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Inclusive School Design for Children with Visual Impairment: The Relation between Design Guidelines and Spatial Perception

Sarah Oteifa[1, a*], **Khaled Dewidar**[2, b,] **and Yasser Mansour** [3, ab]

1 Assistant Lecturer at the British University in Egypt
2 Vice Dean at the British University in Egypt
3 Professor of Architecture at Ain Shams University
E-mail: [a*]sara.magdy@bue.edu.eg, [b]Khald.Dewidar@bue.edu.eg,
[ab]yasser_mansour@eng.asu.edu.eg

Abstract

Inclusivity is a design approach that aims to include everyone, specifically people who are excluded or marginalized, and giving them equal opportunities. Visually impaired children tend to suffer from physical barriers in schools, due to the existing architectural visual dominance. The main research problem is that the inclusive school design criteria usually address the aspects of safety and accidents avoidance, not giving enough attention to the spatial experience. In this study, the relation between existing inclusive school guidelines for the visually impaired and the visually impaired perceptual tools is analysed. The results show how the design criteria that depends on non-visual spatial design details affect the spatial perception of the visually impaired children, and the strength of relationship between the available guidelines and spatial perception. It also prioritizes the guidelines based on their importance in relation to the visually impaired perception. The results can help school designers to enhance the visually impaired spatial experience by knowing which perceptual attribute to address.

Keywords: Inclusivity, Disability design, visually impaired children

1. Introduction

According to the World Health Organization, at least 2.2 billion people suffer from visual impairment, with 2.2 million in Egypt [1]. Efforts have been made worldwide to include challenged children in the educational mainstream by creating schools that promote justice and enhance the learning and performance of all children. Inclusivity aims to bring change, to readdress, through design, the many struggles in everyday life that do not accommodate the diverse capabilities children with disabilities [2]. Relatively, little published research, specifically in the field of special education has been conducted in Egypt. A movement towards normalization and inclusive education is taking place in Egypt since 2016. The Minster of Education issued a decree that children with disabilities should be allowed in normal schools and not segregated, except by choice. One of the main regulations restricted on schools to allow children merging is: "Rebuilding or renovating the school buildings and create environments that suit the needs of the disabled students" [3]. Inclusivity is a concept that gives equal opportunities to all children in the education system. The following (fig.1) illustrates the meaning of inclusivity and its difference between it and integration and segregation.

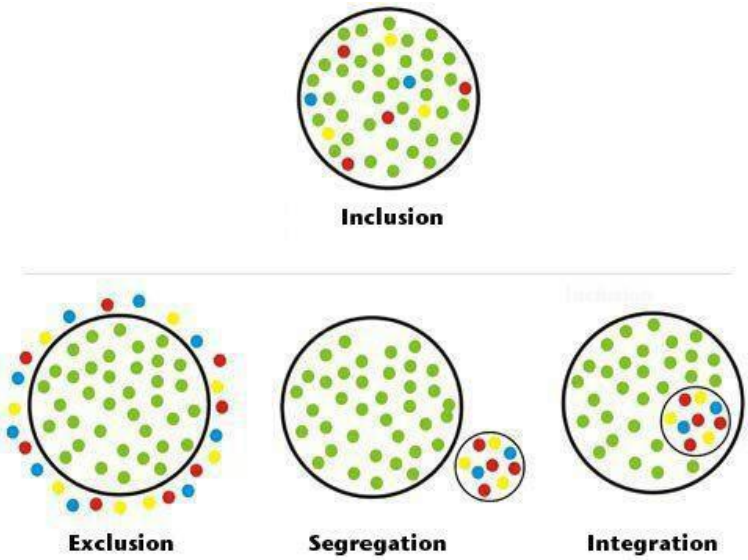


Figure 1. The difference between Inclusion, segregation, integration and exclusion [4]

2. Research Limitations

There were several limitations in this research. Firstly, the research questionnaire was administered to different experts in the architectural engineering field, some of them were not in close contact with visually impaired cases. Therefore, predicting the strength of relationship between the different physical factors and the perceptual attributes can be different. The access to shadow teachers who dealt with visually impaired children was not easy and resulted in a limited number of participants. The findings also depended on the repetition if the physical factors which have strong relations while in fact, some of inclusive design guidelines, address one perceptual attribute only, and yet, are extremely important for example in avoiding accidents.

