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Universal Architecture Study on The Redesign of Marsudi Putra 2 Pandak Special School

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Abstract—Sekolah Luar Biasa (SLB) are schools that are intended for children with special needs so that they can obtain basic education services. SLB Marsudi Putra 2 Pandak was chosen as the object of research because this school has shortcomings in terms of building facilities and infrastructure due to inefficient room layout. The purpose of this study is to examine the universal architectural approach to SLB Marsudi Putra 2 Pandak so that an evaluation can be carried out so that SLB Marsudi Putra 2 Pandak meets the standards for universal design. The research method used is a precedent study and qualitative approach, namely by taking precedents from several SLB buildings through direct observation, interviews with users, and documentation studies related to the building. The results of this study are that SLB Marsudi Putra 2 Pandak has not met the building standards for universal architectural design, so a design proposal was submitted for this building which was able to show that the application of universal architecture can provide design concept results that accommodate the comfort and needs of students with special needs and provide an effective basic concept in terms of space, room shape, lighting system, measurement, and comfortable room elements for people with special needs.

Keywords: special school; universal design; universal architecture; comfort; disability.

1. Introduction

Universal design is a topic of discussion in which in the architectural world must be able to design spaces that meet the needs of everyone, all groups, both young and old or people with disabilities and special needs. From an architectural perspective, it tends to focus on accessibility for people with disabilities, but in fact universal design is a philosophy that must be able to include accessibility for all users.

Sekolah Luar Biasa (SLB) Marsudi Putra 2 Pandak is a school located on Jalan Kauman, Wijirejo, Kapanewon Pandak, Bantul Regency, DI Yogyakarta. This school provides education for students with special needs to gain basic skills and abilities in order to follow the education curriculum in public schools and be able to develop themselves so that they become independent children who are able to take care of themselves. Judging from the 2014/2025 academic year, the school's history shows that the school has a list of students with Blindness (A), Deafness (B), Mental Retardation (C), Physical Disability (D), Emotional Disability (E), Multiple Disabilities (G). Although this school is located on a rural road, the students of the school have many advantages including in the fields of art and athletics. This is evidenced by the presence of several students who have participated in the National and International special needs children's sports olympiads. Therefore, the Marsudi Putra 2 Pandak Special School (SLB) has become a destination for local residents and those outside the city as a place to send their children with special needs to school, and has made the Marsudi Putra Foundation receive several aspects of assistance from related agencies such as the DIY Education, Youth and Sports Agency.

Marsudi Putra 2 Special School was chosen as the object of research because there were deficiencies in the level of building facilities and infrastructure and inefficient room layout, such as:

1. The placement of the hall which has a public zone on the 2nd floor makes it difficult for students with special needs such as the mentally

retarded and visually impaired to access the room. This is due to the lack of a ramp to get to the room on the 2nd floor.
2. The only access to the 2nd floor room is a concrete staircase with a step height of 27 cm, making the road circulation access uncomfortable for building users.
3. The function of the room that is doubled as a classroom that is only separated by a notice board and a classroom that is used to store sports equipment and sound system equipment. This is left because there is no mature planning during the construction process from the beginning because this building is a building that grows following the flow of needs and causes problems with irregular spatial planning and is not considered causing the function of the space, human circulation, ventilation, and lighting to not be optimal.

Marsudi Putra 2 Pandak Special School (SLB) is expected to develop by considering building standards for the disabled and environmental context. Although located in a rural residential area with limited land, this school needs to have adequate facilities for children with special needs (ABK) as well as teachers and employees.

A universal architectural approach that emphasizes equality, safety, and comfort for all users is important in designing this building. Universal Design is a concept that allows everyone, regardless of age or disability, to access buildings and the environment independently (Connell et al., 1997 in Subhedar, NM, 2020).

