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Inclusive Schools Design: A Phenomenological Investigation into Visually Impaired Lived Experiences

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Abstract Inclusive design is an approach that aims to include special children with the general student population by developing the whole system, including the built environment, to accommodate their needs. Although efforts have been made to include children with visual impairments in the educational mainstream, available design guidelines often miss their "real lived experience". Available inclusive school design criteria are considered limited and the necessary design qualities of space to cope with their impairments are often missing the phenomenological, holistic approach. This study is conducted using a mixed method. The necessary spatial qualities are extracted from visually impaired children's real experiences through a phenomenological approach. An in-depth interview is done with visually impaired participants; transcriptions are extracted and analysed through thematic analysis. Thematic analysis is done by the NVIVO qualitative research analysis program. The themes are later validated through a personal experience at the blind museum "Dialogue in the Dark" in Cairo, Egypt. Research findings show and explain the main four themes that affect the visually impaired experience, which are: senses stimulation, accessibility, sense of place and perception of safety and they can be translated into design considerations.

Keywords Inclusive Architecture Design, Social Sustainability, Visually Impaired, Accessible Design

1. Introduction

Sensory impairment is the loss of one of the senses, causing deafness, blindness, visual impairment, or hearing impairment. This loss affects the perception of people in space and thus greatly affects the spatial experience. Losing the sense of sight, also known as visual impairment, can greatly affect one's ability to carry out everyday tasks safely and independently, leading to frustration and therefore "disability" [1]. Children with visual impairment struggle and face spatial obstacles due to the built environment visual dominance and ocular-centrism. There are several known reasons for ocular-centrism, one of the main reasons is that the sense of vision is the major medium for receiving information from a distance in a normal spatial perception process, and it typically takes precedence over information gained by the other senses [2], [3].

There are several models of disability, but this paper focuses on the social model, which does not consider the disability "a person's problem" but rather "an environmental barrier" [4]. The social model promotes the idea of deinstitutionalization, which means inclusion of children with sensory impairments and other disabilities in the community [5]. School design criteria for children with impairments are very limited, and the necessary design qualities of space to cope with their impairments are often missing in the built environment [6]. The main aim of this paper is to add a layer to inclusivity, by including visually

impaired children's real lived experiences in the inclusive design guidelines. The available guidelines usually address avoiding accidents rather than how to enhance the experience of the children themselves.

1.1. Visual Impairment and the Built Environment

The issue of architectural visual dominance has recently come up for discussion. Modern architecture is criticized by Juhani Pallasmaa for failing to address all human 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" [7]. Even though architectural practice has always been known for its visual dominance, architects and designers nowadays have started taking other senses into consideration. It is also of great importance how designers move beyond the exclusively visual focus in architecture that has been discussed in the writings of Juhani Pallasmaa and others, to consider the contribution that happens by other senses in spatial perception [8]. The built environment is one of the main considerations when referring to the social model of disability; it is probably the biggest symbol of the exclusion of people with impairments from society. Creating an environment that is convenient and suitable for everyone to use, means taking into consideration all the details, including materials, textures, lighting, sounds, and other design details. Building accessibility is not just a matter of creating a suitable physical layout; accessible environments should also provide enough information to the users. Creating this 'intellectual' and 'emotional' access for the users means considering all the different design details and tectonics. [9].

Space Perception refers to the ability to recognize relationships between various spatial aspects with respect to one's body's orientation in the presence of distracting information. Perception is the first thing that happens to people when they interact with space. It is the interface, the first contact between the body and the surrounding environment [10]. Perception is influenced by the cognitive structures of the individual. A blind person's spatial perceptions are formed using a cognitive map comprised of routes and landmarks [11]. When a person has a problem with one of the senses, the rest of the senses are automatically affected, causing low adaptability to the surrounding environment in which the person lives. Therefore, it contributes to the improvement of environmental conditions by establishing a suitable psychological and environmental climate that allows him/her to live with the circumstances considering the disruption of one of the senses [12].

