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Research paper

Learning Space in Public Secondary Schools for Students Psychological Development and Well Being

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Abstract

This paper explores on learning spaces in Malaysia's public secondary school as it plays vital role that responds towards students' psychological needs. Past literature on public secondary schools in Malaysia only focuses on teaching and learning methods as well as from the aspect of school management and maintenance. None of the above literature discusses on how to design appropriate learning space in Malaysian public secondary schools. To conduct this study, qualitative and quantitative methods involving perception of public secondary school students and direct observation on two selected case studies were done to establish appropriate learning space design attributes. There are two key factors that contributed in the psychological development of student in their learning environment. These are the physical classroom aspects like access and circulation, classroom proportion, furniture layout, and technology capability. as well as the the functional characteristics of learning space involving the air quality, room temperature, lighthing dan acoustics. The findings are of benefits for future designers, builders, education providers and related authority to build conducive learning space to improve the quality of public education infrastructure for students learning advancement in the future.

Keywords: *learning space; public secondary school; student psychology*

1. Introduction

Learning space is an important attribute in contributing towards the development of education as well as impacting student behavior as main user. The reviews of past scholars concluded that the environment of schools does make a difference in students learning and the school where students attend can make a significant difference in their level of academic achievements [11,4]. In reference to previous scholars, this learning spaces can be understood from three interrelated perspectives namely the role and function of pedagogy like SCL, PBL, HOTS and others, the application of technology such as ICT tools and the creation of physical space [13]. Although these three components contribute to the students' educational development, the aspect of providing conducive space is much vital in promoting creative learning as well as producing better quality students with positive emotion [13]. Nevertheless, the existence of this learning space namely in Malaysian public schools are insufficient and undermined in terms of design approaches. In other words, lack of design sensitivity to cultivate mentality and well being of students [36, 29, 33]. Majority of local scholars also agreed that some schools have not achieved a conducive and safe environment for students. This is based on several incidents that shocked the nation recently relating to reported cases of gangsterism, bullying, loafing, free socializing, extortion, fighting, theft, rape, murder as well as black metal culture which provide the public with an unsafe impression in present school design involving primary as well as secondary schools [36,29,33]. Moreover, past studies on Malaysian schools namely focuses on five aspects. These are the impact of facilities on learners to improve learning possibilities [32]; pedagogy and teaching methods in learning spaces [37]; the exploration of student abilities to be bilingual using interactive module and tools [30, 16, 7]; personalized learning environment (PLE)and WBL (Web base learning) via digital technologies [27]; management of effective schools concerning school managers leadership and governance as well as the role and importance of smart school environment [38]. None of the studies elucidates on providing better learning space design that caters to the qualities of an effective learning spaces in school towards the development of student psychological well being. This aspect is important because physical environment of the classroom will result to optimal learning and create positive environment for cultivating constructive knowledge culture.

This study therefore aims to investigate the condition and problems of existing schools in Malaysia as well as to showcase the influence and effectiveness of learning space for student psychological development focusing only on secondary public schools. This paper also attempts to get students perception towards their learning space. The outcome of the study will be on providing a design guideline framework on conducive learning space for secondary schools. The scope of the study is on secondary schools and education because in many develop countries the increased demand for workers and employment are mostly with secondary schooling as the produced graduates are well associated and equipped with basic skill-biased to adapt to technological change and country's economic growth. Studies done by scholars [3, 5], highlights that economic growth of developed countries namely is positively related to the starting level of average years of adult

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male school achievement at secondary and higher levels instead of primary attainment.To support this, scholars also states that there is a strong effect of secondary and higher schooling on the diffusion of technology as secondary education is a part of a virtuous circle of economic growth within the context of globalized knowledge economy [3,10]. For the benefit of the study and to fulfil the objectives, section two will discusses on the literature review.

2. Literature Review

2.1 Meaning, Typology and Characteristic of Public Secondary Schools

In general, secondary schools can be defined as intermediate schools between primary schools and colleges or universities. Secondary schools may comprise of several categories involving public, technical, vocational, or pre-college curriculum. In the Malaysian context, secondary schools are known as secondary high schools or national secondary schools. Education in Malaysia is overseen by the Ministry of Education (Kementerian Pendidikan) following the Malaysian Education Act (1996). In the Malaysian education, there are seven categories of secondary schools involving National secondary school (Sekolah Menengah Kebangsaan) using Malay as the main medium of instruction, full boarding schools, technical schools, religious schools, National Type Secondary School (Sekolah jenis Menengah kebangsaan) providing teaching of Chinese and Tamil languages as well as Cluster and Smart Schools. Secondary education lasts for five years, referred to as Form (Tingkatan) 1 to 5. Form 1 to Form 3 are known as Lower Secondary (Menengah Rendah), while Form 4 and 5 are known as Upper Secondary (Menengah Atas). At the end of Form 3, the Pentaksiran Tingkatan 3 (PT3) or Lower Secondary Evaluation, currently known as PBSMR (Penilaian Berasaskan Sekolah Menengah Rendah) or Lower Secondary School Based Assessment. At the end of Form 5, students are required to take the Sijil Pelajaran Malaysia (SPM) or Malaysian Certificate of Education examination.Students who graduated from form 5 will then proceed to pre-college or university matriculation.

2.2. Teaching and Learning Approaches in Public Secondary School

Teaching and learning approaches in secondary school involve three main areas which are cognitive, affective and psychomotor domain. The cognitive domain much related to mental action or processes of acquiring knowledge and understanding through students thought, experience, and the senses. In brief, cognitive taxonomy can be understood based upon Bloom's [5] with Anderson [1] and Artzt [2] taxonomy whom emphasis on students thinking domain involving the aspects of knowing, understanding, applying, analyzing, evaluating, and the last and finally the highest function which is the level of creating. This cognitive approach adopts teaching and learning process that is based upon one-to-one way of communication to promote open discourse among students as well as between students and teachers. This is vital to encourage instructional responses from students to expose them to independent learning in the form of open questions and answers dialogues. By promoting cognitive approach students understanding will be enriched with knowledge and equipped with independent learning skill. Affective domain on the other hand involve teaching and learning that concerned with feelings or emotions development. In adopting this domain there has to be a very clear instructional intention for growth in this area specified in the learning objectives. The psychomotor domain involves learning that is concerned with the movement of body parts. Usually students are exposed to the psychomotor domain via the school's co-curriculum activities. For example, through sports or school band that involves learning in a practical way to coach students on teamwork, discipline and respect. Other examples include physical education lessons, practical activities in the life skills workshop and the school laboratory. The application of these three domains may occur during the teaching and learning process in indoor learning spaces like classrooms and laboratory or outdoor environment such as open field or school compound.