Universal design principles according to The Center for Universal Design, North Carolina State University (Steinfiefd, 2012) consists of: (1) Body Fit; (2) Comfort; (3) Awareness; (4) Understanding; (5) Wellness; (6)Social Integration; (7) Personalization; (8) Cultural appropriatness

Fulfillment of building ease requirements is carried out through the application of Universal Design principles in the planning and construction implementation stages, including the use of adequate basic room sizes (PUPR Regulation No. 14/PRT/M/2017). The Universal Design principles in question are:

1. Equality of use of space: building and environmental design must be usable by all users without discrimination.
2. Safety and security for all: the design of buildings and environments should reduce risks and negative impacts for all people.
3. Barrier-free accessibility: the design of buildings and environments should ensure ease of access and barrier-free access, both physical and non-physical, for all users, regardless of their experience or abilities.
4. Ease of access to information: the design of buildings and environments should provide communicative access to information for all, regardless of the user's sensory conditions.
5. Independence of use of space: the design of buildings and environments must take into account the diverse abilities of users to allow for independent use.
6. Efficiency of user effort; the design of buildings and environments should allow for efficient and comfortable use with minimal effort from the user.
7. Ergonomic suitability of size and space: size and space should be designed to be accessible and usable regardless of the user's position, size, posture or mobility

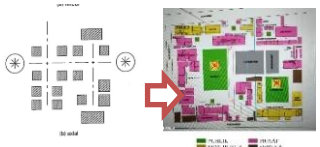
2. Methods

The method in writing is done by precedent study and qualitative method. Precedent study is done by analyzing and studying the building of the architect's work that is considered relevant to the object of study as a tool to group conceptual aspects, pragmatic aspects, and formal aspects (Siregar, 2011), such as analysis of the building of SLB Negeri 1 Bantul and SLB N 2 YogyakartaIn Methods, authors should state the methods that were used in the research through a very short literature survey in order to record the existing solutions or methods.

The number of precedents taken was two buildings, namely SLB N 1 Bantul and SLB N 2 Yogyakarta. At each object, observations and interviews were conducted with school administrators. The resource persons involved were 2 people in each school. The selection of resource persons was based on daily users, namely school administrators and students. The precedent analysis process was carried out by collecting data from literature and direct observation. After the data was collected, a matrix/table was made covering the topic of principle analysis regarding universal design.

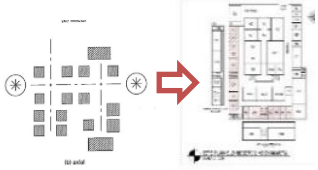
Table 1. Analysis of Precedent Study of SLB N 1 Bantul

Conceptual Aspects	
Philosophy	-
Concept of Form	The shape of this building resembles a public school, with a pyramid roof and brick walls. 

Aspect Pragmatic	
Function of Space	Security post, Mentally disabled building, Mosque, Dance room, Tennis court, Basketball court, Volleyball court, Physically disabled building, Deaf building, Blind building, Autistic building, Physically disabled building, Gathering point, Skills building, Hall, Library, Playground, Health clinic, Therapy room. 
Space Zoning	PUBLIK SEMI PUBLIK PRIVAT SERVICE
Circulation & Light	Natural lighting can enter the room because the openings are maximized with transparent materials that directly face the outside. 
Formal Aspects	
Structure	The structure of this building uses concrete, while the corridor uses wooden pillars **Concrete pillars**  **Wooden** 
Room Configura- tion	This building uses an axial configuration where each group of spaces is connected by a road or access. 

Universal Principles of Architecture	
Equality of Space Users	User access is considered equal because each access is equipped with railings, guilding blocks and ramps 
Ease of access without barriers	Easy access without barriers because each access is equipped with guiding blocks for the blind, railings, and ramps that make it easier for the physically disabled. 
Safety and security for all	The use of railings and 15 cm high concrete rocks aims to reduce the risk of danger. 
Ease of Access to Information	Ease of access to information can be obtained through the presence of signage at every street corner. 
User Independence of space	Easy access provides equal convenience for all users. 
Efficiency of user efforts	For example, a gentle ramp can increase the efficiency of a building's users' efforts. 
Ergonomic fit of size and space	-

