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Developing a Conceptual Model for the Causal Effects of Outdoor Play in Preschools Using PLS-SEM

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Abstract: This study attempts to establish the causal effects of outdoor play through a conceptual model consisting of six latent constructs. Seventy Penang preschool operators took part in a questionnaire survey conducted from June to July 2021. All of the 70 respondents agreed that outdoor play is important for children's development even though only 62 respondents implemented outdoor play yards in their preschools. Raw data from these 62 respondents were used to develop the conceptual model by PLS-SEM. Measurement models were assessed by checking the indicator reliability, internal consistency reliability, convergent validity and discriminant validity. The structural model was assessed by checking the SRMR and NFI. The measurement models are found to be acceptable with AVE > 0.50 for all of the constructs and all of the 34 indicators have loadings > 0.50. However, there are 16 indicators with difference between loadings < 0.10, and the structural model does not have a good fit with SRMR > 0.10 and NFI < 0.90. Lack of discriminant validity could be remedied by removing eight indicators with difference between loadings < 0.10. Model fit could be improved with larger sample size since bootstrapping with 1000 iterations yielded SRMR = 0.098 at 95% for the saturated model. Seven significant paths were found among the six constructs in the final conceptual model.

Keywords: childcare; early childhood education; outdoor play; preschool education; PLS-SEM

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1. Introduction

Studies show that early childhood education's major goal is to help children achieve normal physical and mental development while also preparing them for formal education [1,2]. A plethora of evidence suggests that when children interact with others, they learn more than when they do not. Children learn more when they are engaged in a learning task rather than becoming distracted. Furthermore, when learning material is directly tied to their lives or related to something they already know, rather than presented abstractly and out of context, children learn more successfully [3–5]. Children, in particular, derive these learning experiences from their play experiences, which provide them with opportunities to interact with the built environment [6].

Outdoor play, in particular, provides unique learning and development opportunities in early childhood education. Outdoor play also aligns with the United Nations Convention on the Rights of the Child in that it allows children to play, experience nature, and, in the long run, help to alleviate global sustainability concerns. Indoor and outdoor play areas must be regarded as equally valid learning environments in early childhood education. Outdoor play and learning in early childhood education is a multifaceted topic that includes everything from children's well-being and physical skills to risk management and play-space design to immersion in natural outdoor settings and teachers' outdoor pedagogies and dispositions [7].

In a study on the importance of outdoor play at preschool, researchers [8] emphasize that outdoor play should not become overly academic or overly controlled by teachers.

According to the experts, outdoor play areas should be large enough and designed in such a way that children's play can be fully expressed, where they can make a mess, run, jump, and hide, shout, whistle, and explore the natural environment. The quality of an outdoor play yard for preschoolers is determined by a number of elements. Design of the play area, safety concerns, play equipment, accessibility, and adult supervision are just a few of them.

In Malaysia, preschool education is a vital experience for every young child. The Malaysian Ministry of Education (MOE) implemented an early childhood education (ECE) program, also known as National Preschool Curriculum Standard or Kurikulum Standard Prasekolah Kebangsaan (KSPK) to improve the quality of preschool education for children [9]. KSPK is the main standard guideline provided to all preschools in Malaysia with the goal of striking the full development of children in terms of physical, emotional, social, intellectual and spiritual, in addition to providing a safe and good learning environment [10].

In order to achieve the goals mentioned in KSPK curriculum, learning through play (LTP) is the most appropriate approach to be incorporated into children's learning. This is due to the fact that play is an effective strategy for learning as play can be taken in any form to fulfil children's physical, social, emotional, academic and especially cognitive development [11,12]. According to Lim and Azizi Bahauddin [13], this approach is significant for preschool teachers in their lessons since it is a way where children can play and learn at the same time. Children deserve to play as part of their childhood experience to help them to make sense of the world before they grow up [14].

Studies on preschool physical environments to support play have frequently found physical environment is fundamental to the quality of play and learning for children. Instead of viewing the overall environment of preschools, it is also crucial to look into their outdoor spaces. According to Habibe Acar [15] and Mariam Felani Shaari and Sabarinah Sh Ahmad [12], outdoor spaces have often been overlooked in preschool settings. Outdoor spaces are the ideal setting for children to engage in active and creative play. Outdoor environments provide diverse affordances which stimulate children's senses as well as improving their growth and development [16].

The quality of childcare, preschool, kindergarten, and other early childhood education is related to the quality of the physical designed environment [17,18]. The Children's *Physical* Environments Rating Scale (C*P*ERS5) has been devised to assess the quality of the physical environments of childcare, preschool, kindergarten, and other early childhood education facilities, in particular subscale 12 and subscale 13 in Part D (Outdoor Spaces) which evaluate the functional needs and development needs of outdoor activity areas around the building, its play yards, and surrounding conditions, respectively. In addition, the quality of outdoor play spaces is related to children's cognitive, social, and emotional development [19,20]. Shaari et al. [21] concluded that excellent preschool physical environment (PPE) could potentially improve childhood cognitive development. They found that design quality of PPE has significant positive relationship with cognitive school readiness of pre-schoolers, comprises of reading, counting, colour recognition, cognitive as well as problem-solving skills.

Whitebread et al. [22] (p. 4) mentioned in their whitepaper that "while researchers in evolutionary and developmental psychology, anthropology, neuroscience and educational studies have hypothesised about how play might enhance children outcomes, much of this evidence however merely establishes associations rather than firm, causal relationships". Besides, National Preschool Curriculum Standard (NPCS) in Malaysia do not provide adequate strategies for developing physical environment reflective of child-centred pedagogy advocated in NPCS.

This study attempts to establish the causal effects of outdoor play by linking the variables in subscale 12 and subscale 13 of C*P*ERS5 to the outcomes of outdoor play using Partial Least Squares Structural Equation Modeling (PLS-SEM) through a conceptual model.

2. Literature Review

The importance of outdoor play and outdoor play yards to support play for children's well-being, learning and development is reviewed from the context of physical development, cognitive development, social and emotional development and academic learning.

2.1. Importance of Outdoor Play to Children

Outdoor play is increasingly being recognized as a basis for children's development. Outdoor play encourages children to explore the environments around them. It has been observed and revealed by researchers that outdoor play promotes children to communicate, express their feelings, explore and discover the world surrounding them [23].

Outdoor is an environment whereby children have the chance to encounter nature, including experiencing and exploring the natural environment. On top of that, outdoor offers new possibilities for children to explore and supports the multi-sensory experience such as sights, sounds, smells and touch [24]. Wilson [25] stated that a feeling of love, sensitivity and empathy towards nature will unconsciously develop in children when children are constantly exposed to the natural world.

The role of the outdoor environment is significant in early childhood learning. Outdoor environment provides a platform or space that challenges children and allows children to investigate and think, to conduct their favorite activities including meeting new friends [26]. New learning is directly introduced through exploration in outdoor environments together with providing children the ideas of the world surrounding them. Yildirim and Özyılmaz Akamca [27] found that learning in outdoor can contribute to physical, cognitive, language and particularly social emotional development.

