Preschool Physical Environment Design Quality: Addressing Malaysia's PISA Rankings

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Abstract

PISA assessments revealed cognitive abilities of Malaysian children remained unsatisfactory. Poor cognitive school readiness (SR) among preschoolers, contributing to inadequate cognitive development, is a factor. Excellent preschool physical environments (PPE) could potentially improve childhood cognitive development by boosting cognitive SR. This study aims to highlight the significance of PPE design quality on children's cognitive SR in Malaysia. A cohort study comprising 16 Ministry of Education (MOE) preschools with 336 children was done. PPE design quality showed significant positive association with cognitive SR. Conclusively, good PPE design should contribute to improved PISA ranking by ensuring better cognitive development of Malaysian preschoolers.

Keywords: Preschool Physical Environment; Cognitive School Readiness; Piaget's Theory of Cognitive Development; PISA

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1.0 Introduction

Children's cognitive development is one of the pillars of many education systems worldwide. The importance of cognitive abilities in human development, particularly at such a young age, is undeniable (UNICEF, 2017). Proficiency in cognitive-oriented tasks and skills form the foundation for most other aspects of development in children. Currently, the Programme for International Student Assessment, or PISA, is the most widely-recognized standardized cognitive assessment adopted in many countries across the globe. PISA evaluates the proficiency in mathematics, reading as well as science of 15-year-old children and is organized by the Organization for Economic Cooperation and Development (OECD) (OECD, 2018).

With regards to Malaysia, although it's rankings in recent PISA assessments (2012, 2015 and 2018) have somewhat improved, notwithstanding, at a slow rate, Malaysian children remained 50 to 70 points below the global OECD average in all three aspects (MOE, 2019). Here it is noteworthy that in PISA, a 38-point difference corresponds to approximately one schooling year. This implies 15-year-old Malaysians are nearly two schooling years behind global peers in terms of their cognitive abilities (OECD, 2018). Worryingly, PISA assessments further uncovered that Malaysian children lagged in problem-solving and critical thinking skills (MOE, 2019; OECD, 2018).

In recent decades, Malaysia has consistently shown its ambition to prioritize education; often reflected in its policies for government spending (MOE, 2019). Hence, these recent PISA findings have led to increasing concern among policymakers, particularly the MOE (MOE, 2019). Indeed, efforts have been introduced in the past to address this, but the present PISA findings tell us they are insufficient. As a country aspiring to be fully developed, with high-quality human capital at the helm and heart of its economic machinery, Malaysia has always envisioned an education ecosystem capable of developing its citizens to be on par with international standards. Thus, drawbacks in children's cognitive capabilities (a core aspect of human development) threaten to derail Malaysia's vision of future citizens to spearhead the country's growth and development (MOE, 2019). A study of potential solutions to recommend re-alignment of current MOE efforts is needed to address this growing issue.

2.0 Literature Review

In 2013, the MOE took proactive measures to address Malaysia's PISA rankings. As such, the Malaysian Education Blueprint 2013 – 2025 (MEB 2013 - 2025) was introduced as a national transformation program to improve public education in Malaysia by 2025. Among the goals stipulated in MEB 2013 – 2025, improving Malaysia's performance in previous PISA benchmarks was one of them (MOE, 2019). To achieve this particular objective, a comprehensive roadmap to improve facilities, optimize teaching syllabi to maximize education quality, and increase enrolment rates, particularly in rural areas, was outlined. In terms of implementation and its underlying objective to standardize nationwide efforts, the blueprint is rather wide-ranging; it encompasses all public education institutions from preschool to post-secondary (MOE, 2019).

