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How Architectural Elements of Blind School Effect the Psychology of Users

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Abstract: Architecture is the main component of the surrounding environment and cannot be considered as an art represented only by visual elements, but it is a multisensory art that can be used to feel and understand our surrounding environment using multisensory tools to achieve the best design performance. Despite the development that the world is witnessing in all aspects of life, which we see its impact on the field of construction and reconstruction, we lack the existence of qualified educational spaces for people with special needs that form an important part of society, which has led to their restriction and the obligation of their parents to accompany them to practice their lives smoothly. This study discusses the importance of studying and analyzing the interior design of educational spaces for the weak and blind that allows them to integrate with society and study the impact of design by sensory perception to achieve the idea of employing architectural tools that all our senses can feel. The use of architectural spaces to have the same ability to understand by other senses by providing qualified spaces, functionality, and design that the different senses of students can feel. In addition to highlighting the basic senses that must be used to design a suitable educational vacuum for the visually impaired that meets their psychological, behavioral, and physical needs to reach a multisensory educational vacuum.

Keywords: Sensory perception, multi-sensory architecture, visual disabilities, educational spaces

1.INTRODUCTION.

Eyesight is said to be the most important sense among all human senses in a way that approximately 80 percent of impressions are received by our sight. It helps us to distinguish light from darkness, protects us from danger, and ensures our participation in daily communication, activities, sports, work, as well as education (Carl Zeiss Vision, 2010). It might be difficult for most of us to imagine how a blind person manages to live in a society where most architectures and facilities are established for sighted people. Likewise, it can be hard for sighted people to think about how a blind student manage to study in a classroom that is well equipped with visual learning materials. This research therefore explored the difficulties bind students encountered in schools and provision and support blind students experienced to be appropriate the psychological well-being of blind school. users is intrinsically linked to their overall quality of life and educational outcomes. Individuals with visual impairments often face unique psychological challenges, including feelings of isolation, dependence, and low self-esteem. The built environment can either exacerbate these challenges or serve as a catalyst for empowerment and inclusion. By understanding how architectural elements impact the psychology of users, designers and educators can collaborate to create environments that promote positive psychological outcomes and enhance the overall educational experience.

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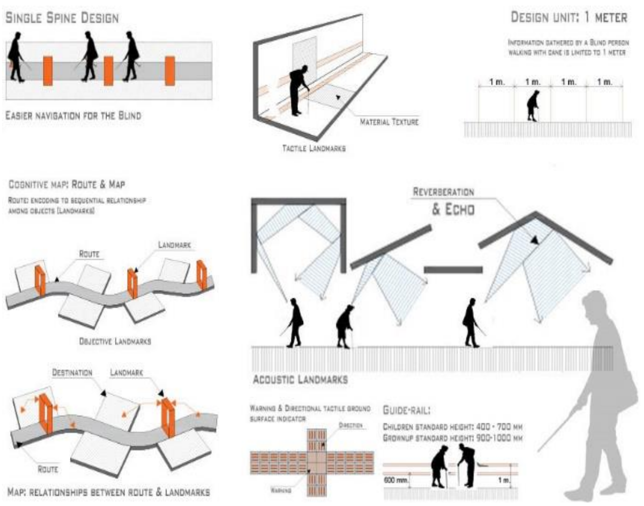
2. Impact of Architectural Design on the Psychology of Blind School Users.

Architectural design plays a critical role in shaping the experiences and psychology of blind school users. While accessibility is a primary concern, the design of blind schools goes beyond physical accommodations to address the emotional, social, and cognitive needs of visually impaired individuals. Below are key areas where architectural design influences the psychology of blind school users.



2.1. Spatial Layout and Navigation:

- Independence: Well-designed spatial layouts provide clear circulation paths and intuitive wayfinding cues, empowering blind school users to navigate their environment independently. This fosters a sense of autonomy and self-reliance, enhancing their psychological well-being.
- Confidence: Accessible environments with consistent layouts and tactile landmarks instill confidence in users, reducing feelings of anxiety and uncertainty associated with navigating unfamiliar spaces.

