A COMPARATIVE STUDY ON THE USER COMFORT PERCEPTION OF THE POST-INDEPENDENCE AND POST-MILLENNIUM ERA PUBLIC SECONDARY SCHOOL CLASSROOM IN MALAYSIA

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Abstract
The physicality of the classroom has significant influence on the comfort on both teacher and students which associated with the school learning environment. With the current trends moving towards improving the education system and programs in Malaysia, many standards in terms of the comfort level in the classroom of the public school were not taken into consideration as part of the reform measures. This study aims to investigate and analyse how public secondary school classroom design built during Post-Independence and Post-Millennium era affects the perception of student comfort level. A comparative study between public secondary school built in Post-Independence and Post-Millennium Era to uncover the relation of classroom design on the user comfort level, where one case study from each school from respective era is selected for on-site observations and survey questionnaire method is carried out. The fundamental parameters of comfort level are being assessed which is (a) thermal comfort, (b) visual comfort and (c) air quality through case study observation and questionnaires set up with the students on their perception of comfort level being in the classroom. The results were then analysed by carrying out statistical analysis, and evidence indicates that the conditions of the classroom has significant impact on the occupant's comfort level. Furthermore, the classroom in school built during the post-independence era and post-millennium has different architecture and planning aspect which has an impact on the conduciveness of the classroom and contributes to certain comfort level factor satisfaction. This research and findings will aid to provide a guide for the development of future public secondary school design that promotes user comfort in the classroom which will then create an effective learning space.

Keywords: Classroom; Comfort Level; Public Secondary School

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INTRODUCTION

Over the course of time, the Malaysia education system has been revised from time to time, from adopting the British English school education system to Malaysian education system (KBSR and KBSM) and now heading towards creating a 'Smart School' education system in line with the Malaysian Super Corridor (MSC) project whereby the integration of modern technology is incorporated in the teaching system (Ahmad, 1998). Despite the initiative to improve the education system in Malaysia is often discussed and implemented by the government, the physicality of the school which is the architecture of the school is always neglected and hardly ever a topic of deliberation in relation to the education system.

With the current trends moving towards improving the education system and programs in Malaysia, many standards in terms of the comfort level in the classroom of the public school are not taken into consideration as part of the reform measures. This is because to develop the approaches to create a good comfort level in the classroom of a school and to accommodate the design strategies to unbind the current school learning environment is a challenge. The communication between the research branches of the ministry of education, Malaysian Public Work Department and the architecture barely exist (Kaur, 2017).

From the first public school established in Malaysia, the architecture design and approach of the school remains the same throughout the decades and till this present day. The public school in Malaysia, both primary and secondary, is based on a standard architecture design and spatial planning by the Malaysian Public Works Department and the same prototype of architecture design of a school was duplicated for all the public schools in Malaysia. In general, the standard architecture planning and design of a public school in Malaysia by the Malaysian Works Department are based on the curriculum syllabus which is administered by the Ministry of Education (MOE) where it is designed to be efficient and spaces are allocated based on a specific order and discipline (Denan, Z. et al., 2018). However, it does not encourage and promotes gratifying learning environment for students.

This verifies that the evolution of the education system does not take account on the physicality of a school into considerations. The current layout and spatial planning of the public school architecture in Malaysia design by the Malaysian Public Work Department not extremely provide to conducive and effective learning environment. Previous studies on public secondary school in Malaysia has been conducted which mainly focused on the physical aspect of the classroom such as access and circulation, size, furniture arrangement and modern technology integration in improving the learning environment. However, limited studies involving objective and subjective investigations have been reported related to the thermal comfort in schools in Malaysia. Hussein et. al. (2009) highlights from their study for that majority of the respondents can accept the current indoor thermal conditions even though environmental assessments exceeded the standard. The objective measurement from Kamaruzzaman et al. (2013) also showed none of measured classes falling within the comfort zone based on the standard. Furthermore, Puteh et. al. (2012) reported that surveyed students have high level of awareness regarding the climate change and suggested that systematic assessment of thermal comfort for the learning environments in classroom are needed to improve the quality and effectiveness of teaching in the classrooms. Nevertheless, the fundamental parameters of comfort level in a classroom are still not taken seriously into consideration in designing the public school in Malaysia.

From the above-mentioned studies suggested that architecture strategies to improve the occupant's comfort level should be discussed and considered to unbind the poor current learning environment as one of the approaches to improve the learning environment in public schools in Malaysia. Therefore, this study will investigate and analyse the relationship of the occupant's comfort perception in the classroom with the condition of public schools in Malaysia and also to discover on how architecture design strategies and approach will solve and overcome the issue of poor comfort level which affects the learning environment. The same architecture narrative around public schools in Malaysia must change – and in this change, it will highlight new holistic approaches to learning.

LITERATURE REVIEW

Overview of Malaysia Public School

The Malaysian public-school education structure is split into two category which is primary and tertiary education levels. Beforehand, the primary education governing body was governed by the Ministry of Education (MoE) while the tertiary education governing body is governed by the Ministry of Higher Education (MoHE). On May 2013, these two governing body was merge and form a single governing body and named the Ministry of Education Malaysia (Kementerian Pendidikan Malaysia) but was separated again on July 2015.