1.2. Inclusivity

Inclusive, as defined by Marriam Webster means "including all people: accepting, accommodating and adapting to people who suffered from exclusion due to race, gender or disability". Inclusivity related to education promotes to include students with disabilities with the general student's population [14]. Over the past few years, accessibility, and equal opportunity for all have gained importance. Nowadays, accessibility is taken into consideration in most of the design decisions. The terms "design for all," "universal access," and "inclusive design" refer to various methodologies that mainly concentrate on enhancing the accessibility for all users. The goal of inclusive design is to eliminate obstacles that cause extra efforts. It makes it possible for everyone to engage in daily activities in an equitable and independent way.

1.2.1. Inclusivity in Education: Design for All

Creating spaces like classrooms, along with academic programs, and extracurricular activities that can accommodate students with disabilities in a way that encourages participation and learning among all students is known as inclusion in education. It is a whole system, including the built environment. Non-visual designs, addressing the other senses like hearing, smelling, and touching, are used when creating environments for visually impaired people. This means that in addition to being impacted by the architecture's visual elements, the users will have a multisensorial experience [13].

There are general principles of inclusive design, as shown in Fig. 1, and these include [9], [14]: Focusing on the people, as they are the main "heart of design", taking into consideration the diversity and differences of users, removing barriers of any kind, and meeting as many people's needs in space as possible, offering choice to people, where a single design solution cannot accommodate all users, providing flexibility and adaptability, providing buildings and environments that are convenient and enjoyable to use for everyone and finally, making environments easy to use for everyone means considering signage, lighting, visual contrast, and materials.

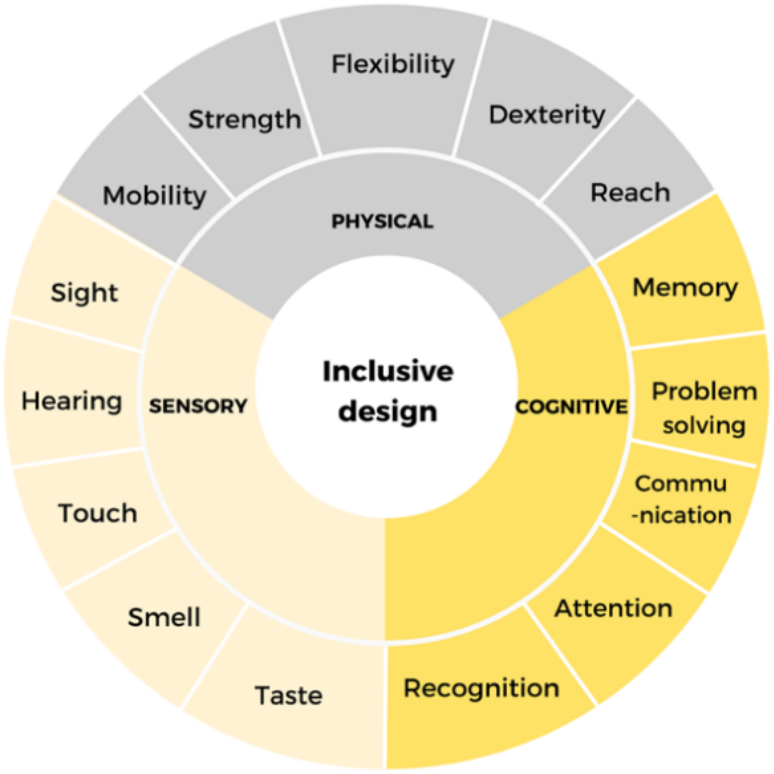

Figure 1. Inclusive design structure in terms of physical, sensory, and cognitive factors [15]

Many of the inclusive design architectural principles overlap and sometimes cause contradictions, so a designer needs to find the best design alternative using a holistic and well-coordinated approach [16]. According to the guide for designing for disabled children and children with special educational needs, and according to Abouelsaad, considering the different architectural needs of all expected children in schools is essential in inclusive schools. 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 [16], [17]. Visually impaired children require the following architectural design principles according in schools:

