International Design Journal

Volume 12
Issue 3 *Issue 3*

Article 20

2022

The impact of sensory perception on interior architecture standards for visually impaired and blind students in educational facilities

Amira Fawzy Helmy Almaz
Associate Professor of Interior Architecture, Department of Architecture, Faculty of Engineering, Horus University-Egypt (HUE), aalmaz@horus.edu.eg

The impact of sensory perception on interior architecture standards for visually impaired and blind students in educational facilities

Amira Fawzy Helmy Almaz

Associate Professor of Interior Architecture, Department of Architecture, Faculty of Engineering, Horus University-Egypt (HUE), aalmaz@horus.edu.eg

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, behavioural, and physical needs to reach a multisensory educational vacuum.

Keywords:

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

Paper received 7th March 2021, Accepted 20th April 2022, Published 1st of May 2022

Research objective:

The research explains the concept of sensory perception of architectural spaces as a multi-sensory tool for experiencing and interpreting the environment to create an integrated educational space free of barriers for this group's integration into society by:

- Creating an urban environment for the visually impaired that allows them to cognitively perceive the surroundings and move freely.
- Providing educational facilities that allow the visually impaired to do all duties pleasantly and comfortably.
- Choosing educational facilities as a research sample is because they represent one of the most important functional spaces that must positively adapt the visually impaired to the surrounding environment and prepare him for the practice of the educational process in a way that assists him in adapting to the surrounding environment.

Research problem: The visually impaired person lives in more constrained and limited surroundings, and he wishes to be able to leave and enter the world of the sighted to allow him optimal adaptability to one's circumstances; therefore, they require guiding services, as well as appropriate family, educational, and professional guiding services, to overcome unpleasant reactions that exclude them from ordinary people.

Research Methodology: Approach to theoretical analysis: arguing theoretical points What function does architecture play in the lives of students who are blind or visually impaired? A discussion of multisensory design ideas for establishing a healthy environment for visually impaired students, as well as the necessity of multisensory architecture.

introduction: Visual impairment is described as a condition in which a person loses the ability to use his or her sense of sight successfully, which has a negative influence on performance and growth. DeMott defines visual impairment as impairment in any of the five visual functions caused by anatomical distortion or disease: central vision, visual adaptation, binocular vision, colour vision, and optical refraction.

Architects that employ Universal Design understand that the demands of the blind and the sighted are not mutually exclusive. The design for the blind and visually impaired is an excellent example of a comprehensive and accessible design approach, for example, paying attention to the right orientation of the spaces to provide enough sunshine and consistent ventilation in the various places.

Visual impairment is a challenge for architects and interior designers who believe architecture is nothing more than a visual tool. This challenge asks you to think about how you may utilize your other senses to achieve and increase efficiency as well as a sense of beauty. (Adler, 2012)

- Architects use employ texture, sound, heat, and aroma to define spaces and functions.

- Tactile clues such as changes in floor textures and temperature swings serve as markers for persons who cannot sight.

One of the most important challenges is to offer educational spaces for the blind due to an increase in the number of blind children and a shortage of educational spaces for them to enhance their abilities and talents and integrate into society. Architects and interior designers may build an appropriate setting for blind and visually impaired pupils by leveraging the digital and informatics revolutions, as well as computer technology. The role of architecture in creating a life that is appropriate for visually impaired students is centred on sensory design, not simply visual architecture, by emphasizing the use of senses such as hearing, touch, and scent. (Almaz, 2017)

•What is Universal Design? "Universal design" incorporates well-known concepts such as accessibility and "barrier-free space" design. If a design is universal - that is, if it is appropriate for everyone - it is also accessible by definition. This refers to the accessibility of places built to suit the needs of persons with special needs, such as the blind or visually impaired, as well as those who have cognitive issues, to be accommodating for everyone and give functional comfort for all. (Maisel, 2012)

The unifying factor in all universal design is physical accommodations for a wide range of demands, which is why universality must begin with the design itself. Rather than trying to retrofit the design to suit needs, the objective should be to include accessibility into the design from the start.

Visually impaired persons are classified into two types:

a) The first type is known as Braille readers, and it refers to blind persons who read with their fingertips. **Fig (1)**

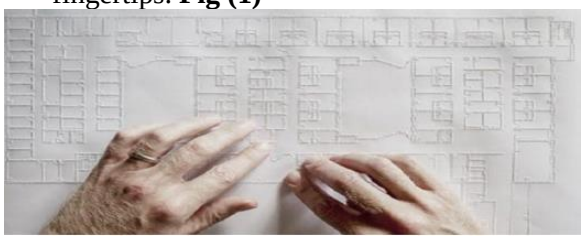


Fig (1): Prominent floor plan for blind and visually impaired users. (Photo by: Don Fogg)

b) The second type is the partly sighted category, which comprises people who read with their eyes and are known as large-type readers. (Impaired., 1998)