All levels of education except for the tertiary level are held responsible by the MoE in line with the provision of the Education Act 1996. According to (Ibrahim, 2014), apart from the responsibilities of the MoE to administer the education system at pre-school level up to secondary school level, it also administers all education institutions be it public or private based. It is in all effort that the Ministry of Education to improve the education system along the years and searching for ideas and strategies to bring the Malaysia education to the next level which was describe in the National Education Blueprint 2013-2025.

In Malaysia, the public-school students generally spent between five to ten hours per day in school and a total average of 10,677 hours are spent in the public school which consist of the combination of primary and secondary education (MoE, 2019). The long hours spent in the public school by the students generally indicates that the architecture of the school has significant impact and plays a vital role in shaping the student learning. There is an argument on where and how a student learn is as important as what they learn (Day, 2018).

Public School Architectural Design in Malaysia

During the post-independence era, it is observed that the design of the public school is based on a standard design. The standard design is defined as the design that includes repeated façade design, layout, spatial planning and building materiality that is used. Building form, layout of classroom, size and capacity and facilities provided were found to be similar. During this era, Denan, Z. et al. (2018) state that the standard design would be utilised and employed as to reduce the time, labour and cost incurred to produce a large number of public-school building to meet the demand.

In the post-millennials, one-off public-school architectural design can be observed. According to Nordin, N. et al. (2019), one-off design refers to the design that includes unique building layout, spatial planning and façade that may not be found on other public schools. The features discovered on these public school were uncommon, unique and improved over time. Among the features are application of sun-shading devices, classroom height, window and opening sizes, better acoustic and improved

ventilation strategy such as the used of ventilation blocks and adopting the cross-ventilation strategy. Theoretically, these features will create an impact on the energy consumption in a building, providing comfort to the students and teachers whilst also create diverse façade in the public school.

Figure 1: Categories of Malaysia Public School Architecture. Figure in reference from Nordin, N. et al. (2019)

The space planning of standard school architecture design typology is based on the syllabus of the latest curriculum for primary and secondary schools which is governed by the MoE. The number of classes and type of classroom such as music room, science laboratories, halls and outdoor space are determined based on the number of courses or subject required (Denan, 2018). Public schools are to adopt the use of natural ventilation with the support of mechanical ventilation and daylight for lighting, which accustomed to the theory of passive design strategy which is to produce energy efficient buildings but still maintaining the user comfort (Mardon & Jaques, 2008).

Generally, the typical standard public-school typology layout is arranged in a linear spatial organization with one sided corridor. It usually consists of two to four blocks with three or up to five stories are facing one another with a court placed in the middle. The blocks that faced one another are connected with a bridge and the staircases are shared by having it placed in the middle. Washroom are always located at the end of the block and the fire staircases are located either in the middle or at the end of the block. Other spaces such as hall, laboratories, workshop, canteen and prayer room are located at another separated physical building form. As for outdoor space, it is provided to be utilised as a working compound for specific subject such as science or vocational landscape or co-curriculum activities (Denan, 2018).

Malaysia Standard Public-School Architecture Design Issues

The standard design of public-school architecture is resulting in unsatisfactory school environment as most of the school possess “hidden and negative areas”. Due to the low natural surveillance in the school and poor natural lighting, it is difficult to instil methods to overcome inadequate school environment which affects the daily learning-based activities. Classrooms arranged continuously in the form of row and are usually placed further away from the administration section such as the library, staff room and principal’s office. Obscured area such as washrooms, storeroom and unused area are often found in public schools encourage these activities and crimes to happened (Kaur, 2017).

Besides that, the standard public-school classroom, corridor and common area are too small and only allow little space for projects or group activity. Certain hallways and rooms are poorly lighted requires artificial lighting and creates an unsafe zone area for the students. Furthermore, the low ceilings and the size of the classroom is too small and having insufficient learning materials discourage the learning environment. Classroom are also designed based on limited learning methods such as testing knowledge and presentation prohibit the flexibility of a classroom to be utilised for other form of learning methods or activities (Mathalamuthu, 2018).

The thermal factor in a learning environment was not taken into consideration as well which lead to high surrounding temperature and promote unconducive learning environment. Moreover, the ease of maintenance of the school was not considered as well in terms of building material selection leads an increase in vandalism which resulting in poor school environment. Subsequently affecting the school appearance which then becomes the main contributing factor to student motivation to learn and the teacher’s performance as well (Cardellino, 2011).

RESEARCH METHODOLOGY

For this research, two secondary public schools in Malaysia are selected as the case study. One of which the secondary public schools are built during post-independence era which is from the year 1957 – 1999 and the other secondary public school built during post-millennium era which is from the year 2000 – current (2019). The reason case study was selected from each era is to obtain sufficient insight of how the design of the school in respective to each era affects the students comfort level in the school, specifically in the classroom as it is the main learning environment and the longest time spent in it. This study is conducted on secondary public schools instead of primary public schools is because the data acquired has higher validity due to the comprehension by the students.

