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Pre-school Classroom Environment: Significant upon Childrens' Play Behaviour?

Mohamed Yusoff Abbas^{a*}, Mansor Othman^b & Puteri Zabariah Megat Abdul
Rahman^c

^aCentre for Environment-Behaviour Studies, Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA, 40450,
Shah Alam, Selangor, Malaysia

^bDepartment of Interior Architecture, Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA, 40450, Shah
Alam, Selangor, Malaysia

^cChildren Specialist, Universiti Tun Abdul Razak, Malaysia

Abstract

This paper investigated the relationship between the physical environment of public pre-schools and the children's play behavior. Three types of physical environment of 20 classrooms in 10 Selangor's pre-schools, and the children's five types of play behaviours were investigated. Data collection involved 264 preschool teachers' questionnaire respondents, natural unobtrusive observations with video recordings upon 494 pre-school children, structured interviews upon 20 pre-school teachers and 37 professional interior architects and Moore's (2008) Children's Physical Environment Rating Scale (CPERS). Data were analysed using the SPSS statistical analysis. Influence of the physical environment upon the childrens' behavior was supported and best practices suggested.

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* Corresponding author. Tel.: 006-03-55211541; fax: 006-03-55444353.
E-mail address: myusoff801@salam.uitm.edu.my

1. Introduction

Malaysia envisioned becoming a developed country by 2020, with the emphasis on both first-class infrastructures and first-class mentality. Already she has moved away from being just a Developing Nation and attained the Newly Industrialised Country (NIC) status in 2008 (Cheah, 2008). The most critical element identified towards the achievement of the national mission is on the quality of her human capital. That is why, quality human capital development is a key thrust in the 9th Malaysian Plan (9MP, 2006-2010), currently being implemented. In producing quality human capital development, the nation is currently focusing upon every level of education, starting from pre- schools. The emphasis is on the quality of education and training to be at par with international best practices (EPU, 2006, p. 237, 254).

More recently, Malaysia has identified six KRAs (Key Result Areas) which had been accorded priority in the 2010 Budget and in the planning of the 10th Malaysia Plan, 2011-2015. Amongst those areas identified is on quality and affordable education (Bernama, 2009). Of interest is the Permata Negara programme which focused on early childcare and education which had been allocated RM100 million in the 2010 Budget recently announced. To date, the Permata programme, has been introduced in 457 childcare centres and benefited 17,565 children (NST, 2009). However despite the huge allocation in Budget 2010 for the Permata programme, the emphasise seemed to focus on just the non-physical aspects of pre-schools such as the children's curriculum and the training of the pre- school teachers, without any mention in improvement on the physical environment aspects of the pre- schools, very similar to the soon to be concluded 9MP.

Indeed, the importance of early childcare and education had been recognized much earlier, locally and in the more developed nations. For example, according to Raja Harun, et.al. (2005), pre- school educations are critical years and form the basis for further education in ensuring success of an individual. Weinstein and David (2005) concurred that formal pre-schools contributes to cognitive development amongst Western children which leads to greater intellectual competence and cognitive maturity as compared to Eastern children. Unlike in Malaysia, the more developed nations had given equal emphasis towards both the physical and non-physical environments of pre-schools. For example, Morrow (2007) had stressed that the importance in pre-schools should not only concentrate on lesson planning but of equal importance the spatial arrangements or physical environment. In fact, Moore (2008) concurred that it is already well known that the quality of pre-schools and the like is related to the quality of the physical designed environment.

Does the non-emphasise on the physical environment of Malaysian pre-schools in the 9MP and the forthcoming 10MP means that our pre-schools had attained the quality standard at par to those of other developed nations? What are the ingredients of a quality pre-school? Would emphasis just upon quality curriculum, quality training and on quality child psychology development – the non-physical environment aspects – alone suffice? Those seemed to be the focus of the 9MP and in most of the local literatures, such as by Sharani (2006), Raja Harun, et. al., (2005), and Majzub (2003). What about the physical environment aspects, such as environment for human comfort, quality furnishings and finishing, spatial quality, conducive environment, etc.? Are not those factors of equal importance towards generating quality pre-schools? Those questions prompted the FRGS study conducted from which this paper was based upon.

2. Objective of the Study

The objective of the study was to determine whether the physical environment of those pre-schools are of international standards or quality that would support the children's emotional, social and physical needs. For the purpose of this conference, this paper focused upon the section of the Post Occupancy

Evaluation (POE) which involved the analysis of the relationship between the internal physical environments of the classrooms located at urban and non-urban areas and the types of play behaviours in which the children engaged as children do learn through play. It specifically examined upon the relationship between the children's social behaviours (interactive, non-interactive, appropriate, inappropriate, neutral) and three types of the interior environment of the classrooms, categorized architecturally as well-defined, moderately defined, not defined).

3. Literature Review

Many western-based studies (e.g. Moore, 2008) had revealed the influence of the physical environment, both indoor and outdoor, not only upon children's behaviours and their development but also amongst adults (Abbot, 2001; Neuman and Dickinson, 2001).

3.1. Indoor Environment

In relation to the indoor spaces of pre-schools, studies had been conducted pertaining to the main aspects of human spatial behaviour - which Abbas (2000) identified as personal space / proxemics, territoriality, privacy and crowding. For example, Maxwell (2003) found that the girls' academic achievement was negatively affected by less space per student. The boys' classroom behavior was negatively affected by spatial density conditions, as they naturally required larger personal space as shown by many earlier studies, such as Sommer (1969). Still on the issue of space requirements and crowding, Kantrowitz and Evans (2004) found that the ratio of children to the number of activity areas in the classroom is positively correlated with off-task time. There is also a marginal, negative correlation to engagement in constructive play. Han, et.al. (2008) study on territorial behavior of the children demonstrated the advantages of being on one's own turf. Ahrentzen and Evans (1984) reported that students in classrooms with amenities for private study actually report lower levels of privacy than those students without such classroom amenities. This unexpected finding may be due to limited access to these amenities even when present in the classroom. The children prefer to be in secluded study areas or corners when they wanted to be alone. Other studies of the indoor environment included implications of the volume and wall colour, equipment, playroom arrangement, environment comfort, maintenance and safety. For example, Read et.al. (1999) found that differentiations in ceiling height or wall color were related to higher levels of cooperative behavior among pre-school children. On the issue of space perception, Stankovic and Stojic (2007) reported that if some space is constructed and equipped in the right way, the development of a child's increased abilities gets supported, and that allows a child to confirm itself at the existing level of its capacities.