Regarding preschool-level education for children aged four to six years old, MEB 2013 - 2025 tasks public preschools with the main objective of maximizing children's school readiness (SR), primarily cognitive SR, to ensure preschool children transition into primary school with minimal problems (MOE, 2019). Although other aspects of SR were deemed equally important, cognitive SR was particularly emphasized. Rightly so, cognitive SR reflects a child's level of cognitive development and is a crucial element in preschool education as it allows preschoolers to transition seamlessly into primary school and continuously perform well in later stages of education (UNICEF, 2017). Various elements of cognitive learning, namely higher-order thinking (HOT) skills and science, technology, engineering, and mathematics (STEM), were introduced in preschool syllabi to enable early exposure to higher-order cognitive tasks (MOE, 2019).

According to the UNICEF, cognitive SR comprises reading, counting, colour recognition, cognitive as well as problem-solving skills (UNICEF, 2017). Preschoolers who are cognitively ready for school are better-equipped to experience more complex cognitive tasks as they progress through primary school; allowing them to stay ahead in class and continuously hone their cognitive skills. As Raghubar & Barnes (2017) argues, preschool cognitive SR forms a crucial basis for correct childhood cognitive development as it enables children to participate in the primary school curriculum and learning activities efficiently, with minimal problems. Contrastingly, children who are not ready tend to be left behind in primary school curriculum. As Blair & Raver (2015) finds, preschool children with low cognitive SR were at higher risk of dropping behind peers and performing poorly in cognitive assessments later in life. This may be because each level of cognitive tasks encountered as the child progresses through primary school education becomes an insurmountable obstacle which compounds the effect of being unready for school. Taken together, emphasis must, therefore, be given to maximize preschooler's cognitive SR to ensure correct cognitive development and prepare them for education later in life.

Forming the theoretical basis for our understanding, Piaget's Theory of Cognitive Development has been a mainstay in the field of educational and developmental psychology. In fact, it is often adopted in the West to promote better school and preschool building designs to maximize cognitive development (Schultz & Schultz, 2016). In particular, for preschool-aged children, Piaget's theory states that the preschool physical environment (PPE) is an essential source of reinforcing stimuli to encourage correct cognitive development (Moore, 2012). As per the theory, PPEs must be tailored to ensure favourable day-to-day learning experiences to maximize children's grasp of knowledge in classes. Also, the PPE must actively function to reinforce positive learning experiences and minimize negative ones for children's pedagogy as well as cognitive development to thrive. Most importantly, in the absence of appropriately designed PPEs, other aspects of the preschool system cannot properly serve its purpose; a well-designed syllabus or teaching program cannot be conducted correctly without a conducive classroom, and so on.

As Moore (2012) argues, to apply Piaget's theory in preschool design, an ideal PPE must, first and foremost, comfortably accommodate all preschool users – space must be the top priority. PPEs must also augment positive stimuli by ensuring appropriate indoor environment quality (IEQ), maximize unobstructed teacher-children interactions, encourage pretend play, and allow exploratory behaviour among preschoolers (Shaari & Ahmad, 2018; Mohidin et al., 2015). PPEs designed with children's cognitive development in mind should also minimize distressing stimuli by insulating classroom users from unwanted distractions as well as visual, noise, and air pollution. This is important as distressing stimuli and distractions can elicit confusing signals to a child's developing brain, negatively impacting their cognitive development. Above all, a positive and encouraging environment is sure to stimulate curiosity as well as promote interest in learning among preschool children, which goes a long way to promote better learning (Abbas et al., 2016).

However, amidst various governmental constraints, PPE design quality among public preschools remains generally overlooked in Malaysia despite overwhelming studies to justify its importance - quality is often compromised to maximize quantity and enrolment rates. This is somewhat unfortunate as nowadays, better PPE design does not necessarily impose higher long-term costs. In truth, robust planning and excellent building design are what matters. Better choice of site, innovative spatial design, and sustainable approaches can greatly improve the long-term cost-to-benefit ratio of public preschools. The fallacy of "better quality is always expensive" is increasingly incorrect (Alwetaishi & Gadi, 2018). Moreover, current advancements in architecture allow for innovative designs to overcome budget constraints; all it takes is awareness.