The two schools that was selected for the case study fulfilled the following requirement: a) completed and operational, b) situated within the Klang Valley (city centre), c) public secondary school utilizes teaching method set by the Ministry of Education. Since the majority of secondary public school in Malaysia built during the post-independence era are designed based on a standard, the school selected from this era are given the title 'Cluster School' which is identified as being excellence from the aspect of student achievement. The reason public secondary 'Cluster School' was selected for the case study for this era is to ensure that the investigation is more comprehensive in terms of getting data and observing the factors of the design of the school affects the user comfort level and how it promotes a conducive environment to improve the standard and the school education achievement and also to create an impartial observation and investigation due to the common generalization of the standard public secondary school design. Whereas for the case study selected from the post-millennium era, one-off design secondary public school is selected, which consist of unique building feature which supposedly enhancing the school environment and creating better comfort.

For this research, quantitative research method is carried out. The best way to evaluate user perception on comfort level in a space is by conducting surveys in the form of questionnaires and performing on-site observation to identify the factors or features that influences the comfort level of an individual. To acquire data and information from the respondent, structured questionnaire is used. The components consist in the questionnaire are in relation to the user perception of comfort level in a specific space in the form of 7-point Likert-type scale as it is more accurate due to better reflection of the participants true evaluation.

In the questionnaire, it consists of two sections that the participants is required to complete, first section is the participant general information and the second section is the perception of comfort level of the participant where it is to obtain response from the participant on the designed variables based on the comfort level factors. The type of survey carried out in this study is cross-sectional survey as the research investigation is based on one location which is the public secondary school classroom where the questionnaire survey was conducted between September 2019 to October 2019, which is during the period with high rainfall, lower general average temperature and high humidity. Besides that, it was after the school final examination and students are able to participate in this study without disrupting the regular lessons conducted in the classroom. The data collected is then subsequently evaluated by carrying out statistical analysis.

For this study, non-probability sampling method is adopted and the type of non-probability method utilized in this research is purposive sampling as the research requires to obtain data from a particular target participant which are the students in the classroom. The selected case study for this research is shown in Table 1, as well as the sample size is identified by adopting the Krejcie & Morgan (1970) table, that conforms to 5% margin of error with 95% confidence level based on the population whereby the data is obtained from the Ministry of Education Malaysia as at 31st July 2019.

Table 1: Case Study, Population and Sample Size

Case Study	Public School Era	School	Total No. of Students	Sample Size
1	Post-Independence	School A	1346	302
2	Post-Millennium	School B	884	274

RESULTS AND FINDINGS

Case Study of School A

School Planning

There is a total of seven blocks in the School A which vary from 2-storey to 4-storey height. Every classroom block is design in a single loaded corridor system. As for access, it consists of three main entrances to the school, two of which is along the secondary road and the other is along tertiary road. The school is situated on a land which has only three sides, one side facing the secondary road and the other two sides facing resident houses. Classroom blocks are located further away from the side facing the wherein the school field is located instead to act as a buffer between the road and school block where the school activity mainly takes place. There are open green spaces in between the classroom blocks as well as trees planted along the school perimeter along the side facing the residential houses.

Figure 2: School site planning of School A.

Classroom Design

The classroom design of School A is basically similar to the other standard secondary public-school classroom design. Every classroom is of the same size which is approximately 9.9m in length and 7.5m in width. There is total of 40 units of student desk and chair and one (1) unit of teacher desk and chair. The overall classroom design and layout are illustrated in Figure 3, Figure 4 and Figure 5. The desk is arranged in pair in an alternate manner, creating three walkways in between the rows. Entrance are placed at the end of each side of the class and open inwards towards internal of the classroom. As for the fenestration, operable louvre window with fixed louvre window above is used throughout the sides along the corridor and facing towards external. Along the corridor outside of the classroom, steel railing is used instead of the commonly used parapet wall and aluminium louvre is installed above (Figure 6). On the other side of the classroom, shading devices with metal fin-like fixed horizontally at 45 degree is installed on the façade along the classroom windows (Figure 7). The classroom fixtures consist of three (3) units of ceiling fan located at the centre which divide equally across length wise and six (6) units of pendaflour lighting directly fixed on the floor slab which is located on both side of the ceiling fan (Figure 8). Overall height of the classroom from the floor finish level to the ceiling is approximately 3m.

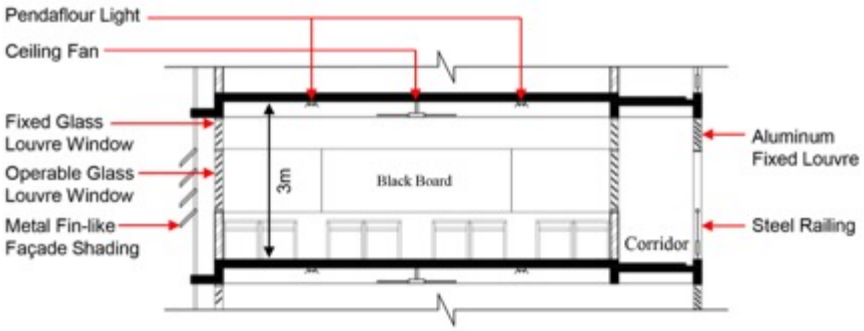

Figure 3: Cross-Section of the classroom of School A.

