

The Application of Texture and Color for Education Centre of the Visually Impaired People in Jakarta

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Abstract

Education Centre for Visually Impaired People in Jakarta is a forum and facilities that provide the activity needs for visually impaired people. With the number of visually impaired people increasing every year, additional facilities are required to fulfil the necessities in one place to make it convenient for the visually impaired. Those needs are to hone and to improve the sensory abilities of hearing senses, touch senses and smelling senses. Not only just to improve sensory abilities but also to hone oneself in increasing knowledge, training the ability to see for those with low vision and to strengthen mental health. The interior design will pay attention to designs that are informative, easy accessibility, safe for activities and environmentally friendly

Keywords

Texture, Color, Education Centre, Visually Impaired

1. Introduction

In this world, there are all kinds of various people, different races, skin colors, physical form, people that have advantages and disadvantages. One of the disadvantages is a deficiency in bodily functions or people with disabilities, among them are the visually impaired people. The number of visually impaired people in Indonesia in 2020 is estimated to reach 4 million or 1.5 percent of the total population of Indonesia. This number is estimated to continue to increase in the coming years. With the increasing number, more facilities are required, especially information and education facilities. According to the Law of The Republic of Indonesia, Number 4 of 1997 Articles 5-15 concerning persons with disabilities, children with special needs have the same rights and opportunities as other normal children. Widjaya explains that a person is visually impaired if during learning process they need or require special tools or methods or with certain techniques so that they can learn without sight (Widjaya, 2013). With the number of visually impaired people who continue to increase every year in Indonesia especially in Jakarta, there is still a lack of facilities to help the educational needs of the visually impaired. It is necessary to add and provide complete educational facilities to help visually impaired people.

One of the facilities that is already available in Jakarta is Yayasan Mitra Netra on Jl. Gn. Balong II No.58, Lebak Bulus, South Jakarta. However, the interior condition of Yayasan Mitra Netra can still be improved and optimized. Based on the preliminary observations, currently, the only access for the visually impaired and low visions are handrails in front of the main building, while inside the building, there are no handrails, guiding blocks, and any other accessibility. There are no significant color contrast treatments in the interior elements, the circulation inside the building is not too safe for the visually impaired to orientate. Even though it is for the visually impaired, the design of each area and room still needs to be considered. Treatments for walls, floors, ceilings still need to be finished with color and material that are appropriate and safe. Furthermore, at Yayasan Mitra Netra the overall interior design was not the main concern since the available furniture are lacking as well. Classes were just desks and chairs, there are even desks outside of the classes that make the circulation not appropriate for the visually impaired.

According to Anthony Sully, there are nine elements' interiors include environment; space; light; ground planes; enclosures; supports; displays, storage, and worksurfaces; decorations; as well as information. Efforts to fulfill needs for the visually impaired are done because they need to learn to be able to live independently through practice practical learning and can handle situations with different environments. The physical environment is a trigger for the visually impaired people to carry out their activities (Sully, 2012). To help the visually impaired with their orientation in a

space as well as their safety, special interior elements are needed in the arrangement and design of the space, thus the visually impaired will be able to carry out their activities comfortably and safely. For example, the physical environment is necessary for the movement of the visually impaired. This element can be the main aspect that attention to help the visually impaired in getting used to self-use the surrounding environment as a reference orientated and engaged in activities; Support, this element consists of equipment supporting activities visually impaired activities such as chairs, tables, canes, and touch tool. Displays, storage, and work surfaces show the layout of the room and the design of the space suitable for visually impaired people; Information, this element is required for the control system so that it can know about what needs are needed by visually impaired people. These elements include patterns, signs, symbols, or graphic images (2D or 3D) that convey information or instructions to warn, inform, or give advice (Sully, 2012)

1.1 Objectives

There are many elements of interior that can be design and adjusted to the need of the visually impaired, such as the use of colors, textures, lighting and so on. These adjustments will help to stimulate not only their sight senses but also their other sense and guide them throughout their activities in the facilities. This research aims to find how to design the interior of an education center for the visually impaired with the appropriate texture and color approach that can stimulate the remaining sense of sight, especially for the low visions to help with their orientation and can move around the space in safe and comfortable environment