Great architecture for the blind and visually impaired isn't like any other architecture, in that it appears and functions the same while giving a deeper and more sensory experience. Providing schools for the blind and visually impaired, as well as integrating them into educational settings, is a significant design problem that must be addressed to provide a safe and welcoming atmosphere. The schoolyard, movement paths, openings, doors, floor coverings, Paths, stairs, ramps, classroom furniture, lighting, colours, and finishes of walls and ceilings, acoustics, and sanitary spaces are all areas where the school environment promotes a sense of belonging and self-worth - as the target group. (Craven, 2020)

Sensory perception and its effect on creating criteria for blind interior design: When one of the senses is disturbed, the rest of the senses are affected, resulting in low adaptability to the environment in which he lives. Then he must contribute to the improvement of environmental conditions by establishing a suitable psychological and environmental-climate that allows him to live with his circumstances in light of the disruption of one of his senses. (Pallasmaa, 1996) By incorporating many senses into building design and creating a multisensory constructed environment in which the senses interact in distinct interior spaces, we can design spaces for the blind and create an interactive (dynamic) architecture, allowing the senses to feel connected while thinking independently. As a consequence, visually impaired persons can better grasp their environment. Touch is our most primitive and deeply related sense to our surroundings. We may include visually challenged areas and forms by building different spaces with sensory quality in mind. (Kreij, 2008)

According to sensory architecture research, visually impaired people benefit from a design that communicates with them through their remaining functional senses. As a result, acoustic, tactile, and smell architecture have all been emphasized in this design.

This design employs the single spine design principle as well as a cognitive map. A blind person's spatial perceptions are formed through the use of a cognitive map comprised of routes and landmarks. This objective point is generated by a blind person's mental picture of the voyage, which is physically defined by auditory, tactile, and olfactory clues.

The visual sense is the most important in the perception of places and things since it helps and allows a person to avoid environmental threats as well as understand situations and events. When this sense is lost or disrupted, the person struggles to engage with his surroundings. As a result, several factors should be considered in the interior design of visually impaired people's living quarters to assist them in coping with these environments, such

as allowing them to imagine the space in which they live as if they could see it and realize the dimensions of the furniture so that they can enjoy and feel comfortable without seeing it. The sense of vision is the most important in the perception of places and things because it allows the individual to avoid environmental risks and comprehend situations and events, and when this sense is lost or disrupted, the individual experiences incompatibility issues with the surrounding environment. When a person loses a sense, research shows that learning behaviour enhances other senses. (Danielsen, 2012)

- **Texture & Touching**

Texture and touch should be incorporated into interior design. To help blind or visually impaired in improving their senses. Touch alarms can be used on private outdoor pathways such as:

- Use a variety of flooring materials to provide textural contrast, making it simpler to differentiate moving pathways from one spot to another.
- Understanding directional spaces by the use of texture in walls that may be aligned to internal and exterior movement pathways.
- Use different physical partitions to identify areas depending on the texture of the wall and the texture of the materials utilized. **Fig (2)**
- Use rhythm in the design of wall panels to make them more understandable.

Fig (2) A combination of textures, such as a stone surface or ornamental concrete walls

1. Movement paths:

Starting at the main entrance, the difficulties of blindly manipulating ramps rather than a ladder must be considered. Slope, width, and length have all been specified as technical requirements for slope and step scales for special needs schools. There are also certain specifications for the railing. (Department for children, 2008) **Fig (3)**

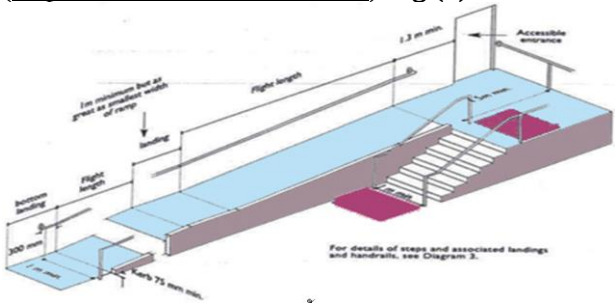


Fig (3) Specifications for special schools' sloped/stepped approach.

- Avoid spiral staircases and twisty passages.
- The use of anti-slip materials
- Avoid unfamiliar materials to allow the blind to navigate more freely around them. This is facilitated by the use of sliding doors, as well as the placement of high lighting units at a height of 2 meters.
- Install a speaking device in elevators to help the blind, as well as a slanted design on the doors that points toward the handle.

the materials used in the blind's movement Routes that contrast with the surrounding environment have a significant influence on the ability to utilize the blind for the stick. Because of the consistency of the path, the blind may use their stick to detect its passing via the texture of the ground. It's a dotted or longitudinal track that makes moving down a straight path easier. **Fig (4) Fig (5)**

Fig (4) using contrast materials in the blind's movement paths patterns helps them to continue moving with the stick.

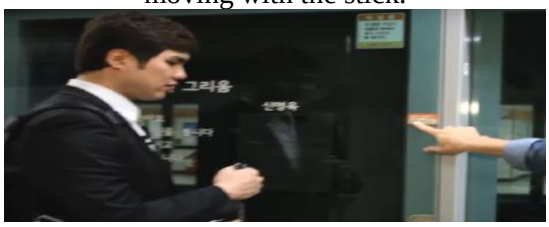


Fig (5) In elevators, support the blind or visually impaired by using a talking device and Braille buttons.

