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Inclusive Architecture for Individuals with Visual Impairments: A Study of Pacelli School for the Blind and Partially Sighted in Surulere, Lagos, Nigeria

Bolawole Ogunbodede *, Segun Okunola, Akinfolarin Jobi, Jesufolahanmi Oyedeji

Department of Architecture, University of Lagos, Lagos, Nigeria

ABSTRACT

This research on architecture examines the challenges faced by individuals with visual impairments as they navigate schools and other built environments. It highlights the idea of "architectural visual bias," which favors sight over other sensory experiences. The study promotes architectural designs that go beyond visual considerations to enhance sensory interactions, ultimately aiming to make spaces more accessible to those with visual impairments. The objective is to identify the requirements of visually impaired individuals in the built environment, propose design principles and recommendations for inclusive architecture, and create a design for Pacelli School for the blind and partially sighted that embodies inclusive architectural design principles. A qualitative approach, including observations, interviews, and case studies, demonstrated how tactile surfaces, auditory signals, and olfactory cues enhance spatial awareness, stressing the importance of refining urban and architectural designs to support independent mobility in everyday activities for the visually impaired. The research indicates that such designs should employ strategies such as tactile feedback, sound indicators, and careful consideration of form and function to improve safety, mobility, and orientation for students. It illustrates why designers should integrate multisensory architectural principles to promote inclusivity. The study wraps up by urging professionals to follow universal design principles and other relevant guidelines that accommodate a range of abilities, ensuring that designs are not just accessible but inclusive for everyone.

Keywords: Inclusive architecture, Blindness, Vision, Visual impairment, Ocular bias, Multisensory, Tactile

1. INTRODUCTION

Every person should have the chance to attain and sustain a satisfactory level of learning since education is a fundamental right. Nigeria's educational philosophy encourages

*Corresponding author
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educational opportunities for all citizens at the primary, secondary, and tertiary levels, both inside and outside the formal school system, as stated in the National Policy on Education of 2014 **(Omoregie and Yeats, 2017)**. **(Farouk, 2003)** emphasized that education is a social benefit enshrined as a right in the Nigerian constitution, which must be respected and upheld. Everyone deserves the opportunity to complete their education **(UNICEF, 2000)** since it serves as the foundation for both individual growth and societal development.

However, the effectiveness of education relies heavily on equal access to educational opportunities, regardless of a person's ability or disability **(Shields et al., 2023)**. Unfortunately, many learners have been excluded from school due to their disabilities **(Habulezi and Phasha, 2012)**.

According to **(Mohit, 2007)**, one in twenty people has a disability, and more than seventy-five percent of these people reside in developing nations. One major worldwide problem that is an example of such a disability is visual impairment. According to projections from the **(World Health Organization, 2023)**, at least 2.2 billion people globally suffer from vision impairment, with around 50 million of those affected in Nigeria alone **(Adejoro, 2022)**.

Visually impaired school-age children frequently have inferior academic attainment levels **(World Health Organization, 2023)**. Since many Nigerian educational institutions do not take into account inclusive design principles for students with visual impairments, architecture is essential in tackling this issue **(Omede, 2015)**. It can be challenging for sighted people to comprehend how visually impaired persons do everyday activities in these settings because the majority of structures and infrastructure were created with sighted people in mind **(Khan et al., 2024)**.

When engaging with their environment, those who are visually impaired rely more on their other senses than their sense of sight. Therefore, rather than concentrating only on visual features, designers need to consider these additional senses **(Mahya, 2020).** Humans use all of their senses, not just their eyes, to interact with the world. This calls for spatial analysis that takes into account information from sources other than ocular experience. Since traditional ways of analyzing and evaluating the built environment rely mostly on vision, further research is needed to support future design initiatives in order to satisfy this need **(Maseide and Grottland, 2015)**. This article focuses on individuals who perceive and understand spatial structures through senses other than vision and explores ways to introduce new sensory spatial qualities into architectural design. The goal is to create engaging, memorable, and multisensory experiences for both visually impaired and sighted users.

Visually impaired individuals encounter many challenges and spatial barriers because the built environment is often primarily designed with visual elements in mind. This issue, known as architectural visual bias or ocular centrism, can considerably impede their ability to navigate spaces effectively **(Pallasmaa, 2024)**. The Pacelli School for the Blind operates in a facility that is architecturally sound from an educational and institutional perspective. However, it lacks specific design features that support the mobility, safety, and overall learning experiences of its visually impaired students. Therefore, it is essential to investigate how blind and visually impaired individuals perceive their surroundings by relying on sensory modalities other than vision and to explore different architectural principles that can address these challenges.