2.3. Definition, Form and Problem of Learning Spaces in Public Secondary Schools

In the context of secondary schools, there are various factors influencing the students' learning conditions that includes three aspects; the student-teacher relationship, management and classroom condition [24]. The classroom climate is a compilation of factors including social interactions between students and teachers, behavioral and academic expectations, as well as the physical environment of the classroom [9,20]. In addition, there are also other factors like influencing the students' learning conditions which includes three aspects; the student-teacher relationship, management and classroom condition. Nonetheless, learning spaces are the most important space in forming the backbone of school design planning. This is because learning is defined as an identification process about something that can give an understanding of knowledge and experience whether formally or informally, thus the physical aspects of space can also have an impact towards learning as it can shape the experience of the student towards a positive way in the form of creative exploration and collaboration, or in negative way. According to research by scholars, classroom design could be attributed to a 25% impact, positive or negative, on a student's progress over the course of an academic year [20]. This assertion is also supported by past scholars [15, 25;12] who states that, 'People are coining alternatives to the word classroom—such as learning zone—to indicate that this space is something deeper and more purposeful, as it shapes one thinking and behavioral pattern.'

According to Johnson & Lomas [25; 12], ―When asked to define the "spaces for learning" , many identify it as classrooms or laboratories. These "formal" spaces are usually controlled via parameters such as scheduling requirements, set hours of use, set number of seats, and predetermined learning activity patterns such as lectures or discussions. Even in formal learning spaces, however, instructors can take advantage of emerging student practices in a variety of ways'. According to Johnson & Lomas [25;14] on the other hand,―'General teaching spaces in schools have been dominated in the last century by one type of design: tutor-focused, one-way facing and presentational, with seating arranged in either a U shape or in straight rows.'

Johnson & Lomas [25] outlines that a comfortable and conducive classroom is very important as it plays a role in influencing the students' behaviour. Even so, many schools will only create classroom environments that is equipped with basic furniture only such as tables, chairs, closets, whiteboards and notice boards for teaching materials. Typically, a classroom is filled with tables and chairs for 30-40 students, as well as a table set for the instructor in front of the classroom space. The arrangement will likely be auditorium-styled or U-styled. The classroom will have maximum window opening on one side of the design space to ensure an abundance of natural light. The placement of the entrance doors will typically be at the front and back of the classroom, where it leads to an open and covered corridor passageway adjacent to the classroom.

According to Neufert [23; 78], a typical measurement for a classroom is per the following, 'Classroom: one classroom per class, square if possible, in exceptional cases rectangular, max. 32 pupils, minimum of 65-70m2 (approx. 2.00m2 X 2.20m2 per pupil) if possible daylit on two sides. Furniture either in rows of informally arranged.' Based on this understanding with regards to the condi-

tion and context of classrooms normally found in secondary schools, thus various issues and problems arise related to the existing layout configuration and classrooms. Scholars have outlined that there are two (2) main aspects in terms of physical and non-physical requirements encompassing several factors that contribute to the usage of current available learning spaces to be less effective on the students that utilize these spaces. Among these factors are-

a)Lack of emphasis on the non-physical aspects such as the air quality control, unsuitable room temperature, the lack of lighting control and the ineffective acoustic insulation.

Most classrooms are designed in a typical rectangular style and even with a side opening on both opposing sides of the wall, there is hardly enough air circulation to cool the entire internal section of the classroom especially the central portion. The air circulation conditions in a classroom becomes more critical whenever it rains, as the windows are closed to avoid rain splashes from getting into the classroom. This will result in a crowded and closed learning space, combined with the students' and instructors' body heat, leading to classroom conditions that are more humid and hot. Even though a ceiling fan is available, the air circulation is poor, and indirectly increases the temperature inside the learning space to an uncomfortable level and unconducive for learning. This is supported by studies from scholars [26, 24], that outlines that if the room temperature and humidity increases, the students' performance achievement and observation can deteriorate. An appropriate room temperature condition is closely linked to the students' emotional development and can lead to an increase in students' productivity The optimal temperature range for learning appears to be between 20° to 26 deg celcius°[18, 21]. In an experiment on effects of temperature on learning, male undergraduates performed best on a test of word associations when they had learned those associations in a 26 deg celsius° room, and performed significantly worse as temperatures became more extreme in either direction [34]. He also asserts that the increase in temperature will lead to an increase in carbon dioxide levels in a classroom due to the lack of air circulation and disrupt the students' focus and concentration on their studies [34].

The effect of lighting in learning spaces also contributes to the shaping of students' behaviour. According to past scholars, there exists a significant gap in the academic achievements between students in a classroom utilizing natural lighting as compared to students in a classroom utilizing artificial lighting [22]. He also documented in his study that this gap is quite significant that mode difference reaches up to 80 to 90 percent. Students exposed to a significant quantity of natural lighting in a bright classroom, as well as being surrounded by large and wide window openings facing open greenery areas will feel less anxiety, less prone to disinterest, and can easily focus on the learning task at hand as compared to students situated in a relatively closed and dark classroom, with limited lighting illuminated by artificial lighting. Students that are within classroom conditions which are equipped with artificial lighting at a duration exceeding 4 hours and above will easily experience emotional stress, depression as well as the lack of visual stimulation and concentration [12].

