The Role of Environment As Third Teacher Towards The Development Of Educational Space For Dyslexic Children

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ABSTRACT

Educational space that responds towards disable learning student needs is vital for a conducive learning environment. This paper explores on learning spaces for disable children namely the dyslexic in reference to the role of environment as the third teacher towards designing an appropriate educational space to fulfil their needs. Past literature on dyslexia in Malaysia much focuses on the pedagogy and teaching methods rather than discusses the issue of providing better learning space design that caters to the need of dyslexic children towards their psychological well-being. To conduct this study, the qualitative method involving case study as research strategy is used to establish the appropriate learning space design attributes for the dyslexic children. Data sources for this study are obtained from direct observation on three selected case studies of prominent learning disability school found in the global context. There are two key factors that contributed in the learning process and development of learning disability student namely the dyslexic children. These are the non-physical elements comprises of visual cues, auditory, tactile and kinaesthetic approaches as well as physical elements encompasses of density and size including spatial layout arrangement. Findings of the study are in the form of established referential guideline design to inform future designers, builders, education providers and related authority on how to build a conducive learning space environment for the dyslexic children. This is vital in improving the quality of public education infrastructure for dyslexic students in the Malaysian context towards their betterment in the future.

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1. Introduction

Educational space refers to learning environment setting, a place in which teaching and learning occurs (Goouch, 2008). This space therefore, not only limited to indoor physical parameters but also outdoor spaces as well. The existence of this educational space nevertheless, must also be supported with actual or virtual technology application to ensure students obtained better level of education with positive physical, emotional and spiritual enrichment (Brown & Long, 2006). Nonetheless, the existence of conducive educational space in most of Malaysian public schools is still lacking and undermined (Yacob, 2005). This issue however, is much crucial namely in schools that cater for special needs children varying, from ‘mild’ learning disability cases like dyslexia and ADHD to more severe disabilities like
Dyslexia in general terms is defined as disorders that involve difficulty in learning to read or interpret words, letters, and other symbols, but that do not affect general intelligence (Lyon, Shaywitz, & Shaywitz, 2003). In other words, dyslexia is stated as a spectrum learning disability involving reading fluency, writing and phonological difficulties (Lyon et al., 2003). There are no specific cure for dyslexic patient but they can improve their development in literacy and numeracy skill with more intensive instruction and motivational learning surroundings equipped with appropriate facilities. Dyslexia is also referred to as a learning disability, which does not have physically visible signs that can be detected during infants (Lyon et al., 2003). Dyslexia symptoms only can be detected when a child begins his or her education years when it involves process of reading, writing and conducting numerical skills. If untreated, it may disrupt and lessen their academic achievement of vocabulary and numeracy abilities due to poor phonological memory of visual object recognition and speech vocabulary which later resulted to poor social skills and interactions, frustration as well as low self-esteem. In long term this will affect their life time opportunities.

Scholars identifies that there are three types of dyslexia which are visual dyslexia (early stage), auditory dyslexia (medium stage) and deep dyslexia (severe stage) (Frith, 2017). The early stage is defined as phases that applies only to reading task. They only make errors when reading aloud and speaking while not making errors in silent reading. At this early stage, they manage to identify letters and their relative position but still have errors of letter migrations between words. Secondly, is the medium stage. This medium stage in general involve reading and speaking. At this stage, patient commonly make regularization errors in reading aloud. In this sense they typically have problem with accuracy and in comprehension which resulted to slower reading. Finally, is
severe stage. At this phase, they could not understand the words they read although they can read aloud correctly. All three stages above nonetheless require attention from parents and teacher to help those with dyslexic to deal with their difficulties in a much proper approach. Although it is viewed that dyslexia much relates to individual achievement in terms of reading skills, many scholars also do agree that proper learning space and appropriate facilities supported by structured pedagogy may also influence dyslexic patient to develop, stimulate and improve their learning abilities (Frith, 2017). To understand this in depth, the next section will explain on learning strategies and approaches to improve the condition of dyslexic patient.