This research aims to identify design principles essential for creating holistic sensory experiences for visually impaired individuals in architecture design and educational institutions such as the Pacelli School for the Blind.

2. PAUCITY OF LITERATURE ON EXPERIENCES OF THE VISUALLY IMPAIRED

When designing more inclusive buildings for visually impaired individuals, it is essential to review existing literature. However, there is a significant lack of peer-reviewed research specifically addressing the experiences and needs of visually impaired individuals in public spaces and buildings worldwide **(Annakin and Everett, 2023)**.
This review aims to clarify the phenomenon of visual impairment by analyzing relevant international articles and journals. The goal is to derive applicable design principles for the visually impaired.

2.1 Defining Blindness and Visual Impairment

According to **(Centers for Disease Control and Prevention, 2024)**, visual impairment is a disorder marked by a loss of visual acuity, which results in decreased vision clarity or a loss of visual field, which limits one's ability to observe a large area without moving the head or eyes. Depending on the situation, vision impairment might range in severity. For example, according to the **(SSI Annual Statistical Report, 2007)**, "legal blindness" is defined as having a visual field of 20 degrees or fewer or a visual acuity of 20/200 or worse with the best correction. Individuals who meet these criteria are eligible for specific educational and federal programs. Research suggests that definitions of visual impairment differ across countries, influenced by various parameters. **(Vashit et al., 2017)** highlighted the risks of neglecting these differences when comparing global and national standards related to blindness and visual impairment, recommending adjustments to local definitions to align with a universal standard.
According to the International Classification of Functioning, Disability, and Health (I.C.F.), "impairment" is a general term that describes a problem in the function or structure of a person's body due to a health condition **(WHO, 2001)**. This definition aligns with **(Harrison et al., 2021)**. Consequently, a vision impairment occurs when an eye condition affects the visual system and one or more visual functions. The World Health Organization **(WHO, 2019)** further categorizes visual impairment into two main groups: "low vision," defined as a visual acuity between 20/70 and 20/400 with the best possible correction or a visual field of 20 degrees or less, and "blindness," defined as a visual acuity worse than 20/400 with the best possible correction.

2.2 How the Visually Impaired 'See' the Built Environment

The International Classification of Functioning states that people use all five of their senses of sight, sound, touch, and smell to varying degrees and frequently unconsciously while interacting with the built environment. When one sense is diminished or lost, reliance on the remaining senses increases significantly **(Walden, 2008)**. A person who is blind, especially one who has been blind since birth and has never experienced sight, faces considerable challenges in navigating life without the visual faculty that many rely upon most heavily. The perception of individuals with visual impairment affects their interaction with the environment **(Majerova, 2016)**. When the visual modality no longer functions effectively, other senses such as smell, touch, taste, and hearing, along with imagination, become key receptors of stimuli. This gathered information creates new images, words, and other perceptions, forming a new mental representation.
Chris Downey, an architect who had lost his sight, for instance, observed that he could now hear a symphony of faint sounds as he moved around, which he had previously not been able

to notice as much **(Downey, 2025)**. He could find his way around familiar areas thanks to these sounds. Since hearing, as opposed to touch, provides a feeling of distance, hearing architecture enables him to visualize and comprehend space, including its height. According to **(Oteifa et al., 2017)**, hearing aids help visually impaired people determine their location and orientation.

According to **(Bakir et al., 2022),** multimodal design methods for both sighted and blind people can be greatly informed by knowledge of non-visual perception in the experiences of visually impaired and blind people, see **Fig. 1**. In general, blind and visually impaired people can have experiences that are just as rich as those of seeing people. Blind persons are not drawn to the majority of aesthetically pleasing elements in the built environment that sighted people find appealing. But there are plenty of sensory cues in this gloomy environment. Haptic feedback is one of the primary channels through which visually impaired individuals perceive their surroundings. Through the sense of touch, visually impaired people can feel their environment, recognize spaces, and identify materials **(Sarah et al., 2017).**