Table 2. Analysis of Precedent Study of SLB N 2 Yogyakarta

Conceptual Aspects	
Philosophy	-
Concept of Form	The building is in Indies architectural style because it is an old building left over from the Dutch era. 
Aspect Pragmatic	
Function of Space	
Space Zoning	
Circulation & Light	On the 2nd floor of the additional building at the back, natural lighting is obtained through wide openings on the side of the balcony. Meanwhile, on the 1st floor of the old building, natural lighting is considered lacking, so it requires the help of lamps for lighting. 
Formal Aspects	
Structure	The building has a reinforced concrete structure. 
Room Configura- tion	This building uses an axial configuration, where each group of spaces is connected by a road or access. 

Universal Principles of Architecture	
Equality of Space Users	The equality of use of space in this building has not been fully fulfilled, because Special School N 2 Yogyakarta is specifically intended for people with intellectual disabilities. 
Ease of access without barriers	Accessibility for the mentally and visually impaired has been prepared with guiding blocks, while for wheelchair users, ramps are provided only on the 1st floor of the building. 
Safety and security for all	Safety in this building is taken into account with the presence of railings at every access, such as stairs and ramps. 
Ease of Access to Information	Information in the building is conveyed via loudspeakers and posted emergency signage. 
User Independence of space	The bathroom space is adequately sized for wheelchair users, but unfortunately after the renovation, there is no handrail. Meanwhile, the classrooms and other rooms are still easily accessible for people with intellectual disabilities. 

Efficiency of user efforts	The efficiency of user efforts is still maintained safely, because the vertical access of the ladder has standard dimensions and remains safe to use. 	
Ergonomic fit of size and space	-	

Source: Ayuningtyas, Fitrian, Kindi 2025

This qualitative method involves the use of open-ended questions supplemented with observations and non-physical data collection such as interviews. This qualitative research process uses open-ended questions supplemented with observations. The approach applied is phenomenological design (Creswell, 2014), which focuses on the description of individual life experiences related to certain phenomena explained directly by the subject or informant. This qualitative design is used to obtain in-depth views from the subjects determined by the researcher, especially in areas that are still minimally researched (adapted from Creswell, JW, 2007).

3. Results and Discussion

The results of this study indicate that the existing building of SLB Marsudi Putra 2 has not met universal design standards. Therefore, the researcher intends to provide input based on the results of the evaluation of this study. The results of this study include such as the lack of room layout, access that is not intended for all user groups, and the function of the space that is doubled, making this building have quite complicated problems in accommodating disabled and non-disabled users. So it is necessary to redesign which will also accommodate provide effective basic concepts in space, room shape, lighting systems, ventilation, and comfortable space elements for people with special needs.

Improvement proposal :

(1) Application of Conceptual Aspects

a. Philosophy

According to KBBI Philosophy or philosophy is knowledge and investigation of reason regarding the nature of everything that exists, its cause, origin and law. In designing a Special School building there are several meanings contained in the form and design, including:

Figure 1. Façade Philosophy Scheme
Source: Ayuningtyas, 2025

The dominant facade design with vertical line elements depicts strength, stability, and hope. These vertical lines, which stretch from bottom to top, reflect the spirit of people with disabilities who, despite their limitations, still have the strength and hope to develop. Education, as the main facility, plays an important role in helping them achieve their dreams. In addition, the broken and unconnected lines that remain straight upwards symbolize that although each individual has different dreams, their hopes are still directed to be realized. The curved building facade with irregular wave-like shading reflects a dynamic form, which symbolizes spirit and uniqueness. This form illustrates that people with disabilities, although often viewed as shortcomings by some people in society, are actually a gift from God. With their spirit and uniqueness, people with disabilities have the ability to live their lives in a different and special way**.**

b. Concept of Form

The concept of form refers to the depiction of the form of a building. The design of the Marsudi Putra 2 Pandak Special School building is designed with a simple block shape concept. This shape was chosen because the designed building is on a limited site so that to optimize the space a block shape was chosen.