Pertaining to playroom arrangement, Legendre (1999) found that the type of furniture arrangement did not change the joint use of play areas and the social interactions for the peers whose relationships were weak. In contrast, for children showing an emerging relationship, the playroom arrangement affected the quantity and the quality of their social interactions.

The presence of major visual obstacles also markedly hindered their joint use of adult-distant areas, except for some children showing a particularly tight relationship. Ornstein (1997) studied on the satisfaction levels of occupants (teachers, students, and employees) which involved functional factors, environmental comfort, maintenance, and safety regarding fire and crime. Knowledge of these performance environments during their use will lead to the database comprising project guidelines and parameters for preventive maintenance programs.

Implications of the physical environment on to children competency and development had also been studied. For example, Maxwell (1996) developed a rating scale to assess the physical environment's role

in children's development of cognitive and social competency. He found that the physical environment is related to measures of competency. Mashburn (2008) examined associations between quality of social and physical environments in pre-schools and children's development of academic, language, and literacy skills, and the extent to which pre-school quality moderated the associations between child risk and development. He found that high-quality social environments were positively associated with children's academic and literacy skills at the end of pre-school. He also reported that although the quality of the physical environment was not associated with children's outcomes at the end of pre-school, however, higher quality physical environments moderated the negative associations between income and academic development and between non-White race / ethnicity and literacy development.

3.2. *Outdoor Environment*

Studies conducted on implications of the outdoor environment included on the type of outdoor setting, and provisions in the play ground. For example, Taylor, et.al. (2001) found that children function better than usual after activities in green settings and that the "greener" a child's play area, the less severe his or her attention deficit symptoms. Thus, contact with nature may support attention functioning in a population of children who desperately need attention support. Boldemann, et.al. (2006) opined that the physical qualities of outdoor environments are important to trigger healthy behavior in children. Spacious pre-school environments with trees, shrubbery, and broken ground trigger physical activity and yield sun protection in outdoor play. As many children attend pre-school, access to such environments is recommended in community architecture. Stankovi, et.al. (2006) investigated how physical activity levels are influenced by environmental factors. They found that the quality of architectonic design, that is, the quality of organization and materialization of the designed physical environment of the premises correlates with the positive developmental results of the children. Brown and Burger (1984) found that playgrounds with more contemporary designs as compared to those with less did not necessarily promote greater amounts of educationally desirable social, language, or motor behaviors. There were differences in children's behaviors on various playgrounds, but not strictly according to the extent to which they reflected contemporary design suggestions. They found that the most important design characteristics seemed to be zoning, encapsulation, and the provision of appropriate materials (vehicles appeared to be extremely valuable).

Based from the literature reviewed above, it can be deduced that considerations for the physical environment aspects both indoor and outdoor, are highly relevant towards generating quality pre- schools, hence developing quality human capital in achieving the key thrust of the 9MP.

4. **Research Design**

The research design for this study was based on Descombe's (2001) suggestion, whereby any research should be strategised with one out of the five options – surveys, case studies, experiments, action research and ethnography, while the methodologies for the data collection should incorporate at least three methods for triangulation out of the four options – questionnaires, interviews, observations, and documents.

This section is divided into two main parts. The first part explained about the strategy chosen – surveys, which incorporated also on the reasons for the scope of study upon public pre- schools rather than the private pre-schools, the choice of the state of Selangor as the locations of those pre-schools, and the inclusion of both urban and non-urban areas. The second part is about the methodologies chosen. It is divided into two phases – preliminary study and main study which also incorporated methods for the triangulation adopted for the data collection.

4.1. Strategy

Due to the nature of the study, non-experimental approach using repeated measures was implemented. The preschool differs in term of preschool profiles, spatial definition, and student demography. Studies dealing with the preschool setting are best done on a case by case basis. Use of a multiple case-study approach is further supported by the nature of the research questions. That was in line with Yin's (1994, p. 1) where he opined "Case studies are the preferred strategy when "how" or "why" questions are being posed (or) when the investigator has little control over other events, and when the focus is on a contemporary phenomenon within some real-life context".

4.1.1. Why Public Preschools?

There were several benefits to conducting this research at the public preschool in Selangor. Firstly, Public's Preschool Program is accredited by the Ministry of Education (MOE) for the Early Childhood Education program. Accreditation confirms that the preschool meets the highest professional standards in meeting the development and educational needs of the young children. Secondly, the children were accustomed to seeing different people (e.g., undergraduate students, education personal officer) in their classrooms. Therefore, the presence of the researcher did not inhibit children from their routine behaviours. Thirdly, the children's parents were aware that the preschool was routinely used to conduct academic researches.

4.1.2. Why the location in the state of Selangor?

The reason for the choice of the state of Selangor as the location of the public pre-schools as against the other thirteen states of Malaysia was that the preschools in Selangor have become the point of reference for the other states, as stated by the Ministry of Education (MOE), and whatever data gathered can be assumed to represent the public preschools in the whole of Malaysia.

4.1.3. Why both urban and non-urban being considered?

Pre-schools located at both urban and non-urban areas were involved in the study for comparison purposes. This provided richer data for the analysis stage, particularly in relation to commonalities, differences and peculiarities between those both areas.

4.2. Methodology

The methodology emulated previous studies done by Moore (1994, 2008), and by Zimmons (1997). The present study was distinctive in that while both of the previous studies were based on quasi-experiments upon western children in one area, the present study was based on the natural settings of pre-schools upon Malaysian children in two different areas – urban and non-urban. The methodology involved two phases - preliminary study and main study phases. The preliminary study was more of a familiarization exercise for the researcher prior to conducting the main study.

