The Effect of Classroom Design on The Learning Comfort Level of Visually Impaired Students

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ABSTRACT

The classroom environment is essential in creating a conducive learning environment. Learning comfort, especially for visually impaired students, will be better if the learning environment is set according to their ability level. This study aims to identify the influence of classroom design on the learning comfort level of visually impaired students. This study involved 52 respondents from the PISMP program specializing in Special Education for Visual Impairment at IPGKIK. The research instrument included a questionnaire analyzed with descriptive statistics using frequency, percentage, and mean methods. Meanwhile, inferential statistical data was tested using Pearson's correlation to determine the influence of classroom design on the learning comfort level of visually impaired students. The study's findings show the appropriateness of the design elements of the visually impaired students' classrooms, namely space and layout elements and lighting elements, were at a high level (mean = 3.56). In addition, the learning comfort level of visually impaired students, from cognitive and socio-emotional aspects, orientation, and mobility, was also high (mean = 3.93). The findings show a significant relationship between classroom design and the level of learning comfort of visually impaired students (N = 52, r = 0.415, p = 0.01). Therefore, the classroom design for visually impaired students needs to be planned carefully because the appropriate environment can affect the satisfaction of the learning environment and student behavior.

KEYWORDS: classroom design, learning comfort, space and layout, lighting, cognitive, socio-emotional, orientation and mobility, visually impaired students

1. Introduction

Physical facilities, such as conducive classrooms, are the basic requirements to provide optimal learning opportunities for all students. The design of a classroom in the Special Education program is different from mainstream classrooms. Various aspects need to be taken into account before a classroom is built or renovated. According to Kaplan (2022), teacher must know the importance of planned teaching strategie,s and activities that match young children's

developmental needs and characteristics. Children with a learning disability like speech or language disorder, hearing or visual impairment, physical disability, or other type of impairment may need special accommodations or modifications in the classroom. One of the best ways to support children with special needs is by changing the classroom environment to increase children's participation in activities. This is because studies show a positive relationship between the learning environment and student learning outcomes in the classroom regarding student performance, satisfaction, or success (Marinah Awang et al., 2018). However, studies on the interior design of classrooms for visually impaired students have not been carried out much, even though visually impaired students have sensors sensitive to their environment. The modification of the classroom based on the functionality of the students can contribute to a positive atmosphere and encourage the improvement of the performance of visually impaired students.

According to Che Nidzam Awang et al. (2017), comfortable classrooms, spacious spaces, and fun interactions between teachers and students or fellow students will result in more accessible and ongoing learning. Dunn and Dunn's Learning Style Model states that students can improve their performance if the teaching and learning process can be adjusted according to their learning style. Dunn and Dunn's Learning Style Model presented five stimuli that influence a person's learning style, namely, i) environment, ii) emotion, iii) sociology, iv) physiology, and v) psychology. An appropriate learning style will stimulate individuals to respond to the surrounding world. This study focuses on individual learning styles rather than environmental stimuli. Dunn & Dunn (1984) also quoted that humans respond to environmental stimuli and actively move toward their environment by providing new stimuli. Natural and environmental factors have different effects on cognitive development depending on the cultural and historical context in which the individual was raised.

Therefore, as an educator, it is necessary to be sensitive to the atmosphere of the classroom environment. Teachers should check the environment before starting class (Ang, 2014). This is necessary so that teaching and learning can run more smoothly, and an excellent physical classroom environment is vital to generate or stimulate learning.

Research Problem

The classroom is the main place for the learning process at school. Hence, every factor in the construction of classroom design must consider the student's needs. A study shows that the physical aspect of the learning environment of special education students in schools seems to be at a moderate level and does not meet the needs of teachers and students (Mohd Hanafi Mohd Yasin et al., 2013). Learning comfort for visually impaired students will be increased if the learning environment is in a good and secure condition. This is because a study found that the social behavior of visually impaired students is still passive in the existing learning environment (Manisah Mohd Ali & Noorfaziha Hassan, 2014). The visual constraints and learning comfort

that visually impaired students face affect their involvement in learning. The development of the behavior of visually impaired students will create a gap in their social development with typical students and limit their potential in learning activities.