In addition, Habibe Acar [15] and Nor Fadzila Aziz and Ismail Said [28] mentioned that children can learn through the observations of natural or artificial elements in outdoor environments by experiencing three modes of learning, namely cognitive, emotional and moral. The natural outdoor environments also motivate cooperative and imaginative play [29] that triggers children's imagination and curiosity.

Children will benefit from developmental experiences through outdoor play which cannot be easily replaced alternatively. Outdoor play is important to children in terms of physical development, cognitive development, social and emotional development and academic learning [11,30].

Outdoor affords children the freedom to carry out activities that they cannot carry out indoors, such as doing vigorous activities, to be messy and also make loud noises. Outdoor play is very good for children's health and growing. Of late, several health issues have been found to afflict Malaysian children, notably obesity, overweight and physical growth [31,32].

Outdoor play is the best solution that can help to address the issues on children's health crises. Based on the findings of Gubbels et al. [33], children are most likely to have a high level of activities when they are taking part in outdoor play, since open space has fewer restraints and greater flexibility on the children's gross motor activities compared to indoor environment. In addition, physical activities such as running, jumping, walking are usually carried out during outdoor plays, increasing the movement of children. More locomotion results in increasing blood flow which benefits brain development as well as the development of fine motor skills [34]. Outdoor play can greatly minimize health problems among children and their physical development, provided outdoor space is adequate or complete with good infrastructure and equipment.

Cognitive development is defined as the process of forming thoughts, including remembering, decision making and problem solving [35]. Outdoor play helps children to develop imagination and memory, which is important for thinking along with developing cognition [35]. Outdoor play leads children to investigate, explore and make sense of their surroundings. Outdoor provides children the experience of rich multi-sensory as well as promotes a great degree of observation, curiosity of the environment surroundings, encouraging cognitive learning [34].

Various types of play behavior connect the performance on cognitive tasks such as language and scholastic accomplishment [36]. Through outdoor play, children have the chance to interact with nature, which may directly promote the development of the ability to recognize and identify the elements of the environments, things, plants, animals and so forth, which is known as naturalistic intelligence [37]. Padulo et al. [38] found that agility is correlated with English, Italian, mathematics, music, and sport marks, whereas jump is correlated with English, mathematics, sport, and technologies marks.

In outdoor environments, children seem to have more freedom to play including expressing themselves [39]. Children are likely to make friends and enjoy of being with others when they are exposed to outdoor play [40]. In fact, social interactions between children during indoor and outdoor play are varied [39]. Through outdoor play, children develop better communication and perspective-taking skills [41]. During outdoor play, boys are more likely to build friendships when they are chasing each other around while for girls, they will be more positive and confident compared to indoor play. Children also have the tendency to learn cooperation and understanding during their play [42]. Besides social development, emotional development happens when children are interacting outdoors in the natural environment. In conclusion, stress is reduced, and children become more attentive, happier, and healthier with greater self-esteem [40].

According to Piaget [43], children develop three major types of knowledge through play, namely physical, logical–mathematical and social. When children play outdoors, they tend to utilize natural things to represent something entirely unique, such as flowers becoming hair pins. This explains the ability in representing the main concepts of reading and writing [30,44]. Furthermore, since children have the opportunity to explore through nature when playing outdoors, children unconsciously form the recognition of the surroundings and the patterns in surroundings.

Recognizing patterns is fundamental for a creative and meaningful learning such as interpreting the meaning of words and form them into a sentence as well as understanding the numeracy in mathematics [45]. It becomes a part of fun learning development. Lastly, outdoor plays provide first hand experiences for children through their contact with nature. This aids in delivering more comprehensive knowledge about plants, animals and other relevant materials rather than simple meaning and learning from the textbooks [30,46].

It was previously reported that the physical environment of the outdoor play in preschool was deemed important to the learning as well as physical and cognitive development of the children. However, the relationship among the different constructs explored in different studies remains to be explored. Thus, the current study aims to investigate the relationship between the constructs of learning and the physical and cognitive development among Malaysian preschool children. Specifically, the study's objective is to establish a conceptual model to link the six constructs, namely functional needs, development needs, physical development, cognitive development, social and emotional development and academic learning, and to explore the causal relationships among the six constructs in the hope to shed more light into understanding a conducive outdoor environment for children's development in the Malaysian preschool context.

2.2. Importance of Outdoor Play Yard Design in Preschool

Although the role of outdoor play is crucial to early childhood learning, the role of outdoor space must not be underestimated when it comes to fostering play in children's learning. Outdoor play spaces are platforms where children have the freedom to explore and develop skills such as motor, cognitive, and social skills; improving academics that all are vital for their education.

The early childhood education (ECE) in Malaysia trends have shifted towards learning beyond classroom walls, which is basically learning which is more exposed to outdoor environments. Outdoor activities including unstructured plays and physical activities have also been highlighted in the KSPK as part of the learning activities to offer children the chance to gain their own meaningful learning experience. According to Nor Fadzila Aziz

and Ismail Said [16], good spaces with the association of natural and complete elements are crucial in promoting diverse plays that encourage more children's abilities and interests. Therefore, simply knowing the importance of outdoor play for children's development is insufficient for preschool teachers to completely integrate play approach in preschools. The spatial quality of outdoor space has to be supportive of children's play as well. LTP approach that supports play is the most challenging to adopt in ECE. The limitation of quality outdoor spaces provided in preschools is also a problem in this approach.

Basic guidelines, as shown in Table 1, were set up by the Malaysia MOE in 2012 to standardize the built environment of preschools in order to facilitate local authorities to assess the applications of preschool establishments [47]. It is clear that the design of play space environments is not emphasized in the guidelines. Preschool operators have the responsibility to refer to universal design (UD) to set up the outdoor space in preschools as stated in the guideline. UD is defined as the design of environments and products that is applicable to all people including disabling without requiring the adaption or specialized design. There are seven principles in UD, namely equitable use, flexibility in use, simple and intuitive, perceptible information, tolerance for error, low physical effort and size and space for approach and use [48].

Table 1. Requirements specified to support the space environment in preschools.

Items	Requirements
Comfort environment	• Children's comfort must be taken into consideration in the arrangement and the design of the building. • The built environment of preschools must be spacious enough to encourage children to play (move freely).
Minimum space requirement for children	• Internal space area: At least 15 square feet for each child (1.4 m^2). • External space area: At least total 538 square feet (50 m^2).
Universal Design (UD)	• UD is required to refer before planning the preschools environments. • There is a must to incorporate UD and the appropriate indoors building elements that are suitable for children. • Designing appropriate means of escape according to children's abilities is necessary, especially fire escape staircase and the position of staircase handrails. • Provide a play area either indoors or outdoors for children in which the play area must have sufficient daylighting.

Quality outdoor play yards are necessary to support the quality of children's play experience in preschools. According to Álvarez-Bueno et al. [49], schools provide important settings for improving children physical and psychological-cognitive health, and offering opportunities for physical activities. Numerous international assessment tools are available to evaluate the quality of outdoor play yards, for example, the Children's *Physical* Environments Rating Scale, Fifth Edition (C*P*ERS5), Early Childhood Environment Rating Scale, Revised (ECERS-R) and Preschool Outdoor Environment Measurement Scale (POEMS) [17,19,50,51]. C*P*ERS5 is a better assessment tool for evaluating the outdoor play yards quality in preschool compared to ECERS-R and POEMS due to its high reliability and validity since the scale items are more accurate and stable.