Despite the initiatives outlined in MEB 2013 - 2025 as well as improving enrolment rates especially in rural areas, cognitive abilities of Malaysian children remain below the OECD average (MOE, 2019). Surprisingly, a review of the literature revealed no previous study to look at the association between PPE design quality and cognitive SR in Malaysian public preschools. As such, a lack of awareness of the significance of PPE design quality to encourage cognitive development and consequent cognitive SR may be the underlying reason for a lack of attention given by policymakers. Therefore, to shed more light into this, the current study aims to explore the possible relationship between PPE design quality and preschool children's cognitive SR in Malaysian public preschools. This effort is hoped to coax stronger awareness of the importance of PPE design quality in childhood education and encourage future studies to incorporate better PPE design elements into public preschool in Malaysia.

3.0 Methodology

3.1 Aims and Objectives

This study aims to define the association between PPE design quality and cognitive SR among MOE preschools in Klang Valley, Malaysia. Complementing this aim, the objectives are to evaluate the status of PPE design quality and cognitive SR of MOE preschools and pre-schoolers, respectively.

3.2 Study Design

As elaborated earlier, the theoretical foundation of this study is the Piagetian approach to preschool design and childhood cognitive development. Thus, in adherence to this, the assessment tools employed in this study to assess both PPE design quality and cognitive SR must be based on the Piagetian approach to childhood cognitive development. The Children Physical Environment Rating Scale 5 (CPERS5) is an established post-occupancy appraisal tool to evaluate preschool design quality against the Piagetian approach, hence, it is deemed most suitable for this study to fit the theoretical framework (Moore, 2012). Here, the researcher conducts an independent inclusive survey of the preschool building and marks it according to the CPERS5 standard criteria. It evaluates four main aspects of the preschool building – planning, building as a whole, children indoor spaces, and outdoor areas. Each preschool's overall PPE design quality is rated as Poor (0.00 – 1.00), Fair (1.00 – 2.00), Good (2.00 – 3.00), or Excellent (3.00 – 4.00) based on CPERS5 scores.

After conducting the CPERS5 assessments in said preschool, cognitive SR levels of the recruited children are then determined using the Bracken School Readiness Assessment (BSRA)-3 tool (Bracken, 2007). This tool is intended to assess preschool children's cognitive abilities and reflects a child's cognitive readiness for primary school. For the purpose of this assessment, the researcher asks the child standard questions from the BSRA-3 manual and scores the child on correct answers. To avoid bias, only the researcher conducts all BSRA-3 assessments. The BSRA-3 tool assesses children's proficiency in colour, letters, numbers, shapes, and sizes (elements crucial for cognitive capabilities), appropriate for preschool-aged children. It evaluates a child's cognitive SR before and after a period of time and allows for the examiner to calculate whether a significant change in children's cognitive SR has occurred over some time. These features are appropriate for this study.

To achieve the aim of this study and determine the association of PPE design quality of a particular MOE preschool and children's cognitive SR whilst attending the said preschool, a prospective cohort study involving 16 MOE preschools in Klang Valley and 336 pre-schoolers was conducted. This method of study was deemed most suitable as it permits the study to prospectively discern particular behavioural changes among human subjects within a controlled setting over a period of time. MOE preschools were chosen for this study because they cater to the broadest range of social demographic backgrounds compared to other public preschools in Malaysia (KEMAS, PERPADUAN, and PERMATA). Further, Klang Valley was selected as the region of interest for its balanced and inclusive demographic distribution in Malaysia. Only MOE preschools in Klang Valley constructed after the introduction of the MOE Preschool Project were selected. Lastly, only preschools with six-years-old children were selected to guarantee all participating children were exposed to the same syllabus, teaching, and social environment throughout the study, keeping these factors as constant as possible.