1.1 Internal movement paths:

- The architect and interior designer can design the interior spaces to give the blind or visually impaired a sense of emptiness, for example, by using different sounds for each space, such as the sound of water, and heating units can be used to provide a specific path for the blind or visually impaired to feel the heat source, and we must use corrosion-resistant flooring materials, such as rubber. **Fig (6)**
- The use of a handrail with tactile braille text as well as other forms of tactile pathways across the site will substantially assist vision-impaired youngsters in navigating the site.
- Using infrared headphones to provide audio directions for the blind or visually impaired to provide particular instructions leading to the targeted spaces.
- The sound reflection varies depending on the dimensions of the space and the finishing materials used, and spaces may be defined by

using different architectural solutions:

- Modifying the proportions of the areas as well as the ceiling height. **Fig (7)**
- Adding sound effects to the long Paths to avoid feeling disoriented in a blind children's educational facility. (Picinali, 2014)

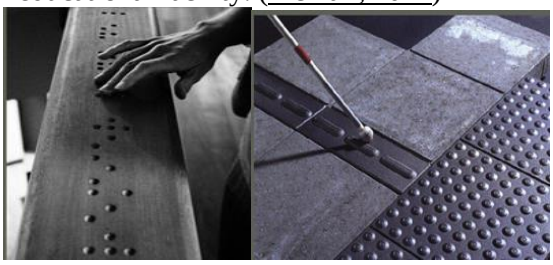


Fig (6) use different patterns of flooring with different contact to distinguish movement paths

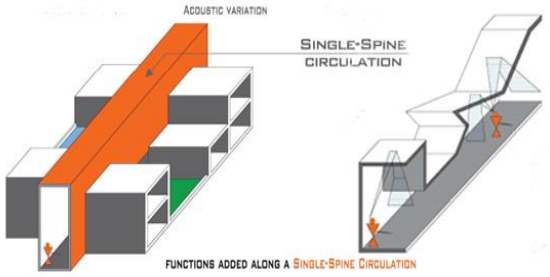


Fig (7) the single spine design notion as a cognitive map in educational spaces

1.2 External movement paths:

The sidewalk edge used to be an essential element for guiding the blind to the continuation of the road, but as urban design elements evolved, the sidewalk edge became equipped with obstacles and barriers, making it nearly impossible for the blind to walk along the river of the road to guide the pavement, necessitating the creation of a special path for the blind with protrusions that constitute a suitable itinerary, and this path was created.

1. The sound produced by the stick colliding with the protrusions, as well as the sensations it experiences, provide some route direction.
2. A path is devoid of any impediments to progress.

This assures the blind that they will not encounter any barriers on their path, and they can employ rectangular units with dimensions of 15*20 cm with texture and protrusions that provide a continuous path. These units are made of ceramics, concrete fibres, or epoxy, and the protrusions have been chosen to not interfere with the movement of wheelchairs or strollers. (Ireland, 2004)

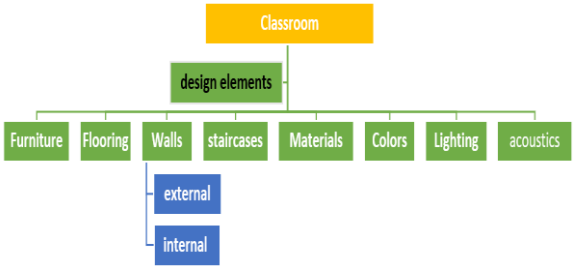
Audio information, banners and symbols, maps and tactile indicators, colour contrast, chromatic coding, and landmarks are all examples of methods that can offer information. Space With the usage of effects the sense of smell in children is beneficial to identify directions or places at crossroads or along lengthy Paths. Flowers and trees can sometimes be smelled from afar. (Danielsen, 2012)

There was a deficiency in the design of blind schools. When building for vision-impaired children who are treated like puppets, architects cannot regard architectural surroundings as only a visual tool so in visually challenged buildings the design of the space becomes a design problem in which all users' needs must be satisfied. The design features and factors of educational settings for the blind and visually impaired can be classified as follow: (Horton, 1988)

Fig (8) Rectangular units with dimensions of 15*20 cm and with texture and protrusions give an itinerary

Fig (9) The use of signage, symbols and tactile indicators can provide space with effects that use the sense of smell

- **The role of different design elements in reaching the multisensory space's functional aim:**



1) Classroom: The most important aspect of classroom spaces is that they are bigger than typical to allow for smoother circulation inside specifically equipped instructional rooms and close to the main entrance. (Leo Care, 2012)

• The classroom is divided into several divisions to allow for individual and small group work. Many children find the central classroom space to be an inspiring place to work, negotiate, and cooperate with their peers.

• A group size of 8-15 children with intermediate needs, 6-8 children with severe needs, and 4-6

children with urgent needs are optimal with one teacher.

• Having ICT equipment in the classroom, as well as one or more network computer workstations and an interactive writing board with a Braille writing capability, allows students with visual disabilities to get the most out of the learning process **Fig (10)**. (Department for children, 2008)

All six surfaces inside the classes must be designed to be interacted with.