Although there is evidence showing that the physical environment influences learning, there are not many studies conducted on the influence of the physical design of classrooms specifically for visually impaired students. In general, the significance of classroom interior design in terms of the physical environment has been recognized for a long time, and only modifications have only taken place in mainstream classrooms. Therefore, this study related to the influence of classroom design on the level of learning comfort of visually impaired students was conducted so that the findings of this study provide a clear statement on the specific needs of visually impaired students in their learning environment. The findings of this study will also provide useful information to various parties in managing the physical environment of the classroom according to the needs and functional level of students.

Research Objectives

This study was conducted to achieve the following objectives :

1. To identify the suitability of classroom design elements for visually impaired students.
2. To identify the learning comfort level of visually impaired students.
3. To determine the influence of the suitability of classroom design elements on the learning comfort level of visually impaired students.

Research Questions

Therefore, this study answers the following questions:

1. What is the suitability of classroom design elements for visually impaired students?
2. What is the comfort level of learning for visually impaired students?
3. Does the suitability of classroom design elements affect the level of learning comfort of visually impaired students?

Hypothesis in this study:

H0: There is no significant relationship between classroom design and the level of learning comfort of visually impaired students.

2. Literature Review

Students spend most of their time in the classroom setting. Therefore, the importance of classroom learning environment quality cannot be overstated (Noraini Mohamed Noh et al., 2013). Active learning in the classroom has a relationship with appropriate and comfortable physical facilities that will stimulate intellectual activity, improve social relationships, promote learning and student development, and limit negative behavior among students (Che Nidzam Che

Ahmad et al., 2016). Consequently, teaching and learning will take place in a comfortable and enjoyable environment. As a result, students' knowledge and understanding may increase. Therefore, the physical aspect of the learning room needs to be well planned because it reflects the ideas, values, behavior, and culture expected in the room (Sanoff, 2010).

Many studies show that classroom environment affects the comfort of the learning process in mainstream schools as well as special education schools. A study conducted by Tania et al. (2016) in a special education school for visually impaired students found a strong correlation between students' perceptions of the classroom learning environment and their attitudes. The researcher also mentioned that the natural atmosphere of the classroom has a significant impact on students' willingness to learn. Therefore, practical strategies to improve the learning environment and teacher behavior should be considered to improve student attitudes in the classroom. A positive relationship between the learning environment and the interpersonal behavior of students was also shown. The facilities and design provided at the school certainly meet the needs of visually impaired students.

In the context of Malaysia, Che Nidzam Che Ahmad et al. (2014) conducted a study on the contribution of physical aspects to the comfort of teaching and learning involving 916 secondary school students in Malacca. It was found that the suitability of the physical aspect of the classroom studied was at a moderate level. The comfort of teaching and learning was also moderate from the student's perspective. This finding means that aspects of furniture, learning space, and indoor air quality that belong to physical aspects are predictors of the comfort of teaching and learning in the classroom. The comfort of teaching and learning will be improved when these aspects are optimized. Therefore, attention should not only be given to the delivery of lesson content alone but also to the physical aspects of the classroom environment.

There is also a study by Zalena Abdul Aziz (2017) that evaluated the quality of Indoor Environmental Quality (IEQ) of classroom design on students' comfort in learning. The study assessed the indoor environmental elements of classroom design in terms of lighting, thermal comfort, relative humidity, sound level, and air distribution in two schools. The result shows that the two schools have different quality values and the students' reactions also differed. According to Zalena (2017), residents or students in a building with a good IEQ will be more comfortable and produce more productive work compared to residents in the opposite building. A conducive environment is vital to produce a high-quality generation. IEQ is a complete component for studying the comfort level and conducive classroom atmosphere. IEQ elements have a considerable impact on the learning and teaching system in the classroom.

