with landscape elements-case study 1

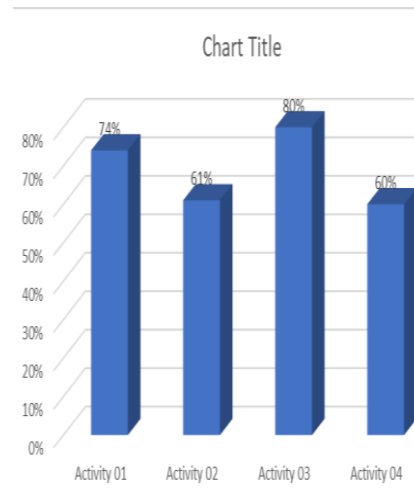


Figure 3: success rate of each activity-case study 1

As shown in layout plan (figure 2) buildings and landscape elements are well planned and organized. Different types of landscape elements such as sand, woods, seating and gathering places, walls with paintings, dramatic play area, habitat gardens, different topographical surfaces, running paths and large active play areas can be observed in outdoor environment. Compared to other case studies the school has well organized large outdoor spaces for primary children and the children are given opportunity to build up a strong connection with the outdoor environment. Except gathering and seating areas, all the outdoor play areas are open to the clear sky while the shading is provided when and where necessary. Outdoor learning environment is visually and physically well linked with the indoor learning environment without any separation. Use of both soft and hard landscaping was observed in case study one.

According to the data (figure 3) students of case study one show the highest success rate percentage for the activity three - one board balance (80%). This finding signifies that the psychomotor skills such as strength and endurance of selected group of students is higher compared to other skills. They were found to have the lowest average for the fourth activity- walking heel to toe forward (60%) indicating low levels in the skill development related to speed, coordination and agility.

4.2. CASE STUDY TWO

Student's connection with the outdoor landscape elements were found as relatively less in case two. School buildings are scattered all over the land. Students are allowed to perform activities within and away from the classroom. This school comprises with spaces which are surrounded by trees, and valleys which provide spaces for them to play. A play area has been formed in order for the students to run around. However the provided area is comparatively small. Some shady trees can be found around this area providing opportunity for the children to play alone and in groups. They have made the surrounding a child friendly environment to some extent.

As shown in layout plan (figure 4) buildings and landscape elements are scattered in land. Less variation of landscape elements in outdoor environment can be observed compared to case -1. Natural elements such as woods, seating and gathering places, dramatic play areas, habitat gardens, different topographical surfaces, running paths, edible spaces and active play areas were observed. Compared to case study- 1, the scale of the outdoor spaces for the primary children are less. But with this limited and scattered spaces, children have built up connection with outdoor environment to some extent. Most of the outdoor play areas are shaded, having a rich vegetation layer. Some Outdoor spaces are found to be separated from the indoor learning environment; e.g. dramatic play area. The outdoor environment has utilized hard landscaping mostly while soft landscape has been incorporated only to some extent.



Figure 4: layout map with landscape elements-case study 2

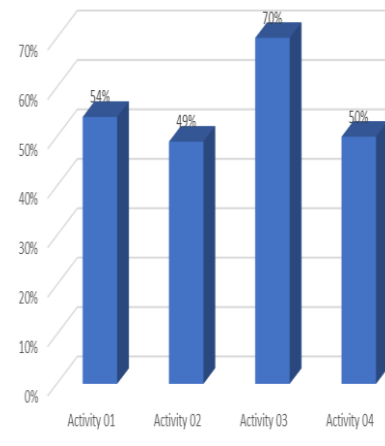


Figure 5: success rate of each activity-case study 2

In case study two, students demonstrated a highest success rate percentage for activity three - one board balance (70%) signifying high development levels in strength and endurance over other skills. Lowest average was observed for the second activity - throwing bean bag (49%) indicating less development in coordination and precision.