- Adequate spaces and areas: Extra rooms, areas, and circulation routes, support rooms, flexible and adaptable spaces, enough storage areas
- Physical movement and wayfinding: Travel easily and safely considering safety precaution elements like tactile pavers, simple, clear layout, easily understood by all users, clear signage and symbols with visual and non-visual aids, easy identification for different spaces in terms of size, color, style, textures, noises and smells from activities happening.
- Visual aspects: good levels of appropriate lighting (controllable and adjustable), boosting the use of appropriate colors and using color contrast of objects
- Acoustic aspects: Using acoustic absorption and sound insulation for floors, walls and ceilings
- Sensory environments and temperature: Enhancing sensory experiences and haptic sense, using adjusting temperature devices wherever possible
- Equipment: Providing suitable equipment and learning aid devices
- Furniture: Using flexible and adjustable furniture, avoiding heavy doors, contrast between doors and frames, using alarm linked devices to hold fire doors open
- Reaching practical solutions, Suitable placement of classroom, avoiding noise or distractions like outdoor views, blind cords, pipes, suitable emergency procedures and exits.

1.2.2. Inclusivity as a Sustainable Approach and its Relation SGDs

Sustainability relies on balancing three factors: environmental, economic, and social. The focus tends to be on environmental and economic features, usually without considering social factors [18]. A socially sustainable built environment should consider "all users" through an efficient plan and design. The following Fig. 2 explains the emerging themes of social sustainability [19]. The highlighted themes are the ones related to inclusivity in schools for children with visual impairments and any other disability.

The Sustainable Development Goals (SDGs) aim to achieve a better, more sustainable future for everybody. From the 17 sustainable development goals listed by the

UN, the following goals will be achieved through applying inclusive designs (fig. 2) [20].

The 2030 Agenda for Sustainable Development was adopted by the General Assembly in September 2015. Based on the idea of "leaving no one behind," the plan uses a "holistic approach" to ensuring sustainable development for all [21].

Figure 2. **f**SDGs goals related to inclusivity [21]

2. Methods

The research adopts a qualitative method, through which a multilayered activity is conducted to reach the main objective. The first methodology layer is existential phenomenological research to extract the visually impaired lived experience through their own transcriptions. This is done through conducting in-depth interviews with 11 VI participants (7 adults and 4 children). Data explicitation is done from the generated transcriptions, followed by thematic analysis to find the themes and sub-themes that will act as guidance to generate the design guidelines. The second layer is a validity check to ensure the validity of the themes extracted from the phenomenological research, as the validity of qualitative research represents the key aspects of the quality of research and its reliability. The validity check is reached through personal experience and engagement in Dialogue in the Dark Museum, a museum that provides the users with blind experience for a certain period to be able to feel the visually impaired person's feelings through a non-visual experience. The methodology process is depicted in Fig. 3.