In addition, a study on the constraints of special education classrooms was also conducted by Mohd Hanafi Mohd Yasin et al. (2013). The study was carried out in Special Education School (SKPK) and Special Education Integration Program (PPKI) throughout Malaysia with a total of 319 respondents consisting of special education teachers. Based on the

feedback, 231 out of 319 teacher respondents throughout Malaysia who were involved in the questionnaire were not satisfied with the classroom infrastructure for special education students in their respective schools. The average of the unsatisfied respondents explained that the classroom size was inappropriate, confined, not conducive, and could not accommodate a large number of students in the classroom. Most teacher respondents think that the infrastructure of special education classrooms in schools needs to be upgraded and given attention because special education students must study in confined classrooms that lack facilities. The provision of equal teaching and learning opportunities must be held for students with special needs to enable them to be independent and develop their respective potential.

Furthermore, Noorainul Arifah Samsuri (2012) studied facilities for people with impairments in special education vocational high schools. The results found that the facilities, in terms of accessibility, are complete and cover the entire campus because the provision of facilities in this school is 81.33% which is an adequate amount and completes the necessary facilities. The findings showed that 211 teacher and staff respondents suggested that special education programs should have spacious and comfortable classrooms in their buildings. This would indirectly make it easier for students and teachers to adopt programs that have been compiled to help them establish a conducive environment for teaching and learning. This study shows how important it is for special education classroom infrastructure to be built based on standard specifications according to the criteria for students with disabilities for each school based on the teaching and learning needs as well as the students' physical disabilities.

Regarding this, a conducive physical environment will facilitate the comfort of teaching and learning. The comfort of students in the classroom can be a factor in the quality of their learning. Classroom design factors, such as the classroom's location, size, furniture, heat, lighting, and indoor air quality, affect the teaching and learning process. Nurazuan Razali (2013) further asserted that a quality environment means that the infrastructure of the learning environment is well-planned and organized and meets certain criteria and is in line with the needs of the students and the goals of the curriculum.

3. Methodology

The study adopted a quantitative approach. The design of this study is also in line with previous studies in Malaysia that have examined the relationship between the physical environment and student learning comfort (Che Nidzam Che Ahmad et al., 2014; Marinah Awang et al., 2018). The respondents consisted of 52 student teachers and student-teacher alumni specializing in Visually Impaired Special Education who followed the Bachelor of Teaching Program (PISMP) at Institut Pendidikan Guru Kampus Ilmu Khas (IPGKIK). The respondents consisted of PISMP Intake 2014, PISMP Intake 2015, PISMP Intake 2016, PISMP Intake 2017, and PISMP Intake 2018.

This study employed a Google Forms questionnaire instrument to collect respondent data online. The instrument's construction was adapted from a study on the "Evaluation Instrument for the Effects of the Classroom's Physical Environment on Students" built by Che Nidzam Che Ahmad et al. (2014), which has high reliability based on Cronbach's Alpha value of 0.87. However, some items were changed to adapt to the scope of the study and to answer the research questions. The questionnaire instrument consists of three parts. Part A contains 25 items about respondents' information. Part B comprises 10 items on the appropriateness of classroom design elements for visually impaired students, while part C consists of 15 items on the learning comfort level of visually impaired students. All the items are answered with a scale number based on a four-point Likert scale.

The data obtained were analyzed using the Statistical Package for Social Sciences (SPSS) software. The two types of statistical analysis used are descriptive statistics and inferential statistics. Descriptive statistical analysis was used to describe the findings in the form of mean scores for the construct of the suitability of classroom design and the construct of the comfort level of learning for visually impaired students. The interpretation of mean values is shown in Table 1.

Table 1

Mean score interpretation guide

MEAN SCORE	LEVEL
1.51 to 2.50	Low
2.51 to 3.50	Moderate
3.51 to 4.00	High

In addition, inferential statistics were used to see the relationship between the influence of the suitability of classroom design on the level of learning comfort of visually impaired students. Therefore, Pearson's correlation coefficient test was used to see the relationship between the two variables. The correlation coefficient values and data interpretation data are shown in Table 2.