2.2 Sensory Stimulation:

- Engagement: Architectural elements that incorporate tactile, auditory, and olfactory stimuli engage multiple senses, enriching the sensory experience of blind school users. This multisensory approach promotes cognitive engagement and emotional connection with the environment.
- Awareness: Tactile surfaces, textured materials, and auditory cues provide vital sensory feedback, enhancing spatial awareness and environmental perception. This heightened awareness contributes to a greater sense of security and comfort within the built environment.

2.3 Lighting and Acoustics:

- Comfort: Thoughtfully designed lighting and acoustics create comfortable and conducive environments for blind school users. Proper lighting levels and glare reduction techniques improve visibility and reduce eye strain, promoting a sense of relaxation and well-being.
- Communication: Acoustic treatments that minimize background noise and echo enhance communication and auditory comprehension, facilitating social interaction and learning activities. Clear acoustics also contribute to a sense of connection and inclusivity within the school community.

2.4 Social Interaction and Inclusion:

- Belonging: Accessible communal spaces and inclusive design features encourage social interaction and foster a sense of belonging among blind school users. Opportunities for collaborative learning, group activities, and shared experiences promote social cohesion and peer support networks.
- Empowerment: Architectural designs that prioritize universal access and barrier-free environments empower blind school users to participate fully in social and educational activities. This promotes a sense of inclusion and equality, enhancing self-esteem and social confidence.

2.5 Emotional Well-being and Confidence:

- Security: Safe and predictable environments with well-defined boundaries and clear circulation paths promote feelings of security and emotional stability among blind school users. Predictable environments reduce stress and anxiety, fostering a positive emotional state.
- Empowerment: Accessible design features, such as Braille signage and tactile indicators, empower blind school users to navigate with greater independence and confidence. This sense of empowerment enhances self-esteem and resilience, contributing to overall emotional well-being.

In conclusion, architectural design significantly impacts the psychology of blind school users by shaping their sense of independence, engagement, social inclusion, emotional well-being, and confidence. By integrating principles of accessibility, inclusivity, and sensory stimulation, architects can create environments that not only accommodate but also empower and enrich the lives of visually impaired individuals within educational settings.

3. Overview of the Significance of Texture, Materials, Forms, and Volume in Architectural Design for Blind Schools.

In the architectural design of blind schools, texture, materials, forms, and volume play a crucial role in creating environments that are accessible, inclusive, and supportive for visually impaired individuals. These elements are carefully considered to address the unique needs and challenges faced by blind school users, aiming to facilitate navigation, enhance sensory experiences, and promote independence. Below is a detailed explanation of how texture, materials, forms, and volume contribute to the creation of inclusive and supportive environments for visually impaired individuals in blind schools:

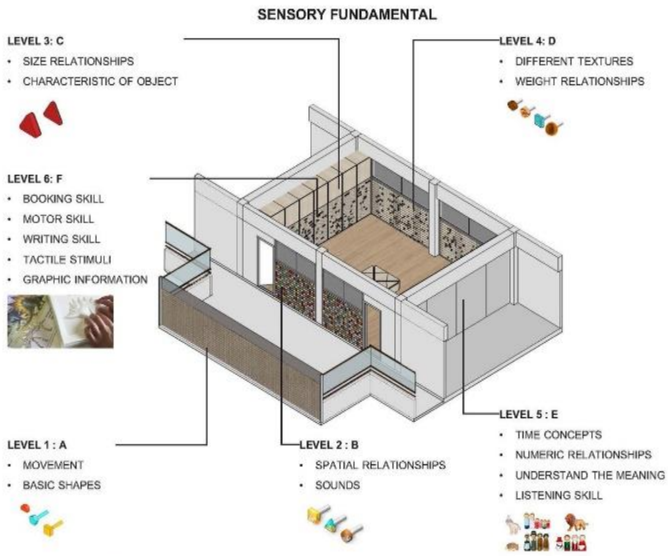


Fig.2. Sensory fundamental

3.1. Texture:

- **Tactile Feedback:** Texture refers to the surface characteristics of materials, such as smoothness, roughness, and patterns, that can be felt through touch. In blind schools, tactile textures provide essential sensory feedback, aiding in navigation and wayfinding for visually impaired users.