A proportionate acoustic insulation plays an important role and influences the achievements and behavior of students. Based on studies reports by scholars that is conducted at the primary and secondary school levels, excessive environmental noise such as road and air traffic noise, or adjacent classroom noise during study lessons can disrupt students. The state of the learning space without sound insulation as well as exceeding the threshold of hearing comfort, which is between 40 to 60 decibels, will expose the students to factors such as distraction, irritation, auditive trauma and fatigue if the effects of noise continues to the maximum degree. Acoustic performance is very important as it is closely related to a classroom's design and influences the students' psychology.

Aesthetical features like wall décor and objects that are displayed in classrooms also may affect classroom culture. The objects present in a classroom influence performance and shape student aspirations as well as influence students' educational interests and choices [8]. This is partly why teachers have displayed pictures of high achievers and reowned figures in classrooms for many years [19]. Everyday objects displayed in a school or classroom can be detrimental when they distract from learning. By creating distinct areas with special display objects for individual and group work, like added plants and inspirational posters, and reorganized materials to make them more easily accessible to student will show sustained improvements in engagement and reduced disruptive behavior among students [8]. The presence of objects in the class environment also signaled who "belonged" in the space. To feel like they belong, students must also be able to relate to the other people who commonly seem to inhabit a space or pursue a type of career. However, the adaptation of amounts of wall adornment must be consider in care as the effect differs according to the needs of individual at all age groups.

b)The lack of attention to the physical aspect needs such as the problem of classroom size and density
Classroom size and density also influences the behavior of students. According to scholars [21, 23, 25], currently many schools are quite dense and possesses limited space due to the increase in student enrolment every year caused by the rising economy and drastic social development. Hence, the capacity of each study classroom has to support a large amount of students and this causes each space in the classroom to be filled with tables and chairs for the students' use. The result is that there is no space left that can be used for various other activities whether it is for individual or group work as a result of the static and rigid furniture arrangement which is more akin to a traditional/standard classroom characteristic with a row-by-column seating. Other than that, the large number of students in a packed classroom can also affect the students' psychology in that they will exhibit a laziness to mix around, be individualistic, and affect the desire to have an associative attitude, and this will reduce the degree of motivation and creativeness of the students. Furthermore, students will be in a noisy and agitated environment due to the issue of overcrowding. Also, the teaching staff will also face difficulty to control the students' behaviour and monitor the students' performance due to the large number of students. According to past scholars, a large class capacity with an overwhelming number of students will reduce the proportion of student participation. The effect is that students will not be able to master academic grade achievements, lose the motivation to attend classes and lose creative values [31]. Based on these two main problems, scholars have outlined recommendations on the methodical approach to create a conducive learning space and suited to the students' psychological development. The exposition put forth by these scholars will be used as an indicator for studying the selected cases.

2.4. The Development Approach of an Effective Learning Space

According to scholars, learning spaces plays an important role to the students' psychology as an effective methodology in designing learning spaces, whether formal or informal, can raise the academic achievement quality and shape the students' emotional as well as intellectual balance. According to Oblinger [25], there are three main components that require attention in designing learning spaces for students. First, is the physical space itself. Secondly, the relationship between the community and environmental context. Thirdly, is the exposure to technological essentials.

a) The physical context of learning spaces

Scholars have stated that physical spaces that fulfil the student's requirements need to be designed in order to be consistent with learning theory in which it involves the process of receiving, preserving and disseminating of knowledge to occur easily. As such, to achieve the above process in order to enable the transfer of knowledge to easily, rapidly and efficiently occur from the teaching staff to the students, the physical spaces that is built needs to be flexible, comfortable and possesses design characteristics that is capable to stimulate the students' five senses in the form of sound, sight, taste, touch and smell. Also, it exhibits a decentred spatial concept, that is a concept that leans towards a socio-constructive design that can encourage learning and build knowledge together. For example, the studio-like classroom [14]. Other than that, it adopts the concept of collaborative living-learning spaces that brings the characteristics, elements and values of the students' homes, for instance privacy, safety, accountability and others integrated with the learning environment. This is important so that students will sense a more welcoming learning environment such as a home-like environment (my school my home). The physical learning space also adopts a design concept that utilises unutilised and negative spaces. Examples include improving the corridor quality, leftover spaces, negative spaces and others. In this respect, the corridor space not only functions as a walkway, but contains pocket-like corners that function as learning spaces or function as discussion spaces or decorated with beneficial elements that provides knowledge [14].

b) Learning spaces that relates to the community and environmental context

According to Johnson [15] and Oblinger [25; 89], *'Community catalyzes deep learning and should be a critical consideration when planning physical and virtual learning spaces.*' In other words, even though learning involves changes to the individual, the changes involves the socio-environmental context that includes many other individuals. Thus, all aspects of learning including learning spaces design planning needs to emphasise the awareness of community life.

c) Learning spaces with technological essentials

Johnson [15] dan Oblinger [25] stated that students in the era of globalisation are more interested in appreciating learning via digital access, online, and practical manner as well as looking for instant results and socializing. Even though students value online relationships highly, they still require direct interaction with others. Students prefer to learn in a practical manner as compared to learning the traditional way. As such, in designing learning spaces, it needs to give attention to the technological aspects via two main methods. First, is the Internet access - the Internet represents a medium for finding information and the information is very effective in comparison to traditional medium such as books or other physical reading materials. Even though reading materials is still considered important, but the information queries on the reading materials will be done via a search on websites. This medium will be utilised by students looking for quick information without assistance or expecting others' help. Each individual will surf the Internet, evaluate the information while forming a synthesis. The traits of current students are that they are more independent, self-motivated, curious and have a hunger for knowledge. Even so, this digital familiarity does not mean they are skilled using it, and students use the technology to only obtain quick results from their activity without having to wait a long time. In fact, they will develop social network among friends to find the required answer. As a result of social networking, new technologies are frequently adapted and easily taken for granted. Apart from finding knowledge, students also utilises the Internet access to socialise through social network websites such as Myspace or Facebook. This phenomenon has become the norm of students due to their interest to take part and share information among friends that they are acquainted with or new acquaintances. Directly, they share knowledge through this new technology. Most of them will learn new things and teach them to other friends. As such, the learning process is continuous while the social networking is occurring. Other than that, current students feel more at home to work in groups because the interaction duration between them not only happens within the physical space but also in the virtual world.