3. Understanding Disability and the Visual Impairment

This section provides details for typesetting your manuscript according to the formatting guidelines. Generally, disability is any physical or mental struggle that has an effect on one's life activities [5]. Sensory disability is any physical impairment in one or more of the senses and is commonly used to refer to visual or hearing disabilities [6]. The World Health organization grouped disability into visual, hearing-related, physical and cognitive. Visual impairment includes "blindness, low vision, and color blindness" [1].

There are several disability models explained in previous research, from which, the most important in this paper is the social model of disability. The social model was created by the disabled people themselves as a reaction to how oppressed and socially alienated the health and welfare made them feel. It describes disability as the society's problem and not the suffering person's [7]. Fig. 2 shows the difference between medical and social model of disability in children [8].

Medical model	Social model
Child is faulty	Child is valued
Diagnosis	Strengths and needs defined by self and others
Labelling	Identify barriers and develop solutions
Impairment becomes focus of attention	Outcomes-based programs designed
Segregation and alternative services	Training for parents and professionals
Ordinary needs put on hold	Relationships nurtured
Re-entry if 'normal' enough or permanent exclusion	Diversity welcomed; child is welcomed

Figure 2. Difference between medical model and social model of disability [8]

3.1. Visually Impaired Spatial Perception

Visually impaired and blind people's senses are stimulated by multisensory cues in the built environment, which helps them with their perceptual tasks (understanding and making sense of their surrounding environment) consequently, they become able to perform tasks and take decisions based on the cognitive and operating tasks [9]. According to previous studies, based on analysis of thick descriptions from different visually impaired sources, similarities in experience were highlighted to be able to understand their spatial understanding and perception.

The concluded attributes contribute effectively to the visually impaired person's perception, to allow them to use the compensatory non-visual qualities of space to achieve an efficient and independent experience. Senses do not work independently, but rather, they integrate and synchronize to achieve the following:

a. *Safety precaution and accidents avoidance* [10]: The most important consideration when designing for the visually impaired is to minimize collisions, accidents, and obstacles.

b. *Spatial awareness and understanding* [11], [10], [9]: The ability to navigate, maintain orientation, and move around independently requires a strong understanding of the surrounding space. It is essentially what creates the mental map of the environment (vague awareness, identifying spatial characteristics and recognizing the relevant parts of perceptual objects). Designers should provide as much "passive information" as possible.

c. *Spatial recognition and remembering* [11], [10], [12]: The memory is typically associated to spatial recognition, recalling This is what takes place when a person enters a space, comprehends it, and then returns to it later. The blind individual recognizes the identity if this space

d. *Feeling ambiance and atmosphere* [11], [10]: A multisensory experience is typically required to feel the ambiance of the surrounding space. The ability of a location to evoke specific feelings and emotions, knowing the surroundings, identity, atmosphere, and setting rather than merely the physical layout. For the visually impaired person, the synchronization of senses together, hearing specific sounds, certain smells, and touching the surroundings makes him/her understand the ambience. This mood can be natural or man-made, or a mix of both.

e. *Understanding objects properties and attributes* [11], [9]: According to the kinesthetic pressure applied or the direction of moving hands or feet of a person, understanding of objects attributes and characteristics happens. Exploration,

comprehension, and identification of objects involve determining their size, shape, weight, scale, and proportion.

3.2. Typeset Text

Architectural visual dominance has recently been a subject of debate. Juhani Pallasmaa criticizes modern architecture and its inability to relate to all five senses. In his book "Eyes of the Skin", he critiques the imbalance of the five senses and argues that modern architecture favors the sense of vision over all other senses; to him this has led to "detachment, isolation, and exteriority". As mentioned by Pallasmaa, prioritizing vision over the other senses is considered an "inarguable theme". It is well known that the perception of sight is the most important and this is due to physiological, perceptual and psychological facts [13]. As quoted by Le Corbusier: "Our eyes are made to see forms in light; light and shade reveal these forms; cubes, cones, spheres, cylinders, or pyramids are the great primary forms which light reveals to advantage. Everybody is agreed to that, the child, the savage, and the metaphysician. It is the very nature of the plastic arts" [14]. Visual dominance has been particularly noticeable in the past three decades, with the impressive and memorable visualizations dominating architectural discourse. Rather than providing a rich spatial experience, architecture has been using the psychological approach of advertising and persuasion; buildings have become image products, away from depth and sincerity [15].