4.2.1. Preliminary Study

The preliminary study involved four classrooms in two pre-schools randomly selected as well as to represent both the new annex building (Figures 1 and 2) and renovated existing classrooms (Figures 3 and

4), with one located in the urban area while the other located in a non-urban area. The preliminary study served to: - obtain baseline information before the actual study began, allowed the researcher to understand the preschool environment in more detail, provided an opportunity to address and possibly control any unforeseen elements that could impact the study, and to pre-test the questionnaires and instruments.

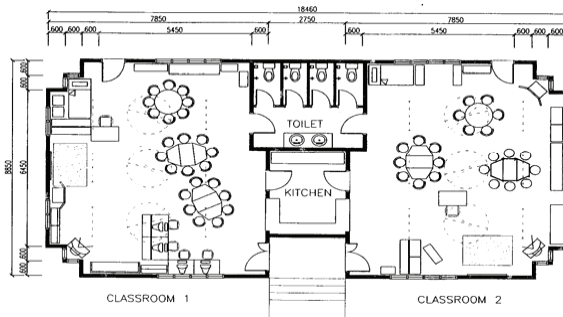


Fig. 1. Example of layout floor-plan of new preschool building (annex building) with two classrooms



Fig. 2 Front view of new preschool building (annex building) with two classrooms.

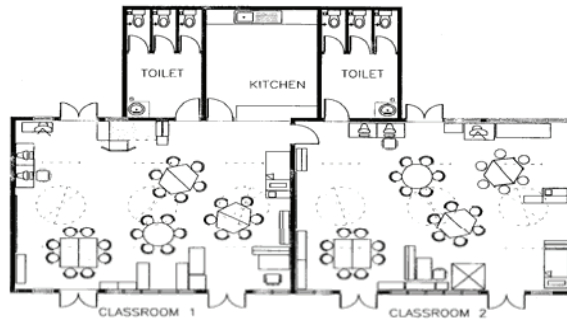


Fig. 3. Example of layout floor-plan renovated existing public preschool classroom



Fig. 4. Front view of renovated existing public preschool classroom

4.2.1.1. Procedure

Prior to the study, permission from the Selangor Education Department, Ministry of Education (MOE) was obtained in the form of a formal approval letter, in order to conduct the survey in the respective public preschools.

Detailed accounts of the activities conducted were as follows:-

- Day 1: Met with the headmaster and preschool teacher to explain the research method and to get their approval. Preliminary questionnaires distributed.
- Day 2: Drew spatial layout of the preschool classroom, and got acquainted with the children and their teacher. Drawings were done to show the spatial organisation, furniture layout, position of mechanical ventilation (ceiling fan) and other architectural features. Photographs were taken to show the classroom in the context with the primary school complex, its compound and play area, as well as the different features that include the internal finishes, the openings (doors and windows), the furniture used and the equipments provided and how they are arranged by the teacher and his / her assistant, the different spaces available in the classroom and its sizes, such as the actual study area, kitchen and toilets.
- Day 3: Unobtrusive natural observation, video recording, took photographs of the children behaviour and mapping their locations. During the third day, the researcher arrived approximately 90 minutes before the scheduled free-play period from 11.00 – 11.30am. Early arrival allowed the researcher time to prepare for the upcoming observations (e.g., setting-up the video camera, position, date, temperature, sunlight direction and preview the observation instrument). Observations were recorded at 30 second interval for the total duration of the free-play period. Recordings were upon the child's behaviour during the onset of the interval and how the behaviour best corresponded to the behaviours described in the Observation Sampling of Classroom Behaviour (Ladd & Price, 1987) an observational instrument specifically designed to assess children's classroom behaviours

4.2.1.2. Data Collection

- Non-Participant Observation

Non-participant observation, the method adopted in this study, occurs when the researcher does not interact with the person(s) or event being observed. This method of observation was adopted for three reasons. Firstly, being disengaged from the process allowed the researcher to be more objective than being a participant would have allowed for. Secondly, as the researcher did not interact with the subjects of the observation it allowed time to take field notes and mapping the children's behavior which were used for reflections on the observations and issues raised. Finally, the researcher desired to be as unobtrusive as possible that the impact on the data collected would be minimal.

The engagement of the researcher in the process of teaching and learning was firstly felt to be disruptive to both teachers and students and secondly would not enable the researcher to fulfill the aim of allowing the data to present itself as naturally as possible. The researcher, however, acknowledges the presence of any third party in the 'intimate' environment of the classroom would cause some nervous tension. The strategies by which such issues were minimized will be elaborated in further.

- The preliminary observation of children's spatial behaviour

The preliminary, unstructured, unobtrusive and observations in natural settings on the children's spatial behaviour were done during their 'free play' time (during recess but after meal). During this period of time of 10 minutes, the researcher observed that:

The children have their own spatial preferences during the 'free play' time, where the majority of the female children tend to complete whatever uncompleted tasks given by their teachers earlier.

The male children tend to 'play' more by running around and engaging in active social interactions. However, there were a few passive onlookers who just observed their classmates, or just looking out the windows, from their designated seating area. Several children engaged in 'role play' by playing- out their favourite superheroes character, example the Ultraman.

The male children tend to play amongst themselves but in small groups of 2 to 4. There were some interactions between the different genders but rather hesitantly.

Most of these 'free play' activities take place in the circulation paths under the ceiling fans, where it is more comfortable.

It was also observed that the children tend to gather where there are soft furnishings, such as the carpet and rubber floor mat. Nevertheless, there were cases of children who chose to isolate themselves by creating their own spaces under their tables or in nooks and corners, regardless of gender.

The female children preferred reading storybooks, played with soft toys and fascinated with the computers. The male children were also fascinated by the computers but the duration of concentration tended to be shorter than the female children. They instead preferred to play with building blocks.

Within the renovated existing classroom, the children tend to be noisier and louder. This could be because of the high 'outside' noise from the rest of the primary school complex, drowning the preschool children's voices. Even the teachers have to speak, sometimes yell, to get the children's attention. This problem does not arise with the new annex preschool buildings because they are located slightly farther away from the rest of the primary school complex.