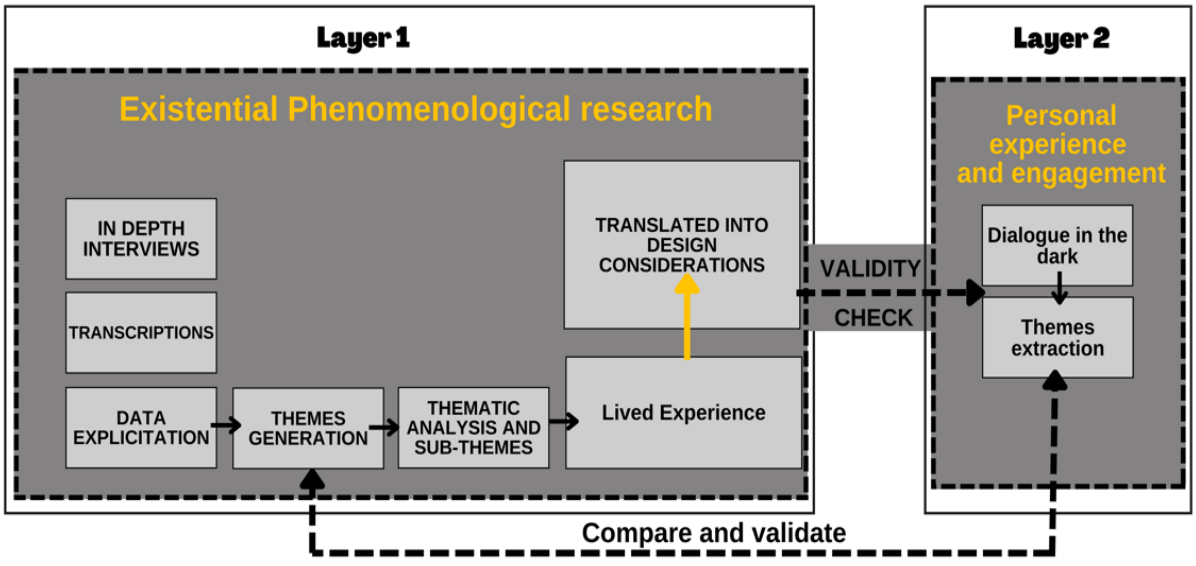

Figure 3. The methodology diagram (by researcher)

2.1. Methodology Phase 1: Existential Phenomenological Research

Existential phenomenological research is a qualitative research approach that explores the subjective experiences of individuals and the meaning they give to their experiences. This approach is rooted in existential philosophy, which emphasizes the unique and individual experiences of people, and phenomenology, which focuses on the subjective experiences of individuals and how they make sense of their world. Generalizability, for such an approach to human experience, is based more on understanding rather than statistical procedures [22]. In this type of research, content analysis is a qualitative analysis process, which involves the examination of implicit meanings expressed verbally and clarified from the inside by their psychological significance.

2.1.1. Participants

Phenomenological research requires that only a limited number of people be interviewed, given the largest amount of information and data extracted from a single interview [23]. The number of participants in a phenomenological study can vary depending on the goals and objectives of the research. The general rule is to aim for saturation, which means to continue collecting data until no new themes or insights emerge. A small number of participants can provide rich and in-depth information [24]. According to Creswell, 5-25 participants are suggested for a phenomenological study [25]. In the selection of participants for this study, it is important to consider the criteria for inclusion and exclusion, as well as the objective of the study. The participants are individuals who have had personal visually impaired experiences because this is the phenomenon being studied and they should be willing and able to share their experiences. The participants should also be diverse in terms of age, gender, ethnicity, and other relevant factors to ensure that the findings are representative of the target population. Adults are included in this study, with the same phenomenon as the targeted children, because due to the age constrain, children sometimes find it hard to express their feelings into words. The participation of adults, who were blind during the school period, was necessary to extract the required data. The following table (1) shows the interviewed participants, with their age and condition.

Table 1. Participants profile for the in-depth interview

Participant	Gender	Age	Condition
P1	Female	17	Totally Blind, Congenital
P2	Male	17	Totally Blind, Congenital
P3	Male	12	Totally Blind
P4	Male	16	Legally blind: low vision
P5	Female	14	Legally blind: low vision
P6	Female	22	Legally blind: low vision
P7	Male	25	Totally Blind
P8	Female	7	Totally Blind
P9	Female	9	Totally Blind
P10	Male	9	Legally blind: low vision
P11	Male	8	Totally Blind

2.1.2. In-depth Interview

In this research, transcriptions are extracted through inductive analysis of in-depth interviews conducted with 11 visually impaired participants as mentioned in the previous section. In-depth interviewing involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular situation or phenomenon. Average conducted interview duration was 15-20 minutes per person. Interview driving points were prepared to act as a guide and direct the conversation without affecting the transcription. The points of discussion were as follows:

1. Talk about your navigation experience in school, orientation, and mobility
2. What was/is your favorite place, and why?
3. What was/is your favorite design feature?
4. Places you liked and disliked, and why?
5. Recommend a design feature that will help your overall school experience overall experience.

2.1.3. Transcriptions Analysis and Themes Generation

The interviews are transcribed exactly as the respondents said them (see Appendix 1 for the transcriptions). When analysing reading and rereading the generated transcriptions, it was concluded that certain themes were repeated across the interviews. Themes are patterns that capture something significant or interesting about the data research question gathered from interviews. The repeated and imported words are highlighted and coded (Appendix 1) to help in data clustering in the thematic analysis process.