The problem is, how can a visually impaired person deal with his/her everyday life in such a visually biased world

4. Inclusive Design

4.1. Inclusive Design Principles

Inclusive, is the idea of "including everyone", allowing and accommodating people who have been known for being excluded based on their race, gender, or ability. Relating to education, it is the concept in which students with disabilities are included with the general student population" [16]. Referring to education, it is an approach of redesigning mainstream schools by developing classrooms, academic curriculum, and activities to accommodate students with disabilities, allowing all students to learn and participate together [17]. The following fig. (3) illustrates the importance of inclusive education on the social, economic, and educational levels.

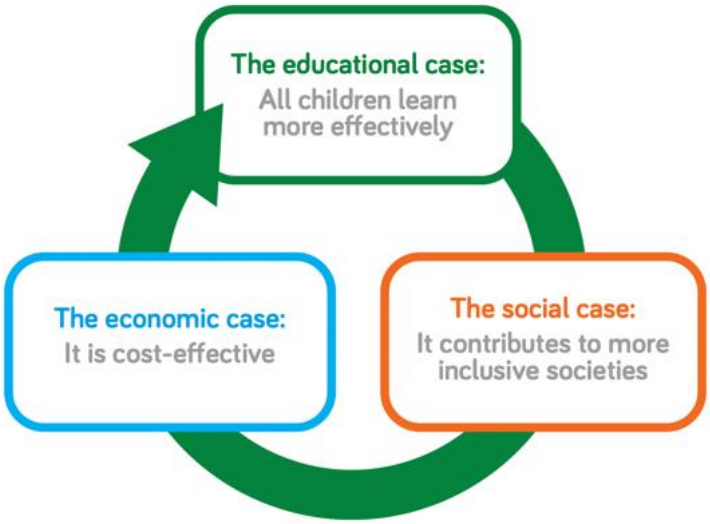


Figure 3. The importance of inclusivity on the educational, economic, and social levels [17]

According to the guide for designing for disabled children and children with special educational need, table 1 shows the inclusive design principles for schools [18, 19, 20]:

Table 1 Inclusive design principles for school design

Access	• Accessible environments help children clearly understand and navigate space by having: • Simple, clear layout, easily understood by all users • Accessible circulation routes, with enough width • Caring for details (such as door handles) • Means of escape designed to be easy for everyone
Space	• Some children with disabilities have different spatial requirements • It is important to have a safe clearance around furniture and equipment

Sensory awareness	Sensory experience is very important for developing all children, including the ones suffering from sensory disabilities: • glare-free controllable lighting • good sound and acoustical design, considering the needs of people with sensory impairments • Visual contrast and texture • adjusted levels of stimuli and distractions • Sensory elements: designing color, light, sound, texture, and scents
Enhancing learning	well-designed environment enhances the educational experience for all children, not just the visually impaired. Designers need to consider: • Accessible workstations with space for learning aids and assistants alongside • Furniture, fittings, and equipment that support a range of learning and teaching styles
Flexibility and adaptability	Schools must be adaptable and flexible to meet the current and future needs of children with disabilities. Methods include: • Rationalizing spaces so their functions be adaptable over time • Spaces with partitions to be easily readjusted • Minimizing fixed furniture and fittings
Health and well-being	Promoting health and wellbeing is very important and can be through: • Thermal comfort • Well ventilated spaces with the right oxygen level • Minimizing background noises
Safety and security	Feeling safe is extremely important for all children: • Minimizing the risk of harm, accidents and collisions through design

4.2. Inclusive Design Principles

According to Abouelsaad, considering the different architectural needs of all expected children in schools is essential in inclusive schools. In the following table (2), Abouelsaad discusses the overlaps and conflicts of the requirements and needs of different user groups and mentions the most common requirements and adjustments for including the widest spectrum of different needs [19]. In this research, we are focusing only on sensory, visual impairment.