3. Methodology

Due to travelling restrictions during COVID-19 pandemic, only private preschool operators in Penang were targeted as the respondents to provide the required information in this study. A total of 110 private preschools in Penang were trawled from the Internet to obtain their emails and mobile telephone numbers. For convenience of data collection and retrieval, the survey questionnaires created using Google Forms were distributed to these private preschool operators through either emails or mobile telephone numbers by WhatsApp Messenger. Distribution and collection of questionnaires were around one-month duration between June–July 2021.

The respondents were given ample time to answer the questions in the questionnaires. However, only 70 respondents participated in the questionnaire survey. As in this study, this method entails sending questionnaires in the form of Google Forms to a large sample of preschool operators spread across Penang Island. Google Form questionnaires are typically delivered and received 'cold' without any prior contact between the researcher and the respondent. Depending on the content and length of the questionnaire, the response rate for this method is typically low. During the current study's lockdown due to the COVID-19 pandemic, no preschool was allowed to open. Despite follow-ups with targeted respondents via emails and WhatsApp messenger, many (36%) were still hesitant to participate in the survey.

3.1. Questionnaire Design

The questionnaire comprises of three main sections with closed-ended questions as explained below.

3.1.1. Demographic Information

This section is designed to collect the background information such as gender, age and the total number of years of respondents operating preschools. Additional information such as the number of preschools operated by the respondents is necessary to ensure the data is collected from reliable experienced professionals.

3.1.2. Importance of Outdoor Play and Play Yards for Early Childhood Learning

This section is separated into three parts. Part 1 focus on the importance and implementation of outdoor play for children, part 2 on the importance and implementation of outdoor play spaces/yards, and part 3 on the importance of outdoor play to children measured in terms of four constructs, namely health and physical development, cognitive development, social and emotional development, and academic learning. From literature review, four variables were identified to measure health and physical development, five variables to measure cognitive development, seven variables to measure social and emotional development, and four variables to measure academic learning. In part 3, the respondents were first asked to rate the four constructs by using a checklist. They were then requested to indicate the importance of outdoor play to children for each construct measured on a 5-point Likert scale from '1 = strongly disagree', '2 = disagree', '3 = neutral', '4 = agree' to '5 = strongly agree' based on their opinions and experiences.

3.1.3. Outdoor Play Yards Design in Preschools

This section contains 14 questions adopted from C*P*ERS5 to investigate the quality of outdoor play yards in preschools. Specifically, this section is mainly based on the six questions in subscale 12 and the eight questions in subscale 13 of C*P*ERS5, namely Play Yards: Functional Needs and Play Yards: Developmental Needs, respectively. The respondents were requested to rate the quality of outdoor play yards based in their preschools on a 5-point rating scale from '0 = not met', '1 = slightly met', '2 = moderately met', '3 = met' to '4 = fully met'. Those respondents who do not have outdoor play yards in their preschools do not have to participate in this section.

4. Results

4.1. Descriptive Analysis

Table 2 gives the demographic information of the respondents who operated preschools in Penang and participated in the study. Out of the 70 completed questionnaires received, 57 of the respondents are female (81.4%) and 13 are male. Of the 70 respondents, 65 of them (92.86%) are above 30 years old, and only 5 of them are between 21 to 30 years old. In terms of total number of years operating preschools, 55 of them (78.6%) have operated preschools for more than 6 years and above. When they were asked to indicate the number of preschools operated by them, 44 of them (62.9%) mentioned they owned two or

more preschools. It is understandable that in order to set up and operate a preschool in Malaysia, all preschool operators must have preschool education credentials recognized by the Malaysian Ministry of Education.

Table 2. Demographic information of respondents (n = 70).

Variable	Response Category	Number	Percentage (%)	Total Percentage (%)
Gender	Male	13	18.6	100
	Female	57	81.4	
Age	21–30	5	7.14	100
	31–40	10	14.29	
	41–50	29	41.43	
	51–60	26	37.14	
	>60 years old	0	0.00	
Years of experience operating preschools	5 years or less	15	21.4	100
	6–10 years	9	12.9	
	11–15 years	20	28.6	
	16–20 years	15	21.4	
	>20 years	11	15.7	
Number of preschools operated by respondents	1	26	37.1	100
	2	24	34.3	
	3	11	15.7	
	4 and above	9	12.9	

4.2. Importance of Outdoor Play and Outdoor Play Yards

Table 3 presents the results on the importance and implementation of outdoor play and outdoor play yards to children's learning and development. Of the 70 respondents who completed and submitted the questionnaires in Google Forms, all of them replied outdoor play is important to children's development and suitable outdoor play space is essential to support outdoor play experience, even though eight of them (11.4%) indicated they do not implement outdoor play and own an outdoor play yard in their preschools.

Table 3. Outdoor play and outdoor play yard in preschool (n = 70).

Statement	Response Category	Number	Percentage (%)
Is outdoor play important to children's development?	Yes	70	100.0
	No	0	0.0
Does your preschool implement outdoor play for children's learning?	Yes	62	88.6
	No	8	11.4
Is suitable outdoor play space essential to support outdoor play experience?	Yes	70	100.0
	No	0	0.0
Does your preschool own an outdoor play yard for children's learning?	Yes	62	88.6
	No	8	11.4

Four constructs measuring the importance of outdoor play to early childhood learning are operationalized by the variables shown in Table 4, where the raw data from those respondents without outdoor play yards were excluded from analysis. Among the four constructs, social and emotional development was rated the most important with an overall mean score of 4.640, follows by cognitive development with an overall mean score of 4.539, and academic learning with an overall mean score of 4.436. Health and physical development is rated the least important among the four constructs with an overall mean score of 4.420.

Table 5 presents the results based on the responses obtained from 62 respondents who implemented outdoor play yards in their preschools. Based on the responses obtained from 62 preschool operators in Penang, with overall mean scores of 2.333 for functional needs

and 2.218 for development needs, respectively, the outdoor play yards in the preschools operated by them have moderately met the quality requirements specified in C*P*ERS5.

Table 4. Importance of outdoor play to children (*n* = 62).

Construct	Indicator		Mean	Standard Deviation	Overall Mean	Ranking
	Description	Symbol				
Health and physical development	Children are more likely to be active	P2Q4	4.677	0.467	4.420	4
	Reduce obesity among children	P2Q5	4.081	0.809		
	Prevent children from being overweight	P2Q6	4.191	0.800		
	Good for physical growth	P2Q7	4.726	0.447		
Cognitive development	Develop imagination	P2Q8	4.355	0.805	4.539	2
	Have a chance to interact with nature	P2Q9	4.726	0.481		
	Enhance brain memory	P2Q10	4.403	0.750		
	Improve children's senses of sights, sounds, smells and touch	P2Q11	4.484	0.615		
	Promote in recognizing the surroundings such as plants, animals and building structures	P2Q12	4.726	0.481		
Social and emotional development	Have more communication	P2Q13	4.694	0.495	4.640	1
	Children have more freedom to express themselves	P2Q14	4.839	0.409		
	Easy to make friends	P2Q15	4.532	0.615		
	Children are more confident and positive	P2Q16	4.484	0.641		
	Cooperation is learned when children are playing with each other	P2Q17	4.581	0.525		
	More feelings such as understanding, empathy are easier to develop	P2Q18	4.435	0.612		
	Children are happier	P2Q19	4.919	0.326		
Academic learning	Children can be fast learners in class	P2Q20	4.403	0.706	4.436	3
	Children learn how to speak and behave well	P2Q21	4.161	0.807		
	Learning becomes more meaningful and enjoyable	P2Q22	4.565	0.612		
	Children are more creative	P2Q23	4.613	0.605		

Table 5. Functional and development needs of play yards (*n* = 62).