Sub-themes are elements that exist under the umbrella of the main theme, they are specific ideas within a larger theme quotation. Subthemes are generated based on the main themes, and the transcriptions, to act as guidance to translate the interview transcriptions into design considerations and guidelines.

Thematic analysis is done through NVIVO qualitative analysis research tool. NVIVO is computer-assisted qualitative analysis software that helps with coding and thematic analysis. After the analysis and coding of extracted transcriptions, it was concluded that there are 4 main themes mentioned and repeated, the following figure 4 shows the extracted themes.

Each theme was mentioned and repeated, with a different intensity. As shown in fig. 5, the most common and repeated theme was "senses stimulation" while the second one is "accessibility" with s, the third is "Sense of place", the fourth is "Perceived safety". Across the transcriptions, it was repeated many times how important it is to have elements that stimulate the other senses. The first extracted theme was sensory stimulation. Sensory stimulation is defined as the activation of one or more of the human senses, and this includes taste, smell, vision, hearing, or touch. This was the main extracted theme because, during the absence of vision, other modalities and higher cognitive functions can become more engaged and developed through what is called "sensory compensation". Senses stimulation tremendously affects the experience. The following table (2) shows the phrases that triggered the "stimulation of senses" theme with the subsequent sub-themes and indications for design considerations.

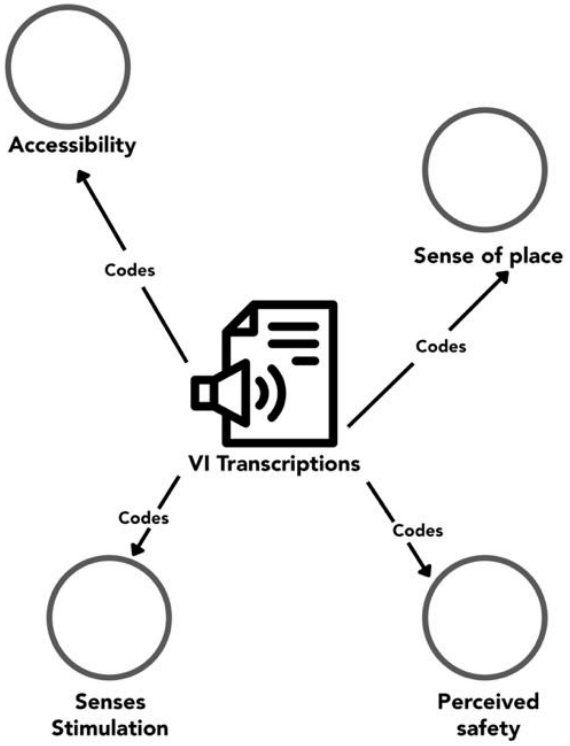

Figure 4. Extracted themes from transcriptions through NVIVO

The second theme was repeated information regarding accessibility, where respondents discussed important information regarding their journey from one place to another or their navigation and mobility obstacles and barriers. Accessibility has always been one of the most important aspects when designing for the visually impaired. Inclusive environments must be accessible for all, with good qualities of reaching and moving from one point to the next. Improving accessibility means improving the overall experience of visually impaired people. Previous research on the relationship between the built environment and disabled people's navigation suggests that a variety of physical factors play a significant role in reducing their independence. The following table (3) shows the phrases that triggered the "accessibility" theme with the subsequent sub-themes.

Table 2. Theme: Senses stimulation with subthemes

SENSES STIMULATION	
Transcriptions phrases	Sub theme: Indication
feel everything through my other senses	Non-visual cues
posters hung all year long on the wall-landmarks that lead me	Tactile/interactive walls
have a change in floor pattern	Tactile paver
following the sound of the ball	Sensory games
rope or handrail on the walls	Grab-railing
protruded printed label	Tactile labels
different smells to mark places.	Scented landmarks
change in pavers between areas.	Tactile paver
trying to follow the sounds	Auditory landmarks
high echo sometimes become very distracting	Eliminating noise
school theatre because of the high sound echo	Eliminating noise
what helped me the most is the posters hung all year	Tactile/interactive walls
Nature makes me feel so good	Integration with nature
I love the smell of grass	Integration with nature
the sound of running water	Integration with nature
smell of flowers	Integration with nature
shaded and had some greenery. I loved the weather there	Shaded areas
change in the floor texture	Tactile pavers
made me engage more and get more attached to my classroom:	Tactile/interactive walls