2. Literature Review

There are two types of visually impaired, total blindness and low vision. Total blindness is where physically, the condition of visually impaired children is no different from normal children in general, however the real difference is the visual organs, some of the symptoms that can be seen physically are squints, frequent blinking, squinting, red eyelids, eye infection, irregular and rapid eye movements, watery eyes, and swelling of the skin where the eyelashes grow, although sometimes there are visually impaired children who look like normal children, while the characteristics of low include writing and reading at a very close distance, can only read large letters, other visible eyes appear white in the middle of the eye (cataract) or the clear part in front of the eye looks foggy (cornea) (Smart, 2010). Cited in Fatharani, Evans et al, states that, the effect of lighting on daily activities results in bright lighting (800lux) which makes it easier for someone to carry out activities and the position of the light source will also affect the comfort of seeing things. Thus, since the low visions can still see a little bit of light and color, modification of the lighting system can improve visual function and visual acuity as well as visual comfort in this case, the ability to read with strong light at the level of 150 lux. Kodrat and Hartiningsih adds that the placement of the overhead light source just above the plane with a height of 2 m and a reading distance of 10-30 cm using 7-32mm letters (Fatharani, 2017). Furthermore, Fatharani mention that according to Gilbert, contrasting colors can help people with low vision in their activities. These contrasting colors make things easy to see, while according to Gardner and Myres, writing in light color, such as white and yellow with a dark background such as black, blue, and purple is easier to see than a combination of writing in a light or dark background (Fatharani, 2017)

Wilkinson state that colour contrast in interior for the visually impaired is important. They often need to pause to gather information about the space or to adjust to the change of luminance when entering a space. They will first try to discern the visual contrast at the wall or ceiling junction to establish a change of surface area or feature. Moreover, he explains that the main feature of a surface, which appears to be strongly correlated with the ability of visually impaired people to identify colour differences, is the amount of light a surface reflects, or its light reflectance value (LRV). This is the total quantity of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source. The LRV scale runs from 0, which is a notionally perfectly light-absorbing surface that could be assumed to be totally black, up to 100, a notionally perfectly reflective surface that could be the purest white. For all practical purposes, black is always greater than 0, and white never equals 100 (Wilkinson, 2017)

The 'Colour Contrast & Perception' document produced by Reading University uses light reflectance values (LRVs) to measure color and contrast in products/surfaces and determines whether a suitable contrast has been achieved between surfaces. The study concluded that visually impaired people may be unable to perceive some or all colors. However, many people with a visual impairment can perceive light and dark and, therefore, LRVs are a suitable method to measure contrast. Reflectance is the proportion of light that a surface reflects compared to the amount of light that falls on the surface. An LRV is a value given to a surface to denote the amount of light reflected. LRVs are marked on a scale of 1 to 100 depending on the percentage of light reflected. Dark, matt and/or textured surfaces

absorb a large amount of light (Figure 1) and, therefore, have low reflectance values. On the other hand, light, glossy and/or smooth surfaces reflect most of the light that falls on them and have high reflectance values. For example, a color with an LRV of 60 (which means it reflects 60% of the light that falls on it) will reflect lighter than that of a color with an LRV of 30. (Gradus, 2018)

Light reflectance scale



Figure 1. Light Reflectance Scale Source: GRADUS

Tarsidi (2011) mention that visually impaired people can learn to use the senses other than the sense of sight in a way that is different from that used by sighted people in general so that they can increase the information they get to function adequately. The sensory organs function to obtain information from the environment and send it to the brain for processing, storage, and action. Each sense organ is tasked with obtaining different information. Visual information such as colour and shape images are obtained through the eyes. Auditor information in the form of sound or sound is obtained through the ear. Tactual information such as smooth or rough is obtained through the surface of the skin that covers the entire body. The skin of the fingertips is the most sensitive access to tactual information, and therefore this sense is called the sense of touch. In addition to tactile information, the skin also perceives temperature information (hot or cold) (Tarsidi, 2011)

3. Methods

Sachari points out several approaches commonly used in art and design studies include qualitative approach, quantitative approach, and multimethod approach (Sachari, 2005). To achieve the aim of this study to design education center for the visually impaired people, the qualitative method with a case study approach will be used. By using this approach, an in-depth study about a case of phenomena will be done by collecting detailed information through various data collecting methods within a determined time frame (Creswell, 2008).