Construct	Indicator		Mean	Standard Deviation
	Description	Symbol		
Functional Needs	The play yards have both sunny and shady areas.	P3Q1	2.710	1.098
	The play yards allow mobility for children using wheelchairs or crutches (e.g., wide and hard paths, smooth ground surfaces, gentle slopes and ramps, etc.).	P3Q2	1.871	1.100
	Some of the play yard is open and largely flat.	P3Q3	2.500	1.118
	There is a large accessible storage room for outdoor play equipment.	P3Q4	2.129	1.085
	There is a sandpit with a partial shade cover.	P3Q5	2.258	1.269
	There are roofed outdoor areas that protect children's activities in most local weather conditions (e.g., heat, rain, etc.).	P3Q6	2.532	1.146

Table 5. *Cont.*

Construct	Indicator		Mean	Standard Deviation
	Description	Symbol		
Development Needs	The play yard(s) provides enough diversity, such as a variety of surfaces for different types of play, to be interesting for children (e.g., grass, hard surfaces, sand, etc.).	P3Q7	2.274	1.124
	The play yards have both large and small areas for children to play.	P3Q8	2.435	1.145
	The play yards have space for social and fantasy play (e.g., quiet areas away from physical play, cubby house, outdoor playhouse, storage for dress-up props, etc.).	P3Q9	2.290	1.022
	Some of the play yards are smaller and have a friendly feeling (e.g., intimate character, natural elements, etc.).	P3Q10	2.355	1.109
	Some of the play yards contain shape structures that are safe yet challenging enough for children to play on.	P3Q11	2.435	0.994
	Secret or rest places exist for a child to take time to be alone yet within sight of adults.	P3Q12	2.194	1.281
	There is a garden that children help to maintain.	P3Q13	1.823	1.185
	There is an identifiable area for outdoor water play (e.g., outdoor water table, tap, sprinklers, natural ponds, etc.).	P3Q14	1.935	1.469

4.3. Structural Equation Modelling

Mann-Whitney U tests carried out separately earlier showed that there were no significant differences between the male subgroup (nine respondents) and female subgroup (53 respondents) for all of the indicators of the six constructs. The raw data for the male and female subgroups were then combined for developing a conceptual model using SmartPLS 3 software. The two-step procedure consisting of assessments of measurement models and structural model recommended by Henseler et al. [52] was adopted.

4.3.1. Conceptual Framework

There are six measurement models in the conceptual framework as indicated in Figure 1. Functional Needs of an outdoor play yards is conceived as an exogenous latent construct with six indicators. Development Needs is an endogenous latent construct to Functional Needs with eight indicators, which in turn is an exogenous construct to the Social and Emotional Development construct (seven indicators), Health and Physical Development construct (four indicators), Cognitive Development construct (five indicators) and Academic Learning construct (four indicators). The arrows connecting any two constructs indicate the perceived causal relationships between two constructs. Barclay, Higgins and Thompson (cited in [53] (p. 6)) stated that the sample size for a PLS model should be higher than the larger value of either (i) 10 times the largest number of formative variables used to measure a latent construct; or (ii) 10 times the largest number of paths directed at a latent construct in the structural model. In Figure 1, the variables are all reflective, and the largest number of paths directed at a latent construct is four, thus the minimum sample size is 40. The sample size of this study was 62, higher than the threshold. Using partial least Squares structural equation modeling (PLS-SEM), PLS algorithm and bootstrapping with 1000 iterations were conducted to obtain the path loadings, t statistics, and p values (as shown in Table 6).

4.3.2. Conceptual Model

To obtain the conceptual model, the following procedures were followed:

(a) Path with lower t statistics was removed one at a time (paths 11, 10, 9 and then 8).
(b) Every time a path is removed, PLS algorithm and bootstrapping function were conducted to obtain the path loadings, t statistics and p values.

With the removal of path 11, path 10, path 9, and finally path 8 (in that order), it was observed that the path loadings for the conceptual model shown in Figure 2 are all significant. The results are shown in Table 7.

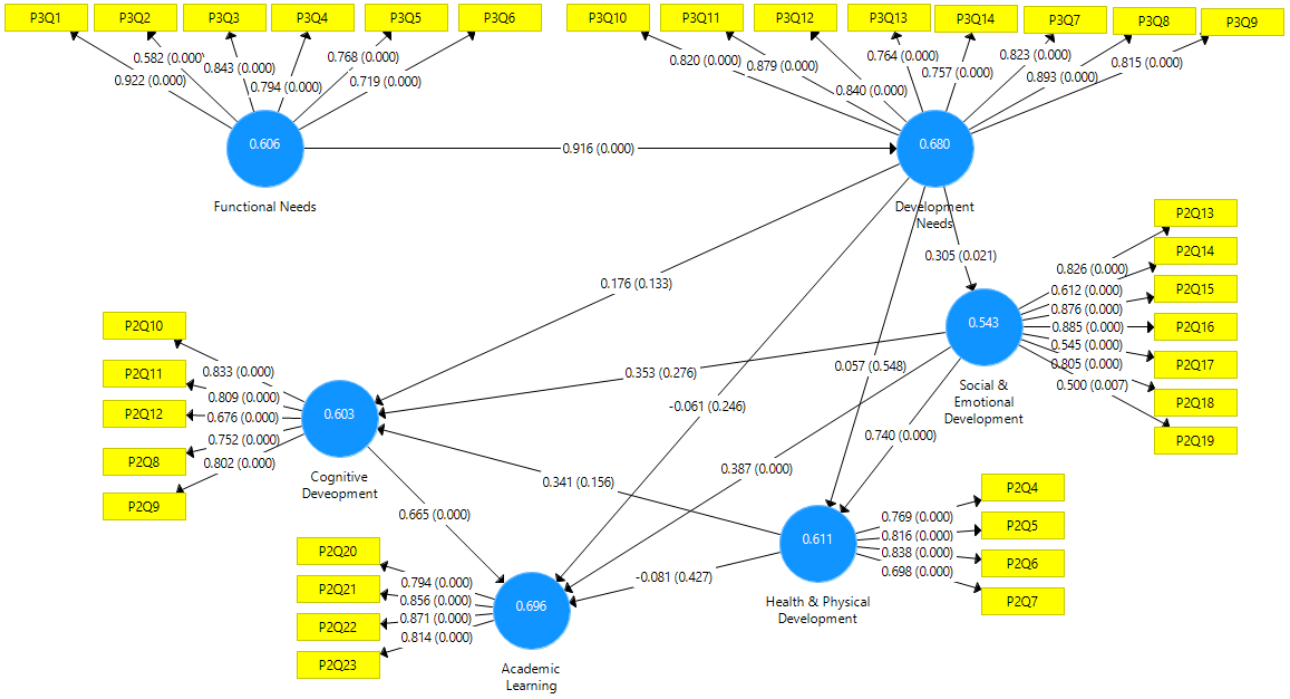


Figure 1. Conceptual framework with AVE values in each construct, path loadings, and *p* values.