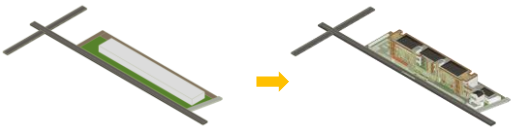


Figure 2. Façade Philosophy Scheme
Source: Ayuningtyas, 2025

Figure 3. Mass Composition
Source: Ayuningtyas, 2025

Symmetrical building shape to accommodate the element of equality and Dynamic shapes to accommodate unique elements.

Figure 4. Building Façade
Source: Ayuningtyas, 2025

(2) Application of Conceptual Aspects

a. Fuction of Space

The function of space in design refers to the role and purpose of various spaces in a building. In the design of the Marsudi Putra 2 Pandak Special School, it is designed with the following spaces.

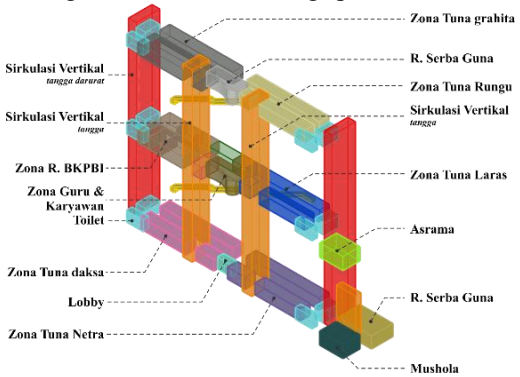


Figure 5. Space Function
Source: Ayuningtyas, 2025

b. Space Zoning

Zoning architectural space is the division of zones in a building based on function and activity. In the building of The Marsudi Putra 2 Pandak Special School, it is divided into several zones as follows.

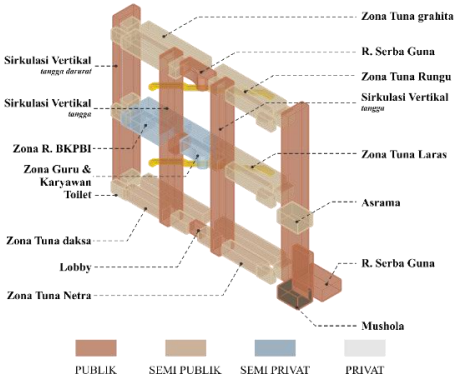


Figure 6. Building Zoning
Source: Ayuningtyas, 2025

c. Circulation & Lighting

The building planning takes into account air circulation and natural lighting. The hallway is designed to direct the wind throughout the space, while direct lighting is used for spaces with external windows, and indirect lighting through the hallway gap for the corridor.

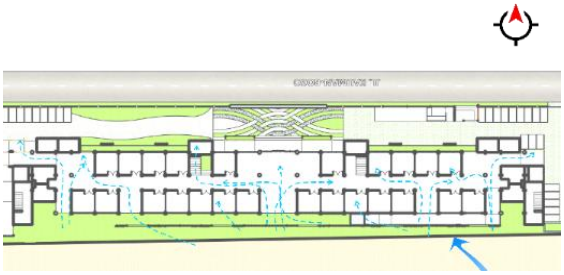


Figure 7. Building Circulation
Source: Ayuningtyas, 2025

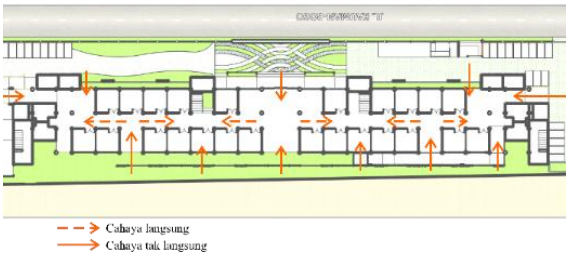


Figure 8. Natural Lighting
Source: Ayuningtyas, 2025

(3) Application of Conceptual Aspects

a. Structure

The building structure functions as a load distributor and building bone. In the design of the Marsudi Putra 2 Pandak Special School, pile cap foundations, reinforced concrete columns and beams, and light steel roof frames are used.