Secondly, are mobile technology devices - Mobile technology such as laptops, iPods or even mobile phones are usually carried around as it has become a necessity in the lives of students. Most of them spend time downloading and storing their numerous song collection in an MP3 player. If we look at the entirety of this culture, it is as if it has become a symbolic status for students with various series model, shape and colour. In terms of the usage of these devices, it can be seen as an easy facility to surf the Internet, or send Short Messaging Services (SMS) that is intended to communicate and share information about their location or activities with their acquaintances. These activities continually occur not only through text, but also through shared images, video or audio.

Based on 3 main indicators that are mentioned previously, thus the researcher have used these three indicators to investigate two case studies of public secondary schools in Malaysia to observe the effectiveness of its design and propose improvements that can be made in the context of students' psychological development in the Malaysian context. The next section will explain the study methodology that was utilised to elucidate the methods used and the analysis that was made.

3. Methodology

This study will utilise case studies as the research strategy under the framework of mixed methods which is the combination of qualitative and quantitative approaches. For the data collection method from the case studies chosen, the scientific research method, direct observation and close-ended questionnaires are used to obtain data based on the three outlined characteristics to understand classroom spaces as a conducive place for the sake of the students' psychological development. Because these three characteristics involve the planning of spaces and elements that defines space, hence indicators that relates to the physical space aspect which is access, circulation, scale as well as classroom proportion, hierarchy and function, the provision of space encompassing air quality, room temperature, lighting, and acoustic conditions as well as the technology capability will be utilised. This is important to answer the study objectives in outlining the design space approach that is suited for the development of conducive learning classrooms towards a positive students' psychological development. The analysis of study findings that will be conducted on the three chosen methods. First, to analyse the study findings from scientific research, the hermeneutic method via coding is utilised to analyse data from scientific research which consists of primary and secondary sources. Secondly, to analyse the data from direct observation, methods such as semiotic is used as it involves the study of meaning and sign. This method of analysis is considered as an important contribution as it introduces new ways of looking at ecology houses as a system of 'sign' as well as proposing indicators to investigate this matter in depth. Data from observation then is built upon the theories and concepts outlined by Saussure on sign relations, Barthes on levels of signification and Gottdiener on reading the built environment as reliable ways for analysing and understanding the design of classrooms in selected schools. To analyse data from questionnaire SPSS method is used and findings are tabulated for discussion. All collected data then is used to propose the best possible design guideline for classroom design to achieve the objective of the study.

The findings then will be discussed in two main parts. The first part of the research will be focusing on the observation of physical design attributes representing 2 case study of school located in Putrajaya and Kuala Lumpur. These schools are Sekolah Menengah Kebangsaan Miharja and Sekolah Menengah Kebangsaan Putrajaya

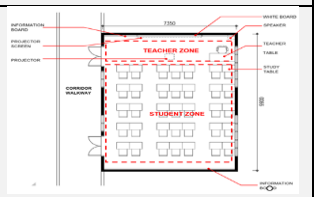
Presint 16(1). Justification selection of the two-case study are based upon two main criteria. The first criteria are on the category of school which represent government school type. The first is of a government school which was built to provide education whether at the national level, regional or local, that is provided by the civil government institution and paid for by the tax received by the government. The education system is based on the curriculum set by the Ministry of Malaysian education. The second criteria is according to the location and placement of the school in which one is situated in the urban context and the other is located in suburban context. Location is an important aspect to look at as it may indirectly influence the shaping of the school and classroom design. As according to scholar urban school districts operate in densely populated areas serving significantly more students compared to school in suburban areas. In comparison to suburban and rural districts, urban school districts are frequently marked by higher concentrations of poverty, greater racial and ethnic diversity, larger concentrations of immigrant populations and linguistic diversity, and more frequent rates of student mobility [17]. Hence, indirectly determine the size, capacity and density of student will effect the class design.

The second part handled on the response of 120 students representing each case study based on the conducted questionnaire. The justification for number of sampling size respondents were determined referring to number of students from the upper secondary level which is form 5 students at the range age between 17 to 18 years old. This is because at this category they often spend longer time in class namely during normal learning hours in the weekdays from 7am to 3pm and at weekends. This is because they usually have extra tutorial hours in average of 4 to 5 hours during weekends to prepare for high school examination (SPM) or the Malaysian Certificate of Education, which is a national examination taken by all fifth-year secondary school students in Malaysia equivalent with O- level before entering into a tertiary level education at a university or other higher education institutions. Hence, the utilization of classroom spaces is mostly used by this type of respondent compared to other students. The sampling size is also determined based upon the benefits of Central Limit Theorem that highlights adequate size of finite population. The respondents are also selected based on age group from various ethnicity with different cultural background. The students are inquired referring to the indicators developed from the elements that define spaces encompassing the physical space aspects which are access, circulation, scale as well as classroom proportion, hierarchy and function of the provision of space encompassing air quality, room temperature, lighting, and acoustic conditions as well as technology capability. This is important to determine whether the classroom design fulfils the criteria of effective and conducive learning space as highlighted by scholars from the literature review. The focus of the questionnaire however is studied based on classroom as learning spaces not include others. This is because many scholars indicate that personalization of individual spaces among students much occurs in the classroom rather than other learning spaces like library or laboratories. This is important as classrooms are easy to adapt, giving both students and teachers a sense of ownership for their space.

4. Results and Findings

This section discusses on the findings gathered from observation on the two selected case study above. The observation is conducted referring to five main indicators which are accessibility to classroom (CI1) circulation to and within classroom (CI2) scale and proportion (CI3), hierarchy and function (CI4i & CI4ii) involving setting and furniture arrangement as well as technology capabilities.