Table 2

Correlation coefficient value and interpretation of the coefficient value relationship

CORRELATION COEFFICIENT VALUE (r)	RELATIONSHIP INTERPRETATION
0.91 – 1.00	Very strong
0.71 – 0.90	Strong
0.41 – 0.70	Moderate
0.21 – 0.40	Weak
Less than 0.20	Very weak

4. Findings And Discussion

The distribution of 52 respondents is shown in Table 3.

Table 3

Distribution of Respondents

PROGRAM	NUMBER	PERCENTAGE (%)
PISMP Intake 2014	8	15.4
PISMP Intake 2015	18	34.6
PISMP Intake 2016	17	32.7
PISMP Intake 2017	5	9.6
PISMP Intake 2018	4	7.7

The Suitability of Visually Impaired Students' Classroom Design Elements

The findings of the suitability of classroom design from space and layout, and lighting elements are shown in Table 4.

Table 4

Classroom Design Elements for Visually Impaired Students

ITEM	ELEMENT	MEAN SCORE	LEVEL
1.	Space and layout	3.41	Moderate
2.	Lighting	3.71	High
	Overall	**3.56**	**High**

The analysis results of the overall suitability of design elements were at a high level, with an overall mean score of 3.56. Table 4 shows the mean score data for the appropriateness of classroom design elements for visually impaired students for space and layout (mean = 3.41) and lighting (mean= 3.71). This finding implies that the respondents agreed with the appropriateness of the design elements of the classroom, and it is essential to be modified according to the functionality and ability of visually impaired students.

Furniture usually dominates the student's work environment. According to Che Nidzam Che Ahmad and Nurul Jannah Amirul (2017), the characteristics of the learning space are typically flexible, easily accessible, reduce the risk of injury, and promote learning and teaching. Consequently, the classroom space elements and furniture layout should be suitable for the students and allow for movement. Furthermore, the study of Raed Zedan (2010) also emphasizes that nowadays, learning and teaching in the classroom are student-centered instead of teacher-

centered, so the learning and teaching style will often change to accommodate the latest teaching methods. Therefore, classroom layout needs to be emphasized to boost students' confidence in dominating and exploring the space.

This finding also makes us realize that teachers must pay attention to the lighting elements in the classroom. Lippman (2010) stated that sufficient light circulating in the classroom could arouse the spirit of learning and bring comfort to students throughout the learning process. Optimal lighting is especially important for reading or work activities that require detailed vision. A study by Rozita Farzam (2011) found that the level of lighting will decrease in areas far from windows and close to furniture. Furthermore, the balance between lighting and the position of furniture is vital. The uniform distribution of classroom lighting, students, and furniture is salient for the satisfaction and comfort of learning. The study by Wan Nur Amirah Ibrahim et al. (2018) also supports the effects of poor lighting on health, such as headaches and high pressure, causing eye pain and prolonged visual impairment. Therefore, there is a need to improve and modify the suitability of classroom design elements for visually impaired students.

Learning Comfort Level of Visually Impaired Students

Table 5 shows the findings of the learning comfort level of visually impaired students from cognitive, socio-emotional, orientation and mobility aspects.

Table 5

Learning Comfort Level of Visually Impaired Students

ITEM	ASPECT	MEAN SCORE	LEVEL
1.	Cognitive	3.85	High
2.	Socioemotional	3.96	High
3.	Orientation and mobility	3.97	High
	Overall	3.93	High

The results in Table 5 show that all items of the learning comfort level of visually impaired students were at a high level with an overall mean score of 3.93, covering the learning comfort level of visually impaired students for the cognitive aspect (mean= 3.85), socioemotional aspect (mean=3.96) and orientation and mobility aspect (mean=3.97). This finding implies that the respondents agreed with the aspects that must be emphasized to ensure learning comfort for visually impaired students in the classroom.