The 'free play' time allocated is only ten minutes in the current syllabus, as part of their recess time of twenty five minutes, where the first fifteen minutes are spent on their meals. The researcher found out that the ten minutes allocated for 'free play' was insufficient due to the time sequence sampling method used. Therefore, a special permission was later requested by the researcher, supported by the supervisors, and approved by the Ministry of Education (MOE) Malaysia for an additional of five minutes 'free play' time, totaling fifteen minutes of 'free play' time, especially for the second stage observation process of this research.

- Field Notes and Behaviours Mapping

Data based on the observational measures was used to understand better the students' behaviour in classroom environments. In that sense, the researcher proceeded to write field notes which were then used for two purposes. Firstly, these provided a context for the children's behavioural activity and secondly mapping their location in the classroom.

Behaviour mapping, also called activity mapping, involves recording on a plan or map the pattern of movement of people and use in a particular space or place, and may include getting users themselves to plot how they use spaces. Cognitive mapping techniques have been suggested as useful alternatives to survey methods for exploring children's awareness and knowledge of their environment (Morrow, 2001). There are a number of mapping methods that have been developed, including drawing (Morrow, 2001), and photographing the physical environment (Orellana, 1999). These techniques have been shown to be useful tools for explored children's perceptions and thoughts about their environments, as they provide the child with the opportunity to interpret and actively record their experiences (Dell Clack, 1999). In this study, the aims are to establish the pattern of location (movement) of the children in relation

to their physical environment and their social interaction behaviour (appropriate, non-appropriate, and neutral) (Sanoff, H., 1995).

The behavioural mapping technique has been used in order to show students' locations and their movement patterns distributed spatially in school environments. It is a form of direct observation that people's movements are tracked and their behaviours are observed in relation to the settings. Mapping identifies the uses of space as a factor in behaviours (Ittelson et. al., 1974). Behavioural mapping also describes patterns of activities and the use of physical space (Rivlin and Rothenberg, 1976). Recording the type and location of activities helps to study the behaviour in its functional relation to a particular environment. Behaviour is shaped as a result of the opportunities and limitations of physical settings in which it occurs. The standard procedure for behavioural mapping involves observing and recording individuals' activities and their locations through a time period.

This study uses behavioural mapping technique in order to understand students' behaviour and its distribution within school buildings with different spatial layouts. In general, it looks for the relationships between the observed and described properties of physical settings and the observed and described reactions of students in those settings. Therefore, together with the activity logs, the plans of each classroom were provided to the students where they marked their activity locations and movement patterns on the floor plan. The scheduled observations adopt the Behaviour Mapping method for children using time- sampling during free-play activities (6 minutes for each scan, 3 scans, total of observation time is 18 minutes).

4.2.2. *The Main Study*

Prior to the main study, a few adjustments were made in the observation process as follows:-

- Need to carry out a more detailed, structured, unobtrusive, time-sampling method observations.
- Need to observe the spatial behaviour of children within a slightly longer period of time; 15 minutes instead of 10 minutes. This is because of the time-sampling method adopted where it is split into 3 intervals of 5 minutes each.
- Need to include the behaviour-mapping of the children in the classroom in order to identify the spatial choice and location in the classroom during 'free play' time.
- Need to do comparative study between the urban and non-urban classroom settings.
- Need to categorize the classroom layouts into well-defined, moderately-defined and poorly defined in order to facilitate the observation of social interactions and spatial behaviour in context with the physical environment of their classrooms.

Overall, the data collection involved a period of 12 weeks each on the pre-schools located at the urban and non-urban areas.

5. Analysis of Main Findings

Overall the study involved the observation of social behaviours of 494 children, aged 5-6 years, of both genders, in 20 classrooms, categorized into well-defined, moderately-defined and poorly defined, from the 10 pre-schools located at both urban and non-urban areas. The categorizations of the classrooms were based on expert opinion amongst 37 professional interior architects. Amongst the 10 classrooms in the urban and non-urban areas, 70% were categorized as moderately-defined in both areas. However 20% were categorized as poorly-defined in the urban area, while the same proportion were categorized as well-defined in the non-urban area as shown in Table 1.

Table 1. Distribution of Categorised Classrooms According to Areas

Classroom Spatial Definition	Overall (%)	Urban (%)	Non-Urban (%)	Similar	Different
	N=20	n=10	n=10		
Moderately Defined	70	70	70	√	
Well Defined	15	10	20		√
Poorly Defined	15	20	10		√

Data analysed for the occurrences of the five types of social behaviours – Appropriate, Non-Appropriate, Interactive, Appropriate Interactive and Non-Interactive – in relation to the three categories of classrooms – Moderately-defined, Well-defined and Poorly-defined are as shown in Table 2.

Overall, majority which involved all the five types of behaviours occurred at the Moderately- defined classrooms. Notable majority for the Well-defined classrooms involved Appropriate, Interactive and Appropriate Interactive behaviours. A similar proportion for those behaviours for Well-defined classrooms was reflected in both urban and non-urban located classrooms. Notable majority for Non-Appropriate behaviours was observed for the Poorly-defined classrooms in the urban located classrooms. The Poorly-defined classrooms located at the non-urban area recorded notable majority in terms of the Non-Interactive behaviours.

In terms of gender interactions, notable majority was observed at Well-defined classrooms as compared to the Poorly-defined classrooms in urban located classrooms, while the opposite was the case at non-urban located classrooms.

The result of MANOVA as shown in Table S1 concluded that there is a significant difference of number of occurrence of all type of behaviour between poorly-defined setting, moderately defined setting and well-defined setting classroom ($F = 3.565$, $p = 0.0057$).

Upon finding the significance, a series of separate univariate ANOVA tests were performed. Univariate test helped determine which one(s) of the five dependent variables when examined under independent variables, yielded a statistically significant result. Results of the univariate ANOVA for each dependent variable were reported in Table S2.