4.3. CASE STUDY THREE

Very less variety of landscape elements and lack of organized outdoor spaces were observed in case study three. Accordingly, the student's connection with the outdoor landscape elements is less. Though the school has rich open spaces, those are unorganized. School buildings are scattered all over the land. Within this circumstances, the students have not been able to build up strong connections with the nature to a greater extent. The teachers were found to focus mostly on indoor learning rather than outdoor activities. This school comprises of spaces which are surrounded by trees, and valleys which provide small spaces for the children to play. A play area and a running pathway has been formed for the students to run around in a clear area which is relatively large. Some shady trees can be found around this area where the children are given the opportunity to play alone and in groups to some extent. The school has mostly utilized hard landscaping for outdoor.

Landscape elements incorporated are not well planned and organized. On the other hand, the range of landscape elements incorporated in the outdoor environment is less. Only seating and gathering places, running paths and active play areas were observed in Case - 3. Though case- 3 has large outdoor spaces compared to other two case studies, they are not organized for the children's activities and their exposure to the outdoor environment is poor. Except gathering and seating areas outdoor play areas are open to the clear sky. A small area has been provided for the primary children and for their outdoor activities. Compared to the other schools, this school has the longest running pathway. Outdoor learning environment is visually and physically linked with the indoor learning environment but encouragement was not there from the landscape design.



Figure 6: layout map with landscape elements-case

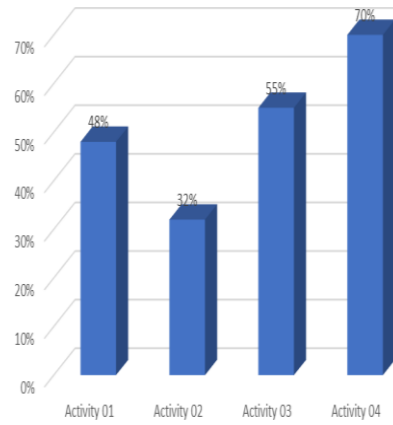


Figure 7: success rate of each activity-case study 3

Case-3 showed (figure 7) the highest success rate percentage for the fourth activity- walking heel to toe forward (70%) indicating high levels of children’s coordination, speed and agility compared to other psychomotor skills. They got lowest average for the second activity (32%) which was throwing the bean bag. It was observed that coordination and precision skills showed a poor development for this sample.

5. Analysis and Results

Table 4: Available Landscape element in case studies

Case study	Elements							
	E1	E2	E3	E4	E5	E6	E7	E8
01	Available	Available	Available	Available	Available	Available	Available	Available
02	Available	Available	Available	Available	Not available	Available	Available	Not available
03	Not available	Available	Available	Available	Not available	Not available	Not available	Not available

Available Not available

List of landscape elements

E 01	Dramatic play area
E 02	Active space
E 03	Gathering/seating space
E 04	Running path
E 05	Natural elements
E 06	Different topographical surfaces
E 07	habitat garden
E 08	Edible spaces

Table 5: Average scores for all activities and availability of landscape elements.

Case study	Landscape Elements								AVG. score for all activities	Availability of landscape elements tested
	E 1	E 2	E 3	E 4	E 5	E 6	E 7	E 8		
Case study 01	Available	Available	Available	Available	Available	Available	Available	Available	69%	100%
Case study 02	Available	Available	Available	Available	Not available	Available	Available	Not available	55%	75%
Case study 03	Not available	Available	Available	Available	Not available	Not available	Not available	Not available	51%	38%