Table 1: Results from observation -Sekolah Menengah Kebangsaan Miharja, Kuala Lumpur(SMKM)

Classroom Indicator (CI)	**Case study 1 (SMKM) Sekolah Menengah Kebangsaan Miharja, Kuala Lumpur**	**Figures**
	This school was built in the year 2000 in tandem with the rapid pace of development and population growth in the Taman Miharja area.	
Accessibility to classrooms (CI1)	The school utilises centralised planning with large open courtyard in the middle of school compound surrounded by corridor walkways for access to the classrooms. The corridor walkway facing the large courtyard obtained enough breeze and sunlight but the corridor space close to the stairways lack of sunlight penetration and breeze hence causing the space to be damp, dark and dim.	
Accessibility to classrooms (CI1)	In fact, the corridor space close to the stairways is wide and unfunctional in terms of its spatial utilisation. Due to the placement of corridor design adjacent and beside the classrooms, students meeting each other while walking along the corridor contributes to noise levels and disturb the students' concentration while undergoing learning sessions.	 Dark corridor space positioned at the corner of the building. 
Circulation in and within classrooms space (C12)	The circulation of the classroom spaces, in general is divided into several zones. The teacher's zone is the area where the teacher conveys lessons to the students. The second zone is the students' circulation zone in which the space is semi chained due to row by row column table and chairs arrangement. Due to limited space movement and for discussion in small groups the students will utilise the teacher's circulation zone for the	

	purpose of group learning activities, performance or presentations. The third zone is the circulation zone outside the classroom which is the use of the corridor as a walkway or exit/entry point to the classroom.	
Scale and proportion of internal classroom (CI3)	The classroom space has a size of 70.2 m2. There is a corridor with a width of 2.3m adjacent to the classroom. Each classroom has 4 openings, of which 2 openings consists of 2 windowed louvers at a position closest to the corridor while the other 2 openings consists of 5 windowed louvers. The classroom has a height of about 2.8 m from the floor to the ceiling. All classrooms do not have an open beam and utilises ceilings except the classrooms on level 4. There are two entrance doors to the classroom located at the front and back.	
Hierarchy and function (CI4i) furniture setting and arrangement	Classroom spaces do not possess a complete technology capability. The classroom is equipped with very basic learning and lessons facilities which are the notice board, projector and whiteboard for displaying information. Wifi facilities and or Internet access, and power sockets are not available if students bring their laptops .	

Table 2: Results from observation - Sekolah Menengah Kebangsaan Putrajaya Presint 16(1), Putrajaya (SMKP)

Classroom Indicator (CI)	**Case study 2 (SMKP) Sekolah Menengah Kebangsaan Putrajaya Presint 16(1), Putrajaya**	**Figures**
	This school is located in Presint 16, Putrajaya and was the third school opened in Wilayah Persekutuan, Putrajaya. It began operations on the 6th of January, 2003.	
Accessibility to classrooms (CI1)	The school adopt centralised planning with an open courtyard that is small in size located in the middle of school complex and surrounded by open corridor walkways for access to classrooms. The corridor walkways did not receive direct sunlight due to its large size and width.	
Accessibility to classrooms (CI1)	Since there is no air circulation the corridorway become extremely hot during the day unsuitable for any activities. Furthermore, heat that is released from the parking space at level one also trapped at the corridorway. Hence, making the air circulation in this corridor space inadequate and heaty. The corridorway also gives bad odour and unpleasant smell from the toilets that are located at both ends of the corridor walkway. The condition of the corridor walkway is noisy similar like the condition in the first case study.	
Circulation in and within classrooms space (C12)	The circulation space in classroom is similar to the first case study.	
Scale and proportion of internal classroom (CI3)	The classroom space has a size of 81.89 m2. There is a corridor with a width of 2.3m adjacent to the classroom. Each classroom has four openings; one window opening is positioned close to the corridor within the inner space of the school building; while three other window openings is positioned towards the external side of the school building. The classroom has a height of about 3.3 m from the floor to the ceiling. All classrooms do not utilise ceilings except the classrooms on level 4.	
Hierarchy and function (CI4i) furni-	Furniture setting and arrangement in classroom is similar	

ture setting and arrangement	to the first case study. However there are additional furnitures like locker rooms, bookcases and notice boards in classroom.	
Hierarchy and function (CI4ii) technology capability	Several teaching aids are provided such as the speaker system, TV, power sockets, video projector and slide projector for the use as visual aids that can be connected to digital devices like laptop in each classroom.	

This next section discusses on the findings gathered from questionnaire to review the level satisfaction of students and their response on classroom enviroment on the two-selected case study Sekolah Menengah Kebangsaan Miharja, Kuala Lumpur(SMKM) and Sekolah Menengah Kebangsaan Putrajaya Presint 16(1), Putrajaya (SMKP). The questionnaire is conducted referring to four main indicators which is classroom comfort involving air quality (CI5), room temperature (CI6), effective lighting (CI7) and acoustic(CI8). For classroom comfort no mechanical tools or instrument testing are used as the main objective of this research is to gather data only from user's perception.

Table 3: Results from questionaire Sekolah Menengah Kebangsaan Miharja, Kuala Lumpur (SMKM) and Sekolah Menengah Kebangsaan Putrajaya Presint 16(1), Putrajaya (SMKP).