Table 2. Distribution of Categorised Classrooms in Relation to Social Behaviours According to Areas

Social Behaviours	Classroom Spatial Definition	Overall (%)	Urban (%)	Non-Urban (%)	Similar	Different
		N=1131	n=320	n=811		
Appropriate Social Conversation (SC) Cooperative Play (CP) Friendly Touch (FT) Unilateral Bid (UB) Teacher-Child (TC) Child-Teacher(CT) Solitary Play (SP) Parallel Play (PP) Onlooker (ON) Transition (TR) Unoccupied (UN)	Moderately Defined	61	60	61		
	Well Defined	29	25	31	√	
	Poorly Defined	10	15	8		
		N=235	n=36	n=199		
Non- Appropriate Argue (A) Rough Play (RP)	Moderately Defined	70	69	70		
	Well Defined	12	6	14		

Object Possessiveness (OP) Aggression (AG) Victim of Aggression (VA)	Poorly Defined	17	25	16	√	
		N=1027	n=237	n=790		
Interactive Social Conversation (SC) Cooperative Play (CP) Friendly Touch (FT) Unilateral Bid (UB) Teacher-Child (TC) Child-Teacher (CT) Argue (A) Rough Play (RP) Object Possessiveness (OP) Aggression (AG) Victim of Aggression (VA)	Moderately Defined	60	62	59		
	Well Defined	30	23	32	√	
	Poorly Defined	11	15	9		
		N=572	n=156	n=416		
Appropriate Interactive Social Conversation (SC) Cooperative Play (CP) Friendly Touch (FT) Unilateral Bid (UB)	Moderately Defined	56	63	53		
	Well Defined	34	22	38	√	
	Poorly Defined	11	15	9		
		N=466	n=157	n=309		
Non-Interactive Solitary Play (SP) Parallel Play (PP) Onlooker (ON) Transition (TR) Unoccupied (UN) Other (O)	Moderately Defined	70	60	75		
	Well Defined	14	20	10		
	Poorly Defined	16	20	15		√
		N=219	n=130	n=89		
Gender Interaction	Moderately Defined	66	76	52		
	Well Defined	17	16	19		
	Poorly Defined	16	8	29		√

Table S1. Summary result of MANOVA

Preschool location	Statistics	Value	F	p-value
Urban Preschool	Pillai's Trace	1.686	6.716	0.004
	Wilks' Lambda	0.018	6.464	0.008
Non-urban Preschool	Pillai's Trace	1.034	1.337	0.327
	Wilks' Lambda	0.010	8.905	0.003
Total Preschool	Pillai's Trace	0.7854	2.425	0.038
	Wilks' Lambda	0.2454	3.565	0.006

Table S2. Summary result of MANOVA

Preschool location	Types of Behaviours	Spatial Definition Setting	N	Mean	Std. Deviation	F	p-value	Sig
Urban preschool	Appropriate	Well defined	1	80.00	.	35.850	0.000	yes
		Moderate defined	7	27.43	4.54			
		Non-defined	2	24.00	11.31			
Non-urban preschool	Non-appropriate	Well defined	1	2.00	.	0.082	0.922	no
		Moderate defined	7	3.57	5.44			
		Non-defined	2	4.50	0.71			
	Interactive	Well defined	1	54.00	.	12.744	0.005	yes
		Moderate defined	7	21.00	5.94			
		Non-defined	2	18.00	8.49			
	Non-interactive	Well defined	1	28.00	.	18.521	0.002	yes
		Moderate defined	7	10.00	2.65			
		Non-defined	2	10.50	3.54			
	Neutral	Well defined	1	4.00	.	3.662	0.082	no
		Moderate defined	7	3.43	0.79			
		Non-defined	2	5.00	0.00			
Total preschool setting	Appropriate	Well defined	2	125.00	7.07	25.466	0.001	yes
		Moderate defined	7	70.57	10.11			
		Non-defined	1	67.00	.			
	Non-appropriate	Well defined	2	13.50	6.36	0.293	0.755	no
		Moderate defined	7	20.00	21.17			
		Non-defined	1	32.00	.			
	Interactive	Well defined	2	126.00	1.41	6.656	0.024	yes
		Moderate defined	7	66.29	22.10			
		Non-defined	1	74.00	.			
	Non-interactive	Well defined	2	12.50	0.71	6.090	0.029	yes
		Moderate defined	7	24.29	4.64			
		Non-defined	1	25.00	.			
	Neutral	Well defined	2	3.50	2.12	0.254	0.783	no
		Moderate defined	7	6.29	9.27			
		Non-defined	1	11.00	.			
Total preschool setting	Appropriate	Well defined	3	110.00	26.46	8.798	0.002	yes
		Moderate defined	14	49.00	23.62			
		Non-defined	3	38.33	26.08			
	Non-appropriate	Well defined	3	9.67	8.02	0.046	0.955	no
		Moderate defined	14	11.79	17.12			
		Non-defined	3	13.67	15.89			
	Interactive	Well defined	3	102.00	41.58	4.892	0.021	yes
		Moderate defined	14	43.64	28.17			
		Non-defined	3	36.67	32.88			
	Non-interactive	Well defined	3	17.67	8.96	0.070	0.932	no
		Moderate defined	14	17.14	8.25			
		Non-defined	3	15.33	8.74			
	Neutral	Well defined	3	3.67	1.53	0.260	0.774	no
		Moderate defined	14	4.86	6.49			
		Non-defined	3	7.00	3.46			

- For Appropriate behaviours

It was found that number of occurrence of appropriate behaviour statistically differs between poorly-defined setting, moderately-defined setting and well-defined setting classroom ($F = 6.13$, $p < 0.01$). A post hoc Least Significant Difference (LSD) revealed significant between the following treatments; well defined and moderate defined, and well defined and poorly-defined setting.

- For Non-Appropriate behaviours

Non-appropriate behaviours included: argue, rough play, object possessiveness, aggression, and victim of aggression. F-test is significant ($F = 8.84$, $p < 0.01$) concluding that there is a significant difference in the number of occurrence of non-appropriate behaviour between poorly-defined setting,

moderately-defined setting and well-defined setting classroom. Significant differences, as measured by post hoc Least Significant Difference (LSD) was found between well defined and poorly-defined setting and, moderate and poorly-defined setting.