In all, a total of 21 pre-schoolers were randomly selected from each preschool. This is done to standardize the number of participants per school. Cognitive SR of each pre-schooler before and after the study period at the selected MOE preschools was measured with BSRA-3. Then, the BSRA-3 final score is obtained using this formula:

$$\textbf{BSRA-3 Final Score} = \text{BSRA-3 Post-Test} - \text{BSRA-3 Pre-Test} \quad (1)$$

According to BSRA-3 assessment guidelines, BSRA-3 Post-Test is the score attained by children at the end of the study period, while BSRA-3 Pre-Test is the score attained at the beginning of the study. The BSRA-3 Final Score is derived from these preliminary scores and reflects the change in cognitive SR of a child whilst attending a particular preschool, as shown in the formula above.

Finally, to achieve the aim of this study, Pearson's correlation analysis was conducted to determine the association between PPE design quality and cognitive SR among MOE preschools. For this purpose, Pearson's correlation analysis was chosen because, as Field (2013) argues, it's known as the best method of calculating association between variables based on parametric covariance; the exact nature of the variables in this study.

3.3 Variables

The independent variable is the selected MOE preschools while the dependent variable is the level of cognitive SR among six-year-old pre-schoolers attending the selected MOE preschools. Constant variables are the preschool type and site, as well as the respondent's age, nationality, and additional past educational experiences.

3.4 Limitations

This study is limited to preschools with the abovementioned criteria (the type of preschool, location, year built, and age of children served). Therefore, this study could not be indiscriminate to other populations. Additionally, only one evaluator was employed in this study and although best efforts have been made to maintain consistency of assessment, bias may still be unavoidable in the evaluation process.

3.5 Data Analysis

Firstly, normality and reliability testing of CPERS5 and BSRA-3 raw data were conducted. Then, significance testing of BSRA-3 results with a paired T-Test was done. Finally, Pearson's correlation analysis was conducted to determine the relationship between CPERS5 and BSRA-3 final scores. All statistical analyses were done using SPSS version 21.

4.0 Results

Below are the results of the CPERS5 and BSRA-3 assessments.

4.1 PPE Design Quality of Assessed MOE Preschools – CPERS5 Assessment Results

Table 1: CPERS5 score and rating of MOE preschools (N = 16)

Preschool	Cohort	CPERS5 Score	Rating
Preschool A	Cohort 1	2.26	Fair
Preschool B	Cohort 2	2.18	Fair
Preschool C	Cohort 3	2.12	Fair

Preschool D	Cohort 4	2.11	Fair
Preschool E	Cohort 5	2.07	Fair
Preschool F	Cohort 6	2.05	Fair
Preschool G	Cohort 7	2.02	Fair
Preschool H	Cohort 8	2.00	Fair
Preschool I	Cohort 9	1.90	Fair
Preschool J	Cohort 10	1.79	Fair
Preschool K	Cohort 11	1.76	Fair
Preschool L	Cohort 12	1.77	Fair
Preschool M	Cohort 13	1.71	Fair
Preschool N	Cohort 14	1.51	Fair
Preschool O	Cohort 15	1.52	Fair
Preschool P	Cohort 16	1.49	Fair

(Source: Author)

Table 2: Normality test of CPERS5 scores (N = 16)

Shapiro-Wilk (Sig.)	Z-Skewness	Z-Kurtosis	Mean	S. D.
0.187	-0.668	-1.009	1.89	0.249

(Source: Author)

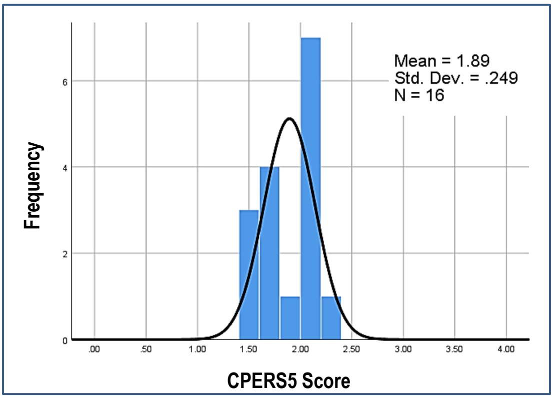

Figure 1: Histogram and normality curve of CPERS5 scores (N = 16)
(Source: Author)