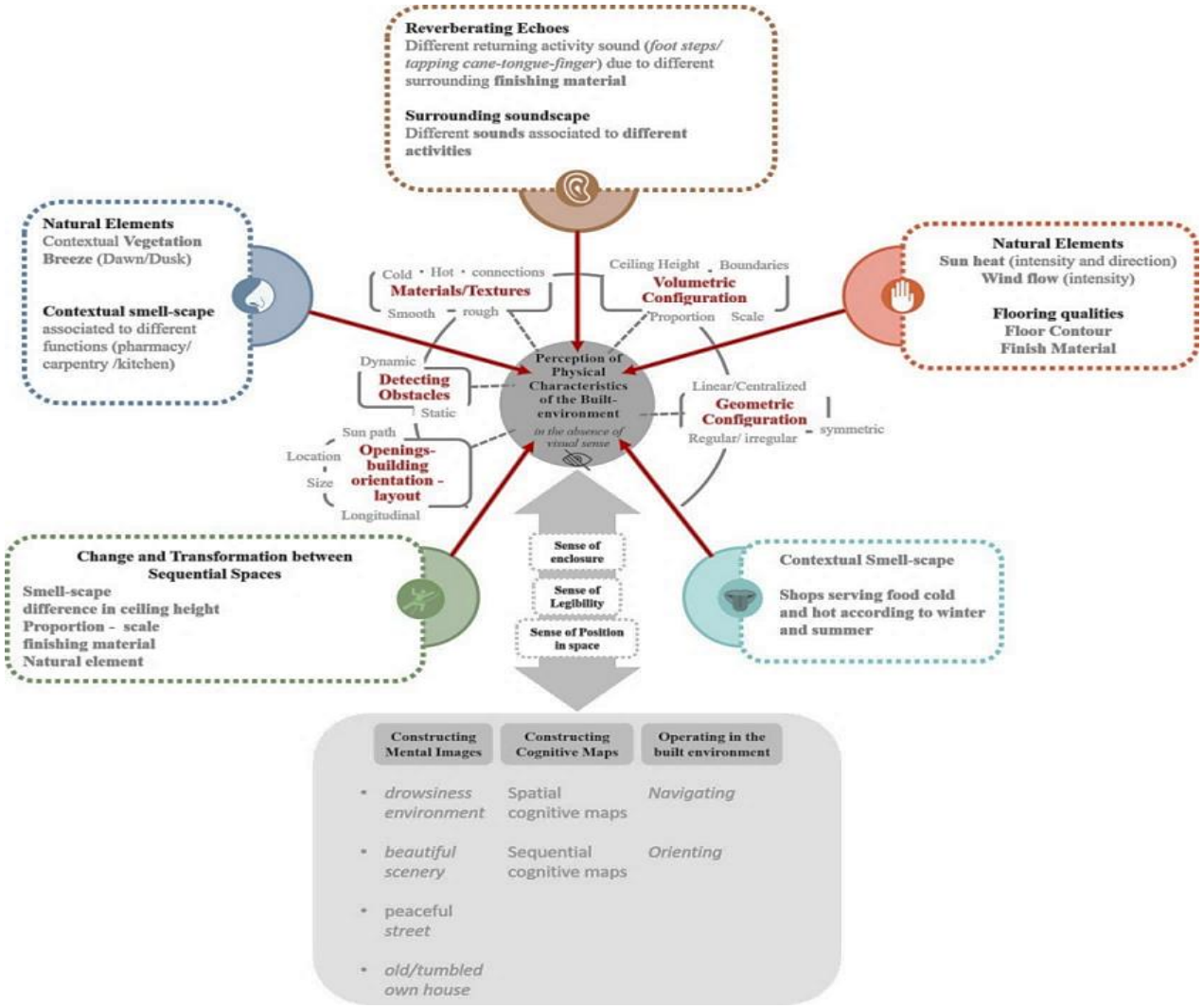

Figure 1. Illustration showing the relationship between the Visually Impaired and the environment (**Bakir et al., 2022)**

A little ramp going into a room, the change from a soft floor to a hard one, the transition from a bright room with hard surfaces to a calm one with soft wall coverings, or the distinction between a warm and a slightly colder room could all be difficult for a sighted person to notice. Those who are sighted frequently ignore these subtleties, but for people who are visually impaired, these sensory cues are essential for navigating and interacting with their surroundings.

(Oteifa et al., 2017) conclude that successful orientation and mobility for visually impaired individuals require a harmonious integration of haptic, auditory, and olfactory perceptions. This synchronization of the senses enables the easy recognition of familiar environments. The process of spatial mental mapping involves obtaining information through the senses, selecting and consciously processing this information, storing it as a spatial representation, making decisions based on this stored representation, and using it for movement and orientation.