As they proceed through the curriculum, children move through the four walls, cultivating their senses. Touch starts with the most fundamental forms, then moves on to sizes, relationships, texture, and weight, and then to more complicated shapes like animals. In addition to the Pre-Braille Curriculum, children are taught to recognize potential harm from daily life by using different smells to teach students about the smell of potential harm such as fire, smoke, gas leakage, etc.

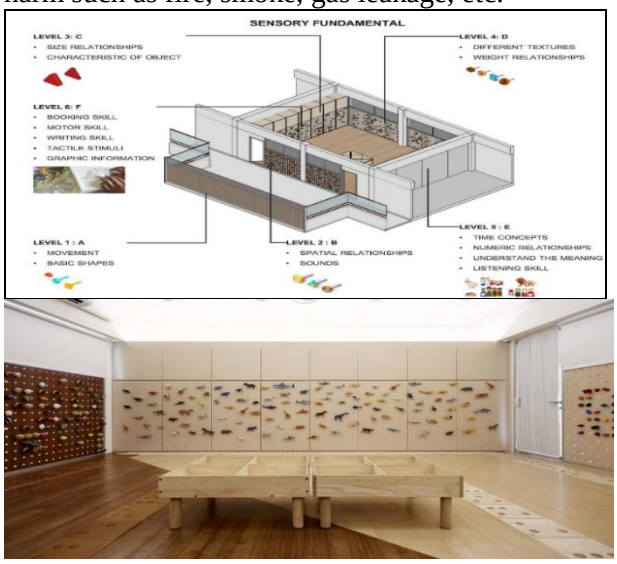


Fig (10) Classes were transformed into a new multi-sensory facility for the blind or visually impaired, constructed in compliance with Pre-Braille Curricula. The spatial quality of the area, as well as its proximity to the circulation path. The interactive façade is pierced with light holes into which "learning pins" may be inserted.

Used sound recordings of the various environment to stimulate students' perception of the world. The lighting is designed to exercise and stimulate visibility in low-vision children. The floor is embedded with braille tactile letters. (Murphy, 2002)

2) Furniture:

The provision of appropriate furniture, equipment, and equipment aids in ensuring full access to learning and social activities. Furniture must be easy to move or may be used for more than one function and can accommodate a wide range of activities and layouts. Furniture surfaces for blind and visually impaired children should be smooth and free of sharp edges or bumps. Furniture must be resistant to fire and flame propagation, as well as meet health and safety regulations. The work surface must be sufficiently large and deep to enable essential learning and communication. There should be enough space for the assistant to sit beside the youngster. An appropriate hue, without etching yet with visual contrast with the surroundings, is necessary. Noise and gleaming surfaces might limit vision and should be avoided. (Botha, 2012)

Fig (11) Furniture surfaces for blind and visually impaired children should be smooth and free of sharp edges.

3) Flooring:

People with low vision learn how to navigate different locations by using specific design elements aspects like floors with pathways.

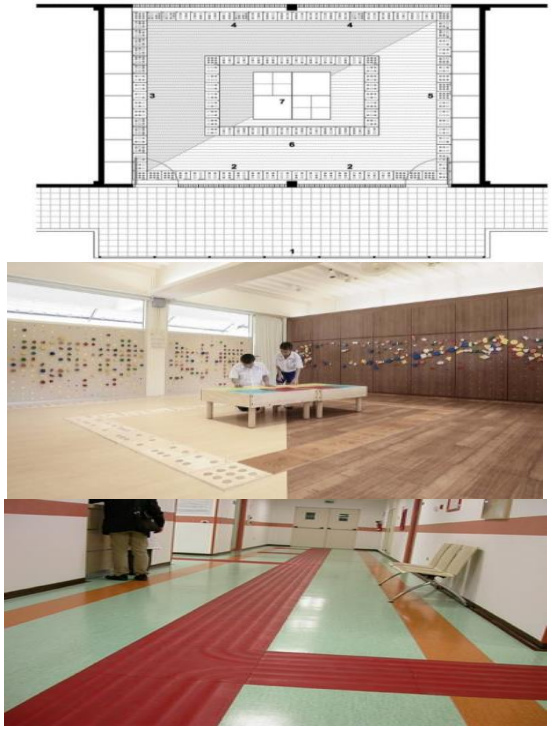


Fig (12) uses more than one type of flooring to help the blind in recognizing the different spaces and determining the direction of the various places.