Based on the determined approach, data collecting was done qualitatively in two stages. The first stage is literature studies. Literature study is a form of data collection in books, journals, articles, and other scientific works that can be used as references. Also, research for information related to the types, functions activities, and needs of the interior design of the Education Centre for Visually Impaired People in general that can help the design process. The next stage is primary data collection through observations and interviews. Observation and survey are technique of collecting data directly by observing interior elements, lighting, space ventilation, and so on. The observation was conducted in Mitra Netra Foundation, South Jakarta, SLB-A Pembina also in South Jakarta, and National Library Disability Service, Central Jakarta. For the interview, open ended questions are given to PERTUNI and Mitra Netra Foundation to obtain an in-depth information related to the users, facilities, and activities of and education center for the visually impaired.

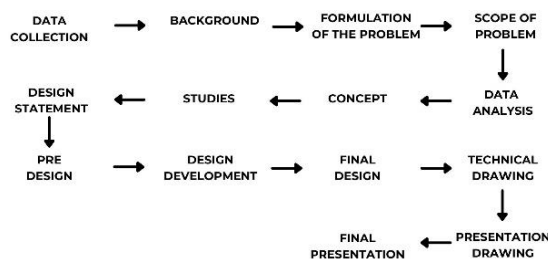


Figure 2. Design Process Scheme Source: Soetrisno, et.al, 2021

Both primary and secondary data were analyzed using descriptive analysis in relation with the interior element approach such as color, texture, lighting well as facilities and requirement needed, continued with the design process

which includes space programming and concept analysis, and the proposed design itself. The stages in the interior design process of Education Centre for Visually Impaired People can be seen in Figure 2.

4. Data Collection

The education center is a public place, specifically design for the visually impaired people that come from all societies and ages and focuses on the education and the health and well-being of the visually impaired. The users will include the members, people with visual impairments and their families or guardians and the administrators which include the board of directors, staffs, instructors, and counsellors. The education center itself will occupy the Jakarta International Korean School (JKS) building, located in East Jakarta, precisely on Jl. Bina Marga No.24, RT.2/RW.4, Ceger, Kec. Cipayung, East Jakarta, Indonesia. Jakarta International Korean School (JKS) has several school buildings, and the building will be used as case study is the gymnasium located in the front area of the school complex. With the size of approximately 1320m², consisting of 3 floors, the 3rd floor is a basketball court. This facility will provide a complete facilities and information that is easily accessed for the visually impaired and low visions. From the user activities analysis, there will be several main facilities available such as library, eye checkup and counselling area, learning assistance, learning class and computer class and other supporting facilities. These facilities are created based on the needs and requirement of the users to improve their abilities and knowledge

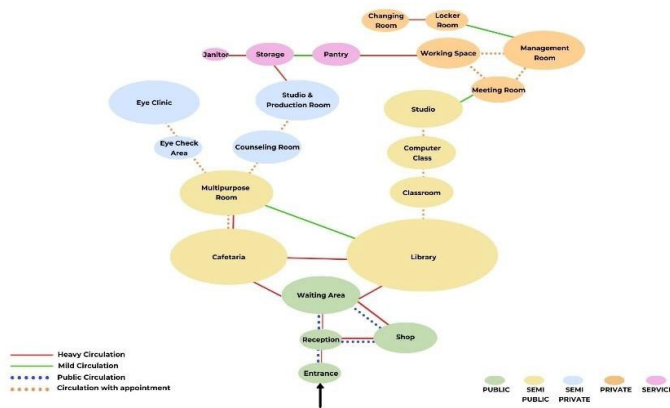


Figure 3. Education Centre of the Visually Impaired Space Programming Source: Soetrisno, et.al, 2021