2.3 Visible Architecture for the Visually Impaired

In "The Image of the City," **(Lynch, 1960)** explores how individuals perceive and navigate urban environments. He focuses on key concepts such as legibility, structure, identity, and "imageability." Lynch's urban theory is relevant for visually impaired users, emphasizing that perception encompasses more than just sight. His examination of "imageability" highlights how people create mental maps of their surroundings. Understanding how blind or partially sighted individuals perceive their environment is essential for designers aiming to create accessible and navigable spaces. Lynch frames this complex relationship through the concept of the mental image, which encompasses how a place is perceived, experienced, and remembered. In his research, he identifies three critical characteristics of a place that shape its mental image: legibility, imageability, and a sense of

Legibility is the "ease with which its parts can be recognized and organized into a coherent pattern" **(Lynch, 1960)**, while perception is the act of seeing as opposed to seeing. Legible spaces provide an atmosphere that is naturally constant and orderly, anchoring one's mental image and enabling safe navigation. The image enhances the depth of one's experience because it is the result of a mutual understanding between place and person. A building is readable if its sections, passageways, and markers are all clearly recognized. Features must be readable regardless of a person's abilities or impairments. For visually challenged users, readability is crucial, hence it's critical to make sure non-visual aids are used to achieve legibility **(Engel, 1999)**. However, the potential for "new patterns of activities" may be hampered by an excessively structured environment that directs the user at every turn. Including spaces that allow for "new patterns of activities" and opportunities for self-exploration may be advantageous **(Lynch,1960)**

Perception involves understanding rather than merely seeing, while legibility refers to the "ease with which its parts can be recognized and organized into a coherent pattern" (Lynch, 1960, pp. 2-3). When places are legible, they provide a consistent and ordered environment that helps anchor a person's mental image, enabling secure navigation. This mental image develops from a shared understanding between the individual and the place, enriching one's overall experience **(Cheng, 2022)**.

A building that has easily identifiable areas, markers, and routes contributes to legibility. It is important for all individuals, regardless of their abilities or disabilities, to be able to navigate their surroundings effectively. Legibility is particularly essential for visually impaired users, and it is crucial to incorporate non-visual aids to enhance this legibility

(Engel, 1999). However, an overly structured environment that guides users at every turn may limit opportunities for 'new patterns of activities.' Therefore, it can be beneficial to create areas for self-exploration and spaces that promote the emergence of 'new patterns of activities' **(Lynch,1960)**.

2.4 Paths

These are the channels through which individuals commonly, occasionally, or potentially move. Lynch distinguishes between major and minor paths. Major paths include streets and transportation networks, while minor paths encompass walkways, sidewalks, corridors, and waterways used for circulation. Although minor paths are often undervalued and can seem peripheral, they play a significant role in shaping how individuals perceive their environment.

2.5 Nodes

Nodes are strategic points within a city where individuals can enter. They serve as central focal areas that attract people and facilitate movement. Although they may seem minor within the overall city image, nodes can manifest as large squares, courtyards with extended shapes, or even entire central districts, depending on the city's scale. Lynch identifies two main types of nodes: junctions and concentrations. Junction nodes mark the convergence of various elements and are particularly significant for city observers. At these junctions, which represent breaks in transportation routes, individuals must make decisions, leading them to pay closer attention to their surroundings. Nodes can be categorized as either introverted or extroverted. Introverted nodes focus inward with little connection to the surrounding city, while extroverted nodes engage with nearby elements. Additionally, some nodes can be challenging to define, as they may exist within other elements of urban design. For instance, nodes can be found within districts at their central point, or at the convergence of paths **(Ibrahim, 2016)**.

2.6 Edges

The features that divide one area from another are called edges. Because they mark areas of discontinuity in the urban environment, these places are frequently important. Shorelines, railroad cuts, development boundaries, and barriers are a few examples; each denotes a shift, the end of one region and the start of another. These changes may show up as a sharp contrast or as a point of convergence between two areas. These aspects of change provide an individual's experience with a more profound context and have a long-lasting effect on the general perception of a location **(Lynch, 1960)**.

2.7 Districts

Districts are large sections of a city that come together through a central, identifiable character that individuals can mentally recognize. These areas share common spatial qualities and identities. The physical characteristics that define a district consist of thematic elements, which may include aspects such as texture, space, form, detail, symbols, building types, uses, activities, inhabitants, and topography. To identify a district, one can use various sensory clues, including sound and scent **(Blair et al., 2005)**.

2.8 Landmarks

The last of the five elements are landmarks, which differ slightly from the others. Landmarks are exterior physical features that act as reference points within their surroundings, in contrast to the other aspects that rely on the experiences of the occupants to create a mental image. Although the magnitude of these items can vary, their color, detail, size, and distinctive qualities greatly aid in navigation and aid in orienting people in a location. Buildings, storefronts, facades, trees, and urban constructions are all common examples of landmarks. These components produce recognizable monuments that demarcate the area and draw attention to its surroundings. Landmarks contribute to the overall image of an area, as items like signs, trees, doorknobs, and other details serve as reference points for visually impaired individuals. According to **(Passini, 1984)**, "The characteristic that would give a space landmark value is its distinctiveness from other spaces."