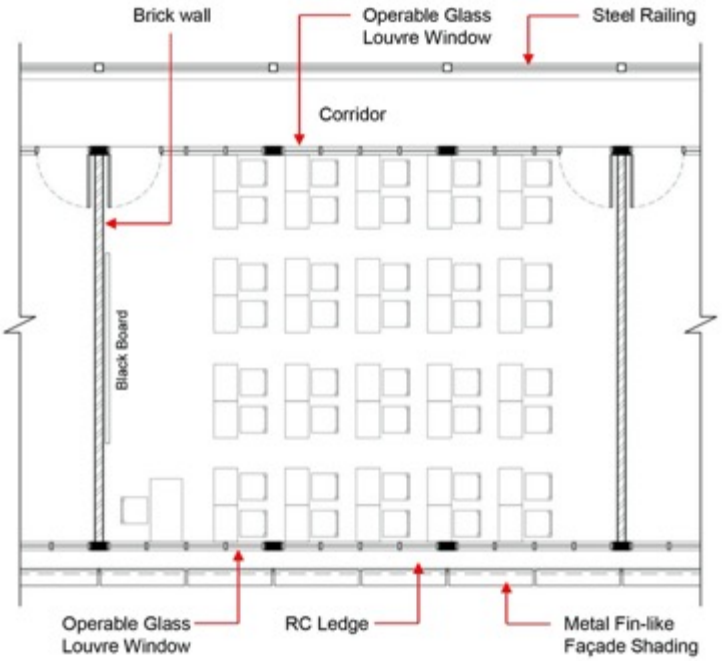

Figure 4: Floor plan of the classroom of School A.

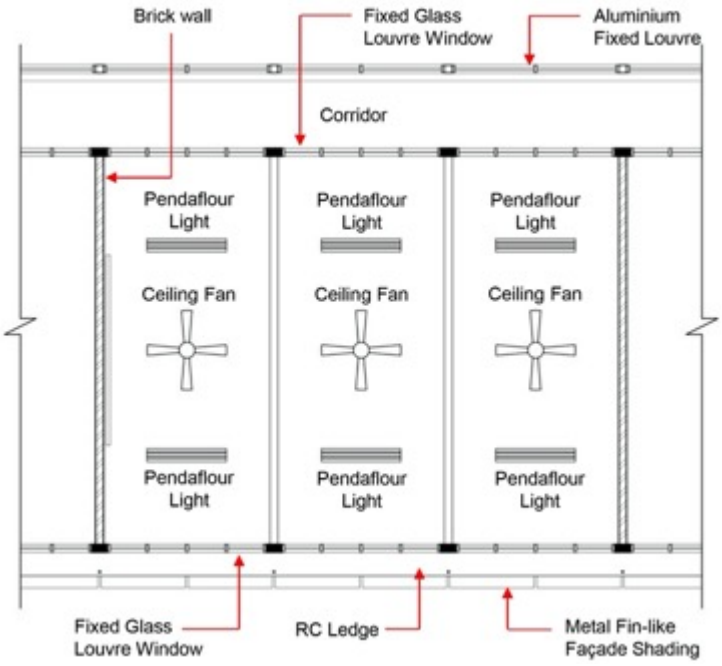

Figure 5: Reflected ceiling plan of the classroom of School A.

Figure 6: External view of the classroom of School A.

Figure 7: Shading device installed on the external side of the classroom of School A.

Figure 8: Internal view of the classroom of School A.

Case Study of School B

School Planning

There is a total of eight blocks in School B. The blocks vary from 2-storey to 6-storey height. Every classroom block is design in a single loaded corridor system which promotes natural surveillance. As for access, it only consists of one main entrances to the school which is along the tertiary road and two secondary entrances which is closed all the time and does not cater for vehicular to access. The school is situated on a land which has four sides, one side facing the tertiary road, another side facing 15-storey apartment and the other two sides facing undeveloped land. Every block is situated within the perimeter of the land except at the side next to the apartment. There is classroom block at every side of the school whereas the administration block situated right at the school entrance. The school field is at the centre of the school, situated within the school block. Open green spaces are not available except for the large field and there are not many trees and vegetation planted within the school compound as to promote visibility from the external and to avoid hindrance. Besides that, the amount of vegetation such as trees are relatively less at the perimeter of the school between the school compound and the roadways.

Figure 9: School site planning of School B.