Table 2 Architecture Design guidelines to achieve inclusivity for visually impaired children [19]

Different/ Special needs / Design requirements		1) CaL				2) BEaSD	3) CaI		4) SaP			
		a) SPLD	b) MLD	c) SLD	d) PMLD	a) BESD	a) SLCN	b) ASD	a) HI	b) VI	c) MSI	d) PD
1- Adequate spaces and areas	Extra rooms, and areas, and circulation routes [a]	√	√	√	√	√	√	√	√	√	√	√
	Support rooms [b]	√	√	√	√	√	√	√	√	√	√	√
	Flexible & adaptable spaces [c]	—	—	—	—	√	—	√ [c*]	√	√	√	√
	Enough storage areas [d]	—	—	—	—	√	—	√	√	√	√	√
	Suitable toilets & changing spaces [e]	—	—	√	√	√ [e*]	—	—	—	—	√	√
2- Physical movement and way-finding	Travel easily and safely [f]	√	√	√	√	√	√	√ [f*]	√	√	√	√
	Clear signage and symbols around with visual and sound signal alarms [g]	√	√	√	√	—	√	√ [g*]	√	√	√	—
	Easily identification for different spaces in terms of size, colour, style, noises and smells from activities happening	—	—	√	√	—	—	—	√	√	√	—
3- Visual Aspects	Good levels of appropriate lighting (controllable & adjustable) [h]	√	√	√	√	√	√	√ [h*]	√ [h**]	√ [h***]	√	√
	Boosting the use of appropriate colours & using colour contrast of objects [i]	—	—	—	—	√	—	√ [i*]	—	√ [i**]	√	—

Design requirements \ Different/ Special needs		1) CaL				2) BEaSD	3) CaI		4) SaP			
		a) SPLD	b) MLD	c) SLD	d) PMLD	a) BESD	a) SLCN	b) ASD	a) HI	b) VI	c) MSI	d) PD
4- Soothing environments	Well-proportional flat spaces painted by pale colours without any bright objects or paintings	—	—	—	—	—	—	√ [j]	—	—	—	—
	Colourful stimulating environments	—	—	—	—	—	—	X [k]	√	—	X	—
	Using different materials, finishing, and aromas	—	—	√	√	—	—	—	√	√	√	—
5- Acoustic aspects	Minding the shape & proportions of spaces [l]	—	—	—	—	—	—	√	√	—	—	√
	Using acoustic absorption and sound insulation for floors, walls and ceilings [m]	—	—	—	√	√	—	—	√	√	√	—
	Careful placing and timing for noisy activities	—	—	—	—	—	√	√	√	—	—	—
	Appropriate materials that will not disadvantage some pupils [n]	—	—	—	—	—	—	√	√	—	—	√
6- Sensory environments and temperature	Enhancing sensory experiences and haptic sense	√	√	√	√	—	√	—	√	√	√	—
	Using adjusting temperature devices wherever possiple [o]	√	√	√	√	√	√	√	√	√	√	√
7- Equipment	Providing suitable equipment and learning aid devices [p]	√	√	√	√	√	√	—	√	√	√	√
8- Furniture	Using flexible and adjustable furniture [q]	—	—	—	√	√	√	√	√	√	√	√
	Avoiding heavy doors, contrast between doors & frames, and using alarm-linked devices to hold fire doors open	—	—	—	—	—	—	—	—	√	—	√

9- Fixtures and services	Keeping the main cables of electrical supply away from pupils areas [r]	—	—	—	—	—	—	—	√	—	√	—
	Providing induction loops and radio systems [s]	—	—	—	—	—	—	—	√	—	√	—
10- Reaching practical solutions	Creative timetabling and good management of available resources	√	√	√	√	√	√	√	√	√	√	√
	Suitable placement in the classroom [t]	√	√	√	√	√	√	√	√	√	√	√
	Avoiding noise or distractions like outdoor views, blind cords, pipes, etc.	—	—	—	—	—	—	√	√	√	√	—
	Extra safety precautions	—	—	√	√	√	—	√	—	√	√	—
	Minding possible changes of needs and new possible impacts on design	—	—	√	√	—	√	√	—	—	√	√
	Suitable emergency procedures and exits [u]	√	√	√	√	√	√	√	√	√	√	√
	Using robust materials	—	—	—	—	√	—	√	—	—	—	—

5. Method

The main aim of this paper is to try to find the strength relation between the existing inclusive schools architecture design guidelines, specifically addressing the visually impaired, with the visually impaired spatial perceptual attributes. Each guideline can be related to one or more perceptual attributes and by finding this relation, guidelines can be prioritized based in their importance. The inclusive design guidelines are mentioned in table 2, while the visually impaired perceptual attributes are: 1. safety precaution and accidents avoidance, 2. spatial awareness and understanding, 3. spatial recognition and remembering, 4. feeling ambiance and atmosphere, 5. understanding objects properties and attributes.