Findings		**Case study**	**Level of satisfaction %**					**% Positive respond total PR**	**% Negative respond total NR**
			1 NR	**2 NR**	**3 PR**	**4 PR**	**5 PR**		
CI5	Comfortable air quality for learning activities in classroom involving- *-no breathing discomfort;* *-adequate ventilation system;* *-sufficient fresh air intake and air flow;* *-appropriate humidity level, no health associated symptoms like feeling drowsiness, eye, nose or throat irritation, discomfort, headaches;* *-able to concentrate or to assimilate information;*	SMKM	10	57	15	18	0	33	67
		SMKP	10	48	32	10	0	42	58
CI6	Comfortable room temperature for learning activities in classroom involving- *-approriate room temperature- not stuffy, not too hot or too cold,* *-enough numbers of locally control mechanical system – like ceiling fans and HVAC* *-enough quantities of self-operable openings and can be open windows*	SMKM	20	65	15	4	0	19	81
		SMKP	30	60	10	13	0	23	87
CI7	Enough and appropriate lighting for learning activities in classroom involving- *-Attain enough visual comfort* *-Adopt energy efficient for mechanical lighting* *-Attain enough daylighting* *-Adopt the application of passive lighting strategies, like unilateral and bilateral lighting, light shelves and fixed sunlight protections*	SMKM	15	82	3	0	0	3	97
		SMKP	20	68	10	2	0	2	88
C18	Appropriate acoustic for learning activities in classroom involving- *-low sound transmission class (STC) levels (low reverberation and low background noise) in classroom* *-Adopt absorptive material such as carpet to limit reverberation in classroom.* *-Adopt appropriate floor–ceiling systems, and carpet on upper floors, to improve the impact insulation class (IIC) rating between levels.* *-Separation of learning spaces from noisier environments such as gyms, cafeterias and music rooms is to reduce background noise and sound transmission class (STC) levels* *-Utilization of classroom amplification systems technology like audio system to overcome challenges associated with classroom acoustics*	SMKM	35	40	18	7	0	25	75
		SMKP	47	37	11	5	0	16	84

5. Discussion and Recommendation

With reference to the above findings from observation and questionnaire, it indicates that classrooms have strong implications in shaping students' behaviour pattern and psychological development.

There are no such thing as good and bad school when doing the analysis but there are clearly more or less effective classrooms design being established. This is because many respondents tend to agree that the provided classrooms for learning purposes are only adequate in which still lacking and did not fully address the basic necessity needs for students learning development involving two main aspects.

First is the physical classroom aspects like access and circulation, classroom proportion, furniture layout, and technology capability. Second, is the functional aspect of learning space that encompasses air quality, room temperature, lighting and acoustics. Many respondents suggested for improvement as they feel that the architectural design is insufficient and not functional. From the questionnaire conducted, the respondent outlined their feedbacks and recommendation as follows for a better and conducive classroom learning environment.

a) Providing appropriate classroom learning environment addressing physical aspects like-

i) Better access and circulation

To have wide pathway, large and orienting corridorways to access classrooms separated by buffer like landscaping or displays are important to consider. It is vital as by having little greeneries or landscape will lessen noise level derived from movement of passers by which may interrupt learning activities in classroom. In addition, mental attention also can increase if students are sorounded by a more natural, greener environment. This is because many of current school design prefers to provide corridor located beside the classroom to lessen construction cost and for easy building structural support using cantilevered design concept. However, corridorway if left untreated will become leftover spaces with single function as connecting walkways.

Another solution is to redesign corridorways by having functional pocket spaces with seatings for relaxation, rewidened corridor for pupils' storage or by providing displays like artworks at corridor to establish appropriate visual diversity, wayfinding, familiarity and better orientation for students. Previous studies also indicate that personal displays by students will create sense of ownership which and give positive effect in building students self esteem.

Circulation within classroom area should also be flexible representing aspects of space fluidity, versatility, convertibility, scaleability (like expansion or contraction), and modifiability (active manipulation and appropriation) as students require the sense of individualisation and intimacy within a classroom space rather than just having an open plan concept. This is because students learning progress and psychological development much influenced and shaped by the spaces that they are in. This is important so that spaces can be converted to accommodate for changes in enrolment, curriculum, or pedagogy

According to scholars [22,23,25,26], a well- defined behaviour setting will result to a more significant exploratory behaviour among students as well as promote social interaction and develop cooperative values. This is achieved when clear division of breakout spaces within the classroom is provided. In other words, a classroom should have a clear division and visibly defined with visual or structural parameters to indicate various function like learning area, discussion zones, storage facilities and display area (multiple uses).

By having this, distractions are minimized as there will be an area for independent or group learning. This is important as it will influence students' behaviour and develop their interest towards various learning activities and student can experience different type of teaching method rather than the normal one like tutor-focused or one-way facing form. Large wall areas for personal displays or any architectural elements that make the classroom unique is also significantly correlate with students learning progress. In this sense, overall room and display diversity will stimulate pupils' knowledge advancement. Therefore, classrooms also need to be equipped with larger and wider walls that may act as flexible partition to provide display opportunities. Proposal for learning space design is as follows.

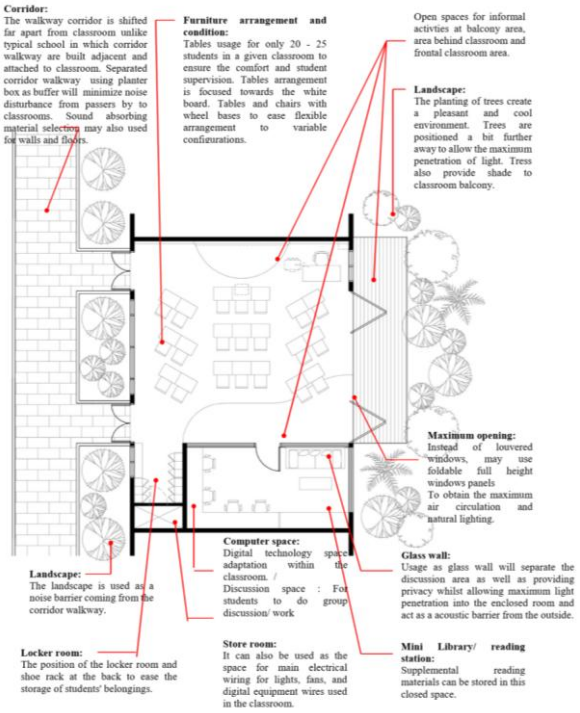


Figure 1*:* Proposed alternative design plan for classroom learning space

Ii) Approriate Classroom Size Involving Density, Occupancy Load, Floor Area and Shape