Classroom Design

The classroom design of School B is different in comparison to the other standard secondary public-school classroom design. Every classroom in this school are of the same size which is approximately 9.6m in length and 8.4m in width. The details design and layout are depicted in Figure 10, Figure 11 and Figure 12. There is total of 36 units of student desk and chair and one (1) unit of teacher desk and chair. The desk is arranged in a cluster manner, facing sideways from the blackboard and creates four walkways in between the rows. Entrance are placed at the end of each side of the classroom and open outwards from the internal side of the classroom. As for the fenestration, full height sliding door with fixed top glass and aluminium bottom panel is used along the side facing towards external and aluminium sliding glass window on the side facing the corridor (Figure 13). Along the corridor outside of the classroom, perforated steel railing is used instead of the commonly used parapet wall and also installed inside the classroom along the sliding door for safety reason (Figure 14). There is no shading device installed however reinforce concrete ledge is introduce above the sliding door at 0.6m deep. The classroom fixtures consist of four (4) units of ceiling fan which is position equally across the classroom and nine (9) units of pendaflour lighting fixed on the plaster board ceiling which is located on each side of the ceiling fan (Figure 15). Overall height of the classroom from the floor finish level to the ceiling finish level is approximately 3.15m.

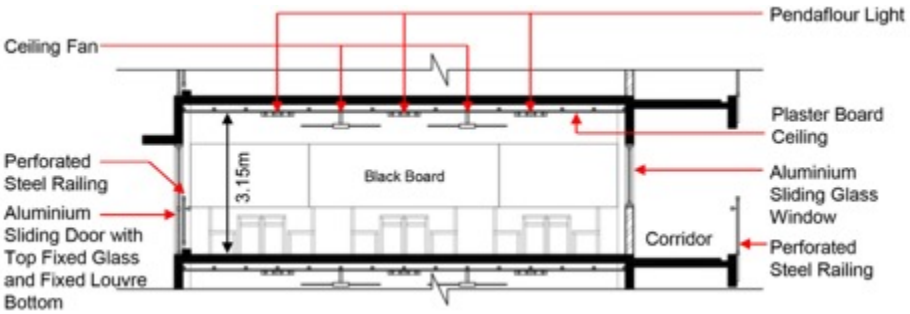

Figure 10: Cross-Section of the classroom of School B.

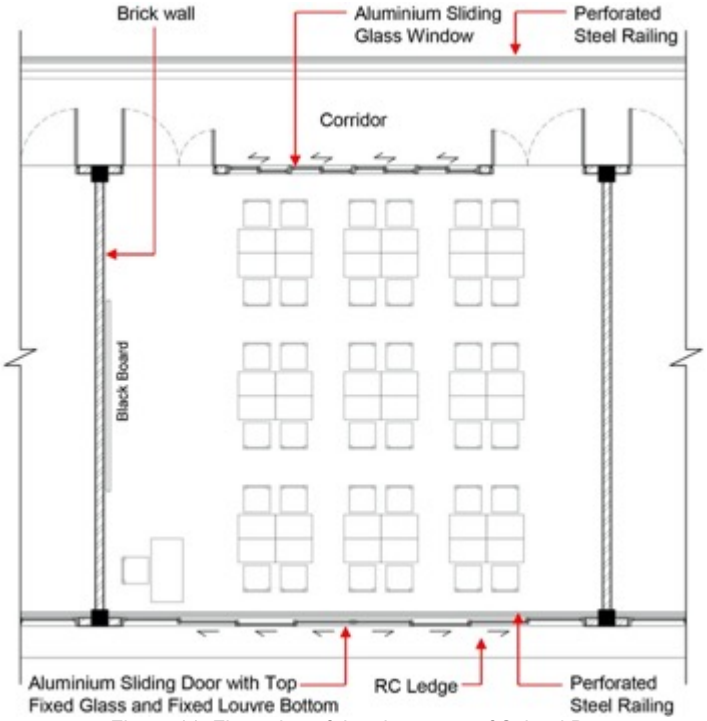

Figure 11: Floor plan of the classroom of School B.

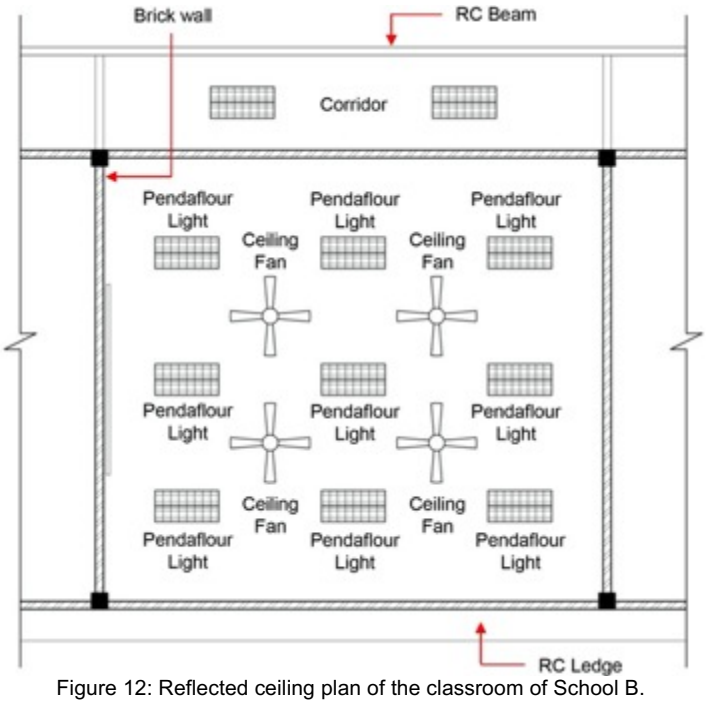

Figure 12: Reflected ceiling plan of the classroom of School B.