5.1. Research design

A survey questionnaire was given to a sample of experts in the architecture design field, interior designers and shadow teachers that are in close contact with visually impaired cases, residing in Egypt. The questionnaire asked them to rate the strength of relationship between the different physical factors and how strong they think they are related to the

different perceptual attributes. The questionnaire was filled by 30 participants, 60% of the respondents are architects, 27% are shadow teachers, and 13% interior designers (fig.4).

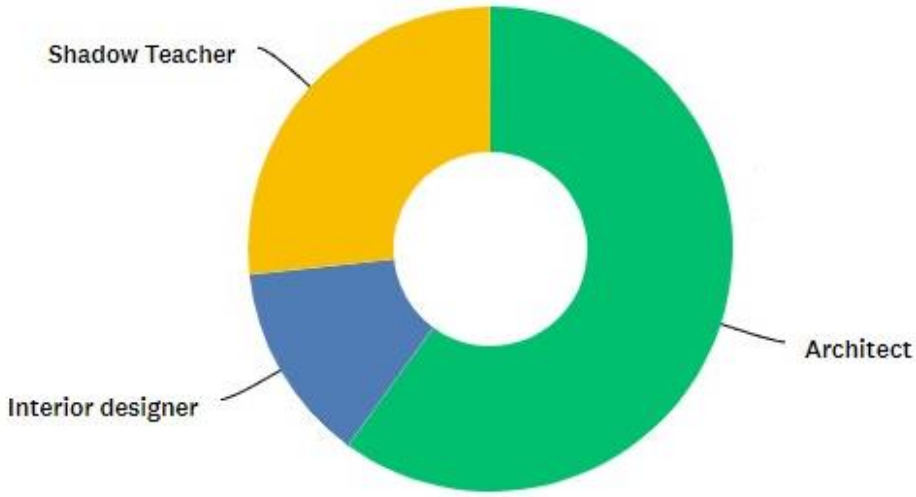


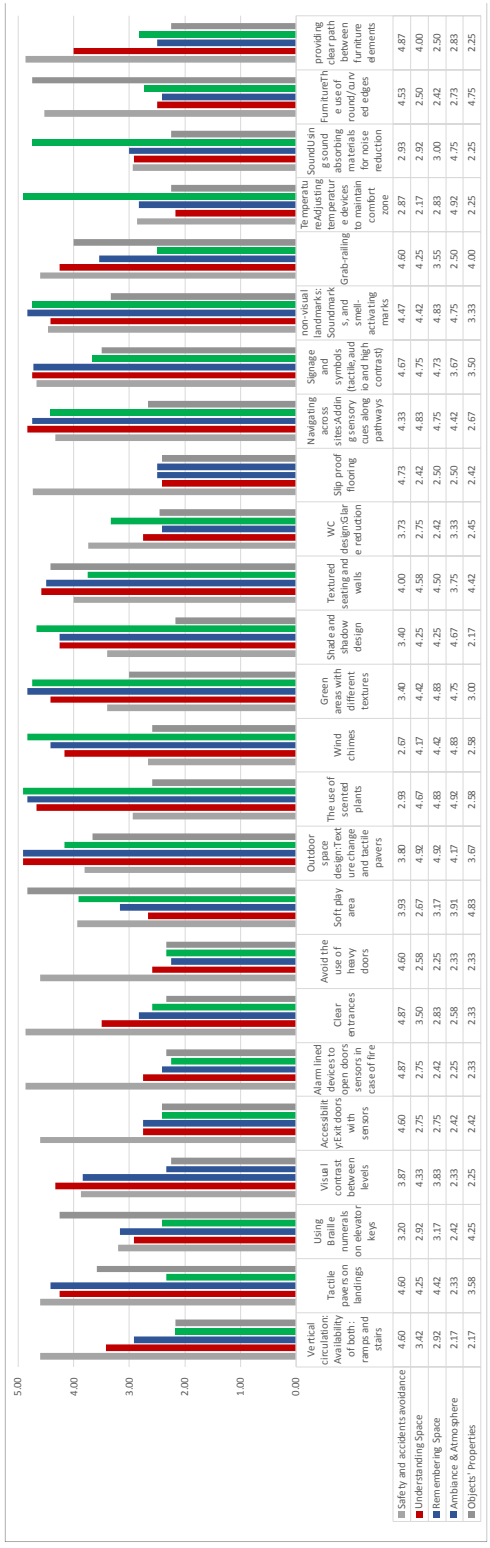
Figure 4. Questionnaire respondents' profession