The classroom size and the number of students in it is an important aspect in designing an efficient learning space. A comfortable and ample space as well as the optimum number of students is important in order that the learning is more effective and students can focus fully. According to scholars, the best and suitable class density for learning and teaching effectively and comfortably is 20 - 25 students per classroom. This is because if too many students are in a classroom, it will create not only emotional tension and stress to the teachers but the students as well. Thus, larger rooms with simpler shapes (squarer) enabled students to function better in whole class learning and seen to be much appropriate for room size flexibility and functionality to promote the value of individualisation among students. In addition, the classroom need to reflect simpler shapes because formal instructions are easily delivered through the usage of white or blackboard where all students must be in a position to easily see the front and simpler plan seems appropriate.

iii) Functional design in terms of flexible furniture setting, arrangement and ergonomics

The physical setup of chairs, tables, and presentation in a classroom can significantly influence learning. Instructional communication theory suggests that seating arrangements can impact how the instructor communicates with students and how the students interact with one another, impacting engagement, motivation, and focus [10].More recent research also suggests that students tend to prefer more flexible seating arrangements [10]. In particular, students have been shown to be more partial towards classrooms with mobile vs. fixed chairs, and trapezoidal tables with chairs on casters as opposed to rectangular tables with immobile chairs. In general, spaces designed in a student-centered manner, focusing on learner construction of knowledge, can support student learning [28]. In reality, however, many classrooms at colleges and universities have been built using more conventional models for lecture and seminar-type courses. Instructors can consider ways to modify seating arrangements and match arrangements with the demands

of classroom activities in order to help maximize student learning. In addition the selection of type of furniture namely study table and seating which approriate to ergonomics postural, anthropometric and fuflfill the orthopaedic aspects of sitting and related activities will encourage comfort during learning process

iv) Technology abilities and facilities

Classroom design must take into account the place of electronic infrastructures in relation to existing teaching and learning structures. Computer network connections should reach students beyond the classrooms such as the use of wireless technology. This is important to increase the versatility of hybrid spaces. In other words, classrooms must be wired for the communication and electrical needs of supplying network access in which furniture must be redeployed to facilitate computer use for work collaboration to provide online instruction, lesson plan and others.

b) Providing appropriate classroom learning environment addressing functional aspects-

Ventilation - The performance of four typical air distribution methods was studied in a mock-up classroom with different load conditions. The measured air distribution methods were: a corridor-wall grille, a ceiling diffuser, a perforated duct diffuser and a displacement ventilation concept. From the tested concepts, displacement ventilation is the least sensitive for different load conditions of all studied concepts. Using a ceiling diffuser, air velocities were reasonable low in all cases. Together with displacement ventilation, ceiling diffuser is the other recommended solution for classrooms. A wall grille gave high velocities in both summer and winter conditions. With a perforated duct diffuser, air distribution is quite unstable causing increased draft risk in some load conditions. The performance of a wall-grille and a perforated duct diffuser is sensitive for strength and location of heat gains.

Lighting – Classes should be provided with energy-efficient windows and skylights to give positive psychological and physiological effects of daylighting. The lighting must be modified to alleviate glare problems.

Acoustics – In addressing the issue of acoutics, four important aspects need to be considered. This include the reduction of reflected sound by adding sound absorbing material to a room ceiling, wall and floor. Carpeting can also help reduce reflected sound, although not nearly as much as the ceiling, because it is generally poor at lower frequencies. Carpet also can reduce background noise from chair and foot impacts or scuffling. Carpeting can also reduce the transmission of this impact noise to the room below. Reducing noise traveling through the plenum by providing acoustical ceiling panel that has a high Ceiling Attenuation Class or CAC value. The CAC indicate a ceiling's ability to block sound between two rooms that share a common plenum. The higher the number, the better the ceiling acts as a barrier to airborne sound transmission. In addition to higher CAC ceiling panels, other solutions include back loading the suspended ceiling with fiberglass insulation batts, or installing a gypsum board plenum barrier between the adjacent rooms is needed. reducing noise travelling through the walls by using appropriate and suitbale wall construction to block sound. Adding fiberglass insulation in the cavity between the layers will reduce noise transmission, as will adding a second layer gypsum board to each side. Sealing all gaps between the walls and the floor and ceiling, as well as any openings in the wall such as piping, electrical outlets, and HVAC registers will reduce noise transmission even more.

6. Conclusion

From the above, it is clearly noted that in designing schools there are two main aspects that contributed to the level of wellbeing of the students- which are the physical classroom aspect like access and circulation, classroom proportion, furniture layout, and technology capability. Second, is the functional aspect of learning space encompassing air quality, room temperature, lighting and acoustics. These aspects are crucial as it could lead to conducive learning and teaching environment. The government including developers and involved authorities should put all these into building consideration and work together with education providers in providing a better learning environment to elevate the education quality in terms of student comfort and psychological well being.

References

[1] Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). A taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives: Longman.

[2] Artzt, A. F., & Armour-Thomas, E. (1992). Development of a Cognitive-Metacognitive Framework for Protocol Analysis of Mathematical Problem Solving in Small Groups. Cognition and Instruction, 9(2), 137-175.

[3] Barro, R. J. (2000). Education and economic growth. Retrieved from AIA guide to building life cycle assessment in practice, (2010).

[4] Berliner, D. C. (1990). What's all the fuss about instructional time? In The nature of time in schools: Theoretical concepts, practitioner perceptions. (pp. 3-35). New York, NY, US: Teachers College Press.

[5] Bloom, B. S. (1956). Taxonomy of educational objectives. Vol. 1: Cognitive domain. New York: McKay, 20-24.

[6] Committee, J. I. S. (2006). Designing Space for Effective Learning: A Guide to 21st Century Learning Space Design., 1-32. Retrieved fromhttp://webarchive.nationalarchives.gov.uk/20140703004833/http://www.jisc.ac.uk/media/documents/publications/learningspaces.pdf

[7] Creese, A., & Blackledge, A. (2010). Translanguaging in the bilingual classroom: A pedagogy for learning and teaching? The modern language journal, 94(1), 103-115.