3. RESEARCH METHODOLOGY

3.1 Research Limitations

One of the primary limitations was the inability to gain access to multiple institutions catering to the visually impaired in Nigeria. While Pacelli School offered a rich architectural and experiential analysis site, other organizations lack permanent or accessible educational structures. Their focus is on vocational training or advocacy, rather than formal schooling. The experience with Bethesda School for the Blind further illustrates the challenge of institutional gatekeeping. Although an initial visit was scheduled, access was revoked when it was clarified that the research would not include financial or material aid. This situation highlights a recurring challenge within under-resourced contexts, where organizations may equate academic engagement with potential philanthropic support. Such expectations can compromise the integrity of academic research and prevent critical institutional reviews.

A significant impediment to the research was also the near-total absence of publicly available data on special education facilities for the visually impaired in Nigeria. Online repositories, institutional websites, and government portals provided minimal or outdated information. There was a lack of published architectural plans, performance audits, or spatial usability studies from the institutions reviewed. This data vacuum necessitated a heavy reliance on primary data collection through interviews and observations.

3.2 Methodology

The methodology used in this study is qualitative. Gathering and analyzing non-numerical data, such as text, audio, or video, in order to comprehend ideas, viewpoints, or experiences is known as qualitative research. It might produce fresh concepts for a study project or obtain in-depth understanding of an issue **(Tenny et al., 2017)**.

3.3 Instrument of Data Collection

The data needed for this research employed primary and secondary sources. The primary source was a guided tour of the school complex and in-depth semi-structured interviews with the administration and 10-12 visually impaired students. The data collection also used instruments like photographs, sketches, and notes. The secondary data sources include extensive literature reviews on the Visually Impaired, inclusive design for the visually

impaired and ethics to consider in the design process. The researcher also consulted archives, case studies of buildings, and history books to derive relevant data for this study.

3.4 Sampling

The type of sampling adopted for this exercise was the purposive sampling method to understand the demography and what strategies can be implemented to cater to their needs. An exercise was conducted at Pacelli School for the Blind and Partially Sighted at Surulere, Lagos. This research is based on different sources of experience. Insights from an interview with the school principal and two other staff to obtain demographic data, the curriculum and the sighted individuals' perception of the Visually Impaired.

Twelve students were selected, one blind and one partially sighted student from each class from primary one to six, to share their spatial experience within the school environment. The informants were willing to participate in the study, approved by the administration, but their names must be kept confidential. Prompts were used during the interviews to encourage informants to provide clarifications and more information. This allowed the informants to have freedom about issues discussed to obtain rich data. Throughout that interview, each informant described their most and least favoured spaces to the researcher, explaining how they attached importance to those spaces.

4. FINDINGS

The extracted narrations from the autobiography, transcription of the audio recording of interviews, along with the observations during the tour, were analyzed qualitatively using an analysis method adapted from **(Diekelmann, 2001)**. This method of analysis involves a thorough transcription of the interviews and identifying relevant notes from the principal's narration. After transcription, the researcher read and re-read both transcriptions in order to acquire familiarity and understanding of the subject matter.

Table 1. Extracts from the interview with major stakeholders at Pacelli School for the Blind (The Principal and selected members of Staff)

	Aspect	**Consensus**
1	Capacity	There are 145 visually impaired students in the school currently, as that's the current capacity they can take There are 45 staff, with both teachers (about 12/13) and non-academic staff (carers)
2	Wayfinding	They play football (i.e. a special ball), read and write specially with braille, use phones with top bars, computers with jaws, and so on. Materials such as tactile tiles to mark positions for wayfinding exist, but they are barely used or considered in architectural designs, especially in Nigeria, even as architects clamour for inclusivity and considerations for the visually impaired all the time
3	Mental Imagery	They usually navigate their surroundings on their own, as long as they're used to the compound. When a student comes newly, they are given an orientation of the surroundings, after which the handrails help guide them in their movement until they get used to the layout of the school

4.1 Orientation and Wayfinding

The principal of the school addressed a common societal misconception, that visually impaired children are dependent and incapable of handling tasks on their own and emphasizes their abilities rather than their disabilities. Society often pities these children and assumes they cannot function independently, but the school environment fosters the opposite. The students compensate for their lack of sight with heightened intelligence, sense of touch, smell, and hearing, which they use to navigate the space effectively; the principal stated, "What they lack in sight, the children make up for in intelligence, these kids compete with others and achieve anything they want to".