5.2. Questionnaire design

The questionnaire administrated to the sample consisted of 5 main questions, each question is asking to rate the strength of relationship between each perceptual attribute with to all the extracted inclusive design guidelines through Likert scale. The scale used is from 1 to 5, where 5 represents very strong relation and 1 represents very weak relation. The quantitative data (means) generated from the distributed questionnaire is analyzed by Likert scale. The questionnaire started by asking about the profession and if the participant was in close contact with a visually impaired case.

5.3. Results

The mean values show the effect of the different attributes on the perception of the visually impaired. The following charts in Fig.5 shows the effect of the different physical guidelines on the perceptual attributes of the visually impaired.



	Vertical circulation: Availability of both ramps and stairs	Tactile pavers on landings	Using Braille numerals on elevator keys	Visual contrast between levels	Accessibility Exit doors with sensors	Alarm lined devices to open doors sensors in case of fire	Clear entrances	Avoid the use of heavy doors	Soft play area	Outdoor space design:Texture change and tactile pavers	The use of scented plants	Wind chimes	Green areas with different textures	Shade and shadow design	Textured seating and walls	WC design:Glare reduction	Slip proof flooring	Navigating across sites:Adding sensory cues along pathways	Signage and symbols (tactile and high contrast)	non-visual landmarks: Soundmarks, and smell-activating marks	Grab-railing	Temperature:Adjusting temperature devices to maintain comfort zone	Sound:Using sound absorbing materials for noise reduction	Furniture:The use of round/curved edges	providing clear path between furniture elements
Safety and accidents avoidance	4.60	4.60	3.20	3.87	4.60	4.87	4.87	4.60	3.93	3.80	2.93	2.67	3.40	3.40	4.00	3.73	4.73	4.33	4.67	4.47	4.60	2.87	2.93	4.53	4.87
Understanding Space	3.42	4.25	2.92	4.33	2.75	2.75	3.50	2.58	2.67	4.92	4.67	4.17	4.42	4.25	4.58	2.75	2.42	4.83	4.75	4.42	4.25	2.17	2.92	2.50	4.00
Remembering Space	2.92	4.42	3.17	3.83	2.75	2.42	2.83	2.25	3.17	4.92	4.88	4.42	4.88	4.25	4.50	2.42	2.50	4.75	4.73	4.83	3.55	2.83	3.00	2.42	2.50
Ambiance & Atmosphere	2.17	2.33	2.42	2.33	2.42	2.25	2.58	2.33	3.91	4.17	4.92	4.83	4.75	4.67	3.75	3.33	2.50	4.42	3.67	4.75	2.50	4.92	4.75	2.73	2.83
Objects' Properties	2.17	3.58	4.25	2.25	2.42	2.33	2.33	2.33	4.83	3.67	2.98	2.98	3.00	2.17	4.42	2.45	2.42	2.67	3.50	3.33	4.00	2.25	2.25	4.75	2.25

Figure 5 Questionnaire results: mean values

According to the mean values concluded from the questionnaire, the physical environment has a direct effect on the perception the visually impaired. For the first perceptual attribute:

- *Avoiding accidents and providing a safe environment*: the following physical factors has the strongest effect: Using alarm lined doors with sensors in case of fire with M=4.87, having clear entrances without obstacles, providing clear pathways between furniture elements. The following physical factors are also strongly related to accidents avoidance respectively: Using slip-proof flooring, using tactile and audio signage and symbols, availability of both ramps and stairs in each level change, using tactile pavers on stairs landings, using exit doors with sensors, avoiding the use of heavy doors, using grab-railing, using furniture with curved edges, adding non-visual landmarks, using textures seating and walls. There are other physical factors that affects avoiding accidents and safety precautions, but the mentioned factors have the highest effect.