- **Wayfinding Cues:** Textured surfaces, such as textured flooring, walls, and handrails, serve as tactile wayfinding cues, helping users orient themselves within the environment and navigate safely. For example, different textures can indicate transitions between spaces or highlight important landmarks.

Fig.3. Texture (Wayfinding Cues)

- **Safety and Comfort:** Texture also contributes to safety and comfort within the built environment. For example, slip-resistant textured flooring enhances stability and reduces the risk of falls, while soft tactile materials provide comfort and sensory stimulation.
- **Navigational Cues:** By incorporating textures with varying patterns, roughness, or raised elements, architects can create distinct navigational cues that guide users through the environment. Tactile surfaces help users understand their surroundings, locate amenities, and navigate independently with confidence.
- **Spatial Awareness:** By incorporating varied textures throughout the built environment, architects can enhance users' spatial awareness and perception of their surroundings. Tactile textures provide valuable information about the layout and scale of spaces, promoting a greater sense of comfort and confidence among blind school users.

3.2. Materials:

- **Tactile Properties:** Materials selected for blind school environments are chosen for their tactile properties, durability, and safety. Tactile materials, such as wood, stone, and textured surfaces, offer distinct sensations that can be explored through touch, enriching the sensory experience for visually impaired users.
- **Contrast and Visibility:** The selection of materials with contrasting colors and textures enhances visibility and legibility for users with low vision. High-contrast materials improve perceptibility and help users distinguish between architectural elements, signage, and wayfinding cues.
- **Durability and Maintenance**: In addition to tactile properties, materials are chosen for

their durability, ease of maintenance, and resistance to wear and tear. Durable materials ensure longevity and reduce the need for frequent repairs, contributing to the overall functionality and sustainability of blind school environments.

- **Aesthetic and Functional Integration:** Beyond tactile and visual considerations, materials are chosen for their aesthetic qualities and functional integration within the architectural design. Integrating a variety of materials allows for the creation of dynamic, stimulating environments that cater to diverse sensory preferences and cognitive abilities.

3.3. Forms:

- **Spatial Organization:** Forms refer to the shapes, configurations, and spatial arrangements of architectural elements within the built environment. In blind schools, well-defined forms and spatial organization facilitate intuitive navigation and orientation for visually impaired users.
- **Psychological Comfort:** Forms and volume also contribute to psychological comfort and environmental perception. Well-defined architectural forms create a sense of enclosure, security, and enclosure, promoting a feeling of safety and familiarity for users. Additionally, the perception of volume enhances spatial awareness and facilitates cognitive mapping of the environment.
- **Clear Spatial Hierarchy:** Architectural forms establish a clear spatial hierarchy, delineating circulation paths, activity zones, and functional areas within the school environment. Clear spatial organization reduces confusion and enhances users' ability to understand and navigate the space effectively.

- **Architectural Identity:** Architectural forms contribute to the overall identity and character of blind schools, reflecting the values, mission, and aspirations of the educational institution. Thoughtfully designed forms create a welcoming and engaging environment that fosters a sense of belonging and pride among users.

4. Volume:

- **Scale and Proportion:** Volume refers to the physical dimensions and proportions of architectural spaces, including height, width, and depth. In blind schools, carefully considered volumes and proportions create environments that are spacious, comfortable, and conducive to learning and social interaction.
- **Enclosure and Openness:** Volumes define the enclosure and openness of spaces within blind schools, creating a balance between privacy and connectivity. Enclosed volumes provide a sense of security and enclosure, while open volumes promote social interaction and visual connectivity.
- **Environmental Comfort:** Volume influences environmental comfort by regulating factors such as air circulation,

temperature, and acoustics within the built environment. Well-designed volumes contribute to a comfortable and supportive atmosphere that enhances users' well-being and overall
satisfaction.