Due to visual sensory constraints, visually impaired individuals master the cognitive aspect through the sensitivity of other senses. Children need to learn through the environment related to the senses, namely touching, hearing, smelling, feeling, and seeing, so they are aware of the changes in their surroundings (Muriza Mustafa et al., 2013). A learning environment that is not conducive in the classroom can cause students to be unable to adapt, limit creativity, and make students less active. Therefore, the importance of the learning environment in the classroom

cannot be overlooked to assist students in achieving the success they dream of by maximizing their various potentials.

The classroom atmosphere will comprehensively impact the satisfaction of students' socioemotional aspects, such as fun and satisfaction when they learn in a classroom tailored to their needs. In fact, according to Yesim & Nesrin (2011), the quality of education is not only evaluated by the level of achievement but also by the interaction of students with the learning environment. This statement is also supported by Samani (2011), who stated that if students can maintain motivation in their classrooms, their potential is more developed. Therefore, it is crucial to see the relationship between human interaction and the current environment.

The aspects of orientation and mobility are closely related to visually impaired individuals because according to Muriza Mustaffa et al. (2013), the physical environment is important in keeping students safe, reducing the risk of injury, and further contributing to students' attitude patterns and creativity. Students who can move freely in the classroom will easily relate to the teacher and other students immediately, thus increasing the level of interaction significantly (Manisah Mohd Ali & Noorfaziha Hassan, 2014). The higher the level of student interaction with teachers and friends, the better learning results can be obtained. Ang (2014) also stated that the arrangement in the classroom could contribute to control, relationships, and collaboration opportunities. Thus, visually impaired students will feel satisfied to explore and more confident to move in a safe and conducive space.

In a student's life, most of his time is allocated at school, especially in the classroom. Dunn and Dunn's learning style model states that students can improve their performance if the teaching and learning process can be tailored according to their learning style. Therefore, an appropriate learning style will stimulate individuals to respond to the surrounding world and use their learning style to interact with their environment. Accordingly, the quality of the physical environment in the classroom is essential because Amla Mohd Salleh et al. (2013) stated that the physical classroom environment interacts with the learning and teaching that takes place.

The Influence of Classroom Design on the Learning Comfort Level of Visually Impaired Students

This study used Pearson's correlation to determine the relationship between classroom design and the level of learning comfort of visually impaired students. These findings are shown in Table 6.

Table 6

The Correlation of the Appropriateness of Classroom Design on the Level of Learning Comfort of Visually Impaired Students (N=52)

		Classroom design	**Learning comfort level**
Classroom design	*Pearson Correlation,* r	1	.415
	Sig. (2-tailed), p		.002
	N	52	52
Learning comfort level	*Pearson Correlation,* r	.415	1
	Sig. (2-tailed), p	.002	
	N	52	52

** significant correlation at the 0.01 level *(2-tailed)*

The findings in Table 6 shows that the Pearson r value is (N=52, r = 0.415, p<0.05). The value of the coefficient (r = 0.415) is a moderate level, and the significance of this relationship is at the significance level of p<0.01. This shows a moderate but significant relationship between the two variables. The interpretation implies that this finding may be influenced by the size of the study respondents because if the size of the respondents is large, it can detect a significantly small correlation (Othman Talib, 2013). Although r was small, there was significant confidence that could be trusted. In other words, the correlation can be believed to exist and not just happen by chance. The results of the test also explain that the better the classroom design, the higher the level of learning comfort for visually impaired students. With that, the null hypothesis that is H0, there is no significant relationship between classroom design and the level of learning comfort of visually impaired students, is rejected.

This finding is in line with the learning style model of Dunn & Dunn (1984), which emphasizes the importance of the relationship between the learning environment as a determinant in the effectiveness of the student's learning process in the classroom. Factors such as learning style and classroom layout need to be given attention to because these elements will interact and affect the well-being and comfort of teaching and learning (Che Nidzam Che Ahmad & Nurul Jannah Amirul, 2017). In addition, the learning environment is not just a physical space about furniture, color, lighting, and air quality. Instead, it contains various materials and sources of information, interactions, relationships between and among students and teachers, and expectations and rules for learning and behavior. But there is no denying that there are other learning styles presented by the Dunn & Dunn learning style model, such as psychological, physiological, sociological, and emotional stimuli that also affect the comfort of students' learning in the classroom.