Table 6. Path loadings for conceptual framework (9 males, 53 females, *n* = 62; CI = 95%).

Path	Original Sample		Standard Deviation	t Statistics	*p* Values	Decision on Path
	Loading	Mean				
1. Functional Needs → Development Needs	0.916	0.918	0.015	61.418	0.000	Retained
2. Social and Emotional Development → Health & Physical Development	0.740	0.762	0.056	13.171	0.000	Retained
3. Cognitive Development → Academic Learning	0.665	0.662	0.095	7.003	0.000	Retained
4. Social and Emotional Development → Academic Learning	0.387	0.382	0.110	3.527	0.000	Retained
5. Development Needs → Social and Emotional Development	0.305	0.332	0.132	2.303	0.021	Retained
6. Development Needs → Cognitive Development	0.176	0.140	0.117	1.505	0.133	Retained after reanalysis
7. Health and Physical Development → Cognitive Development	0.341	0.275	0.240	1.419	0.156	
8. Social and Emotional Development → Cognitive Development	0.353	0.451	0.324	1.091	0.276	Removed
9. Development Needs → Academic Learning	−0.061	−0.065	0.052	1.161	0.246	Removed
10. Health and Physical Development → Academic Learning	−0.081	−0.074	0.102	0.795	0.427	Removed
11. Development Needs → Health and Physical Development	0.057	0.041	0.095	0.600	0.548	Removed

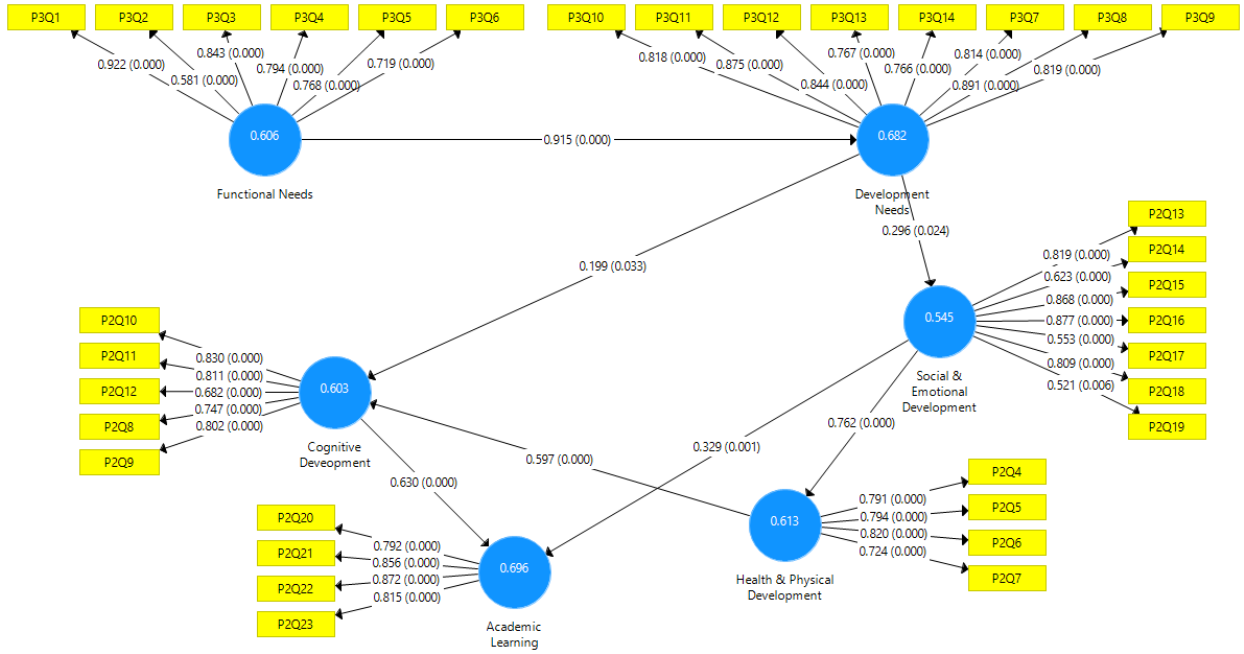


Figure 2. Conceptual model with AVE value in each construct, path loadings, and *p* values.

Table 7. Path loadings for conceptual model (9 males, 53 females, *n* = 62; CI = 95%).

Path	Original Sample	Sample Mean	Standard Deviation	t Statistics	*p* Values	Decision on Relationship
1. Functional Needs → Development Needs	0.915	0.917	0.015	60.370	0.000	Significant
2. Social and Emotional Development → Health & Physical Development	0.762	0.777	0.044	17.317	0.000	Significant
3. Cognitive Development → Academic Learning	0.630	0.630	0.083	7.623	0.000	Significant
4. Social and Emotional Development → Academic Learning	0.329	0.328	0.095	3.459	0.001	Significant
5. Development Needs → Social and Emotional Development	0.296	0.312	0.131	2.258	0.024	Significant
6. Development Needs → Cognitive Development	0.199	0.202	0.093	2.111	0.033	Significant
7. Health and Physical Development → Cognitive Development	0.597	0.601	0.096	6.189	0.000	Significant

Assessment of Measurement Models

The following are the criteria adopted to assess the measurement models in Figure 2:

(a) Internal consistency reliability:
   (i) A construct with high Cronbach's alpha value indicates the indicators have similar range and meaning [54].
   (ii) Composite reliability (CR) values greater than 0.60 are acceptable in exploratory study [55].

(b) Indicator reliability: Loading values equal to and greater than 0.5 are acceptable if the summation of loadings results in higher loading scores, contributing to AVE scores of greater than 0.5 [56].

(c) Convergent validity: In order to achieve adequate convergent validity, each construct should account for at least 50% of the average variance explained (AVE $\geq$ 0.50) [57–59].

(d) Rho_A: The reliability rho_A will usually lie between Cronbach's alpha and composite reliability [52].

(e) Discriminant validity: The square root of AVE of a construct should be larger than the correlations between the construct and other constructs in the model [58]. Using cross loadings to assess discriminant validity, each indicator should load high on its own construct but low on other constructs. According to Chin [60], the difference between loadings across latent constructs must not be less than 0.1.