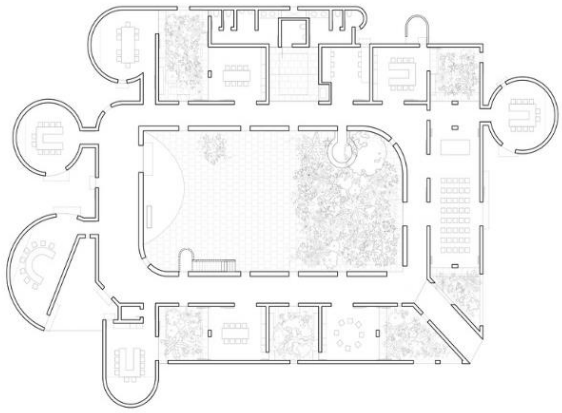


Fig.3. Floor plan

In conclusion, texture, materials, forms, and volume are integral elements of architectural design in blind schools, contributing to the creation of inclusive, accessible, and supportive environments for visually impaired individuals. By carefully considering these elements, architects can design spaces that prioritize the needs and experiences of blind school users, promoting independence, safety, and a sense of belonging within the educational setting.

4. how does perception of space through other senses work in blind school.

In blind schools, the perception of space through senses other than vision is a crucial aspect of navigation, orientation, and overall spatial awareness for visually impaired individuals. Here's how the perception of space through other senses works in blind schools:

4.1. Tactile Perception:

- **Tactile Surfaces:** Blind school environments often incorporate tactile surfaces, such as textured flooring, walls, and handrails, that provide physical feedback to users as they move through the space. These
- understand the layout of the environment, locate key landmarks, and navigate safely.

Fig.4.Tactile Flooring

- **Tactile Maps and Models:** Tactile maps and architectural models with raised features and textures are used to provide spatial information and orientation cues. By exploring these tactile representations, students can gain a better understanding of the school layout, including classroom locations, corridors, and common areas.

4.2. Auditory Perception:

- **Soundscapes:** Blind schools may utilize auditory cues to help students navigate and orient themselves within the environment. This includes sounds generated by various architectural elements, such as echoes in hallways, the hum of ventilation systems, or the reverberation of voices in communal spaces. These auditory cues provide spatial information and help students locate themselves within the environment.

- **Auditory Wayfinding Systems:** Some blind schools incorporate auditory wayfinding systems, such as audible beacons or directional audio signals, to guide students through the space. These systems use sound to indicate points of interest, pathways, and destination points, assisting students in navigating independently and safely.

4.3. Olfactory Perception:

Sensory Stimuli: The sense of smell can also contribute to spatial perception in blind schools. Different areas of the school may have distinct odors or ambient scents that provide additional cues for orientation and navigation. For example, the cafeteria may have the aroma of food, while classrooms may have a more neutral scent.

Sensory Gardens: Some blind schools incorporate sensory gardens or outdoor spaces with aromatic plants and flowers. These spaces not only provide opportunities for relaxation and recreation but also stimulate the sense of smell, enriching the sensory experience and enhancing spatial awareness.

4.4. Kinesthetic Perception:

- **Body Movement:** Kinesthetic perception, or the awareness of one's body movements and spatial orientation, is crucial for navigation in blind schools. Students develop a sense of space and distance through physical movement and exploration of the environment. For example, they may use their walking speed, stride length, and directional changes to gauge the size and layout of spaces.

4.5. Multisensory Integration:

- **Physical Feedback:** The physical feedback received from interactions with architectural elements, such as changes in flooring texture, elevation, or obstacles, provides kinesthetic cues that help students understand the layout and dimensions of the environment.
- **Combining Senses:** Ultimately, perception of space in blind schools involves the integration of multiple sensory inputs, including touch, sound, smell, and proprioception. By combining information from different senses, students construct mental representations of their surroundings and navigate the environment effectively.

Environmental Familiarity: Over time, repeated exposure to the environment and the consistent use of sensory cues help students develop a mental map of the school layout. This familiarity enhances spatial understanding and facilitates independent navigation and orientation.

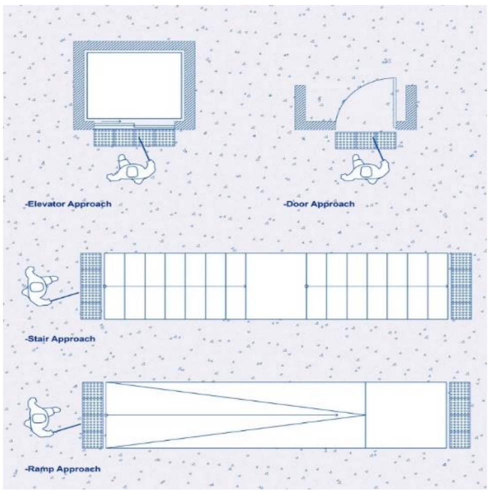
Fig.5. Multisensory Integration:

In summary, the perception of space through other senses in blind schools relies on tactile, auditory, olfactory, and kinesthetic cues to provide spatial information and support navigation and orientation for visually impaired individuals. By leveraging these sensory inputs and promoting multisensory integration, blind schools create inclusive environments that empower students to navigate independently and participate fully in educational activities.