Figure 13: External view of the classroom of School B.

Figure 14: Used of glass sliding door on the external side of the classroom of School B.

Figure 15: Internal view of the classroom of School B.

Questionnaire Survey Result

Participant Information

The participants general information is collected in Section A of the questionnaire survey. This section identifies the demographic characteristics of the participants of the selected case studies, School A and School B. The information is collected through multiple choices stated in the questionnaire and results are tabulated as shown in Table 2 below. For School A, 100% of the participants recorded for this research are female and 0% are male due to the school is an all-girls school. Most of the School A participants (75%) are from the morning session whereas for School B, of the participants are from the morning session as the school does not have afternoon session. Students from both schools generally spent 4 hours in the classroom and 2 hours outside of the classroom which is based on the highest percentage results obtained from participants. As for whether the participants are seated within proximity to ventilation mechanism in the classroom, the majority (60%) of the participant answered 'No' whereas for School B, the majority (76%) answered 'Yes'.

Table 2: Participant Information of School A and School B.

Participant Information	School A		School B	
	Participant (n=302)	Percentage (%)	Participant (n=274)	Percentage (%)
Gender				
Male	0	0	156	57
Female	302	100	118	43
Education Level				
Form 1	38	12.5	16	6
Form 2	53	17.5	47	17
Form 3	45	15	58	21
Form 4	91	30	66	24
Form 5	60	20	79	29
Form 6	15	5	8	3
Class Session				
Morning	227	75	274	100
Afternoon	75	25	0	0
Hours Spent in Classroom				
<1 Hour	0	0	0	0
2 Hours	0	0	0	0
3 Hours	0	0	2	2
4 Hours	151	50	53	53
5 Hours	60	20	21	21
6 Hours	91	30	24	24
Hours Spent Outside of Classroom				
<1 Hour	140	46	123	45
2 Hours	162	54	143	52
3 Hours	0	0	8	3
4 Hours	0	0	0	0
5 Hours	0	0	0	0
6 Hours	0	0	0	0
Seat Location in Classroom				
a. Column				
Near Window	91	30	99	36
Centre	139	46	71	26
Near Corridor	72	24	104	38
b. Row				
Front	60	20	41	15
Centre	166	55	175	64
Rear	76	25	58	21
Proximity of Ventilation Mechanism of Seat in Classroom				
Yes	121	40	208	76
No	181	60	66	24

General Assessment on Classroom

The participants are asked to rate the respective comfort perception towards their classroom. Based on the data collected shown in Table 3, a graph chart is plotted to show the comparison between the two (2) case study on the fundamental parameters of comfort. From the graph, the general temperature in the classroom in School A is considered cooler in comparison to classroom in School B as majority of the participant rate 3 which is towards the 'cool' whereas the later rated 5 which is towards the 'hot'. For brightness, the classroom in School A is considered dark as most of the participant rated 2 which is towards 'dark' whereas classroom in School B is on the bright side, with the majority rated 6 which is towards 'bright'. As for air quality, classroom in School A has better air quality compared to classroom in School B as the highest number of participants in School A rated 5 which is towards 'fresh' whereas in School B most of the participants rated 4.

Table 3: General Comfort Level of Classroom Result of School A and School B.

Frequency	Temperature (Cool – Hot)				Brightness (Dark – Bright)				Air Quality (Stale – Fresh)			
	School A		School B		School A		School B		School A		School B	
1	0	0%	0	0%	10	3.5%	0	0%	0	0%	0	0%
2	11	3.5%	14	5%	133	44%	0	0%	8	2.5%	3	1%
3	120	40%	30	11%	83	27.5%	7	2.5%	18	6%	27	10%
4	95	31.5%	71	26%	53	17.5%	18	6.5%	87	29%	127	46.5%
5	50	16.5%	107	39%	15	5%	82	30%	159	52.5%	89	32.5%
6	23	7.5%	36	13%	8	2.5%	137	50%	30	10%	21	7.5%
7	3	1%	16	6%	0	0%	30	11%	0	0%	7	2.5%