Table 3: Reliability test of CPERS5 scores (N =16)

CPERS5 Item	Corrected Item-Total Correlation	Cronbach's Alpha (α) If Item Deleted	No. of Items	Cronbach's Alpha (α)
Part A : Planning	0.273	0.801	5	0.813
Part B : Building As A Whole	0.454	0.785		
Part C : Children's Indoor Spaces	0.737	0.794		
Part D : Outdoor Areas	0.711	0.807		
CPERS5 Score	1.000	0.783		

(Source: Author)

4.2 Cognitive SR of Assessed MOE Preschoolers – BSRA-3 Assessment Results

Table 4: BSRA-3 score of MOE preschools (N = 336)

BSRA-3 Score	N	Min	Max	Mean	Grade
Pre-Test*	336	7	85	36.51	Moderate
Post-Test*	336	14	85	46.98	Moderate
BSRA-3 Final Score	336	-16	41	10.47	n.a.

*Paired T-test p value = 0.001 (Significant difference, p < 0.05)

(Source: Author)

Table 5: Normality test of BSRA-3 final score (N = 336)

Shapiro-Wilk (Sig.)	Skewness	Kurtosis	S. D.
0.058	-0.101	-0.109	10.588

(Source: Author)

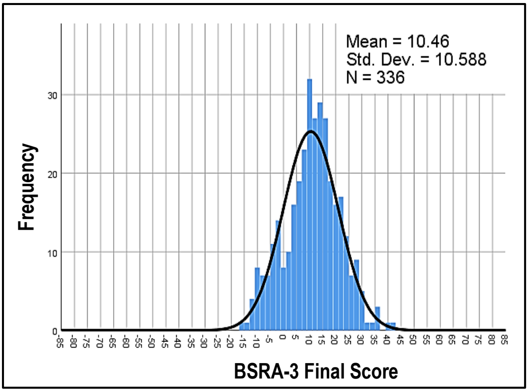

Figure 2: Histogram and normality curve of BSRA-3 final scores (N = 336)

(Source: Author)

Table 6: Reliability test of BSRA-3 final scores (N = 336)

CPERS5 Item	Corrected Item-Total Correlation	Cronbach's Alpha (α) If Item Deleted	No. of Items	Cronbach's Alpha (α)
Subtest 1: Colors	0.290	0.746	6	0.750
Subtest 2: Letters	0.528	0.728		
Subtest 3: Numbers	0.589	0.712		
Subtest 4: Sizes	0.649	0.696		
Subtest 5: Shapes	0.614	0.682		
BSRA-3 Final Score	1.000	0.629		

(Source: Author)

4.3 Association of PPE Design Quality and Cognitive SR of MOE Preschools

Table 7: Pearson's correlation analysis of CPERS and BSRA-3 final scores (N = 336)

BSRA-3 Final Score	BSRA-3 Final Score

	r-coefficient	p-value
BSRA-3 Final Score	0.57	0.001

(Significant correlation, $p < 0.05$)

(Source: Author)

5.0 Discussion

5.1 Status of PPE Design Quality and Cognitive SR among MOE Preschoolers in Klang Valley

Table 1 (CPERS5 results) tells us all assessed preschools were only rated Fair. No preschools were rated as Poor, but none were rated Good nor Excellent either. Conclusively, this finding further helps us argue that public preschools in Malaysia are indeed lacking in terms of PPE design quality. More improvements are needed to ensure better quality across all aspects of the preschool building to achieve higher PPE design quality ratings.