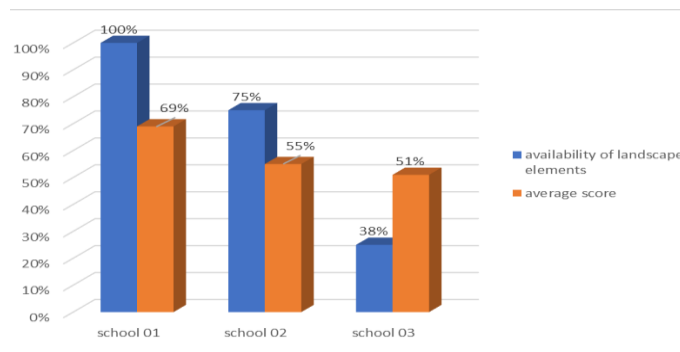


Figure 5: Final average scores and the availability of landscape elements

The research findings have been summarized in to final average scores for MABC tests conducted in comparison with the availability of landscape elements represented in percentages (figure 5). Case study one represented the highest variety in terms of the landscape elements and the extent of outdoor learning environment provided (100%). Validating the line of thinking, the results of case-1 demonstrated the overall highest average scores for three of the MABC tests. Similarly, case - 2 having the 2nd highest availability of outdoor landscape elements (75%) displayed 2nd highest MABC average score. Average test score was found to be the lowest in Case - 3 which was reported to have the least availability of landscape elements (38%). Average scores for all the MABC tests per each case has been further analyzed as follows (table 6).

Table 6: Average scores of MABC tests in case studies

	Activity 1	Activity 2	Activity 3	Activity 4	Average
Case study 1	74%	61%	80%	60%	69%
Case study 2	54%	49%	70%	50%	55%
Case study 3	48%	32%	55%	70%	51%

As per the findings (table 6) case study 01 demonstrates the highest average score for every activity, except activity 4; walking heel to toe forward. Case study 03 obtained the highest score for activity 4 supposedly due to the presence of clear long running pathways rather than the other two cases. Accordingly, it was revealed that clear and large outdoor spaces are supportive in developing speed, agility and grace. Re-affirming Campbell’s (2013) thinking, case studies having quality landscape elements have scored well in MABC tests. Accordingly, the study revealed a clear relationship between the level of exposure to landscape elements in the outdoor learning environment and the level of psychomotor skill development of primary school children

6. Conclusions and recommendations

As depicted by the findings, it can be clearly identified that case -1 has surpassed the other two cases having a variety of landscape elements within the premises leading to the highest average for psychomotor skills of children. The relationship was found to be slimmer with reference to case -2 and case -3 which demonstrated a decrease in the development of psychomotor skills parallel with the lessening of the availability of landscape elements in terms of their availability, variety and usability in outdoor learning environment. Accordingly, the findings of the study establishes that there is an impact of outdoor learning spaces on children’s psychomotor skill development process.

It was further aimed on searching factors/elements of learning landscape having a contribution on primary school student’s psychomotor skills development focusing on the six key components identified by Campbell (2013) as a basis. The study confirmed five key spaces of learning landscape as conducive for primary learning namely; active spaces, gathering spaces, individual spaces, ecological

spaces and experimental spaces. The research affirmed that above five spaces help to develop the psychomotor skills such as speed, precision, coordination, strength, endurance, agility and grace. Concern about outdoor learning experiences in the education system is relatively low in local context compared to other parts of the world. As per the guidelines set by Chambells (2013), even an outdoor learning environment located in a tight urban context can be improved using landscape interventions to nurture child development. It is suggested to introduce natural elements like rocks, sand, plants to improve children's creativity and self-discipline. The method of developing psychomotor skills of primary school children through learning landscapes is rarely used in the Sri Lankan context. Thus, this research provides insights for Architects, Landscape Architects and designers to take the above mentioned factors into keen consideration when creating learning landscape spaces conducive for skill development of children.

With the limited time and resources this particular research was based on a small sample (n=10) of male children of primary schools who are in 7-10 age group. By adopting MABC, this research can be further developed to test the other age bands supposedly, 4-6, 7-8, 9-10, 11-12 with large samples. It is suggestive to conduct the study with female samples to test any difference in the levels of skill development. The study recommends to incorporate larger capacity in landscaped areas, diversity in landscape elements and its organization aligned with the curriculum and outcomes of primary learning as a strategy in developing psychomotor skills in Preschool children within local context.

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