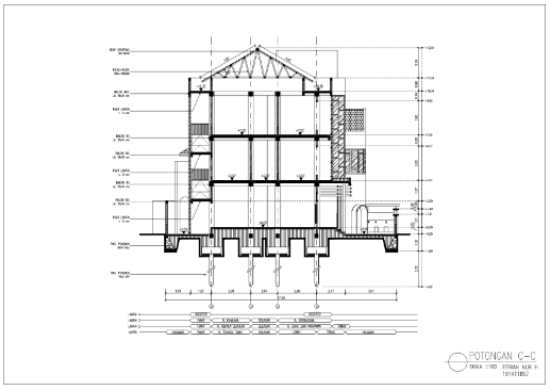


Figure 9. Section
Source: Ayuningtyas, 2025

b. Room Configuration

In this building, a linear space configuration is applied, this configuration is a spatial arrangement with the characteristics of a row of spaces.

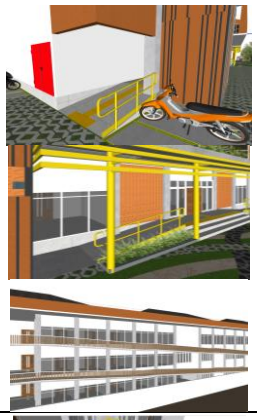
Figure 10. Room Configuration
Source: Ayuningtyas, 2025

(4) Application of Conceptual Aspects

a. Equality of Space Users

Building and environmental design must be usable by all users without discrimination, in the building design of Marsudi Putra 2 Pandak Special School the following is applied.

Table 3. Explanation of Elements of Equality of Space Users

Explanation	Picture
There is a ramp for access for the disabled. People with physical disabilities	
Installation of guiding blocks for the blind	

Source: Ayuningtyas, Fitrian, Kindi 2025

b. All Easy Access Without Barriers

Building and environmental design must ensure easy access and barrier free, both physical and non-physical, for all users, regardless of their experience or ability. In the design of the Marsudi Putra 2 Pandak Special School building, the following is applied.

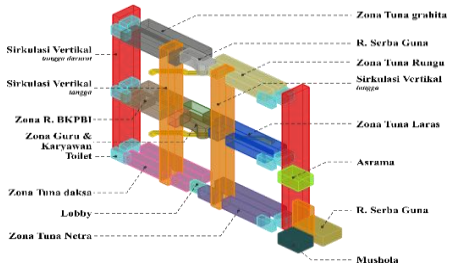


Figure 11. Space Function
Source: Ayuningtyas, 2025

Grouping from the bottom floor to the top. The 1st floor is used for the blind and physically disabled, this is to facilitate activities and for the comfort of these 2 disabled people. The 2nd floor is used by teachers, and the autism zone, where people are still considered able to climb through access to the 2nd floor. Teachers and employees are placed on the 2nd floor to easily reach the 1st and 3rd floors. The 3rd floor is designated for the mentally and hearing impaired. Here, these 2 classifications of people are considered capable of reaching the 3rd floor with existing access.

c. Safety and Security for All

Building and environmental design must reduce risks and negative impacts for everyone. The design of the Marsudi Putra 2 Pandak Special School building is applied as follows.

Table 4. Explanation of Elements of Equality of Space Users

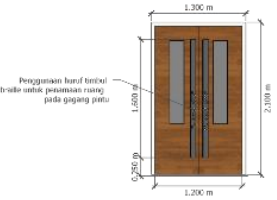
Explanation	Picture
The use of railings as a safety measure for users	
Bathroom handrail as a safety measure when in the bathroom	

Source: Ayuningtyas, Fitrian, Kindi 2025

d. Ease of Access to Information

Building and environmental design must provide communicative access to information for all, regardless of the user's sensory condition. In the design of the Marsudi Putra 2 Pandak Special School building, the following is applied.