Delving deeper, the low CPERS5 scores were mainly due to small building size and low-quality design of the common shared amenities. However, despite this, most preschools were excellent in terms of circulation design. For most of these assessed MOE preschools, circulation was found to be good inherently because of the overall simple and square building shape. But the lack of space jeopardized the design of common shared facilities (teacher office, toilets, and kitchen), hence the observed findings. This was also due to most preschools being a single-story building, which enabled better and less confusing circulation for preschool children. This highlights the importance of ample size in preschool design as it often directly impacts other essential design features (Azhari et al., 2015).

Furthermore, most assessed preschools were lacking in terms of spatial design and average in modified open-planning of classrooms; quite, messy, and physical activity areas were all found to be poorly designed. The main reason for this was because most activity areas were too exposed and not adequately isolated from each other, causing distractions during teaching sessions. To compound this, some key activity areas, such as reading and painting were not even covered with adjustable partitions or movable furniture. This was again ascribed to inadequate space leading to the poor spatial distribution of crucial activity areas within classrooms, making it an inherently crucial factor for low CPERS5 scores. Here we find the quality of activity spaces are the main shortfall of public MOE preschools. Most are not at the level expected to maximize children's cognitive SR.

However, the indoor environment quality was excellent for most preschools. Most preschools had adjustable slits for ventilation, ample artificial lighting to ensure proper visual comfort, and suitably placed ventilators in kitchen and toilet areas to ensure good indoor air quality (IAQ). Nevertheless, improvements could still be made by fitting adjustable lights for sleeping areas to help children sleep better during nap times.

Also, most preschools were rated good in terms of safety and security. As expected, safety and security aspects of MOE preschools should be generally good because they are located inside primary school compounds, exploiting the advantages of parameter and surrounding safety features. This resulted in preschool buildings being far from road traffic, visible to security personnel and often surrounded with parameter fencing. This is consistent with MOE's main purpose for MOE preschool design. The site location functions as an advantage for MOE preschools and must be applied in other public preschools nationwide.

In terms of normality of CPERS5 data, Table 2 and Figure 1 showed data (N = 16) were normally distributed with a mean of 1.89 and a standard deviation of 0.249, whilst Shapiro-Wilk, Z-kurtosis, and Z-Skewness values were all within normal ranges. The reliability test of CPERS5 data shown in Table 3 demonstrates Cronbach's Alpha (α) value of 0.813. Cronbach's Alpha (α) value for each CPERS5 part if the deleted range between 0.783 and 0.807. Conclusively, the collected CPERS5 data portray high reliability, in agreement with Field (2013) and allows for parametric correlation analysis in a later stage of the study.

Concerning cognitive SR, Table 4 shows MOE pre-schoolers are only moderately ready for school. Worryingly, children who scored average and below on readiness tests are very likely to face learning difficulties in primary school (Bracken, 2007). As per BSRA-3 assessment guidelines, for children to be considered satisfactorily ready for school, they must at least be categorized as "advanced". This result supports the earlier suggestion that Malaysian children are not fully ready for primary school, especially cognitively. This may, in fact, be a contributing factor to Malaysia's declining performance in recent PISA assessments because as UNICEF (2017) claims, children who are not fully ready for school often transition poorly into primary school and often perform poorly in later stages.

However, the Paired T-test of Table 4 results show that there has been a significant improvement in BSRA-3 results (p = 0.001) and that MOE preschoolers improved in all aspects of cognitive competencies during the study period. This is generally consistent with baseline anticipations; children are expected to demonstrate positive cognitive development during their pre-schooling period. A more worrying finding would be negative cognitive development, which is not the case in this study.

However, an argument can be made that in this study, most sampled preschool children enrolled into preschool with low cognitive SR, to begin with (as reflected in BSRA-3 Pre-Test results) and only were afforded one-year of preschool education. Therefore, even the best designed MOE preschool in Malaysia may not be able to significantly increase preschool children's cognitive SR. Thus, the reason why preschool children only ended their preschool education with moderate levels of cognitive SR may not be due to PPE quality after all, but other unaccounted for factors. This is in fact an interesting point of discussion. Although this proposition may well be true, there are a few worthy counter-arguments.