### 2.2 Learning Approaches For Dyslexic – Environment As Third Teacher

Dyslexic patient in general may share the same profile and weaknesses in terms of learning disability but in specific they require a variety of approaches and learning strategies to overcome the learning issues. This not only focuses on the implementation of proper pedagogy but also in terms of providing sound environment and surrounding to help their process of learning (Démonet, Taylor, & Chaix, 2004). For instance, based on scholarly research, dyslexic patients whom are struggling with numeracy, usually have problems with directional confusion, sequencing problems, poor short-term a working memory, speed of working, cognitive style, anxiety, stress and self-image. Thus, they require the help of multisensory environment as pedagogical approaches to aid this type of dyslexia. This however, may be different with dyslexic patient whom has spelling difficulties because they have stronger visual senses and semantic ability. In other words, these category of individuals have higher learning abilities to understand new words by the visual strength combined with either kinesthetic and/or auditory channel. In this case, they require strong visual image such as big and colourful elements as well repeating patterns visibly shown within their learning surroundings to help them remember and memorize. From this it is shown that physical learning setting may influenced the experience of an individual towards a form of exploration and collaborations. According to scholars, designing proper learning space and environment will attribute to almost 25% of a student’s achievement over their progress in their whole academic year (Nasir & Efendi, 2017). This however, is much crucial namely for children with learning disability (Nasir & Efendi, 2017).

In this case, the environment becomes the third teacher to facilitate disable learning children to discover variety materials while actively exploring, investigating and solving problems as one way in accomplishing active learning through play experiences (Strong-Wilson & Ellis, 2007). As an example, by providing better environment for the children to thrive in indoor and outdoor learning space will trigger their senses to imagine, think, investigate, create and solving problem based on their experience. This in return will help them be more calm, have high esteem and engaged with society. From conducted literature studies it is found that there are two basic aspects of architectural aspects that needed consideration in establishing a better environment as third teacher to accommodate learning disable children with special needs in their learning process (Strong-Wilson & Ellis, 2007). This involves the physical setting, scale and proportion, materials and finishes adaptation and the non-physical aspects which are environmental considerations as follows (refer Table 1).

<table>
<thead>
<tr>
<th>Physical aspects</th>
<th>Features</th>
<th>Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>Comfortable classroom setting and furniture layout</td>
<td>Combinations of group and individual setting for flexibility and privacy.</td>
</tr>
<tr>
<td>Scale and Proportion</td>
<td>Appropriate class size and density</td>
<td>Appropriate size to ease movements, comfort and wayfinding will create independency for the children in their learning spaces.</td>
</tr>
<tr>
<td>Materials and finishes adaptation</td>
<td>Suitable Multisensory aspects – visual, touch, smell, auditory</td>
<td>Displaying tactile decorated walls, bright warm or cool colors soft stimuli with appropriate materials and finishes implementation will spark the children’s interests towards learning and enhance the sense of arrival. Transparency throughout the space using mirrors, windows, internal glass wall, glass objects, transparent film, large plastic sheets will promote creativity and exploration.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non Physical aspects</th>
<th>Features</th>
<th>Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Integration</td>
<td>Accommodating users’ health and wellbeing - Natural daylighting and shading, air quality control, comfort room temperature and suitable acoustic level</td>
<td>Indoor and outdoor relation, learning spaces near to the courtyard will have clear visibility, usage of appropriate materials, natural lighting at core area with different height of space openings create conducive learning ambience.</td>
</tr>
</tbody>
</table>

In sum, the above had briefly outlined that thoughtful learning experience for disable children is linked with the stimulating learning environment that affects physical, emotional and cognitive readiness of the individual on a new learning task. This is vital to prepare the disable learning children for a much promising adulthood. However, the current special schools namely in the Malaysia context still lacking and undermined in providing better learning environment specifically for the learning disable children. Therefore, the design of current learning setting in Malaysia should be shifted from traditional type for a more holistic approach emphasizes on the physical environment as third teacher to help child's development
especially for children with dyslexia. During live case observation and conducted interviews, there is no specific school built by private or the public government to cater for learning disable children. From Ministry of Education statistics it is estimated that a total of 314,000 students diagnosed to have dyslexia in Malaysia (Nasir & Efendi, 2017). Many of these students are placed in remedial classes with other learning difficulties students since there are limited number of rehabilitation services for children with dyslexia in the country (Nasir & Efendi, 2017). In other words, as a common practice, this learning disable children will enter the public government schools and placed in kelas khas or remedial class but separated from normal children or they enrolled in privately funded individual learning centres operated in rented shop houses or office buildings. Due to this matter it resulted to many disadvantages for the learning disable children to obtain better facilities and sound environment for them to improve their condition. To elaborate on this matter, next section will highlight the existing condition of learning spaces and form making in current Malaysia’s schools for learning disable children that needed consideration and change in the future.