The assessment results on measurement models are summarized in Table 8. Based on the criteria given, the measurement models clearly achieve internal consistency reliability such as Cronbach's alpha and composite reliability, convergent validity with AVE > 0.50 for all of the constructs and indicator reliability with all of the 34 indicators having loadings greater than 0.50. However, Table 9 shows that the measurement models do not achieve satisfactory discriminant validity since the square root of AVE (along the diagonal) is not larger than the correlation (off diagonal) for all of the constructs. The cross loadings between indicators were then compared and the results are summarized in Table 10. There are 16 indicators (in italics) where the difference in loadings for their own constructs with other constructs is less than 0.10 (in italics) and these indicators could be removed to further assess the discriminant validity of the measurement models.

Table 8. Assessment results of measurement models (n = 62; CI = 95%).

Name of Construct	Indicators	Outer Loadings (>0.50)	Outer Weights	Outer Collinearity (For Formative Model) (<5.0)	Construct Reliability and Validity			
					Cronbach's Alpha (>0.707)	Rho_A	Composite Reliability (>0.50, <0.90)	AVE (≥0.50)
Functional Needs	P3Q1	0.922	0.257	**5.695**	0.865	0.885	0.901	0.606
	P3Q2	0.581	0.139	1.464				
	P3Q3	0.843	0.223	4.865				
	P3Q4	0.794	0.195	2.486				
	P3Q5	0.768	0.233	2.049				
	P3Q6	0.719	0.224	2.257				
Development Needs	P3Q7	0.814	0.175	3.164	0.933	0.941	**0.945**	0.682
	P3Q8	0.891	0.178	3.887				
	P3Q9	0.819	0.133	2.857				
	P3Q10	0.818	0.164	2.408				
	P3Q11	0.875	0.163	3.814				
	P3Q12	0.844	0.148	3.517				
	P3Q13	0.767	0.137	2.521				
	P3Q14	0.766	0.107	2.526				
Health and Physical Development	P2Q4	0.791	0.315	**5.704**	0.790	0.795	0.864	0.613
	P2Q5	0.794	0.354	4.819				
	P2Q6	0.820	0.324	4.649				
	P2Q7	0.724	0.282	**5.541**				
Cognitive Development	P2Q8	0.747	0.235	2.054	0.833	0.836	0.883	0.603
	P2Q9	0.802	0.259	2.092				
	P2Q10	0.830	0.262	2.866				
	P2Q11	0.811	0.278	2.393				
	P2Q12	0.682	0.256	1.816				
Social and Emotional Development	P2Q13	0.819	0.203	2.994	0.856	0.900	0.890	0.545
	P2Q14	0.623	0.126	2.273				
	P2Q15	0.868	0.227	**5.678**				
	P2Q16	0.877	0.262	**6.233**				
	P2Q17	**0.553**	0.154	2.228				
	P2Q18	0.809	0.241	2.937				
	P2Q19	**0.521**	0.093	1.625				
Academic Learning	P2Q20	0.792	0.291	1.979	0.854	0.861	0.901	0.696
	P2Q21	0.856	0.335	2.459				
	P2Q22	0.872	0.310	3.682				
	P2Q23	0.815	0.262	3.048				

Table 9. Discriminant validity using Fornell and Larcker criterion.

Construct	Functional Needs	Development Needs	Health and Physical Development	Cognitive Development	Social and Emotional Development	Academic Learning
Functional Needs	0.779					
Development Needs	**0.915**	0.826				
Health and Physical Development	0.233	0.282	0.783			
Cognitive Development	0.275	0.367	0.653	0.776		
Social and Emotional Development	0.236	0.296	**0.762**	0.653	0.738	
Academic Learning	0.213	0.274	0.625	**0.845**	**0.741**	0.834

Table 10. Discriminant validity using cross loadings.

Indicator	Academic Learning	Cognitive Development	Development Needs	Functional Needs	Health and Physical Development	Social and Emotional Development
P2Q4	0.032	0.429	0.292	0.280	**0.791**	0.650
P2Q5	0.663	0.685	0.192	0.155	**0.794**	0.557
P2Q6	0.537	0.569	0.118	0.074	**0.820**	0.559
P2Q7	0.327	0.323	0.297	0.235	***0.724***	*0.634*
P2Q8	*0.664*	***0.747***	0.443	0.400	0.301	0..413
P2Q9	*0.706*	***0.802***	0.304	0.297	0.430	0.446
P2Q10	0.667	**0.830**	0.317	0.210	0.498	0.543
P2Q11	0.592	**0.811**	0.310	0.174	0.705	0.636
P2Q12	*0.655*	***0.682***	0.060	0.005	0.566	0.475
P2Q13	0.653	0.641	0.272	0.211	0.469	**0.819**
P2Q14	0.267	0.174	0.261	0.339	0.393	**0.623**
P2Q15	0.644	0.570	0.182	0.094	0.658	**0.868**
P2Q16	0.710	0.722	0.239	0.136	*0.784*	***0.877***
P2Q17	0.433	0.328	0.175	0.143	0.431	**0.553**
P2Q18	0.659	0.536	0.309	0.278	0.675	**0.809**
P2Q19	0.189	0.034	0.031	0.047	0.358	**0.521**
P2Q20	***0.792***	*0.703*	0.297	0.229	0.386	0.555
P2Q21	***0.856***	*0.758*	0.289	0.260	0.593	0.737
P2Q22	**0.872**	0.742	0.163	0.115	0.605	0.604
P2Q23	**0.815**	0.602	0.152	0.090	0.486	0.558
P3Q1	0.279	0.282	*0.847*	***0.922***	0.251	0.284
P3Q2	0.086	0.163	0.459	**0.581**	0.014	0.093
P3Q3	0.210	0.200	0.735	**0.843**	0.225	0.236
P3Q4	0.265	0.264	0.645	**0.794**	0.192	0.163
P3Q5	−0.037	0.109	*0.768*	***0.768***	0.104	0.073
P3Q6	0.176	0.263	*0.741*	***0.719***	0.247	0.217
P3Q7	0.574	0.579	***0.814***	*0.730*	0.273	0.403
P3Q8	0.262	0.380	***0.891***	*0.859*	0.268	0.296
P3Q9	−0.001	0.085	***0.819***	*0.762*	0.208	0.112
P3Q10	0.265	0.304	***0.818***	*0.809*	0.281	0.288
P3Q11	0.328	0.356	***0.875***	*0.788*	0.181	0.271
P3Q12	0.074	0.171	***0.844***	*0.782*	0.332	0.219
P3Q13	0.191	0.355	**0.767**	0.643	0.257	0.220
P3Q14	−0.074	0.046	**0.766**	0.634	−0.012	0.039

(Note: Loadings for their own constructs are in bold).

Assessment of Structural Model

The following are the criteria adopted to assess the structural model shown in Figure 2:

(a) Standardized root mean square residual (SRMR): A value less than 0.10 is considered a good fit [61].
(b) Normed fit index (NFI): A value above 0.9 usually represents acceptable fit [62].

The assessment results on model fit of structural model are summarized in Table 11, showing the structural model does not have a good fit with SRMR = 0.132 and NFI = 0.373.

Table 11. Assessment results of structural model (n = 62; CI = 95%).