First of all, this notion remains inconclusive because there were no excellent preschools in this study, to begin with, hence a lack of evidence to substantiate this claim. Moreover, the study only recruited preschools with six-year-old children, hence, as far as six-year-old children were concerned, there were indeed no MOE preschools of excellent PPE design quality in Klang Valley, Malaysia. The presence of excellent preschools would allow us to further examine this.

Secondly, most importantly, policymakers, particularly the MOE, would expect a good preschool system to ensure all students achieved "advance" cognitive SR towards the end of their preschooling period, as Bracken (2007) justifies. Thus, fully functional MOE preschools are expected to enhance cognitive SR of all children; more than what is seen in this study. Plus, the MOE requires preschools to boost children's development and actively prepare children for primary school, not act as mere passive checkpoints in the child's life, as highlighted in MEB 2013 - 2025 (MOE, 2019). Therefore, to successfully accomplish this goal, MOE preschools must be designed to maximize children's cognitive development, regardless of the child's background, as seen in other preschool systems in developed countries (Dayaratne, 2016).

Finally, in terms of normality of BSRA-3 final scores, Table 5 and Figure 2 showed data (N = 336) are normally distributed with a mean of 10.46 and a standard deviation of 10.588 while Shapiro-Wilk, Z-kurtosis, and Z-Skewness values were all within normal ranges. The reliability test of BSRA-3 data shown in Table 6 demonstrates Cronbach's Alpha (α) value of 0.750 and the Cronbach's Alpha (α) value for each BSRA-3 subscale if deleted range between 0.629 and 0.746. Categorically, the BSRA-3 data portray high reliability, in agreement with Field (2013). Similar to CPERS5 data, this allows for parametric correlation analysis in later stages of the study.

5.2 PPE Design Quality Demonstrates Significant Positive Association with Cognitive SR

From Table 7, we can see that overall PPE design quality demonstrates a significant positive association with children's cognitive SR (r = 0.57, p = 0.001) among Malaysian public MOE preschools in Klang Valley. This helps us argue that Pearson's correlation analysis results support the theoretical framework for this study. There is indeed a significant association between PPE design quality and cognitive SR among Malaysian MOE preschools. To recall, Piaget's Theory of Cognitive Development stipulates that children's development is inherently influenced by stimuli from the physical environment. Thus, better PPE design quality is stipulated to result in better cognitive development and subsequent cognitive SR. Hence, Piaget's theory perfectly explains the observations made here in this study (Schultz & Schultz, 2016).

It is also important to note that, as Moore (2012) argued, activity areas should be competent to accommodate children's pretend play and encourage explorative behaviour to encourage significant learning. Also, to achieve optimum cognitive development, children must feel attracted and compelled to study, learn, and explore when in their preschools. Simply put, children must be invited and reinforced to receive positive stimuli from the surrounding environment. Further, better PPE design quality for cognitive development could be achieved by implementing modified open-planning in the design and allocation of activity spaces. This again goes to substantiate discussions in subsection 5.1 whereby most assessed preschools were poor in terms of spatial design and mediocre in modified open-planning of classrooms. Hence, this too further supports the theoretical framework put forth in this study.

However, the fact that overall preschool building size and quality of module design in preschools as a crucial foundation for other aspects of the PPE to thrive and function properly is indeed a crucial takeaway. Other facets namely common core of shared facilities, IEQ, quality of module design and spatial allocation of activity spaces must also be well-designed to attain high cognitive development among preschool children (Moore, 2012). But all these propositions of an ideal preschool setting can only be achieved through accurate and holistic planning of preschool buildings in tandem with syllabus as well as learning programs, to begin with. Predictably, these elements were only fair in terms of quality, possibly resulting in the inherently average level of cognitive SR of the most preschoolers in this study.