- *Spatial understanding and awareness*: According to the mean values, the following physical factors have the strongest effect: Texture change and tactile pavers change in space with M=4.92, and M=4.83 adding sensory cues along pathways. The following physical factors are also strongly related to spatial understanding respectively: adding tactile, audio and high contrast signage and symbols, the use of scented plants, using textured seating and walls, using green areas with different textures, visual contrast between levels, tactile pavers on stairs landings, using wind chimes in landscape, using grab-railing, designing shade and shadow in the landscape and providing clear path between furniture elements.

- *Recognizing and remembering space*: According to the mean values, the following physical factors have the strongest effect on recognizing and remembering space in inclusive designs texture change and tactile pavers with M=4.92, then M=4.83 using scented plants, green areas with different textures and using non-visual landmarks (sound-marks and smell-activating).Also, adding sensory cues along pathways, using tactile and audio signage and symbols, using textured seating and walls, tactile pavers on stairs landings, using wind chimes in landscape, designing shade and shadow are strongly related to remembering space, respectively.

- *Feeling ambience and atmosphere*: According to the mean values, the following physical factors have the strongest effect on feeling ambience and atmosphere in inclusive designs the use of scented plants with M=4.92, adjusting temperature to maintain comfort zone, then M=4.83 using wind chimes. Also, using green areas with different textures, using sound absorbing materials to minimize noise, designing shade and shadow and adding sensory cues along pathway.

- *Understanding objects attributes and properties*: According to the mean values, the following physical factors have the strongest effect on understanding objects attributes and properties in inclusive designs: having a soft play area with M=4.83, then M=4.75

using furniture with curved edges. Also, using textured seating and walls, using grab railing are strongly related to understanding objects attributes respectively.

6. Discussion

The data extracted shows how guidelines have a strong effect on certain perceptual attributes more than the others. Inclusive design guidelines are arranged in this research findings according to how many perceptual attribute it will address, and based on the strength of relationship concluded from the questionnaire. The attributes are arranged based on their strength of relationship, starting with the stronger to the weaker. Designers can easily choose the right guidelines according to the design objective. The study shows that there are several crucial design factors that should be considered when designing for the visually impaired. The most important factors are:

Inclusive design guideline	Addressed perceptual attribute/s
Using textured seating and walls.	• Avoiding accidents and providing a safe environment • Spatial understanding and awareness • Recognizing and remembering space: Understanding objects attributes and properties
Using tactile and audio signage and symbols:	• Avoiding accidents and providing a safe environment • Spatial understanding and awareness Recognizing and remembering space:
Tactile pavers on stairs landings	• Avoiding accidents and providing a safe environment • Spatial understanding and awareness Recognizing and remembering space

Furniture with curved edges,	• Avoiding accidents and providing a safe environment • Spatial understanding and awareness • Understanding objects attributes and properties
Adding non-visual landmarks,	• Avoiding accidents and providing a safe environment • Spatial understanding and awareness Recognizing and remembering space
The use of scented plants	• Feeling ambience and atmosphere: • Spatial understanding and awareness • Recognizing and remembering space
Using green areas with different textures,	• Feeling ambience and atmosphere: • Spatial understanding and awareness • Recognizing and remembering space
Using wind chimes in landscape	• Feeling ambience and atmosphere • Spatial understanding and awareness Recognizing and remembering space
Designing shade and shadow in the landscape	• Spatial understanding and awareness • Recognizing and remembering space • Feeling ambience and atmosphere
Adding sensory cues along pathways,	• Spatial understanding and awareness • Recognizing and remembering space Feeling ambience and atmosphere:
Using grab railing	• Feeling ambience and atmosphere: • Spatial understanding and awareness Understanding objects attributes and properties

7. Conclusion

The study shows the importance of inclusive design guidelines in relation to the visually impaired perception. The following guidelines are considered very important when considering visually impaired children in school design, the guidelines are arranged based on its importance, starting with the most important to the least:

7.1. Using textured seating and walls, adding sensory cues along pathways

Tactile simulation is a very important means of communication for the visually impaired person. Creating interacting designs that stimulate the touching sense in classrooms and corridor walls have a great effect on enhancing the children's experience [21]. It can also help in Avoiding accidents, understanding spatial structure, remembering, and recalling space and understanding objects attributes and characteristics, respectively. Sensory walls were used in several case studies addressing the visually impaired and showing great success, like classroom makeover for the visually impaired in Pattaya, Thailand (fig. 6) the case study of visually impaired school in Mexico Taller de Arquitectura (fig. 7) [22] [21].