Item	Saturated Model				Estimated Model			
	Original Model	**Sample Mean**	**95%**	**99%**	**Original Model**	**Sample Mean**	**95%**	**99%**
SRMR (≤0.10)	**0.132**	0.081	0.098	0.104	**0.134**	0.093	0.114	0.130
NFI (≥0.90)	**0.373**				**0.373**			

Discriminant validity for the measurement models could be achieved by removing 8 indicators with difference in cross loadings < 0.10. Figure 3 is the final conceptual model with AVE value in each construct, path loadings and p values. Table 12 compares the cross loading of each indicator among the six constructs. There is only one indicator with cross loading < 0.10, namely P2Q4. Table 13 indicates that the square root of AVE of a construct along the diagonal is larger than the correlations between the construct and other constructs in the model [58].

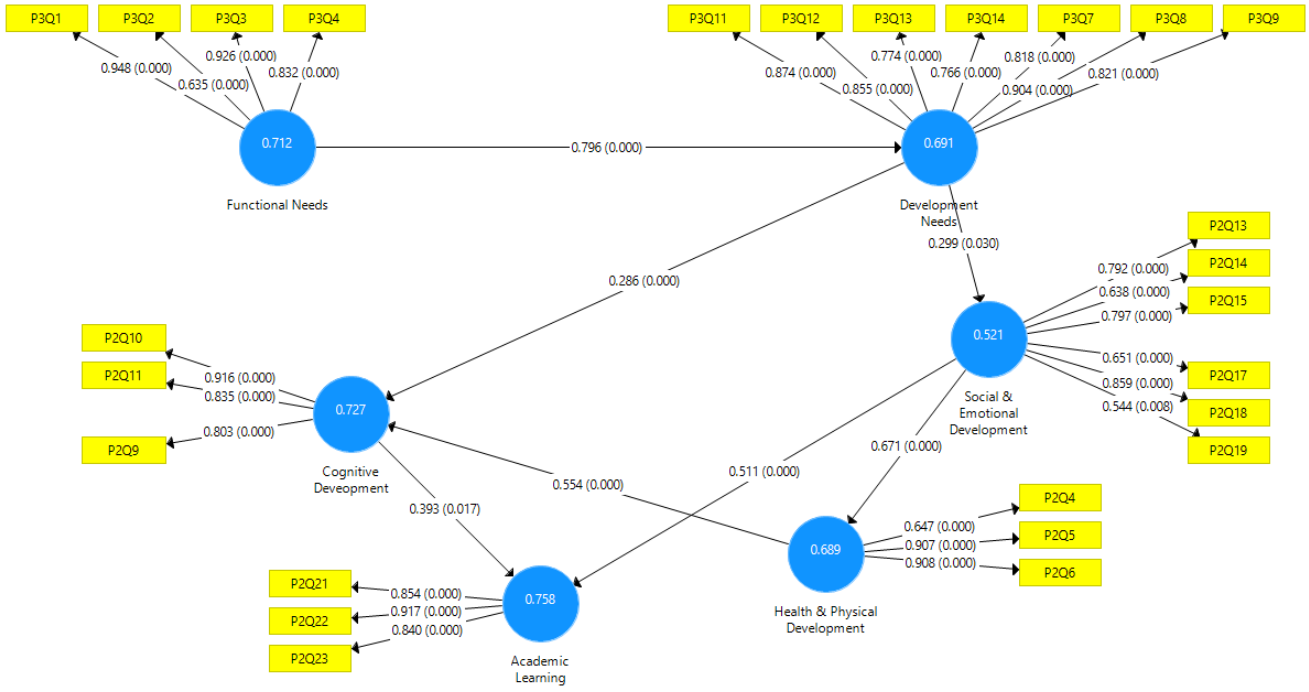


Figure 3. Final conceptual model with AVE value in each construct, path loadings, and p values.

Table 14 presents the results using HTMT technique to assess discriminant validity. The results of HTMT inference show that 90% bootstrap confidence interval do not include the value of 1. Hence discriminant validity is established [63].

Table 15 presents the outcome of the lateral collinearity test. All of the inner VIF values for the independent variables that need to be examined for lateral multicollinearity are less than 5.0, indicating lateral multicollinearity is not a concern in the model. The assessment results on model fit of structural model are summarized in Table 16, showing that the model fit has improved with SRMR = 0.125 and NFI = 0.486.

Table 12. Discriminant validity of final conceptual model using cross loadings.

Indicator	Academic Learning	Cognitive Development	Development Needs	Functional Needs	Health & Physical Development	Social & Emotional Development
P2Q4	0.409	0.393	0.264	0.280	***0.647***	*0.579*
P2Q5	0.699	0.607	0.209	0.174	**0.907**	0.552
P2Q6	0.554	0.527	0.122	0.042	**0.908**	0.538
P2Q9	0.567	**0.803**	0.437	0.409	0.353	0.364
P2Q10	0.614	**0.916**	0.332	0.217	0.564	0.523
P2Q11	0.565	**0.835**	0.312	0.126	0.649	0.547
P2Q13	0.601	0.638	0.279	0.203	0.452	**0.792**
P2Q14	0.256	0.119	0.248	0.292	0.347	**0.638**
P2Q15	0.622	0.604	0.165	0.069	0.575	**0.797**
P2Q17	0.541	0.257	0.200	0.194	0.459	**0.651**
P2Q18	0.708	0.518	0.299	0.357	0.651	**0.859**
P2Q19	0.184	−0.039	0.029	0.041	0.295	**0.544**
P2Q21	**0.854**	0.736	0.279	0.348	0.619	0.731
P2Q22	**0.917**	0.565	0.167	0.153	0.646	0.605
P2Q23	**0.840**	0.417	0.163	0.099	0.481	0.541
P3Q1	0.252	0.304	0.822	**0.948**	0.211	0.307
P3Q2	0.084	0.179	0.434	**0.635**	−0.019	0.108
P3Q3	0.221	0.233	0.728	**0.926**	0.199	0.283
P3Q4	0.250	0.225	0.635	**0.832**	0.209	0.195
P3Q7	0.507	0.580	**0.818**	0.676	0.269	0.381
P3Q8	0.248	0.428	**0.904**	0.800	0.257	0.323
P3Q9	−0.018	0.193	**0.821**	0.678	0.180	0.136
P3Q11	0.320	0.316	**0.874**	0.691	0.139	0.271
P3Q12	0.065	0.241	**0.855**	0.643	0.283	0.218
P3Q13	0.194	0.371	**0.774**	0.569	0.238	0.246
P3Q14	−0.122	0.159	**0.766**	0.505	−0.093	0.042

(Note: Loadings for their own constructs are in bold).

Table 13. Discriminant validity of final conceptual model using Fornell and Larcker criterion.

Construct	Functional Needs	Development Needs	Health and Physical Development	Cognitive Development	Social and Emotional Development	Academic Learning
Functional Needs	**0.844**					
Development Needs	0.796	**0.831**				
Health and Physical Development	0.196	0.238	**0.830**			
Cognitive Development	0.284	0.418	0.622	**0.853**		
Social and Emotional Development	0.279	0.299	0.671	0.567	**0.722**	
Academic Learning	0.250	0.243	0.679	0.682	0.734	**0.871**

Table 14. Discriminant validity of final conceptual model using Heterotrait-Monotrait Criterion.