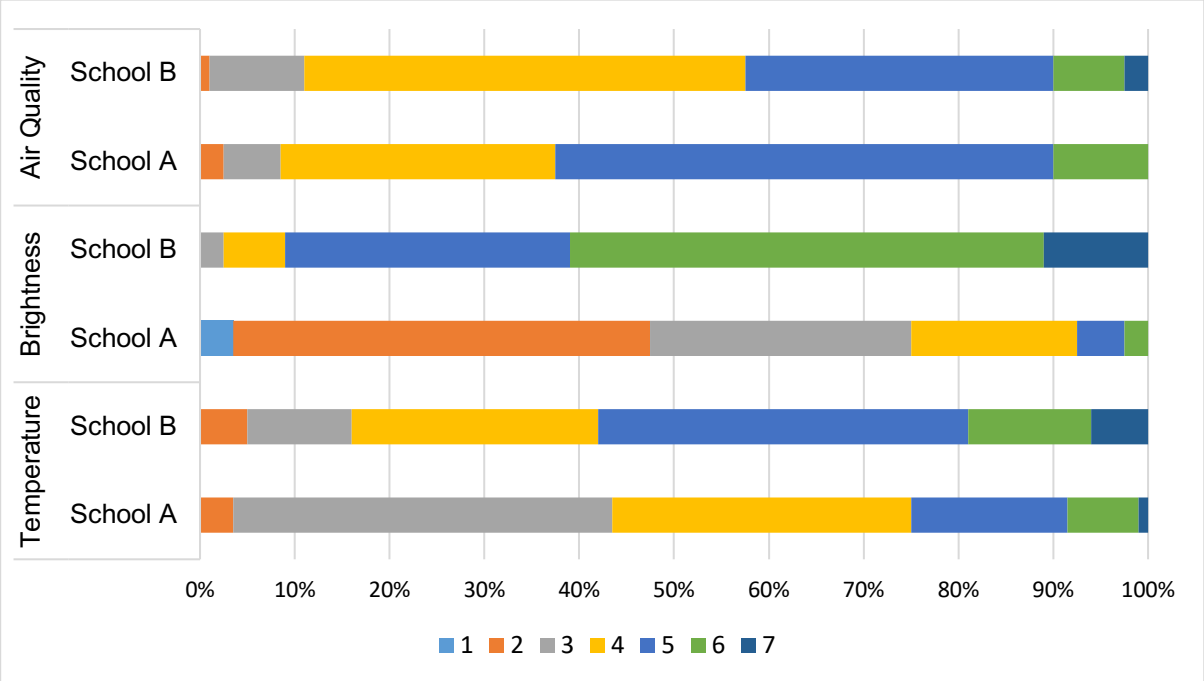

Figure 10: General Comfort Level Comparison of School A and School B Classroom.

Comfort Assessment on Classroom

Based on the comfort assessment on classroom survey result obtained shown in Table 4, the majority of the participants from both schools strongly agree that all three (3) comfort factor is important in the classroom and it contributes to effective learning environment. In terms of thermal comfort, classroom in School A is generally more satisfactory than classroom in School B and majority of the participants agree that the classroom is affected by the heat from sunlight. As for the visual comfort, the participants from School B is more satisfied than School A in terms of lighting. However, it is affected by glare whereas classroom in School A is not affected. On the air quality of the classroom, School A is more stable throughout the day compared to School B. Classroom in School B is somewhat affected by the smell and air pollution and also somewhat dissatisfied with the air quality based on the survey result.

Table 4: School A and School B Classroom Comfort Assessment Result Comparison

Comfort Level Factor	School	*1 = Strongly Disagree*	*2 = Disagree*	*3 = Fair*	*4 = Agree*	*5 = Strongly Agree*
Thermal						
a) Thermal comfort is important in the classroom	School A	0%	0%	4%	13%	83%
	School B	0%	1%	6%	14%	79%
b) The temperature in the classroom is satisfactory	School A	6%	10%	45%	32%	7%
	School B	19%	39%	26%	12%	4%
c) The classroom is affected by the heat from the sunlight	School A	16%	47%	21%	13%	3%
	School B	0%	9%	20%	36%	35%
d) The temperature in the classroom is stable throughout the school session	School A	4%	15%	20%	45%	16%
	School B	12%	25%	28%	21%	14%
e) Comfortable temperature contributes to effective learning	School A	0%	0%	1%	10%	89%
	School B	0%	0%	2%	14%	84%
Visual						
a) Visual comfort is important in the classroom	School A	0%	0%	7%	19%	74%
	School B	0%	0%	3%	16%	81%
b) The lighting in the classroom is satisfactory	School A	52%	24%	13%	10%	1%
	School B	2%	8%	15%	34%	41%
c) The classroom is affected by glare from sunlight	School A	62%	31%	5%	2%	0%
	School B	0%	8%	10%	35%	47%
d) The lighting in the classroom is stable throughout the school session	School A	24%	43%	18%	12%	3%
	School B	8%	13%	20%	32%	27%
e) Comfortable lighting contributes to effective learning environment	School A	0%	0%	3%	16%	81%
	School B	0%	2%	3%	21%	74%
Air Quality						
a) Air condition is important in the classroom	School A	0%	0%	7%	22%	71%
	School B	0%	2%	6%	25%	67%
b) The air quality in the classroom is satisfactory	School A	4%	7%	12%	45%	32%
	School B	7%	27%	36%	20%	10%
c) The classroom is affected by smell and air pollution	School A	40%	47%	8%	3%	2%
	School B	4%	20%	42%	26%	8%
d) The air quality in the classroom is stable throughout the school session	School A	1%	10%	21%	40%	28%
	School B	21%	30%	24%	14%	11%
e) Good air quality contributes to effective learning environment	School A	0%	0%	3%	30%	67%
	School B	0%	3%	7%	25%	65%