This observation aligns with **(Vermeersch, 2013)** idea that the potential of the specific critique people with a visual impairment offer with regard to the built environment is twofold. On the one hand, in their daily business, they are confronted with the problems of being excluded from a significant part of the environment. Because of this, they are in an excellent position to pinpoint problematic situations or building parts. On the other hand, they have an embodied knowledge of non-visual qualities in the environment and how to rely on them in their activities. Translating this knowledge could thus lead to a more prosperous environment, even for those who primarily rely on vision when on the go. The critique on architecture coming from people with a visual impairment is thus potentially a positive form of critique, carrying with it part of the solution.

Visually impaired children at school learn to use their senses to identify the spaces around them. One of the activities of "wayfinding" observed was that the children create a virtual personal space around them with their arms; this space creates a barrier between them and objects around them, and then, arms and feet are used to recognize walls, doors, chairs, table and all other objects. This method aligns with the principle of orientation and mobility (O&M) training, a widely accepted approach in special education that teaches visually impaired individuals to use their remaining senses to move through the environment **(Smith and Penrod, 2019)**. Despite the school's efforts, there are areas where improvement is needed. The lack of tactile tiles and ramps in architectural designs as in **Fig. 2** limits the mobility of the students, especially those newly admitted or less accustomed to the environment, though handbars were added to a part to support the students as shown in **Fig. 3.**

Figure 2. Pathway from one block to another in the school.

Additionally, the principal calls for greater societal awareness and inclusion for visually impaired children in school architecture and public infrastructure like roads, sidewalks and even transport hubs. "Tactile tiles to mark positions for wayfinding exist, but they are barely used or considered in architectural designs, including ours." The absence of tactile features and ramps highlights a broader issue with inclusivity in Nigerian infrastructure. Implementing these elements would make it easier for the students to navigate both the school and public spaces.

The school promotes accessibility by emphasizing peer-led orientation a process that helps new students acclimate to their surroundings. "Old students resume first, then new intakes resume after a week, and are paired in twos with the old student for wayfinding till they're good to go on their own." Pairing new students with older ones fosters peer support and ensures a smooth transition into the environment. Handrails and the step-by-step learning of space (classrooms, hostels, dining hall) contribute to students' ability to navigate independently after a certain period.

Figure 3. Recently added handbars to support students near the playground

4.2 Mental Imagery

The students developed a sense of self-sufficiency by noting each environment involved in their daily routines and extracurricular activities. One of the informants recognized the chapel by the sound of the megaphone, and others simply because it was the first activity in the morning, and the chapel had some acoustic qualities, such as the organ and other musical instruments. Chris Downey, a visually impaired architect, uses echo to understand the surrounding space: "Echo indicates wideness and how crowded it is, high echo means space is wide and empty and vice versa. He usually prefers ceilings with intermediate heights; low ceilings result in high echoes, while high ceilings make it hard to track echo" **(Annakin and Everett, 2023)**.

Other respondents identified spaces such as the dining hall as in **Fig. 4** by its lively acoustics and olfactory qualities: "I know we are in the dining hall because of the food, and the sounds the cutlery and pots make". Places are easily identified by smell because key spaces, such as bathrooms and even living quarters have a particular smell that can be recalled when revisited. Moreover, materials are identified by their smell; the smell of wood, leaves, grass, plaster, paint, and damp concrete is easily recognizable within the school complex. One of the participants described the experience of moving from one block to another as a pathway that brings sudden calmness, air penetrating through grass and leaves. The sunlight warmth

was also a way to recognize being outdoors and the texture of the hedge that marks the pathway to the other block.

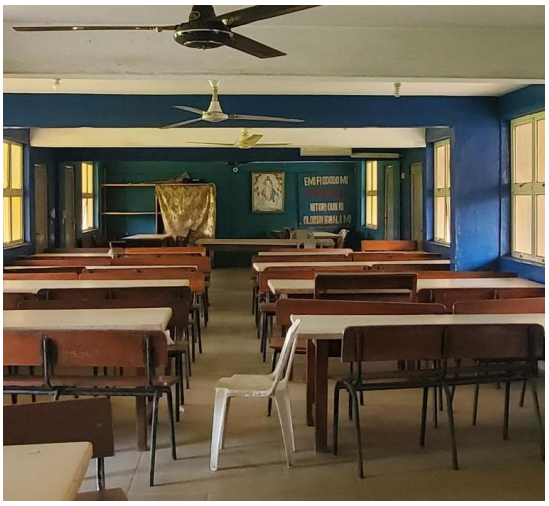

Figure 4. School Dining Hall.

Figure 5. School Swimming Pool.