There are well-established international standards that help maintain these uniform signals around the world, and designers must adhere to them as they work to create spaces suitable for people with vision loss. There are some special requirements in choosing the type of flooring for traffic tracks

within the classrooms for the blind:

1. Floors should not be damp or slippery, especially while using a stick or crutch.
2. The quality of the flooring or how it is built should not provide a barrier; for example, the gaps between the units should not be so wide that they obstruct the stick or wheelchair or cause the person to stumble while walking.
3. Gravel is mixed with cement and put on site since it does not restrict the chair's movement or cause it to skid.
4. It is normally preferable to use more than one type of flooring to help the blind in recognizing the different spaces and determining the direction of the various places.
5. Sand, asphalt, and gravel flooring should not be utilized in outdoor areas because they obstruct the movement of strollers and wheelchairs. (Mayer, 2020)

3.1 External Paths:

Navigating Paths is a major concern for visual disabilities people who want to remain independent and rely on their senses to navigate the Paths, and designers can help by making some design changes both at home and abroad that will make it easier for the blind or individuals with visual disabilities to navigate alone. (Steinfeld, 1980)

Fig (13) Use the floor designs as guideposts on pathways, crosswalks, and transition points.

- Use contrasting materials to refer to variances in certain areas, such as pathways, where fabric changes are merely an excellent indicator of traffic shifts.
- the pavement does not have to be limited as pathways; rectangular margins may be laid along walking trails to help visually impaired individuals determine where they can safely walk, which can help them stay safe.
- Using yellow rubber bands can be used as indicators and floor patterns of the Earth's Surface in concrete, providing a visible and tactile warning of where to walk safely. At junctions and Paths, lines denote traffic direction, whereas bumps denote two directions.

3.2 Interior Paths: Use the senses to traverse the inner Paths to make them more functioning.

- Different flooring textures should be used to designate entrances or openings to seating areas: for example, if the paths are tiled and there is a seating space outside the paths, the seating area floor should be covered with wood or carpet. A person walking with a stick will be able to pick where to sit easily.
- Using contrasting colours on the floor to help with navigation: People with limited vision can benefit from dark squares indicating the path down the main driveway, especially when combined with various tile patterns.
- Steer the path as straight as possible. Straight paths and clear and sharp angles can help people navigate the path within your space more easily.

Fig (14) Using contrasting colours and textures on the floor to help with navigation

4) Walls: are one of the most important elements of interior spaces since it's the visible element by the eye or positioned at the level of sight relative to other determinants, such as floors or ceilings, to define it be ideal for design to visually impaired needs:

- Equipping the walls with hand support on both sides of the walls at a height of between 85 cm and 95 cm, and preferably in the cushions should be circular in diameter between 40mm and 50mm. (Botha, 2012)
- It is advised that the bottom of the walls is covered with a bumper to prevent from rubbing against the walls and protected the corners be with blunt bumpers to provide safety while colliding.

Fig (15) Hand support should be put on both sides of the walls at a height of 85 cm to 95 cm, and ideally in the cushions, with a diameter of 40mm to 50mm.

5) Staircases:

- To make stairs clearer for visual impairment by using the senses of touch and visuals around the stairs we can use contrasting colours or fabric, boundaries, and conspicuous indications.
- Use the fabric from the top and bottom of the ladder. High lines suggest the possibility of stumbling, and blind individuals are aware that they monitor this fabric when navigating an area. To assist guide someone coming or walking in space, lines must go parallel to the step.
- Add a tight tape or another warning indication to the edge of each step. Use the contrast to determine the edge of the steps. In addition to the tape, use contrasting colours to distinguish the edge of the step. Choosing an airtight bar that contrasts with the colour of the step can lead to this.
- Most stairwells must have railings, but make sure they are easily accessible and put them at a regular level and on both sides of the steps, even if local construction standards only demand them on one side.

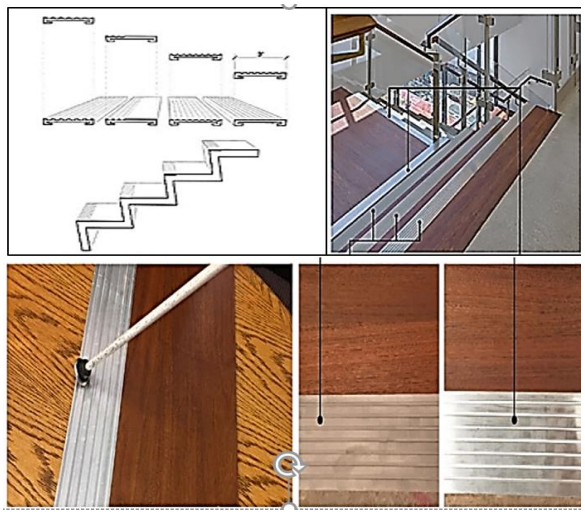


Fig (16) Using the senses of touch and visuals around the stairs we can use contrasting colours or fabric, boundaries, and conspicuous indications.

6) Materials: In general, addressing other senses rather than sight, the designer should rely on a functionally multisensory vacuum design.

- Make use of texture by writing Braille on the walls and dividing the materials on the flooring.
- Using the sense of smell: with the sensory plants of the mouth.
- Hearing aids such as water elements, speakers, or earbuds.

Best materials: (Vinyl to prevent slippage, leather floors, Epoxy, Parquet)

the technique of floor reference points:

- It is either a dotted or longitudinal route that makes it simpler for a person to walk straight and change at crossings or change in height, and if there is a change stop before 30 centimetres and separated by an aluminium path that bears up to 70 degrees Celsius.
- Design each space such that natural traffic zones are devoid of furniture, as well as employ furniture units as a vacuum reference frame.
- To reduce the risk, we uncheck all Paths for stumble risks such as ropes, reducing carpet use to not be covered in its edges. (Parida, 2020)

Fig (17) Make use of texture by writing Braille on the walls and dividing the materials on the flooring.