- For Interactive behaviour

As F test is significant ($F = 5.17, p < 0.0176$), the null hypothesis of no significant difference in the number of occurrence of interactive behaviour between poorly-defined setting, moderately-defined setting and well-defined setting classroom was rejected. The post hoc LSD test found significant difference between well defined and moderate defined and, well defined and poorly-defined setting.

- For Non - interactive behaviour

The F test is significant ($F = 3.78, p < 0.0348$), therefore, it can be deduced that there was a significant difference in the number of occurrence of non-interactive behaviour between poorly-defined setting, moderately-defined setting and well-defined setting classroom. The post hoc LSD test found that significant difference existed between well defined and poorly-defined setting and, moderate defined and poorly-defined setting classroom.

- For Neutral Behaviours

The null hypothesis of no significant difference in the number of occurrence of neutral behaviour between poorly-defined setting, moderately-defined setting and well-defined setting classroom was rejected at 0.05 significance level ($F = 4.08, p < 0.0357$). Significant differences as determined by post hoc LSD existed between well-defined setting and moderately-defined setting classroom. Thus, it can be deduced that physical environment of classroom influenced the children's behaviour.

5.1. Comparing Groups of Behaviours between Spatial Definition Setting and Preschool location

In order to obtain a clearer perspective of impact the Spatial Definition Setting had on the children's behaviours, behaviours similar in nature were grouped together and compared by spatial definition setting and Preschool Location. Since the total numbers of observation were unequal across the spatial definition setting, and preschool location, observation totals were converted into percentages. Percentages better convey how the spatial definition setting may have contributed to certain amounts of observed behaviours.

5.1.1. Analysis of Interactive and Non-Interactive Behaviours between Spatial Definition Setting and Preschool location

The observed behaviours can be divided into two general categories, interactive and non-interactive. Interactive behaviours were operationally defined as behaviours in which a child successfully was able to communicate with another individual. Interactive and non-interactive behaviours can be either appropriate or non-appropriate in nature (Ladd & Price, 1987). Non-Interactive behaviours were operationally defined as action a child engages in independently. At no time does the child attempt to share the behaviour or make contact with another individual. The amount of interactive and non-interactive behaviours was examined between three (3) Spatial Definition Setting and preschool location.

In Non-urban Preschool Setting, the percentage of interactive behaviours was lowest during moderately-defined setting classroom, 24.92% of the total, while non-interactive behaviours activities were the second lowest, 17.02%. Interactive behaviours progressively increased in poorly-defined setting (27.82%), and non-interactive behaviours activities were the highest (47.87%). In well-defined setting

classroom the interactive behaviours were the highest, 47.37% and non-interactive behaviours activities were the lowest (17.02%).

In Urban preschool setting, the percentage of interactive behaviours was highest during well- defined setting classroom, 58.06% of the total, while non-interactive behaviours activities were also the highest, 52.55%. Interactive behaviours progressively decreased in moderately-defined setting (22.58%), and non-interactive behaviours activities were the lowest (22.05%). In poorly-defined setting classroom the interactive behaviours were the lowest, 19.35% and non-interactive behaviours activities were second lowest (25.45%).

Total preschool setting (Non-urban & Urban), the percentage of interactive behaviours was highest during well-defined setting classroom, 55.96% of the total, while non- interactive behaviours activities were the lowest, 31.53%. Interactive behaviours progressively decreased in moderately- defined setting (23.94%), and non-interactive behaviours activities were the second lowest (32.52%). In poorly-defined setting classroom the interactive behaviours were the lowest, 20.12% and non-interactive behaviours activities were the highest (35.96%). A summary of interactive and non-interactive behaviours by Spatial Definition Setting and preschool locations are as summarized in Table S3.

Table S3. Summary of table Interactive and Non-Interactive behaviour for Each Spatial Definition Setting and Preschool location in Preschool Setting

Location of Preschool	Spatial Definition Setting	Total Observation	Observed Behaviors	n	(%)
Non-urban Preschool	Well-defined setting	284 (142)	Interactive	126	47.34%
			Non-Interactive	16	17.02%
	Moderately-defined setting	696(99.4)	Interactive	66	24.92%
			Non-Interactive	33.14	35.26%
	Poorly-defined setting	119 (119)	Interactive	74	27.82%
			Non-Interactive	45	47.87%
Urban Preschool	Well-defined setting	86 (86)	Interactive	54	58.06%
			Non-Interactive	32	52.55%
	Moderately-defined setting	241(34.42)	Interactive	21	22.58%
			Non-Interactive	13.4	22.05%
	Poorly-defined setting	67 (33.5)	Interactive	18	19.35%
			Non-Interactive	15.5	25.45%
Total Preschool	Well-defined setting	370 (123.33)	Interactive	102	55.96%
			Non-Interactive	21.33	31.53%
	Moderately-defined setting	919 (65.64)	Interactive	43.64	23.94%
			Non-Interactive	22	32.52%
	Poorly-defined setting	183 (61)	Interactive	36.67	20.12%
			Non-Interactive	24.33	35.96%

5.1.2. Analysis of Appropriate and Non-Appropriate Behaviours between Spatial Definition Setting and Preschool location

The observed behaviours could also be examined as being appropriate and non-appropriate in nature. Appropriate behaviours included: social conversation, cooperative play, unilateral bid, friendly touch, teacher-child, child-teacher, onlooker, solitary play, parallel play, and transition. Non-appropriate behaviours included: argue, rough play, object possessiveness, victim of aggression, aggressiveness, unoccupied, and other. In non-urban preschool setting, changes across the Spatial Definition Setting levels varied. In well-defined setting classroom, appropriate behaviours totaled 47.61% while non-appropriate constituted 20.61% of total observed behaviours. In moderately-defined setting classroom, the amount of appropriate behaviours activities decreased to 26.88%, non-appropriate behaviours increased to

30.53%. In poorly-defined setting classroom, the amount of appropriate behaviours activities decreased slightly to 25.52%.