Another note that might be attributed to image-making is the extracurricular activities the school designed for the students. One of these facilities is the swimming pool as shown in **Fig. 5,** the researcher observed that it subconsciously serves a dual purpose; students note this point as a node, or the halfway mark, between the two school blocks because of the activity and sound qualities of gently moving water. Another respondent who likes football indicated that physical activities in open spaces, as in **Fig.6,** help to build spatial awareness and confidence, enhancing their ability to navigate unfamiliar environments within the school. However, the informants did not specifically attribute these qualities to the architecture of the buildings or the height or depth of volumes and spatial configurations, as they have no formal training in that regard. However, their responses denote the role spaces play in characterizing their informants' perception of the built environment.

Figure 6. School Playground.

4.3 Adaptation to Existing Design-Layout

The principal noted that the school design should have accommodated the students' needs at inception. However, the school's layout's relative simplicity and the design modifications by the staff (planting flowers, adding rails in **Figs. 3 and 7** and some sort of markers) eventually facilitate independent movement because the layout and position of facilities are relatively clear and easy to locate. This observation reflects what **(Walden, 2018)** indicated that a debate exists between architects who believe that a 'mothering' environment specifically altered to suit their needs is appropriate and those who believe that a 'hostile' environment that makes the visually impaired adapt is better suited. However, design features that indicate level changes, direction and other features are lacking within the school complex, this corresponds with a key argument by **(Goldsmith, 1976).** Goldsmith goes on to propose that people with disabilities are disabled because of the environments in which they are forced to exist.

Figure 7. Handrails to support students in the school corridor.

"A disabled person is not automatically a disabled person; whether or not there is a handicap depends on the nature of the individual's impairment and the circumstances in which he is placed. A physical disability is a handicap only where it constitutes a barrier to achieving specific goals". This argument is reflected in the schools' administrative attempt to compensate for the absence of inclusive design features, as students rely heavily on paired movement and the school staff monitor all their activities around the clock within the school complex. This is also present in the pathways that serve as links to other parts of the school; it was observed that students had modified their route of movement to accommodate their needs, as the stringent nature of the path did not serve their navigation needs.

From observation, there is a need to balance both perspectives in the design process; architects have a role to play by ensuring that the design empowers the visually impaired community and that the building that results serves as an example to the public of accessible architecture, where the architecture meets the users at their point of need. Therefore, it is important for the architect to adequately understand the design requirements so as to create an environment sensitive to the users' concerns.

4.4 Adaptation to Existing Design Forms

Respondents' responses (during the interview) and the authors' observations showed a high capability in describing the layout and geometric configuration of the school's premises. Geometry and layout were perceived through environmental references such as spatial organization, order, and boundaries that acted as sensory stimulants to senses other than the visual. In the description of one of the students, "The classroom block I as in **Fig. 8** think it is like this…" he started to use his hands to describe the geometry of the walls and furniture, "Umm, it is a square or rectangle". He emphasized that the order and spatial organization of the classroom made him able to perceive such geometry. This description indicates that spatial organization is strongly related to a sense of space for the visually impaired.

Figure 8. Classroom layout.

Some other informants described the chapel path via the geometry of the interlocking blocks used to make the walls. They could describe the symmetry of the geometry about the haptic feedback they received from touching and feeling the walls. Overall, the informants could describe more accurately and remember symmetrical geometric configurations compared to those not. Stereognosis is a method developed to train visually impaired children to perceive the size and shape of objects in space through their hands. One of the activities for form understanding is play dough. In this activity, children shape the play dough into spheres, cubes and rods. Once they form the shape, they touch and name it; this activity assures the object's name **(Sarah et al., 2017).**

It was also observed that students subconsciously associated spaces with the geometry of textures as shown in **Fig. 9**. The entrances to the classrooms on one of the class blocks were clad in tiles with a certain pattern. Though not intentional by design, students modified this element by counting its panels until it led them to the door post.

Figure 9. Breeze block pattern wall in the school compound.

The analysis of the Pacelli School for the Blind highlights the vital role of inclusive architecture in promoting independence among visually impaired individuals. While the school currently implements peer-led orientation and handrails to aid students' navigation, it needs essential inclusive design elements, which could significantly enhance the students' mobility in their daily activities. Peer-assisted orientation, an essential practice at the school, must be complemented with tactile planning and other multi-sensory design features to facilitate independent navigation, particularly for newly enrolled students. By integrating these features, the school can align with the principles of inclusive architecture, ensuring equitable access to all users.

Visually impaired students at Pacelli rely on senses such as touch, hearing, and smell to mentally map their surroundings, emphasizing the need for environments that engage multiple senses. The absence of tactile pathways and other supportive design features poses a significant challenge for these students and underscores the necessity for inclusive architecture. Despite the school's simple and functional layout, the absence of ramps, thoughtfully planned pathways, stairs, finishes and material palettes reflects a broader issue

of inaccessible design processes in Nigerian infrastructure. By incorporating universal design elements, the school can better serve its visually impaired students and exemplify inclusive architecture.