7) Colors: A contrasting colour scheme can be regarded as a core issue in visually impaired meddlers. Colours can play a key role in helping pupils guide themselves both in the corridor and on the playground. A primary colour can bring out various learning activities, areas, entrances, window curtains, or other architectural features. (Danielsen, 2012)

- Color contrast or colour grade can be used to identify objects such as wall lighting keys, tools on worktops, or potential risks such as step edges.
- Some guidelines should be taken into account in the use of colours in a school for the blind, and c. For example, brightly coloured items move the space. A bright window on a dark background can be bright and reduce visibility. Bright colours in large spaces or crowded patterns can build a strong influence better to be avoided. Dim pastel colours can be soothing. However, some people suffer from colour blindness, especially red and green.

Fig (18) at a school for the blind, some standards should be considered in terms of light levels, eyesight, maintenance, and psychological impact

8) Lighting: daylight is essential for all schools and the visually impaired are sensitive to light, there is a disparity in the amount of daylight that is appropriate for them. Because legally

blind persons do not live in the dark, they must benefit from illumination and colour reduction. The blind frequently have a sense of light, colour, and true contrast. (Department for children, 2008)

- Design lighting should avoid glare, shadows, and any other interference that can cause visual conflicts, most students with visual impairment are particularly sensitive to glare from direct or reflected sunlight.
- Use dark curtains to control sunlight or daylight levels for added comfort and improved visibility. They also provide privacy and hide external vision to reduce distraction, add colour and personality to space and absorb sound.
- Curtains should be easy to clean, do not collect dust easily, be adjustable and resistant to misuse, and be made of fabric dense enough to control light appropriately.
- One alternative to daylight access is to use the upper window and window glass to control lighting levels and visual access between the inside and outside to avoid distraction. (Leo Care, 2012)
- Electric light bulbs should be low-glare and avoid any unwanted flash or noise, and the fluorescent lamp should be avoided, preferred use an LED lamp that simulates daylight, giving homogeneous lighting, higher efficiency, and longer life.

Fig (19) Blind persons do not live in the dark, they must benefit from illumination and colour reduction. The blind frequently has a sense of light, colour, and true contrast.

9) Audio system:

Children with visual impairment rely mainly on their hearing in their learning process. Providing room acoustics and isolating sound between rooms and external noise improves their access to learning.

Children with visual impairment rely mainly on their hearing in their learning process. It increases their access to learning by providing room acoustics and separating sound between rooms and from outside noise. (Department for children, 2008)

- The use of double glass should provide the required volume noise sound reduction. Doors are the second biggest noise problem.
- Use absorbent surfaces for optimal sound quality in the ceiling.
- Slide-resistant floors with acoustic support - such as linoleum – are healthy and water-resistant. Create spaces that reduce the echo of sound.
- Use audio signals in critical places. Adding an alarm or countdown to an intersection, for example, can make the crossing safer by alerting the blind user when the crossing is safe.

➢ **Practical case study :**

Rehabilitation of educational spaces at Mansoura College school to suit visually impaired and blind students:

The designed school has classrooms for different age stages the design tries to create a sense of learning and excitement by integrating it with open spaces, and these spaces often become a central experience for blind people because this is their educational environment.

The design idea is to compensate for the sense of sight in the other senses.

Multisensory stimulation: Providing a variety of contacts, sounds, and odours to restore life to the inner void can help the visually impaired recognize and deal with different internal spaces by using different senses **First, the orientations:** one axis of movement, regardless of the person's position, was linked to a slanted movement, the right side of which represents horizontal and flat surfaces, and the left side has tilted and curved surfaces, thus confirming the direction and making it easier to recognize the vacuum.

Second, understanding the vacuum and absorbing it:

- Simple, uncomplicated elements were used in the interior design to help accommodate the vacuum
- The dynamic wall contains motion and

represents a visual and sensory sequence, making the direction of the movement-oriented towards the desired path.
- Two horizontal flats give a sense of static
- and suit their function as there is a set of seats on the ground level and effective display space, which is the means of explanation using only the hearing sense.

Thirdly, relying on the rest of the senses:

- The tendencies on the sidewall encourage continued consideration of the end.
- Wood is used to distinguish the space using the sense of touch to distinguish the vacuum according to the contact of the materials.
- Wood absorbs sound, reducing noise and giving a sense of auditory comfort.
- Wood has a distinctive smell that makes users of the vacuum distinguish it without fear.