2.3 Problem of Learning Spaces and form making in Malaysian Schools

In general, there are three aspects that may influence learning process. First is the student-teacher relationship, second is in terms of management aspect and thirdly, is the classroom condition or learning environment. Nonetheless, learning spaces are the most important space that forms the backbone of school design planning. This is because learning is defined as an identification process that can give an understanding of knowledge and experience whether formally or informally. Studies shown that in Malaysian school, students from the age of 7 to 12 years old will spend an average of 25 hours per week in learning environment like school. This learning environment is defined as classroom where the learning process takes place involving physical and non physical elements in order to produce a balance context in terms of psychological and pedagogical aspects which give impacts on the student’s behavior and achievements. In reference to this, the physical and non physical aspects are vital to ensure conducive learning environment. However, the existing layout of the typical classroom in most of Malaysian public schools are not suitable to cater the needs of these learning disable children. In detail, there are two main issues that can be identified on how current Malaysian schools are designed (Ismail & Abdullah, 2018).

a) Deficiency from non-physical aspects comprising of air quality control, room temperature, lighting and acoustic level (Ismail & Abdullah, 2018)

Most of Malaysian 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 closed, noisy, crowded learning space that increase sound decibel in the classroom, combined with the students' and instructors' body heat, leading to a raucous classroom conditions that are also 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. Poor natural lighting also presents in the current classroom design. This is crucial if the classroom block is hidden or blocked by another block that has to utilized artificial lighting. Studies indicate that, students 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. Hence, if the classroom view is dark and enclosed student will not be exposed with a significant quantity of natural lighting, therefore they will feel anxiety, disinterest, and hard to focus on the learning task at hand as compared to students situated in a relatively natural lit bright classroom, with extensive light illuminated by natural lighting.

b) Large capacity, size and dense classroom in terms of physical aspect (Ismail & Abdullah, 2018)

Classroom size and density also influences the behaviour of students. 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.

From the highlighted issues above clearly indicates that from the perspective of encouragement, to date, there is no special design that promotes the development of dyslexia children cognitive and psychomotor development in a comprehensive manner to allow them to stimulate and interact with the existing environment. Since there is no proper design of dyslexic school in Malaysia, the next section will explain on the study methodology and analysis technique using comparative analysis from selected case study at global context to derive the appropriate indicators to produce guidelines in designing better dyslexic school in the Malaysian context in the future.

3. Methodology

This study utilises case studies as the research strategy under the framework of qualitative methods and approaches. For data
collection method, direct observation is used to observed the selected case studies. This is important to answer the study objectives to develop design strategies or guidelines that is suited for the development of conducive learning space for dyslexic children in which focusing on the environment as third teacher concept. The obtained 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 dyslexic schools at the global context. To analyse data from the case study, triangulation technique is used and the data are comparatively analysed and tabulated in table format. All collected data then are finalised to propose the best possible design guideline and strategies for learning space to accommodate the needs of dyslexic children. This is important to achieve the objective of the study. Justification selection on the case study are based upon two main criteria. The first criteria are based on the school category which caters for specific learning disabilities type in terms of curriculum and pedagogy implementation. The second criteria are according to the school approach that portray much emphasis on the implementation of learning environment as third teacher to aid learning disable children namely on the dyslexic patient. This involve the physical and non-physical elements that include multi sensory element involving visual, auditory, kinesthetic and tactile aspects. The finding of the case study will be discussed in Section 4.0. The conducted research framework as in Figure 1.

4. Findings

This section discusses on the findings gathered from observation and literature review on the three selected case study of prominent learning disable school found in global context which are CS1) Pond Meadow School, Guilford CS2) Daaf Geluk School, Netherlands CS3) Stephen Gaynor School, Amsterdam. These three schools are chosen as case study based on the justification of the effectiveness of their applied curriculum and pedagogy as well as the school successfulness in term of addressing the needs of the learning disable children through its unique architectural design in terms of form and space making. The observation on the school learning environment therefore is conducted referring to two main indicators; physical and non-physical elements. A1) Non physical elements comprise of A1i) visual A1ii) auditory A1iii) tactile and A1iv) kinaesthetic approaches. A2) Physical elements encompasses of A2i) density and size A2ii) spatial layout. In overall, all three case study did show similarities in their design approach which adopt environment as the third teacher strategy in determining their design scheme. Although these three case studies did not specifically focus on dyslexia students per say but addressing the learning disable children in general. Hence, it can be summarized that learning spaces are important. Therefore, the two aspects of physical and non-physical elements need to be taken into consideration when designing learning space relating to the role of environment as third teacher to promote better social interaction and learning functions. To understand this

![Figure 1 Research framework to conduct the study](image-url)
matter in depth, the next section will elaborate further how both of the physical and non physical elements can be adopted and implement in reference to propose design at complex, block and units level in terms of form and space making. (refer Table 2).