Construct	Functional Needs	Development Needs	Health and Physical Development	Cognitive Development	Social and Emotional Development	Academic Learning
Development Needs	0.860 CI = 90% (0.774, 0.928)					

Table 14. *Cont.*

Construct	Functional Needs	Development Needs	Health and Physical Development	Cognitive Development	Social and Emotional Development	Academic Learning
Health and Physical Development	0.287 CI = 90% (0.138, 0.441)	0.323 CI = 90% (0.184, 0.493)				
Cognitive Development	0.349 CI = 90% (0.197, 0.512)	0.459 CI = 90% (0.315, 0.618)	0.778 CI = 90% (0.613, 0.891)			
Social and Emotional Development	0.314 CI = 90% (0.171, 0.546)	0.309 CI = 90% (0.156, 0.539)	0.822 CI = 90% (0.674, 0.985)	0.617 CI = 90% (0.358, 0.954)		
Academic Learning	0.265 CI = 90% (0.131, 0.414)	0.295 CI = 90% (0.187, 0.359)	0.827 CI = 90% (0.683, 0.939)	0.793 CI = 90% (0.637, 0.930)	0.792 CI = 90% (0.653, 0.975)	

Table 15. Lateral collinearity assessment of final conceptual model.

Construct	Functional Needs	Development Needs	Social and Emotional Development	Cognitive Development	Health and Physical Development	Academic Learning
Functional Needs		1.000				
Development Needs			1.000	1.060		
Social and Emotional Development					1.000	1.473
Cognitive Development						1.473
Health and Physical Development				1.060		

Table 16. Model fit of final conceptual model.

Item	Saturated Model				Estimated Model			
	Original Model	Sample Mean	95%	99%	Original Model	Sample Mean	95%	99%
SRMR (≤0.10)	**0.125**	0.079	0.098	0.108	0.127	0.092	0.116	0.125
NFI (≥0.90)	**0.486**				**0.484**			

Figure 3 shows there are seven significant paths among the six constructs, and the final results are summarized in Table 17. In order to test the significance levels, t-statistics were generated using bootstrapping function in SmartPLS 3 with 1000 iterations. The results show that:

Table 17. Path loadings for final conceptual model (n = 62; CI = 95%).

Path	Original Sample	Sample Mean	Standard Deviation	t Statistics	p Values	Causal Relationship	Effect Size, f^2
1. Functional Needs → Development Needs	0.796	0.805	0.042	19.036	0.000	Significant	1.734 (p = 0.004)
2. Social & Emotional Development → Health and Physical Development	0.671	0.696	0.062	10.830	0.000	Significant	0.810 (p = 0.049)
3. Cognitive Development → Academic Learning	0.393	0.338	0.156	2.520	0.012	Significant	0.294 (p = 0.258)

Table 17. *Cont.*

Path	Original Sample	Sample Mean	Standard Deviation	t Statistics	*p* Values	Causal Relationship	Effect Size, f^2
4. Social and Emotional Development → Academic Learning	0.511	0.569	0.117	4.356	0.000	Significant	0.497 ($p = 0.007$)
5. Development Needs → Social and Emotional Development	0.299	0.325	0.138	2.173	0.030	Significant	0.098 ($p = 0.481$)
6. Development Needs → Cognitive Development	0.286	0.284	0.079	3.600	0.000	Significant	0.144 ($p = 0.086$)
7. Health and Physical Development → Cognitive Development	0.554	0.564	0.090	6.138	0.000	Significant	0.499 ($p = 0.061$)

(a) The predictor Functional Needs is significantly related to Development Needs (β = 0.796, ρ < 0.001),
(b) The predictor Development Needs is significantly related to Social and Emotional Development (β = 0.299, ρ < 0.05) and Cognitive Development (β = 0.286, ρ < 0.001),
(c) The predictor Social and Emotional Development is significantly related to Health and Physical Development (β = 0.671, ρ < 0.001) and Academic Learning (β = 0.511, ρ < 0.001),
(d) The predictor Health and Physical Development is significantly related to Cognitive Development (β = 0.554, ρ < 0.001), and
(e) The predictor Cognitive Development is significantly related to Academic Learning (β = 0.393, ρ < 0.05).

The effect size of each significant relationship is shown in Table 17. According to Cohen [64], the values of 0.02, 0.15, and 0.35 represent a small, medium, and large effect, respectively.

Table 18 summarizes the coefficient of determination scores (R^2) of the final conceptual model. R^2 is a measure of the model's predictive accuracy and represents the amount of variance in the endogenous construct explained by all of the exogenous constructs connected to it. The rules of thumb for acceptable R^2 scores, according to Henseler et al. [65] are 0.75, 0.50, and 0.25 for substantial, moderate, and weak levels of predictive accuracy, respectively.

Table 18. R square and adjusted R square for final conceptual model ($n = 62$; CI = 95%).

	R Square			Adjusted R Square		
Construct	**Original Sample**	**t Statistics**	***p* Values**	**Original Sample**	**t Statistics**	***p* Values**
Development Needs	0.634 ##	9.510	0.000	0.628 ##	9.264	0.000
Social & Emotional Development	0.089 #	0.973	0.331	0.074 #	0.794	0.427
Cognitive Development	0.464 ##	6.409	0.000	0.446 ##	5.956	0.000
Health & Physical Development	0.450 ##	5.195	0.000	0.441 ##	5.006	0.000
Academic Learning	0.643 ##	11.699	0.000	0.631 ##	11.103	0.000

Note: ## = moderate, # = weak [59].

5. Conclusions

In conclusion, the outcomes of this study back up Li and Azizi Bahauddin's study [13], which found that the physical environment of a preschool stimulates preschool children to participate in outdoor activities. Furthermore, the findings of the researchers show that current NPCS standards do not give suitable techniques for building a physical environment that reflects the NPCS-advocated child-centered pedagogy. In addition, Shaari, et al. [66]

stated in their study that more attention should be paid to the appropriateness of spatial planning in preschools in order to accommodate children's learning behavior.

As it was discovered that Malaysian preschoolers were only moderately prepared for primary school, there is an urgent need for more emphasis to be placed on creating a conducive preschool environment, as this would have a significant impact on the quality of activity spaces and subsequent cognitive development of the preschoolers.

The findings of the aforementioned recent studies would help service providers, educators, built environment designers, and policymakers make decisions about children's physical environments in preschools.

One limitation of this study is the small sample size of 62 respondents, which resulted in poor model fit. Model fit could be improved by using bootstrapping function with 1000 iterations to yield SRMR = 0.098 at 95% for the saturated model. This shows that the study should be replicated by adopting an improved questionnaire with distinct indicators using a larger sample size collected from the various states in Malaysia to assess the model fit by checking the SRMR, NFI, and RMS_theta. This is due to the fact that the NFI value is sensitive to small sample sizes [63].

By using the indicators in subscale 12 and subscale 13 of the Children's *Physical* Environments Rating Scale (C*P*ERS5), this study for the first time proposes a conceptual model to explore and establish the causal effects of outdoor play on their outcomes through empirical evidence. The significant paths and high R^2 values in the final conceptual model could help to elucidate and provide an understanding of the relationships among the six constructs, and the causal effects of outdoor play on academic learning of preschool children.

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