DISCUSSION

Based on the survey result of the inferential analysis conducted on two case study, both did not achieved satisfaction in all of the three (3) fundamental of comfort parameters that contributes to good human comfort space which leads to the students does not experience optimum comfort condition and being in a "neutral state". From the case study site observation and results from the survey questionnaire, there is a clear relationship between the architecture and planning of the school and the occupants comfort level . The selected case study, one which are built during post-independence era and the other built during post-millennium era consist of different architecture design and planning and the result of the survey questionnaire conducted on each of the case study differs from one another as the occupants experience different factors of comfort level satisfaction. The following Table 5 shows the result analysis from the questionnaire survey and in relation to the case study observation.

Table 5: Result Analysis

Component	School A	School B
Temperature	**Satisfied** - Installation of horizontal metal fin-like shading device - Presence of vegetation surrounding the classroom block	**Dissatisfied** - No shading device installed - Large opening from sliding door allows heat & sunlight to penetrate despite high ceiling height
Lighting	**Dissatisfied** - Shading device reduce daylight penetration into classroom - Low ceiling height - Insufficient artificial lighting	**Satisfied** - Sliding glass door as window allow large amount of daylight to enter - High ceiling height - Sufficient artificial lighting
Air Quality	**Satisfied** - Operable glass louvre window - Open courtyards - Lush vegetation	**Dissatisfied** - Lack of vegetation - School blocks facing roadways (pollutants from traffic)

Implication and Recommendation

The architecture design and planning of the school is the prevalent factor that influences the occupants comfort level in the classroom. In order to create a conducive and effective learning environment in the classroom, the occupants comfort level need to be enhanced which is through the architecture design and planning of the school. Based on the case study conducted on the selected public secondary schools built in different era, certain aspect can be adopted and implement to improve the respective comfort level factors in the classroom. The following Table 6 discuss on the recommendation to improve the students comfort level based on the five factors of comfort in relation to the architecture design and planning of the school.

Table 6: Recommendations to Enhance the Comfort Level in the Classroom

Component	Recommendations
Temperature	- Appropriate shading device is to be install at the external side of the classroom which is exposed to direct sunlight to reduce the penetration of heat into internal. - High classroom ceiling height also help to reduce the temperature of the classroom as it provides space for the hot air to rise and not in contact with the occupants - Open courtyards filled with trees and vegetation also cools down the surrounding area and reduces the temperature of the classroom
Lighting	- Large openings towards the external side of the classroom allow maximum daylight to penetrate the classroom - High classroom ceiling height also contributes to better lighting as there is higher surface area which allows more daylight to penetrate through - Installation of sufficient amount and evenly distributed artificial lighting
Air Quality	- Sufficient openings on both sides towards the external to allow air flow exchange - Having open areas with trees and vegetations surrounding the school classroom blocks improve the air quality as it absorbs pollutants and harmful chemicals and - Strategic school building planning such as having the classroom block placed further away from the roadways prevents pollutants and vehicle fumes from the traffic to transmit into the classroom

CONCLUSIONS

The main objective of this research was to analyse and identify the conditions of the Malaysia public secondary school classroom built in different era influences the occupant's comfort level. Based on the result of this research, it is discovered that the conditions of the classroom has significant impact on the occupant's comfort level and the classroom in school built during the post-independence era and post-millennium has different architecture and planning aspect which contributes to certain comfort level factor satisfaction.

The findings of this research display that Malaysia public secondary schools built during the post-independence era is able to achieved occupant's comfort satisfaction on thermal and air quality in the classroom but unable to achieve the occupant's satisfaction on visual comfort whereas public secondary schools built during the post-millennium era is able to achieve occupants comfort satisfaction on visual but unable to achieve satisfaction in thermal and air quality although it is based on different architecture and building planning features.

From the result analysis, it is deducted that strategic planning and placing of school blocks ensures the occupants comfort satisfaction to heighten. The installation of shading device improves the thermal comfort and prevent glare and large openings towards the external side of the classroom create better visual and air quality comfort. School with open courtyards with trees and vegetation planted contribute to better comfort in terms of thermal and air quality. Classroom with high ceiling height as well as having ideal amount of artificial lighting, nine (9) units and ceiling fan, six (6) units installed improves the thermal and visual comfort. With the conditions affecting the comfort perception in the classroom is identified, the main aim of the research was achieved. However, due to the limitations of this research, further studies are recommended by including other parameters of comfort in order to obtain a more comprehensive evaluation on the occupant comfort in the classroom.

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