Table 2 Findings from case study at global context to derive related indicators in determining design strategies

<table>
<thead>
<tr>
<th>Case study</th>
<th>A1) Non Physical elements (learning space)</th>
<th>A2) Physical elements (learning space)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS1- Pond Meadow School</td>
<td><strong>A1i)</strong> Visual cues in learning space</td>
<td><strong>A2i)</strong> density and size</td>
</tr>
<tr>
<td></td>
<td>Provide natural daylight for bright visual effect throughout the day</td>
<td>Provide wide corridors and easy access for all pupils</td>
</tr>
<tr>
<td></td>
<td><strong>A1ii)</strong> auditory</td>
<td><strong>A2ii)</strong> spatial layout</td>
</tr>
<tr>
<td></td>
<td>Appropriate acoustics for low sound transmission in class (LSTC)</td>
<td>Centralized planning concept</td>
</tr>
<tr>
<td>CS2-Daaf Geluk School</td>
<td><strong>A1 iii)</strong> tactile</td>
<td>Open courtyard and shared facilities as focal point</td>
</tr>
<tr>
<td></td>
<td>Sensorial experience and awareness of hand touch and visual problem solving activities</td>
<td>Low rise storey for easy access to individual space</td>
</tr>
<tr>
<td>CS3-Stephen Graynor School</td>
<td><strong>A1 iv)</strong> kinaesthetic</td>
<td>Nodes and gathering area are connected to each other for easy wayfinding</td>
</tr>
<tr>
<td></td>
<td>Flexible and non fix learning space.</td>
<td>Provide wide corridors and easy access for all pupils</td>
</tr>
<tr>
<td></td>
<td>Individually decorated with movable partition wall to create individual and group space</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Openness in learning space to promote interaction between indoor and outdoor environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smaller class size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less than 15 students per class</td>
<td></td>
</tr>
</tbody>
</table>

5. Discussion – Design Strategies And Approaches

In designing learning spaces for children with dyslexia, it is important to shift away from traditional norm to a more holistic approach that emphasis on the physical and non physical element that shaped the environment for the disable learning children development at the complex, block and unit level. (refer Table 3).

In brief, the implementation of appropriate building components in terms of form and space making is important in designing a learning space for children with learning disability, with consideration to the environment as third teacher to meet the needs of different types of dyslexia for their education betterment. To sum, the guideline in designing an institution for dyslexia children is as in Table 4.
Table 3 Proposed Design Strategies For Dyslexic Children Learning Spaces At Complex, Block And Unit Level

<table>
<thead>
<tr>
<th>Physical element</th>
<th>Complex level</th>
<th>Block level</th>
<th>Unit level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial layout, density and size</td>
<td>Should adopt centralized design planning act as a focal point surrounded with classrooms or special areas minimizing travel distance between the learning space with provided facilities (refer Figure 5.1.a)</td>
<td>Should have clear and transparent connectivity between indoor and outdoor nodes that are well linked to the size and shape of the educational blocks. This will optimize the access to all spaces (refer Figure 5.1.a)</td>
<td>Should have appropriate class size. Eg max 8 students in one class for the mild dyslexia, while max 4 students in one class for severe dyslexia.</td>
</tr>
</tbody>
</table>

Figure 5.1.a: Centralized planning with open courtyard in the middle (5) connected by nodes and landmarks (1,2,3,4 and 5) in the overall complex planning to promote accessibility that enhance wayfinding abilities of the children (source: Author)

Figure 5.1.b: Design of different classroom units according to indoor and outdoor interaction, connectivity and accessibility, wayfinding and break space (source: Author)

Figure 5.1.c: Design of learning space units with nucleus for teacher’s space for easy monitoring (Unicef, 2009)
### Non Physical element

<table>
<thead>
<tr>
<th>Complex level</th>
<th>Block level</th>
<th>Unit level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should have visual cues such as photographs, drawings, graphics or computer generated icons in learning spaces as signage to grasp children attention, reduce anxiety in academic learning situations as well help to express their thoughts.</td>
<td>Should have visible and easily recognize visual cues to identify areas and assisting with wayfinding like contrast between objects and their background (refer figure 5.1.e)</td>
<td>Should have visual cues in form of contrast in wall design used for wayfinding (SEGD, 2019)</td>
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</tr>
</tbody>
</table>

**Figure 5.1.d**: Furniture setting in class according to multiple projection with students in clusters for flexible learning style (Smith, 2017)