Figure 6. Interactive walls to enhance sense of touch: a blend of materials, textures, and acoustical features [21] [23]

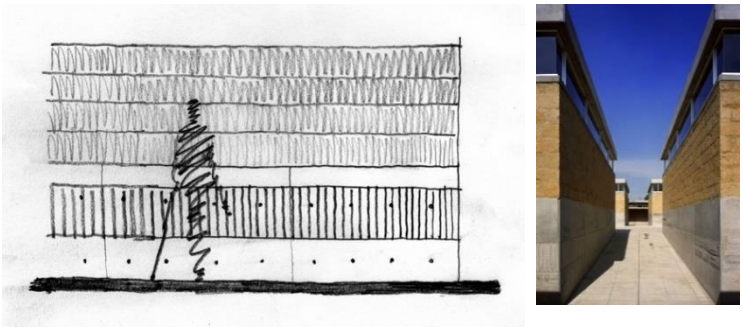


Figure 7. Taller de Arquitectura, textured elevations [22]

7.2. Using tactile and audio signage and labels

Means of communication through signage and labels should be using the other senses including both, tactile labels, and auditory ones. Tactile information, clues, and maps, including Braille, prominent symbols, visual, and sound signal alarms should be provided too in appropriate locations and should be clearly viewed [19]. Adding non-visual signage and labels in closely linked to avoiding accidents, understanding, and remembering space as concluded from this research. Fig.8 shows examples of tactile labels.

Figure 8. Navigation signage for the blind [24]

7.3. Using tactile pavers on stairs landings

Tactile pavers should be used, not only on stairs landings, but also on pathways to show the walking direction, in cross walks, entrances and exits (fig. 9). Adding tactile pavers before and after the staircase on landings is very important to avoid accidents and stair falls, it is also important in detecting the location and navigating. People with visual impairment expect having a different texture in certain areas, if they felt the blisters without finding the staircase for example, the textured pavement becomes not helpful and creates confusion [5].

Figure 9 Tactile pavers on stairs landings

7.4. Using furniture with curved edges

Having furniture elements that suit everyone, including visually impaired children, should be put into consideration. The furniture flexibility and adaptability, with the right dimensions, color contrast, different textures, and most importantly having curved finishing and smooth surfaces for exposed edges [5] [19].

7.5. Multisensorial landscape design

Landscape design allows children to interact with nature, and if the landscape is multisensory and addresses all senses, it can enhance their experience. Designing landscape features that: plays with shade and shadow, adding scented plants in certain areas can act as landmarks to determine the location and can help in navigation, using different landscape tactile textures, using wind chimes that act as auditory landmarks and using water features as guidance and non-visual landmark as well. The following picture (fig. 10) shows the use of different scented plants in visually impaired school in Mexico in front of each different building, as a way to determine the location.

Figure 10. Using scented plants as landmarks, school for the visually impaired [22]

7.6. The use of grab-railings

The availability of handrail is very important for the visually impaired navigation. Handrails should be placed on both sides of the staircase and in corridors, with the correct height and with color contrast to be clear for children with low vision [25]. Handrail should

be easy to grasp and securely fixed as visual impairment can affect the sense of balance. Handrail design can be modified by adding braille inscriptions to easily determine location (fig. 11).

Figure 11. The presence of handrail with braille inscriptions

The compensatory qualities of space, are the ones that when available, can help form an image of the surrounding environment for the visually impaired. Designing classrooms including multisensory features in furniture, walls, floors and all the different elements, staircases and ramps, hallways and corridors, playgrounds and gardens in inclusive schools should be rich enough to allow the blind child to perceive, understand, remember, feel and interact with the surrounding environment.

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