Table 5. Explanation of Elements of Equality of Space Users

Explanation	Picture
The use of doors with long handles so that they are easy to reach for children, wheelchair users, and with the addition of raised Braille letters on the door handles for the blind.	
Implementation of signage at certain points to facilitate evacuation routes	

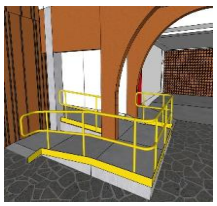
The creation of signage on the wall with a height of 1.30 cm from the floor with a combination of room names, zones, and embossed Braille letters, as well as background colors that are adjusted to the disability zone is expected to make it easier for everyone to read and understand.	

Source: Ayuningtyas, Fitrian, Kindi 2025

e. User Space Independence

Building and environmental design must consider the various abilities of users so that they can be used independently. In the design of the Marsudi Putra 2 Pandak Special School building, the following is applied.

Table 6. Explanation of the Elements of Space User Independence

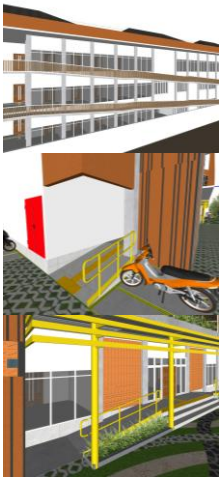
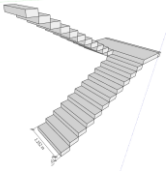
Explanation	Picture
The accessible bathroom has adapted access for wheelchairs and assistive devices for people with disabilities.	
With ramp access for all users and specifically for those using assistive devices, it has a safety railing to protect users from the danger of falling and can be used as a handhold.	
The use of long door handles can be used by users who are less than 100 cm tall to more than 100 cm tall. The use of Braille letters on door handles is specifically for the blind.	

Source: Ayuningtyas, Fitrian, Kindi 2025

f. User Effort Efficiency

The design of buildings and environments should allow for efficient and comfortable use with minimal effort from the user. The design of the Marsudi Putra 2 Pandak Special School building is applied as follows.

Table 7. Explanation of User Effort Efficiency Elements

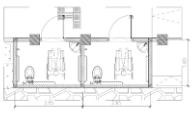
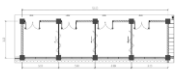
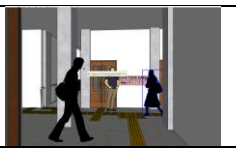
Explanation	Picture
The use of ramp access is determined by a standard slope of 1:10 for ramps inside buildings, while for ramps outside buildings it is 1:12. and every maximum range of 9 meters there is a landing which is intended for taking a short break.	
Stairs with a step height of 15 cm and a step width of 30 cm. With this size, it is still considered energy efficient.	

Source: Ayuningtyas, Fitrian, Kindi 2025

g. Ergonomic Fit of Size and Space

Size and space must be designed to be accessible and usable regardless of the position, size, posture, or mobility of the user. In the design of the Marsudi Putra 2 Pandak Special School building, the following is applied.

Table 8. Explanation of User Effort Efficiency Elements

Explanation	Picture
Disabled bathrooms are sized to suit the ergonomics of wheelchair users.	
The classroom is designed with a size of 3 x 3 with a capacity of 3 to 4 people. And uses partition walls that can be opened and closed to widen the space if needed.	
Wide circulation access to facilitate interaction and create relief in activities.	

Source: Ayuningtyas, Fitrian, Kindi 2025

4. Conclusion

This research is an evaluation process of a building function of a SLB Marsudi Putra 2 Pandak whose existing condition does not meet universal design standards. The proposals that will be submitted based on the evaluation results are adjusted to the universal design standards that must be applied in buildings in order to accommodate all user groups.

The proposed design remains adaptive to the original building and adjusts to the needs of the users. This proposal was submitted to the school management because the school management also felt the incompatibility of the building elements if it was used for a SLB Marsudi Putra 2 Pandak. The proposed design recommendations can be applied in all places, both limited and non-limited conditions, because they can be adjusted to the needs of users and managers. This approach is able to provide results for design concepts that accommodate the comfort and needs of students with special needs and provide effective basic concepts in space, room shape, lighting systems, ventilation, and comfortable space elements for people with special needs.

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