**Figure 5.1.e**: Visual cues in form of contrasting wall design used for wayfinding (SEGD, 2019)

**Figure 5.1.f**: Visual cues in form of contrasting elements like staircase for functional purposes (Studio, 2019)

**Figure 5.1.g**: Visual cues in form of lighting strategies to provide visual clarity (DSDHA, 2019)
### Auditory

<table>
<thead>
<tr>
<th>Figure 5.1.h: Auditory solution in terms of using sound absorbing wall material as well act as visual cues (Brite, 2011)</th>
<th>Should create buffer zone by making playground, outdoor recreation area and playing field as buffer to separate the main learning building from noisy zone like access roads and parking areas,</th>
<th>Should use acoustic absorption materials in walls and ceiling for minimization of noise to reduce sound pollution for learning concentration (refer figure 5.1.h)</th>
<th>Should use proper material to represent opaque, solid, transparent or hollow outlook to enhance connectivity and provide active social interaction. Example hollow and solid walls at the learning pods provides the sense of curiosity, creativity and connectivity to the surrounding. (refer Figure 5.1.j)</th>
</tr>
</thead>
</table>

### Tactile (materials and texture)

| Figure 5.1.j: Usage of different tactile creates visual cues and creativity (Archdaily, 2008) | Should use proper material to represent opaque, solid, transparent or hollow outlook to enhance connectivity and provide active social interaction. Example hollow and solid walls at the learning pods provides the sense of curiosity, creativity and connectivity to the surrounding. (refer Figure 5.1.j) | --- | --- |

### Kinesthetic (variations and movement)

| Figure 5.1.k: Flexible partition walls that can divide the learning space in multiple layouts (Smith, 2017) | Should have flexibility and transformability is where the classroom has installed a movable wall in order for the children to separate the activities according to space and time. (refer Figure 5.1.k) | --- | --- |
Table 4 Design guideline for dyslexic children learning spaces encompassing physical and non physical elements

<table>
<thead>
<tr>
<th>Design Elements of Learning Space (physical and non physical elements)</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| Color | Decorated walls, bright warm or cool colors | • Displaying soft stimuli  
• Spark the children’s interests towards learning  
• Enhance the sense of arrival |
| Indoor outdoor relationship | Interior courtyard and sensory garden as flexible spaces | • Learning spaces are located near to the courtyard  
• Act as buffer zone to separate different function when is necessary |
| Lighting | Natural daylighting, natural shaded, wide window and door sizes | • Clear visual from the interior and exterior of the learning spaces using appropriate materials  
• Punching light to the core of poorly lit spaces and ensure that there will always have lights at the end of the corridor |
| Spatial Layout | Central courtyard | Surrounded by classroom and served as an internal link to shared spaces |
| | Informal auditorium, gathering area | Broad wooden staircase function as the school center and a seating stage act as informal auditorium for the students to gather around. |
| | Location of the public and private space zoning | • Located at the end of the building to ensure that it was provided with its own entrance makes it easier for the students to access after the school hour. |
| Cluster planning | Separate by using two zones one belong to the upper class and lower class connected by the building shared facilities. | Separate by shared facilities which located at the center |
| | Basic square and parallel routing system | • Runs in parallel routing system and sight visibility.  
• Straight and square shapes help the viewer to connect from the corridor to the existing space. |
| Class Size | Small number of students in one class:  
a) 8 students for mild dyslexia  
b) 4 students for severe dyslexia | Small distance between speaker and listener to avoid obstruction along the direct sound path |
| Safety and Surveillance | Teacher spaces | Located inside the classroom and any provided learning spaces to ensure that teacher is always monitoring the children and in walkable distance ease to reach whenever in need |
| Acoustical | Acoustical tiling (sound field system) | • Carpet material, flooring to absorb the echo sounds in the classroom  
• Acoustical flooring installation along the corridor  
• Laminated flooring in the art, dance, drama and music studio gives impact to sound insulations. |
| Vertical Zoning | According to the curriculum and school program | • The noisiest area was located at the ground floor as it was really close to pedestrian street  
• Administration and management located below the academic floor that as a security value in the circulation building. |
6. Conclusion

From the above, it is shown that in designing schools for learning disabled children namely the dyslexic, there are two main aspects that contributed to the level of wellbeing of the students. These are the physical elements like density, size and spatial layout. Second, is the non-physical aspect of learning space comprises of visual cues, auditory, tactile and texture as well as kinaesthetic approaches. These aspects are crucial as it could lead to conducive learning and teaching environment. The government and involved authorities should work together with education providers in providing a better learning environment to elevate the education quality for this learning disabled students namely the dyslexic children as well as to improve their physical and educational development. This is vital in discovering their full potential to enhance their hidden abilities for better living in the future.

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