5.Materials used in blind school.

5.1 Tactile Flooring:

- **Material:** Tactile tiles with raised patterns or textures for wayfinding.
- **Specification:** Typically made of durable materials like rubber or vinyl, with raised dots or lines.
- **Approximate Cost:** ₹500 to ₹1500 per square meter.



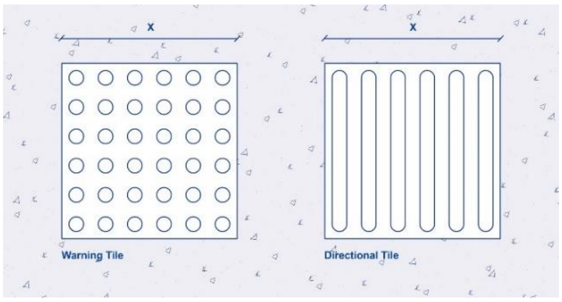


Fig.6. Tactile Flooring

5.2 Braille Signage:

- **Material:** Signage with Braille text and tactile symbols for navigation.
- **Specification:** Made of durable materials like acrylic or aluminum, with raised Braille dots and tactile graphics.
- **Approximate Cost:** ₹500 to ₹2000 per sign.

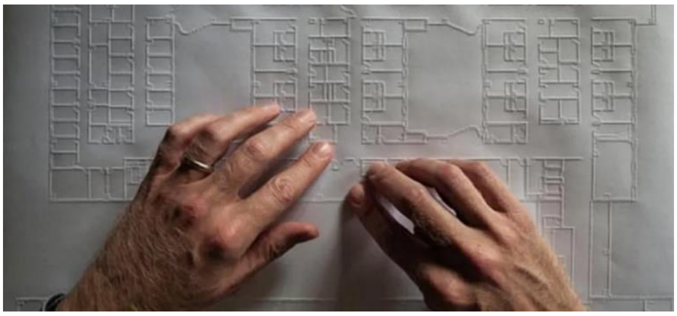


Fig.7. Braille Signage

5.3 Non-Glare Surfaces:

- **Material:** Matte finishes and non-glare surfaces on walls, floors, and countertops.
- **Specification:** Paints or finishes with low sheen to minimize glare and enhance visual contrast.
- **Approximate Cost:** Varies based on material and area covered.

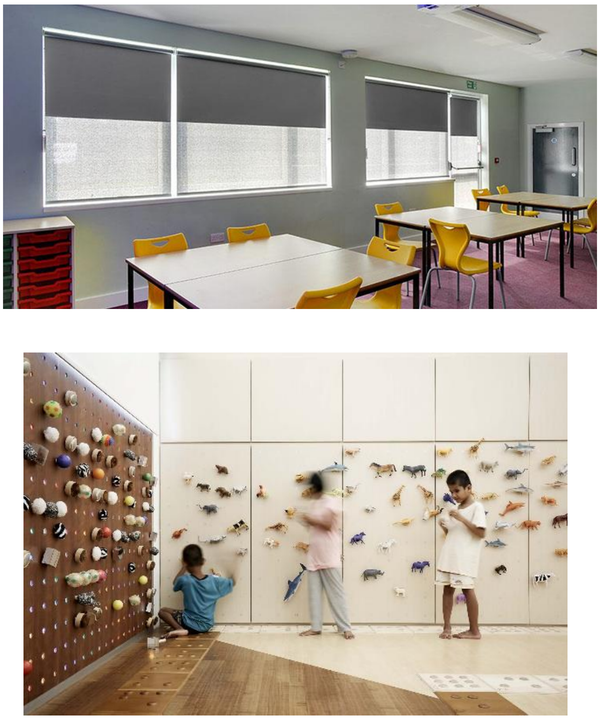


Fig.8. Non-Glare Surfaces

5.4Acoustic Materials:

- **Material:**Sound-absorbing materials like acoustic ceiling tiles, wall panels, and carpets.
- **Specification:** Acoustic tiles made of fiberglass or mineral fiber, wall panels with perforations, and carpets with sound-absorbing backing.
- **Approximate Cost:** ₹200 to ₹1000 per square meter.