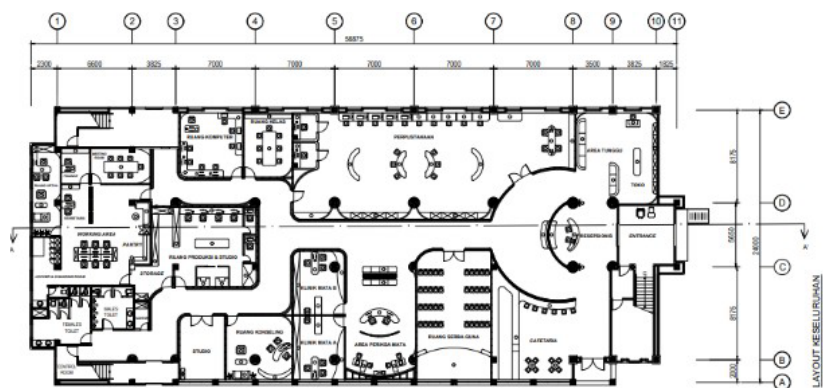


Figure 4. Education Centre of the Visually Impaired Layout Source: Soetrisno, et.al, 2021

To make all the facilities easy to access, they are organized and grouped into 5 zones public, semi- public, semi-private, private, and service zone. All zones will get good sunlight from the windows. Linear circulation pattern will be used for easier access between rooms and area. This circulation pattern will facilitate the needs of visually impaired to memorize and orientate because the rooms will be on either side of the building, so they are easily accessible. The

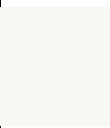




space programming and the proposed layout plan of the facilities is presented in the diagram below (Figure 3 and Figure 4)





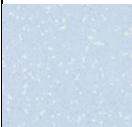
5. Results and Discussion


5.1 Numerical Results

Although the education center is designed for the visually impaired, there are still some users with low vision, thus the stimulation of the sense of sight become as important as the other senses. Some of the low vision users can still see contrasting colors, black and white and can still see dimly. The selection and decision which color or lighting to use play an important role at this point. As have been mentioned before that the role of color contrast and lighting is very important for low vision because it can help with their orientation and direction. Contrasting color can be used with the appropriate LRV (Light Reflectance Value). The purpose of using color by looking at the LRV value is to help the low visions to see color or those who can see black and white can distinguish colors from their LRV value levels. The variation of contrast color will be used in walls, ceiling, and floor element through various material, however for walls and ceiling paint will be mostly used, while for the application of color on the floor through various material as have been mentioned before by still analyzing their LRV value. Different floor colors with different LRV values will be applied for every area of the education center with hoped that the low visions will be able to see the different levels of contrasting colors and can function as a marker of an area. The various material that proposed to be applied in the education center and their LRV values are shown in following Table 1.

Table 1. The various material that proposed to be applied in the education center and their LRV values

Material	Color	LRV
Dulux Vivid White		94%
Dulux Happy		69%
Dulux Red Clown		20%
Linoleum Textura Cliffs Moher		44%
Carpet Tiles Metro Citrus		18%

Material	Color	LRV
Carpet Tiles Canyon Sulphur		31%
Carpet Tiles Penang Sapphire		17%
Carpet Tiles Canyon Clouds		24%
Homogeneous Vinyl Dark Neutral		27%
Homogeneous Vinyl Water		57%

Heterogeneous Vinyl Original Snow		75%			
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The percentages of the LRV are from the Dulux color catalogue and for the floor materials is from the Forbo Flooring catalogue.

5.2 Graphical Results

The design concept proposed for the education center is "*Hulu Bersanding Laras*", the word "*Hulu*" meaning stream or commonly referred to as the center of the river source or the beginning of the river flow, usually located in a mountainous area or hilly river. Upstream is the beginning of the river flow. The word "*Bersanding*" can be interpreted by (sitting) in a row and beauty; side by side; close by, while the word "*Laras*" / "*Selaras*" translates as harmonious, appropriate, commensurate, a good relationship that can create peace. Thus, the design statement can be concluded as an Education Centre for the Visually Impaired, which is a harmonious unity as a source of knowledge, education, information, and physical and mental health. In this education center, the visually impaired, especially low vision, can be stimulated by the rest of their remaining sight as well as their other senses; touch, hearing, and smell through various interior elements such as texture or with contrasting colors that applied to all interior elements of the education center. That way, the visually impaired can be oriented more easily. In this interior design, a design that can stimulate the senses of the visually impaired is applied through various interior elements, the purpose of which is to make it easier for them to orientate themselves. This concept is applied to the design in every area of the education center.