[8] Fisher, A. V., Godwin, K. E., & Seltman, H. (2014). Visual environment, attention allocation, and learning in young children: When too much of a good thing may be bad. Psychological science, 25(7), 1362-1370.

[9] Freiberg, H. J. (2005). School climate: Measuring, improving and sustaining healthy learning environments: Routledge.

[10] Harvey, E. J., & Kenyon, M. C. (2013). Classroom seating considerations for 21st century students and faculty. Journal of Learning Spaces, 2(1).

[11] Henson, K. T., & Eller, B. F. (1999). Educational Psychology for Effective Teaching: Wadsworth Publishing Company.

[12] Heschong, L., Wright, R. L., & Okura, S. (2002). Daylighting impacts on human performance in school. Journal of the Illuminating Engineering Society, 31(2), 101-114.

[13] Ibrahim, N., Fadzil, N. H., & Saruwono, M. (2013). Learning Outside Classrooms on Campus Ground: Malaysia. Asian Journal of Environment-Behavior Studies, 4(13), 97-109.

[14] Ismail, A. S., Mohidin, H. H. B., & Bauzi, N. B. N. (2017). Sustainable Architectural Design Studio Towards the Development of Creative Learning Environment. Advanced Science Letters, 23(9), 9259-9264.

[15] Johnson, C., & Lomas, C. . (2005). Design of the learning space: Learning and design principles. EDUCAUSE Review, 40, 16-28.

[16] Kabilan, M. K., Ahmad, N., & Abidin, M. J. Z. (2010). Facebook: An online environment for learning of English in institutions of higher education? The Internet and higher education, 13(4), 179-187.

[17] Kincheloe, J. L., Bursztyn, A., & Steinberg, S. R. (2004). Teaching teachers: Building a quality school of urban education (Vol. 3): Peter Lang.

[18] Kwok, A. G., & Chun, C. (2003). Thermal comfort in Japanese schools. Solar Energy, 74(3), 245-252.

[19] Latu, I. M., Mast, M. S., Lammers, J., & Bombari, D. (2013). Successful female leaders empower women's behavior in leadership tasks. Journal of Experimental Social Psychology, 49(3), 444-448.

[20] Mainhard, M. T., Brekelmans, M., den Brok, P., & Wubbels, T. (2011). The development of the classroom social climate during the first months of the school year. Contemporary educational psychology, 36(3), 190-200.

[21] Mendell, M. J., & Heath, G. A. (2005). Do indoor pollutants and thermal conditions in schools influence student performance? A critical review of the literature. Indoor air, 15(1), 27-52.

[22] Mott, M. S., Robinson, D. H., Walden, A., Burnette, J., & Rutherford, A. S. (2012). Illuminating the effects of dynamic lighting on student learning. Sage Open, 2(2), 2158244012445585.
[23] Neufert, E., Neufert, P., & Kister, J. (2012). Architects' data: John Wiley & Sons.
[24] O'Brennan, L. M., Bradshaw, C. P., & Furlong, M. J. (2014). Influence of classroom and school climate on teacher perceptions of student problem behavior. School mental health, 6(2), 125-136.
[25] Oblinger, D., & Lippincott, J. K. (2006). Learning spaces: Boulder, Colo,.: EDUCAUSE, c2006. 1 v.(various pagings): illustrations.
[26] Pereira, L. D., Raimondo, D., Corgnati, S. P., & da Silva, M. G. (2014). Assessment of indoor air quality and thermal comfort in Portuguese secondary classrooms: methodology and results. Building and Environment, 81, 69-80.
[27] Poon, W.-C., Lock-Teng Low, K., & Gun-Fie Yong, D. (2004). A study of Web-based learning (WBL) environment in Malaysia. International Journal of Educational Management, 18(6), 374-385.
[28] Rands, M. L., & Gansemer-Topf, A. (2017). "The room itself is active": How classroom design impacts student engagement. Journal of Learning Spaces, 6(1).
[29] Salleh, N. M., & Zainal, K. (2014). Bullying among secondary school students in Malaysia: A case study. International Education Studies, 7(13), 184.
[30] Samuel, R., & Bakar, Z. (2006). The utilization and integration of ICT tools in promoting English language teaching and learning: Reflections from English option teachers in Kuala Langat District, Malaysia. International Journal of Education and Development using ICT, 2(2).
[31] Schneider, M. (2002). Do School Facilities Affect Academic Outcomes?
[32] Strange, C. C., & Banning, J. H. (2001). Educating by Design: Creating Campus Learning Environments That Work. The Jossey-Bass Higher and Adult Education Series: ERIC.
[33] Uba, I., Yaacob, S. N., Juhari, R., & Talib, M. A. (2010). Effect of self-esteem on the relationship between depression and bullying among teenagers in Malaysia. Asian Social Science, 6(12), 77.
[34] Uline, C., & Tschannen-Moran, M. (2008). The walls speak: The interplay of quality facilities, school climate, and student achievement. Journal of Educational Administration, 46(1), 55-73.
[35] WI, W. S., Tan, S. M., Iryani, T., Syamsul, S., Aniza, A., & Zasmani, S. (2009). School bullying amongst standard six students attending primary national schools in the federal territory of Kuala Lumpur: The prevalence and associated socio demographic factors. Malaysian Journal of Psychiatry, 18(1).
[36] Yahaya, A., Ramli, J., Hashim, S., Ibrahim, M. A., Rahman, R., & Yahaya, N. (2009). Discipline problems among secondary school students in Johor Bahru, Malaysia. European Journal of Social Sciences, 11(4), 659-675.
[37] Zakaria, E., Chin, L. C., & Daud, M. Y. (2010). The effects of cooperative learning on students' mathematics achievement and attitude towards mathematics. Journal of social sciences, 6(2), 272-275.
[38] Zin, S. M. S. (2003). Reforming the science and technology curriculum: The smart school initiative in Malaysia. Prospects, 33(1), 39-50.