6.0 Conclusion

Findings within this study demonstrate that the status of PPE design quality of public MOE preschools is from perfect and that many enhancements are still required for them to be able to maximize cognitive development and subsequent cognitive SR of preschool children in Malaysia. Cognitive SR among Malaysian preschool children who attend these MOE preschools were also unsurprisingly moderate and unsatisfactory. This explains why MOE initiatives to improve public preschools were incapable to aid Malaysia to adequately improve its recent PISA rankings; even after almost two decades of implementation. Well-designed preschools are often found to result in better cognitive development and subsequent cognitive SR among children, as long acknowledged and practised in developed countries. Hence, better PPE design quality among public preschools would certainly improve cognitive development among Malaysian children to guarantee that they enter primary school fully prepared. Such improvements to preschool design quality could go a long way to ensure that Malaysian children are afforded better education and allow them to perform better as they progress later in life. Above all, addressing the elephant in the room, Malaysian children with better cognitive abilities will surely perform better in future PISA assessments. Thus, with the findings made here, this study, therefore, hopes that more devotion could be given to improve the PPE design quality of MOE preschools in Malaysia as it is shown to be associated with better cognitive SR and cognitive development among preschoolers.

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References

Abbas, M. Y., Othman, M., & Rahman, P. Z. M. A. (2016). Pre-School Children's Play Behaviour Influenced by Classroom's Spatial Definitions? *Asian Journal of Environment-Behaviour Studies*, *1*(1), 49-65.

Alwetaishi, M., & Gadi, M. (2018). Toward sustainable school building design: A case study in hot and humid climate. *Cogent Engineering*, *5*, 145-165.

Azhari, N. F. N., Qamaruzaman, N., Bajunid, A. F. I., & Hassan, A. (2015). The quality of physical environment in workplace childcare centers. *Procedia-Social and Behavioral Sciences*, *202*, 15-23.

Blair, C., & Raver, C. C. (2015). School Readiness & Self-Regulation: A Developmental Psychobiological Approach. *Annual Review of Psychology,* (66), 711-731.

Bracken, B., A. (2007). *BSRA-3 Examiner's Manual.*Pearson, San Antonio.

Dayaratne, R. (2016). Creating Places Through Architecture: Can Environment-Behaviour Help?. *Asian Journal of Behavioural Studies,* 1(2), 1-12.

Field. A. (2013). Discovering Statistics Using IMB SPSS Statistics. 4th Edition. SAGE Publications Ltd.

Ministry of Education (MOE). (2019). *Malaysia Education Blueprint 2013-2025 (Preschool to Post-Secondary Education).*

Mohidin, H. H. B., Ismail, A. S., & Ramli, H. B. (2015). Effectiveness of Kindergarten Design in Malaysia. *Procedia-Social and Behavioral Sciences*, *202*, 47-57.

Moore, G. T. (2012). Update on The Children's Physical Environments Rating Scale (CPERS5). *Children Youth and Environments*, *22*(2), 311-312.

Organisation for Economic Cooperation and Development (OECD), (2018). Retrieved from http://www.oecd.org/pisa/test.

Raghubar, K. P. & Barnes, M. (2017). Early Numeracy Skills in Preschool-Aged Children: A Review of Neurocognitive Findings and Implications for Assesement. *Clin Neuropsychol.,* 31(2), 329–351.

Schultz, D. P., & Schultz, S. E. (2016). *A History of Modern Psychology.* Cengage Learning, Nelson Education, Ltd., Boston.

Shaari, M. F., & Ahmad, S. S. (2018). Preschool Design and School Readiness. *Asian Journal of Quality of Life*, *3*(10), 109-120.

Shaari, M. F., & Ahmad, S. S. (2016). Physical Learning Environment: Impact on Children School Readiness in Malaysian Preschools. *Procedia-Social and Behavioral Sciences*, *222*, 9-18.

UNICEF (2017). School Readiness A Conceptual Framework. Retrieved from https://www.unicef.org/earlychildhood/files/Child2Child_ConceptualFramework_FINAL(1).pdf.