5. Conclusion and Recommendation

In overall, the findings of the study show that the relationship between the influence of classroom design on the level of learning comfort of visually impaired students is moderate and significant.

Indeed, the findings of this study can be used as a reference in developing guidelines to improve the physical environment in the classroom of visually impaired students. Lippman (2010) also suggested creating an environment that is more responsive to the needs of education in the 21st century. This is because the learning environment in the 21st century is seen as a place where students are involved in independent and cooperative learning activities. Therefore, classrooms should be organized not only according to the needs of visually impaired students but also following the current learning methods.

Recommendations and Implications

Appropriate and comfortable physical facilities will stimulate intellectual activities, improve social relations, promote learning and student development and limit negative behavior among students (Che Nidzam Che Ahmad et al., 2014). Students learning needs, such as a conducive learning environment, should be satisfied for them to achieve maximal functional improvement. With the findings of this study, teachers can be made aware of the importance of providing a suitable learning space for visually impaired students. This is because teachers are the main group that contributes to academic engagement and student comfort in school.

This study is also important for ~~the~~ schools to provide a more practical learning space for the Visually Impaired Special Education program. This is because a physical environment that does not suit the needs of students can affect the attitude and achievement of students as well as thwart the school's vision and mission in the school's efforts to produce quality students with special needs who are equipped with all abilities to face challenges in the future. Special Education Division can also review classroom design requirements specific for students with visual disabilities because there are indeed differences in classroom design for typical students and students with special needs. Therefore, it is very appropriate for Special Education Division to re-draft and study the importance of guaranteeing the learning comfort of visually impaired students.

REFERENCES

Amla Mohd Salleh, Mazdalina Mat Desa & Ramlah Mohd Tuit. (2013). The Relationship Between The Learning Ecology System And Students' Engagement: A Case Study in Selangor. *Asian Social Science, 9(2),* 110-117.

Ang, J.J.E. (2014). *Pengurusan Bilik Darjah: Strategi-strategi Mewujudkan Komuniti Pembelajaran Berkesan.* PTS Akademia.

Che Nidzam Che Ahmad & Nurul Jannah Amirul. (2017). The Effect of The Physical Learning Environment on Students' Health, Enjoyment & Learning. *Jurnal Pendidikan Sains & Matematika Malaysia 7(1),* 47-55.

Che Nidzam Che Ahmad, Noraini Mohamed Noh, Mazlini Adnan, Marzita Putih & Mohd Hairy Ibrahim. (2014). Pengaruh Persekitaran Fizikal Bilik Darjah Terhadap Tahap Keselesaan Pengajaran dan Pembelajaran. *Jurnal Pendidikan Bitara UPSI Vol.6,* 1-7.

Che Nidzam Che Ahmad, Saidatul Ainoor Shaharim & Asmayati Yahaya. (2016). Kesesuaian Persekitaran Pembelajaran, Interaksi Guru-Pelajar, Komitmen Belajar dan Keselesaan Pembelajaran Dalam Kalangan Pelajar Biologi. *Jurnal Pendidikan Sains & Matematika, Vol. 6* No.1, 101-120.

Dunn, R. & Dunn, K. (1984). Learning Style: State of The Science. *Journal Theory Into Practice 23(1),* 10-19.

Kaplan. (2022). *Adapting Classroom Environments For Young Children With Special Needs*. KaplanCo: https://kaplanco.com/ii/classroom-environment-special-needs

Lippman, P.C. (2010). *Can The Physical Environment Have An Impact on The Learning.* OECD iLibrary: https://read.oecd-ilibrary.org/education/can-the-physical-environment-have-an-impact-on-the-learning-environment_

Manisah Mohd Ali & Noorfaziha Hassan. (2014). Perspektif Guru terhadap Keterlibatan Akademik dalam Kalangan Murid dengan Ketidakupayaan Penglihatan. *Jurnal Pendidikan Malaysia 39(2),* 109-114.