In accordance with the design concept, various materials with various texture and colors are analyzed to find out which material appropriate to the requirements and the needs or not. To stimulate the senses of touch, the design will focus on the application of floor material. This is done based on the user activities that often used the area underneath them as direction or benchmark. Thus, the floor will use different materials and floor finishes in each area as a marker and indication that the area is changing. The lobby reception area will use linoleum flooring that has a texture; thus, the users can feel and sense it, this indicates that you are in the lobby reception area. Flooring carpet tiles are used in several areas of the room which indicate that the user is in a stand-still area, sitting area, and reading area. Other flooring material used is vinyl. There are 2 types of vinyl used, heterogeneous vinyl and homogeneous vinyl. Heterogeneous vinyl is a step-safe anti-slip vinyl, used in areas with heavy traffic, where people are walking around densely. While the homogeneous vinyl is used in the eye check area. Beside these various flooring materials, there are also guiding blocks which are the standard for visually impaired accessibility in buildings, the function of which is to guide and direct the visually impaired. Furthermore, for the application on the wall, there are handrails throughout the walls of the education center as well as in the bookcase section in the library area to guide the users to walk and orientate. Padded wall is proposed in the library area not only to protect the users from collision but also to mark the area. Lastly to stimulate their sense of touch, there are way finding and braille signage in the reception area and several other main areas that serve as signs for the users. By using the Braille signage, users can feel and read the signage independently to find out the information listed. To stimulate the sense of hearing, there is a fountain landmark in the transition area between the lobby and the inner area. For fellow user this indicates that he or she are entering the inner area and will pass through a building corridor that will lead to the education center rooms. Lastly to stimulate the sense of smell, there is a humidifier or air freshener with certain scent in some areas that also functions as an area marker.

5.3 Proposed Improvements

Although these concepts are applied in all rooms available in education center, only 3 rooms will be discussed further as samples, they are the lobby area, library, and eye-check area. The application of the design to the lobby area can be seen from the differences in the material and finishing on the floor and from the guiding blocks throughout the floor. Furthermore, there is a wayfinding Braille map signage near the reception desk for the visually impaired users. In the reception area, the partition wall finishes using a contrast color Dulux Red Clown with an LRV value of 20%, the carpet is using carpet tiles metro citrus with an 18% LRV value (Figure 5). The purpose of applying a contrasting color to the area is to stimulate low vision users who have just entered the education center. Alongside part of the wall installed with handrails, to highlight the handrail, a contrasting red color is applied the same as the partition wall in

the reception area and the rest of the wall area using Dulux Vivid White with an 94% LRV value. For the waiting area sofa finishes contrasting blue color is used to show the differences in the area. These difference color contrasts functioned to stimulate the remaining sight for the low vision users



Figure 5. Reception area perspective and axonometrySource: Soetrisno, et. al, 2021

In the library area, the application of different floor materials through color contrasts LRV values, carpet tiles Penang sapphire with an 17% LRV value, carpet tiles canyon Sulphur 31% LRV value, and vinyl original snow 75%. These different LRV contrast values, intended to make it easier for low vision user to distinguish area in the library. Then supported with guiding blocks for easy orientation, as well as the application of contrast colors in other areas. Likewise, with the walls, there is a variation of material and color. For lighting, sunlight is obtained from the window and the stretch ceiling light is installed largely in the middle of the library area. The function of using a contrasting red color on the chair is to highlight the chair. Furthermore, handrails is attached along the bookcase to guide the visually impaired in looking for books.