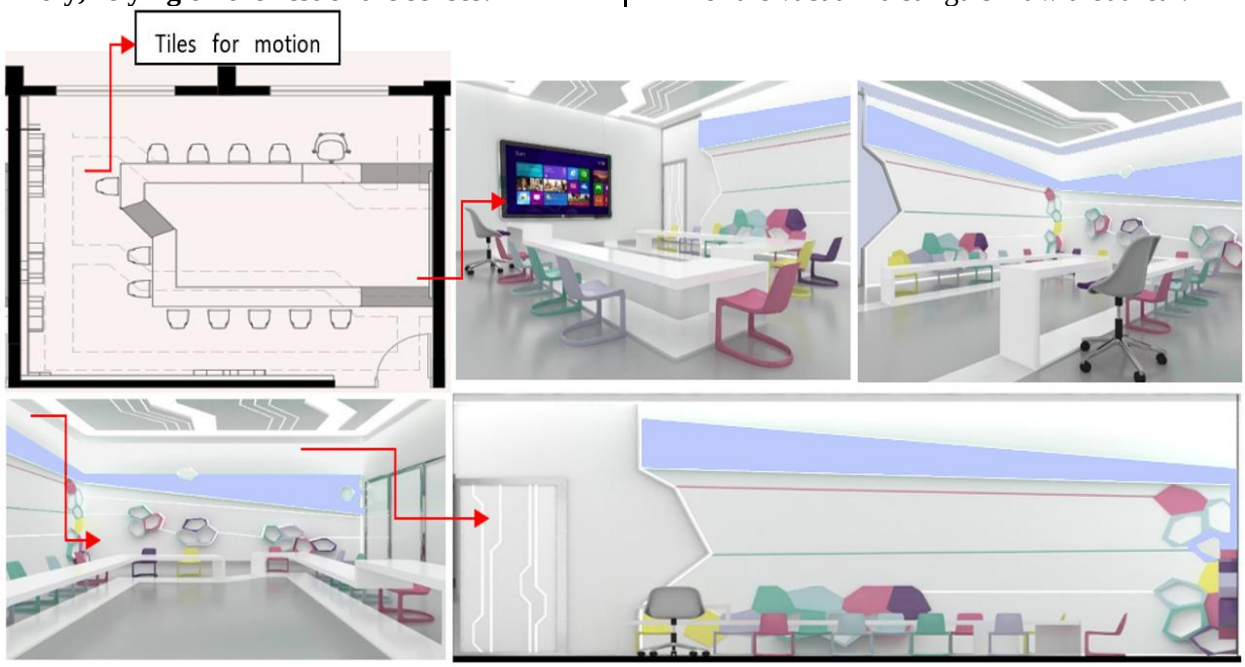


Fig (20) a vision of the design of one of the classrooms where the distribution of sitting units was taken into account continuously to form a compulsory movement path and ensure that there is no dispersion during the movement as the use of different contacts in the walls and pieces of furniture

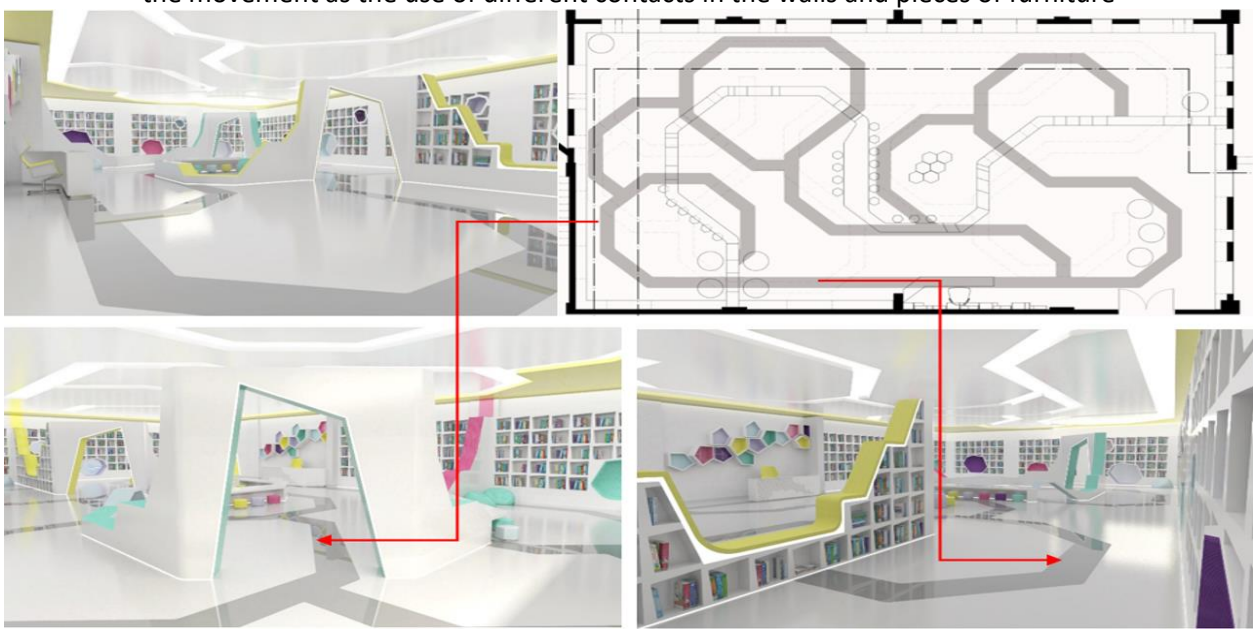


Fig (21) a vision of the design of one of the classrooms where the distribution of sitting units was taken into account continuously to form a compulsory movement path and ensure that there is no dispersion during the movement as the use of different contacts in the walls and pieces of furniture and the use of white indirect lighting

Results:

- When designing different interior spaces, the needs of all people who will use them, including those with vision difficulties, must be taken into account, but it is necessary to ensure that all people of different categories can use

them well.