Fig.9. Acoustic ceiling

5.5 Sensory Stimulation Materials:

Material: Textured surfaces, sound-emitting devices, and sensory toys.

Specification: Textured surfaces made of materials like rubber or fabric, sound-emitting devices with adjustable volume, and sensory toys with tactile features.

Approximate Cost: Varies based on the type and quantity of materials chosen.

Fig.10. 5.5 Sensory Stimulation Materials on wall.

6. CASE STUDY

6.1 School for Blind and Visually Impaired Children / SEAlab

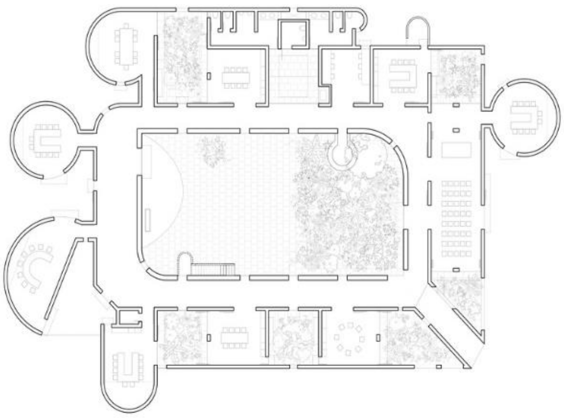
Architects: Sealab

Location: Gandhinagar, Gujrat

Area: 750 msq

Year: 2021

School for the blind and visually impaired children in Gandhinagar is designed for children from remote villages and towns in Gujarat and professors eager to offer them a better education and opportunities in society. Initially, the school occupied an existing building, previously a primary school. The 1st floor was used as classrooms for academic activities and the ground floor as dormitories. Earlier, there was less space for all the students (12 children shared in each dorm room) and no capacity to welcome more.



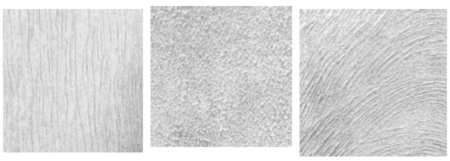
- **Design -** The new academic building, on the west of the existing one, has ten classrooms with five different types arranged around a central courtyard. This space provides a contained exterior space for the children to play, perform, or celebrate festivals. This simple building typology allows the students to create a mental map of the spaces. The corners are identified with strokes of light or articulated volumes, and the corridor surrounding the central plaza has different widths and volumes on each side. This allows the students to identify their location in the building. Each classroom around the central plaza has different features for specific uses – music rooms, meeting spaces, workshops, etc. Based on their functions, the "special" classrooms have various forms, volumes, and light qualities. The other classrooms are like verandahs; each open to a private courtyard with the possibility of outdoor learning. The relation with exterior spaces allows for better ventilation and controlled light quality.

The building is designed to be incremental or built-in phases according to the available funding. The classrooms are smaller cells plugged into the main spaces – the plaza and the corridor. The geometry of these classroom units creates a play of light and shadow and an efficient response to the hot climate. More than 1000 shrubs, plants, and trees of 37 species are planted on campus to provide shade and fruits, invite butterflies and birds, and diversify and improve the natural environment. Khambhati Kuva (Percolation well) – a traditional rainwater harvesting technique of 10ft diameter and 30ft depth was built to collect the rainwater and the recharge ground. The well can absorb 45,000 to 60,000 liters of water in one hour.

This school is designed to be navigated with the help of more than one of the five senses:

- **Sight -** Many students have low vision; they can distinguish spaces that have the contrast of light and shadow or contrasting colors and surfaces. Specific skylights and openings are designed to create contrasting areas with light and shade. For example, the entrance vestibule of the special classrooms is marked by a high ceiling with a skylight making a flare of light. Also, contrasting colors are used on the doors, furniture, and switchboards so that the students can easily differentiate the elements during navigation. Since the students with low vision are sensitive to direct sunlight, the classroom has indirect, filtered light from the private courtyards and skylights.