Figure 6. Library Area PerspectivesSource: Soetrisno, et. al, 2021

The last area that will be discussed is the eye-check area, the visually impaired users especially low vision can examine their eyes in this area. Since this is a recovery area and a clinic area, the colour applied (Figure 6) in this area is softer than other areas, although the LRV value remains in contrast. There are guiding blocks that will lead users to the eye check area. The use of contrasting colors is still applied, such as the blue partition wall contrasting with the yellow chair. The finishing for the blue partition wall is HPL glossy which function to reflect the lights which will stimulate the remaining sight. The contrast between the yellow door and the white wall using Dulux Vivid White with an 94% LRV value. Inside the clinic, two floor types is used, the first one is homogeneous vinyl water with an 57% LRV values and homogenous vinyl dark neutral with 27%. LRV values (Figure 7).



Figure 7. Eye-check Area Perspectives
Source: Soetrisno, et. al, 2021

6. Conclusion

Based on research that has been carried out on visually impaired people in Indonesia, in 2020 the visually impaired are estimated to reach 4 million or reach 1.5 percent of the total population of Indonesia. With the number that continues to grow every year in Indonesia, especially in Jakarta, there is still a lack of facilities and facilities to assist the educational needs of people with visual impairments. It is necessary to provide and add complete facilities and facilities to help the special educational needs of the visually impaired. The education centre will provide a platform for visually impaired people to be able to access facilities and information completely and freely. Facilities that support and assist in the physical and mental health of the visually impaired.

Through the concept "*Hulu Bersanding Laras*", meaning to achieve harmonious unity as a source of knowledge, education, information, and physical and mental health. In this education center, the visually impaired, especially low vision, can be stimulated by the rest of their remaining sight as well as their other senses; touch, hearing, and smell through various interior elements such as texture that is applied to the various floor materials or with contrasting colors that applied to all interior elements of the education center. Color, especially contrasting color by analyzing their LRV values become the focus of the design which aim to guide or help the visually impaired as well as the low vision users to the intended place or room, different textured floors that serve as markers for the visually impaired to identify areas with their feet and canes, and the application of accessibility such as handrails, guiding blocks, braille, and landmarks to makes activity easier for the users

By applying the sensing aspects, textures and color contrast as a design reference to the interior elements of the Education Centre for the Visually Impaired People to be able to help the visually impaired be stimulated by the surrounding area that can help them orient and move comfortably and safely. It is hoped that this design is useful and can be applied to visually impaired education centers in Jakarta to achieve better quality education centers in accessibility, facilities, and design.

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Biographies

Sarah Tahira Soetrino was born in Jakarta in August 1999 and had become a national tennis athlete from the age of nine to fifteen years. After graduating from high school, she decided to major in Interior Design and entered Bina Nusantara University Interior Design Department as an undergraduate student in 2016. During her studies, she actively participated in the activities of the Interior Design Student Association and participated in internship programs at Vilato and ARDS Studio. She graduated in 2021 and currently working as a Junior Interior Designer in PTI Architects, Jakarta.

Anak Agung Ayu Wulandari is a lecturer and Head of Interior Design Laboratory of Interior Design Department, Bina Nusantara University. Completed her bachelor's degree in Interior Design from Pelita Harapan University, Jakarta and went on to complete her Master of Arts (MA) in Arts and Heritage Management from London Metropolitan University, UK. Prior to joining Bina Nusantara University, she was also a lecturer in Pelita Harapan University and Multimedia Nusantara University. Has a great passion in Art and History and focuses her research on art history as well as museum and exhibition design. She teaches Basic Fundamental Design Courses as well as Art and Design History courses, which include History of Western and Eastern Art and History of Indonesian Art and Culture.

Amarena Nediari graduated from Faculty of Fine Arts and Design, Trisakti University majoring in Bachelor of Interior Design and Master of Design. Formerly was the Head of Interior Design Department of Bina Nusantara University, presently working as the Enrichment Program Coordinator, Interior Design Department, School of Design, Bina Nusantara University. Based on experience and comprehension in furniture retail, she believed that good design is a design that can provide solutions for everyday life. Teaching experience of more than 10 years in the Essential Design courses, namely Technical Drawing courses, Interior Design Basic Projects, and Interior Advance Projects.