- By understanding the challenges faced by the visually impaired, and implementing appropriate designs in buildings and outdoor spaces to accommodate them can create spaces that accommodate everyone who needs to use them.
- Technology can visually give vulnerable users more flexibility in understanding spaces and facilitating their use.
- It's important to understand our human senses and that architecture is not just a visual tool.'

Recommendations:

- The architect must not limit his services to a part of society only oblivious to an essential part of it where the visually impaired constitute not a small percentage in society as he has to reach the principle of design unhindered to deal in most architectural spaces, whether public or private.
- Providing easy-to-use entrances as an easy means of movement, whether using wheelchairs or prosthetic devices and the signature of vertical means of communication security that enable the visually impaired to access all the roles of the building.
- Simplifying the movement paths to facilitate the mental image and stay away from different levels on the floors must be the Paths leading to the emergency exits are easy to use
- Use materials of nature and use different materials to simplify the movement paths
- The government must take into account persons with disabilities in city planning. The design of different architectural spaces must provide them with the same or more rights to use streets, transportation, as well as gardens to be the same as other citizens.

Acknowledgement: This work is dedicated to the soul of our beloved professor Dr: Akram El Away, the president and godfather of Horus University-Egypt, who passed away on February 3rd, 2021. We will miss you and love you always. Your love will light our way and your memory will be forever in our hearts. We will grasp you in our hearts till we can cuddle you again in heaven.

Reference:

1) Adler, G. B.-C., Timothy; Fontana-Giusti, Gordana. (2012). *Scale Imagination, Perception, and Practice in Architecture*. Scale Imagination, Perception, and Practice in Architecture.
2) Almaz, A. F. H. A. (2017). The role of the digital revolution in developing creativity in interior architecture. *International Design Journal*, *7*(3), 123-135.
3) Botha, A. (2012). An early childhood development centre for blind and visually impaired children *Interior decoration.Design. Blind Children's Center.* Thesis/dissertation, Manuscript: Dissertations, Academic - South Africa.
4) Craven, J. n. d. (2020). Can You Build Special Buildings for the Visually Impaired? *Thought Co. Accessed-https://www.thoughtco.com/designing-for-the-blind-3972260.*
5) Danielsen, I. L. A. G. (2012). Basic Psychological Need Satisfaction in LeisureActivities and Adolescents Life Satisfaction. *article published with open access at Springerlink.com*, 1589.
6) Department for children, s., and families. (2008). *Designing for Disabled children and children with special educational needs*. UK: Building Bulletin
7) Horton, J. K. (1988). Education of Visually Impaired Pupils in Ordinary School. *Guides for Special Education, 6*, 2–4, 6–7.
8) Impaired., T. S. f. t. B. a. V. (1998). *Performance measure definitions for Texas School for the Blind and Visually Impaired for the agency strategic plan* Austin, Tex.
9) Ireland, G. o. (2004). *Technical Guidance: Access for People with Disabilities*. Retrieved from Department of the Environment Heritage & Local Government:
10) Kreij, K. V. (2008). *Sensory Intensification in Architecture*. *Technical University Delft*.
11) Leo Care, B. (2012). SEN School Design; Inclusion, Integration and Inspiration, design. Retrieved from www.accessappraisals.co.uk
12) Maisel, E. S. J. (2012). *Universal design: creating inclusive environments*. New York, Hoboken, New Jersey: John Wiley & Sons, Inc.
13) Mayer, E. B. (2020). Blind designers: a proposal for schools of design. *a Journal for Design, 1997*(7), 24-31.
14) Murphy, M. G. R. (2002). *Teaching the student with a visual impairment: a primer for the classroom teacher*. U.S.A.: Louisville, KY: American Printing House for the Blind.
15) Pallasmaa, J. (1996). *The Eyes of the Skin: Architecture and the Senses*. London: Academy Group Ltd.
16) Parida, S. (2020). Creative Crews Discusses Its Award-Winning Classroom Makeover for Blind Children in Thailand. *crews-discusses-its-award-winning-classroom-makeover-for-blind-children-in-Thailand, http://de51gn.com/creative-*

17) Picinali, L., Amandine Afonso Jaco, Michel Denis, and Brian Katz. (2014). Exploration of Architectural Spaces by Blind People Using Auditory Virtual Reality for the Construction of Spatial Knowledge. *International Journal of Human-Computer Studies 72*, 393.
18) Steinfeld, J. A. E. (1980). *Accessible buildings for people with severe visual impairments*. The United States. Department of Housing and Urban Development. Office of Policy Development and Research.: [Washington]: The Office: For sale by the Supt. of Docs., U.S. G.P.O.