In Urban Preschool Setting, changes across the Spatial Definition Setting levels also varied. In well-defined setting classroom, appropriate behaviours totaled 60.87% while non-appropriate constituted 19.86% of total observed behaviours. In moderately-defined setting classroom, the amount of appropriate behaviours activities decreased to 20.87%, non-appropriate behaviours increased to 35.47%. In poorly-defined setting classroom, the amount of appropriate behaviours activities decreased slightly to 18.26%, while non-appropriate activities increased to 44.69%.

In Total preschool setting, changes across the Spatial Definition Setting levels varied. In well-defined setting classroom, appropriate behaviours totaled 55.74% while non-appropriate constituted 27.52% of total observed behaviours. In moderately-defined setting classroom, the amount of appropriate behaviours activities decreased to 24.52%, non-appropriate behaviours increased to 33.55%. In poorly-defined setting classroom, the amount of appropriate behaviours activities decreased slightly to

19.43%, while non-appropriate activities increased to 38.90%. Table S4 summarized the amount of appropriate and non-appropriate behaviours recorded for each spatial category.

Table S4. Summary of Appropriate and Non Appropriate Behaviours for each Spatial Definition Setting and Preschool Location in preschool Setting

Location of Preschool Setting	Spatial Definition Setting	Total Observation	Observed Behaviors	n	(%)
Non-urban Preschool	Well-defined setting	277 (138)	Appropriate	250(125)	47.61
			Non-Appropriate	27(13.5)	20.61
	Moderately-defined setting	634(90.5)	Appropriate	494(70.57)	26.88
			Non-Appropriate	140(20.00)	30.53
	Poorly-defined setting	99(99)	Appropriate	67(67)	25.52
			Non-Appropriate	32(32)	48.85
Urban Preschool	Well-defined setting	82(82)	Appropriate	80(80)	60.87
			Non-Appropriate	2(2)	19.86
	Moderately-defined setting	217(31)	Appropriate	192(27.43)	20.87
			Non-Appropriate	25(3.57)	35.47
	Poorly-defined setting	57(28.5)	Appropriate	48(24)	18.26
			Non-Appropriate	9(4.5)	44.69
Total Preschool	Well-defined setting	359 (119.6)	Appropriate	330(110)	55.74
			Non-Appropriate	29(9.67)	27.52
	Moderately-defined setting	851 (60.78)	Appropriate	686(49)	24.83
			Non-Appropriate	165(11.79)	33.55
	Poorly-defined setting	156 (52)	Appropriate	116(38.33)	19.43
			Non-Appropriate	41(13.67)	38.9

5.1.3 Analysis of Appropriate Interactive Behaviours between Spatial Definition Setting and Preschool location

Social conversation, cooperative play, friendly touch, and unilateral bid were categorized as appropriate interactive behaviours. In non-urban preschool setting, well-defined setting Spatial Definition Setting the appropriate interactive behaviours constituted the highest percentage (53.53%) of all observed activities. The percentage fall in moderately-defined setting Spatial Definition Setting (21.39%), while in poorly-defined setting the percentage slightly increased to 25.07%. Table S5 summarized findings for appropriate interactive behaviours.

Table S5. Summary of Appropriate Behavioural for each Spatial Definition Setting and Preschool Location in Preschool Setting

Location of Preschool	Spatial Definition Setting	Total Observations	Observed Behaviour	n	Combined Observed Behaviours	(%)
Non-urban Preschool	Well-defined setting	416	Social Conversation	44	158(79)	53.53
			Cooperative Play	38		
			Friendly Touch	42		
			Unilateral Bid	34		
	Moderately-defined setting	416	Social Conversation	84	221(31.57)	21.39
			Cooperative Play	67		
			Friendly Touch	51		
			Unilateral Bid	19		
	Poorly-defined setting	416	Social Conversation	12	37(37)	25.07
			Cooperative Play	11		
			Friendly Touch	9		
			Unilateral Bid	5		
Urban Preschool	Well-defined setting	156	Social Conversation	10	35(35)	57.85
			Cooperative Play	8		
			Friendly Touch	9		
			Unilateral Bid	8		
	Moderately-defined setting	156	Social Conversation	43	98(14)	23.14
			Cooperative Play	38		
			Friendly Touch	13		
			Unilateral Bid	4		
	Poorly-defined setting	156	Social Conversation	7	23(11.5)	19.01
			Cooperative Play	9		
			Friendly Touch	6		
			Unilateral Bid	1		
Total Preschool	Well-defined setting	572	Social Conversation	54	193(64.33)	60.06
			Cooperative Play	46		
			Friendly Touch	51		
			Unilateral Bid	42		
	Moderately-defined setting	572	Social Conversation	127	319(22.79)	21.27
			Cooperative Play	105		
			Friendly Touch	64		
			Unilateral Bid	23		
	Poorly-defined setting	572	Social Conversation	19	60(20)	18.67
			Cooperative Play	20		
			Friendly Touch	15		
			Unilateral Bid	6		

5.1.4 Analysis of Appropriate Non-Interactive Behaviours between Spatial Definition Setting and Preschool location

Behaviours that were considered appropriate yet non-interactive included: onlooking, solitary play, and parallel play. In non-urban preschool, majority (40.46%) of the appropriate yet non-interactive behaviour occurred at poorly-defined setting, while the least (20.23%) occurred at the well-defined setting. However, the reverse was observed in urban pre-schools, where majority (57.73%) of such behaviours occurred at well-defined setting. In total preschool setting, almost similar proportion of the behaviour was observed at both the well-defined and moderately-defined settings as summarised in Table S6.