- **Hearing -** The sound of the voice or the walking steps changes according to the echo produced in the spaces. The design attributes different heights and widths to areas of corridors and classrooms so that children can recognize them by sound. For example, the entrance corridor has a high ceiling height (3.66m), and it gradually reduces in height (2.26m) and width, giving an identifiable sound quality to each space.



- **Smell -** The landscape has a significant role in the design. Courtyards, located next to the classroom and connected to the corridor, have aromatic plants and trees, which help in the navigation of the building.

- **Touch -** The material and textures of the walls and floor, with smooth and rough surfaces, guide the students throughout the spaces.

- **Floor:** Kota stone is the principal material used for the flooring. Rough Kota stone marks the entrance to each classroom, whereas the other spaces have smooth Kota stone. While navigating, this change in textures guides the students.

- **Walls:** There are five different wall plaster textures used in the building. The two longer sides of the corridor have horizontal textures, whereas the shorter side has vertical textures. This helps students identify which sides of the corridor they are navigating. The central courtyard has a semi-circular texture, whereas the external surface of the overall building is sand-faced plaster.

User engagement approach - For the Schools design, there was a need to reinvent communication and participation tools. We had multiple meetings at different stages of the process to engage the students and teachers on the design. Initially, we relied on cardboard models to start a conversation with students and teachers. They could visualize the built form through touch, but soon, we realized it wasn't easy to comprehend the interior spaces and details. To counter the issue, we developed communication techniques using a 3d printer. This allowed for the construction of tactile drawings and robust models that the students could touch and visualize spaces. We developed a code of textures to communicate the design to students and teachers. These textures overlapped the plan and helped to visualize the architectural spaces. The interior spaces had a different texture than the exterior, just like circulation spaces or classrooms. Moreover, each area (classroom, corridor, courtyard) was marked and written in Braille.

3d printed detailed models were also part of the communication strategy. It enabled students to touch them without breaking them. They had details like furniture and people to help understand the spaces' organization and scale. Before the construction, we did a full-scale line-up on the site. All trustees, professors, and some students circulated throughout the space and gave their feedback. Lastly, during the construction, the contractor-built mock-ups of some techniques that could help the students to navigate the building. For example, some of the students tried different wall plaster textures to clarify their effectiveness.

7.CONCLUSION

In conclusion, visually impaired and blind narratives helped reaching the main study objective which is the understanding of the experiential, multisensory qualities of architectural spaces. The study confirmed that the attention for non-visual perception in the experience of visually impaired and blind individuals, can significantly inform multisensory design approaches for both sighted and blind individuals. It was confirmed that multisensory cues in the built environment stimulate the senses of visually impaired and blind, hence contribute to their perceptual tasks (the understanding and making sense of the built-environment), and make them able to form beliefs and make decisions (cognitive tasks and operating tasks). Overall, it was highlighted that the visually impaired and blind individuals' experiences are as rich as sighted

experiences. Most of the visually appealing features recognized by the sighted people in the built environment would not catch the attention of blind individuals. However, the study showed that visually impaired world of darkness is yet full and rich of sensory stimuli. Multisensory cues in the built environment stimulate their compensatory senses which in turn help them in perceiving physical characteristics. Among these multisensory cues are floor qualities (finishing texture, contour), natural factors (wind, sun, contextual vegetation), boundaries (proportion and scale), spatial organization (different sensory cues associated to different activities), and rhythm of movement (difference in movement directions, encounters, rest periods, and repetitive cycles) all acted as sources in the built environment that catered for the perception of different physical characteristics such as volumetric configuration, geometric configuration, openings (size/location)/building orientation, detecting obstacles, and finishing materials. Hence, such perception of these physical characteristics catered for the understanding of the spatial structure, which then influences the perception of several spatial qualities such as sense of enclosure, legibility, and sense of position in space. This in turn acted

as prerequisite to several other cognitive processing and actions in the built-environment, such as constructing mental imagery, cognitive maps, and orienting/navigating in the built environment.

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