The students and staff at Pacelli have adapted to the environment by using markers, handrails, and spatial memory to navigate. While this is commendable, introducing inclusive design features that meet the needs of visually impaired individuals without necessitating adaptation is crucial for creating a naturally accessible environment. It will be essential to their independence and overall experience significantly within the school and urban setting. Inclusive design must encompass the diverse needs of all users, ensuring accessibility and equality in the built environment. Accordingly, such findings of this study present an avenue to inform the future of multisensory design approaches in architecture to heighten the senses and enhance the experience of the visually impaired, automatically enhancing the sighted experience.

5. CONCLUSIONS

In conclusion, the research justifies the need for inclusive architecture by showcasing the benefits of multisensory design for visually impaired individuals. Findings support the argument that designing spaces to engage all senses benefits visually impaired users and creates more enriching environments for everyone by applying principles of Universal Design and addressing sensory. The research on "Inclusive Architecture for the Visually Impaired: Designing for Pacelli School for the Blind and Partially Sighted" aimed to address the challenges visually impaired individuals face in navigating-built environments that are primarily designed for sighted people. By focusing on integrating inclusive architectural design, the article sought to create sensory-rich spaces that enhance the mobility, safety, and overall experience of visually impaired students. The write-up successfully justified the need for inclusive architecture by demonstrating how sensory-based design can transform educational spaces for visually impaired individuals, promoting both independence and inclusion.

Credit Authorship Contribution Statement

Bolawole Ogunbodede: Writing – review & editing, Writing – original draft, Validation, Software, Methodology. Segun Okunola: Writing – review & editing, Validation, Methodology. Akinfolarin Jobi: Writing – review & editing, Validation, Methodology. Jesufolahanmi Oyedeji: Writing – review & editing, Writing – original draft, Methodology.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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العمارة الشاملة للأفراد ذوي الإعاقات البصرية: دراسة حالة مدرسة باتشيلي للمكفوفين وضعاف البصر في سوروليري، لاغوس، نيجيريا

بولاول أوجونبوديدي*، سيغون أوكونولا، أكينفولارين جوبي، جيسوفولاهانمي أويديجي

قسم العمارة، جامعة لاغوس، لاغوس، نيجيريا

الخلاصة

تتناول هذه الدراسة المعمارية التحديات التي يواجهها الأفراد ذوو الإعاقات البصرية أثناء تنقلهم داخل المدارس وغيرها من البيئات المبنية. وتسلط الضوء على مفهوم "التحيز البصري المعماري"، الذي يفضل الرؤية على غيرها من التجارب الحسية. وتشجع الدراسة على تصميمات معمارية تتجاوز الاعتبارات البصرية لتعزيز التفاعل الحسي، بهدف جعل المساحات أكثر ملاءمة لذوي الإعاقات البصرية. وتهدف إلى تحديد احتياجات هؤلاء الأفراد في البيئة المبنية، واقتراح مبادئ وتوصيات لتصميم معماري شامل، بالإضافة إلى تصميم مقترح لمدرسة باتشيلي للمكفوفين وضعاف البصر يجسد هذه المبادئ. وقد أظهرت منهجية البحث النوعي، التي تضمنت الملاحظات والمقابلات ودراسات الحالة، كيف أن الأسطح اللمسية، والإشارات السمعية، والروائح، تساهم في تعزيز الإدراك المكاني، مما يؤكد أهمية تحسين التصميمات الحضرية والمعمارية لدعم القدرة على التنقل المستقل في الحياة اليومية لذوي الإعاقة البصرية. وتُبيّن الدراسة أن مثل هذه التصميمات يجب أن تتبنى استراتيجيات مثل التغذية الراجعة اللمسية، والمؤشرات الصوتية، والاهتمام المتكامل بالشكل والوظيفة لتحسين السلامة والتنقل والتوجيه لدى الطلاب. وتوضح الدراسة لماذا ينبغي على المصممين اعتماد مبادئ العمارة متعددة الحواس لتعزيز الشمولية. وتختتم بدعوة المهنيين إلى الالتزام بمبادئ التصميم العالمي والإرشادات ذات الصلة التي تراعي تنوع القدرات، لضمان أن تكون التصميمات ليس فقط متاحة، بل شاملة للجميع.

الكلمات المفتاحية :العمارة الشاملة، العمى، الرؤية، ضعف البصر، التحيز البصري، متعدد الحواس، اللمس