Marinah Awang, Mohd Ezrizal Zakaria & Ramlee Ismail. (2018). Hubungan Persekitaran Fizikal Bilik Darjah dan Kesejahteraan dan Keselesaan Pembelajaran dan Pengajaran. *Management Research Journal 7(1),* 86-99.

Mohd Hanafi Mohd Yasin, Hasnah Toran, Mohd Mokhtar Tahar, Safani Bari, Siti Nur Nadhirah Ibrahim & Rozniza Zaharudin. (2013). Bilik Darjah Pendidikan Khas Pada Masa Kini dan Kekangannya Terhadap Proses Pengajaran. *Jurnal Pendidik dan Pendidikan Vol.28*, 1-9.

Muriza Mustaffa, Mohammad Rusdi Mohd Nasir & Nazhatul Zalkis Jamaludin. (2013). *Reka Bentuk Bilik Darjah Sekolah Menengah di Malaysia.* [Paper presentation]. 4th Social Development And Environmental Studies International Conference. Kuala Lumpur, Malaysia.

Noorainul Arifah Samsuri. (2012). Penyediaan Fasiliti OKU di Sekolah Menengah Pendidikan Khas Vokasional. [Unpublished master's thesis]. Universiti Tun Hussein Onn Malaysia.

Noraini Mohamed Noh, Che Nidzam Che Ahmad, Mazlini Adnan, Marzita Puteh dan Mohd Hairy Ibrahim. (2013). *Pengaruh Keselesaan Terma Bilik Darjah Terhadap Keselesaan Pembelajaran Pelajar Bermasalah.* [Paper presentation] International Conference on Special Education. Bandar Acheh, Indonesia

Nurazuan Razali. (2013). *Tahap Prasarana Pendidikan dan Persekitaran Pembelajaran*. [Unpublished master's thesis]. Universiti Teknologi Malaysia.

Othman Talib. (2013). *Asas Penulisan: Tesis Penyelidikan dan Statistik.* Universiti Putra Malaysia Press.

Raed Zedan. (2010). New Dimensions in The Classroom Climate. *Learning Environments Research 13(1),* 75-88.

Rozita Farzam. (2011). *Measurements and Analysis of Day Lighting Condition of Schools in Iran.* [Paper presentation] 5th Symposium on Advances in Science & Technology. Mashhad, Iran.

Samani, S.A. (2011). The Influence of Light on Student's Learning Performance in Learning Environments: A Knowledge Internalization Perspective. *World Academy of Science, Engineering and Technology, 57*, 540-547.

Sanoff, H. (2000). Community Participation Methods in Design and Planning. John Wiley & Sons.

Tania, P.A., Rosaria, O., Doris, C.C. & Knatz, K. (2016). Tools To Include Blind Students in School Building Performances Assessments. *Journal of Accessibility and Design for All 6(1),* 1-25.

Wan Nur Amirah Ibrahim, Zainora Mohammed, Norliza Mohamad Fadzil, Sumithra Narayanasamy & Mohd 'Izzuddin Hairol. (2018). Perubahan Tahap Pencahayaan dalam Bilik Darjah di Sebuah SKPK Cacat Penglihatan dan Perbandingan Tahap Pencahayaan Mengikut Keadaan Berbeza. *Sains Malaysian 47(8),* 1835-1842.

Yesim, B.C. & Nesrin, O. (2011). Effects of Socioeconomic Status and Physical Learning Environment on Motivation of University Students. *European Journal of Social Sciences, 21(1),* 71-79.

Zalena Abdul Aziz. (2017). *Kajian Kualiti Persekitaran Dalaman Untuk Reka Bentuk Bilik Darjah Di Dua Buah Sekolah: Kajian Kes di Sekolah*. [Unpublished master's thesis]. Universiti Sains Malaysia.