Table S6. Summary of Appropriate Non-Interactive Behaviours for Each Spatial definition Setting and preschool location

Location of Preschool Setting	Spatial Definition Setting	Total Observation	Observed Behaviors	n	Combined Observed	(%)	
Non-urban Preschool	Well-defined setting	220	Onlooker	12	25(12.5)	20.23	
			Solitary play	8			
			Parallel play	5			
	Moderately-defined setting	220	220	Onlooker	68	170(24.29)	39.31
				Solitary play	80		
				Parallel play	22		
	Poorly-defined setting	220	220	Onlooker	8	25(25)	40.46
				Solitary play	9		
				Parallel play	8		
Urban Preschool	Well-defined setting	119	Onlooker	8	28(28)	57.73	
			Solitary play	11			
			Parallel play	9			
	Moderately-defined setting	119	119	Onlooker	33	70(10)	20.62
				Solitary play	31		
				Parallel play	6		
	Poorly-defined setting	119	119	Onlooker	5	21(10.5)	21.65
				Solitary play	12		
				Parallel play	4		
Total Preschool	Well-defined setting	339	Onlooker	20	53(17.67)	35.23	
			Solitary play	19			
			Parallel play	14			
	Moderately-defined setting	339	339	Onlooker	101	240(17.14)	34.19
				Solitary play	111		
				Parallel play	28		
	Poorly-defined setting	339	339	Onlooker	13	46(15.33)	30.58
				Solitary play	21		
				Parallel play	12		

5.1.5 Analysis of Teacher-Child and Child-Teacher Interactions between Spatial Definition Setting and Preschool location

The amount of interaction children had with the teachers were examined. Because the two behaviours were closely related, teacher-child and child-teacher interaction were combined. The term “teacher” has been operationalized to include any adult (e.g. including assistant teacher and practical teacher, etc.) interacting with children.

In non-urban preschool setting, well-defined setting recorded 62.95% of teacher-child and child-teacher interaction. The amount of teacher-child and child-teacher interaction for moderately-defined setting decreased to 27.65%. The percentage of observed teacher-child and child-teacher interaction declined to lowest percentage (9.40%) in poorly-defined setting classroom.

In urban preschool setting, well-defined setting recorded 75.80% of teacher-child and child-teacher interaction. The amount of teacher-child and child-teacher interaction for moderately-defined setting decreased to 15.29%. The percentage of observed teacher-child and child-teacher interaction declined to lowest percentage (8.92%) in poorly-defined setting classroom.

In total preschool setting, well-defined setting recorded 69.88% of teacher-child and child-teacher interaction. The amount of teacher-child and child-teacher interaction for moderately-defined setting decreased to 22.64%. The percentage of observed teacher-child and child-teacher interaction recorded the lowest percentage (7.49%) during poorly-defined setting classroom as summarised in Table S7.

Table S7. Summary of Teacher-Child and Child-Teacher Interaction for Each Spatial Definition Setting and Preschool location in Preschool Setting

Location of Preschool Setting	Spatial Definition Setting	Total Observation	Observed Behaviors	n	Combined Observed	(%)
Non-urban Preschool	Well-defined setting	175	Teacher-Child	34	67(33.5)	62.95
			Child-Teacher	33		
	Moderately-defined setting	175	Teacher-Child	53	103(14.71)	27.65
			Child-Teacher	50		
	Poorly-defined setting	175	Teacher-Child	3	5(5)	9.4
			Child-Teacher	2		
Urban Preschool	Well-defined setting	45	Teacher-Child	8	17(17)	75.8
			Child-Teacher	9		
	Moderately-defined setting	45	Teacher-Child	12	24(3.34)	15.29
			Child-Teacher	12		
	Poorly-defined setting	45	Teacher-Child	2	4(2)	8.92
			Child-Teacher	2		
Total Preschool	Well-defined setting	220	Teacher-Child	42	84(28)	69.88
			Child-Teacher	42		
	Moderately-defined setting	220	Teacher-Child	65	127(9.07)	22.64
			Child-Teacher	62		
	Poorly-defined setting	220	Teacher-Child	5	9(3)	7.49
			Child-Teacher	5		

5.1.6 Summary of Gender Interactions

The amount of gender interactions amongst the children were observed for both locations. In non-urban preschool setting, well-defined setting contained 43.38% of gender interactions. The amount of interaction for moderately-defined setting was decreased to 33.17%. The percentage declined to lowest percentage (23.45%) during poorly-defined setting classroom.

In urban preschool setting, well-defined setting contained 45.95% of gender interaction. The amount of interaction for poorly-defined setting was decreased to 35.14%. The percentage of interaction declined to lowest percentage (18.92%) during moderately-defined setting classroom.

In total preschool setting setting, well-defined setting contained 36.17% of gender interactions, and reduced to 34.26% in poorly-defined setting. The percentage of observed interaction declined to lowest percentage (10.36%) during moderately-defined setting classroom as shown in Table S8.

Therefore, it can be deduced that well-defined setting encouraged gender interactions at both locations,

5.1.7 Investigating the effect of location of the pre-school on the children's behaviour.

In addition, the study was interested to investigate the relationship between location of pre-school (non-urban and urban) and behaviour of children. Summary of the analysis in Table S9.1 revealed that the number of occurrences for all types of behaviour in non-urban pre-school was higher compared to urban pre-school. This is in line with the results of MANOVA as summarized in Table S9.2 which concluded that there is a significant difference of occurrence of children in all types of behaviour between non-urban and urban pre-school ($F = 0.0824$, $p = 0.0001$).

Therefore, it can be deduced that location of pre-school significantly influences the behaviour of children.

6. Discussion and Conclusion

In their earlier studies based on quasi-experiments upon western pre-school children both Moore (1994, 2008) and Zimmons (1997) found significant differences between areas within the classroom

spatially designed to support prosocial interaction (cooperative play, social conversation) as compared to areas within the classroom not designed to support prosocial interactions. Their results indicated that when furnishings in the classroom environment created more spatial definition, children responded with more cooperative play and social conversation in spatially defined areas.

The present similar study, though distinct from their studies was based on natural settings of pre-schools upon Malaysian (eastern) pre-school children on two different located areas – urban and non-urban. Results of the present study indicated similar findings in that children's behaviours seemed to not only be influenced by the physical environment of the classrooms, but also more positive behaviours being influenced by the more spatially defined areas. Hence, despite the different cultural background, the findings seemed to be universal. The implications are for the design of quality pre-school classrooms, the activity areas within should be well defined.

Based on the expert opinion amongst the professional interior architects who rated 70% of the classroom under the present study as moderately-defined for both urban and non-urban located pre-schools, much yet to be done on the physical environment of the Malaysian classrooms to be of quality. In addition, as location (urban or non-urban) of pre-school significantly influenced the behaviour of children, further studies on that aspect is suggested for future research.

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