Table 3. Theme: Accessibility with subthemes

ACCESSIBILITY	
Transcription	Sub theme: Indication
Using normal school entrance with everyone was hard	Special entrance
did not have handrail, so I was usually scared to use it.	Grab-railing
posters hung all year long on the wall-landmarks that lead me	Tactile/interactive walls
having a handrail	Grab-railing
long and hard trip for me	Minimize distances
minimize the distance between classrooms.	Minimize distances
rope or handrail on the walls connecting classrooms.	Grab-railing
chart or kind of sign board on each classroom	Tactile/interactive walls
change in pavers between areas.	Tactile/interactive walls
Easy and clear desks and chairs arrangement is usually very important in navigation.	Furniture arrangement
movement becomes really hard,	Furniture arrangement
what helped me the most is the posters hung all year	Tactile/interactive walls
landmarks that lead me	Tactile/interactive walls
boundaries are important	Tactile pavers and fences
change in the floor texture	Tactile pavers
direct access from campus to the buses parking area	Minimize distances
I was so scared until the moment I reach my bus	Minimize distances
walls did not have any guides	Grab-railing
change in the ground texture before stairs and on the landings.	Tactile pavers

The third theme is related to how participants described their relationship with space and how certain non-visual aspects can build a sense of place and place attachment and a strong relationship with their surroundings. It is how some respondents defined their own meaning of livable and high-quality experience in the built environment. The following table (4) shows the phrases that triggered the "sense of place and place attachment" theme with the subsequent sub-themes.

Finally, the fourth theme was concluded when participants mentioned several times the words "not safe", "cautions", "scared". It was concluded that their own perception of safety had certain indications that were extracted from their own words. It is not just by identifying elements that prevent accidents and reduce collisions, but rather, elements that psychologically enhance the perception of safety. The following table (5) shows the phrases that triggered the "perception of safety" theme with the subsequent sub-themes.

According to the intensity of repetition of the themes, the most common and repeated theme was "senses stimulation" while the second one is "accessibility", the third is "perceived safety", the fourth is "sense of place". The following figure 5 shows the different repeated intensities of the generated themes.

Table 4. Theme: Sense of place with subthemes

SENSE OF PLACE	
Transcription	Sub theme: Indication
different smells to mark places	Scented landmarks
large open courts	Recreational space
change in pavers between areas	Tactile pavers
comfortable temperature is important.	Temperature adjustment
don't usually feel comfortable around noise	Eliminating noise
what helped me the most is the posters hung all year	Tactile/interactive walls
usually hard because of the sun	Shaded areas
Nature makes me feel so good	Integration with nature
I love the smell of grass	Integration with nature
the sound of running water	Integration with nature
smell of flowers	Integration with nature
shaded and had some greenery. I loved the weather there	Integration with nature
I love classroom decorations	Tactile/interactive walls
made me engage more and get more attached to my classroom	Tactile/interactive walls

Table 5. Theme: Perceived safety with subthemes

PERCIEVED SAFETY	
Transcription	Sub theme: Indication
I usually felt scared of accidents that might occur	Special entrance
did not have handrail, so I was usually scared to use it	Grab-railing
have a change in floor pattern	Tactile pavers
Handrail had voids, and this made me very cautious while using it	Grab-railing
usually scared of falling	Grab-railing
overly furnished classroom is that it creates many obstacles	Furniture arrangement
very cautious while walking around	Furniture arrangement
loved the most about my school is "acceptance". I never felt odd	awareness
Large playground fields without boundaries make me feel lost	Tactile pavers and fences
boundaries are important	Tactile pavers and fences
change in the floor texture	Tactile pavers
what helped me the most is the I was so scared until the moment I reach my bus	Minimized distances and guidance
walls did not have any guides	Grab-railing
change in the ground texture before stairs and on the landings	Tactile pavers
change in floor texture can be detected by my cane	Tactile pavers

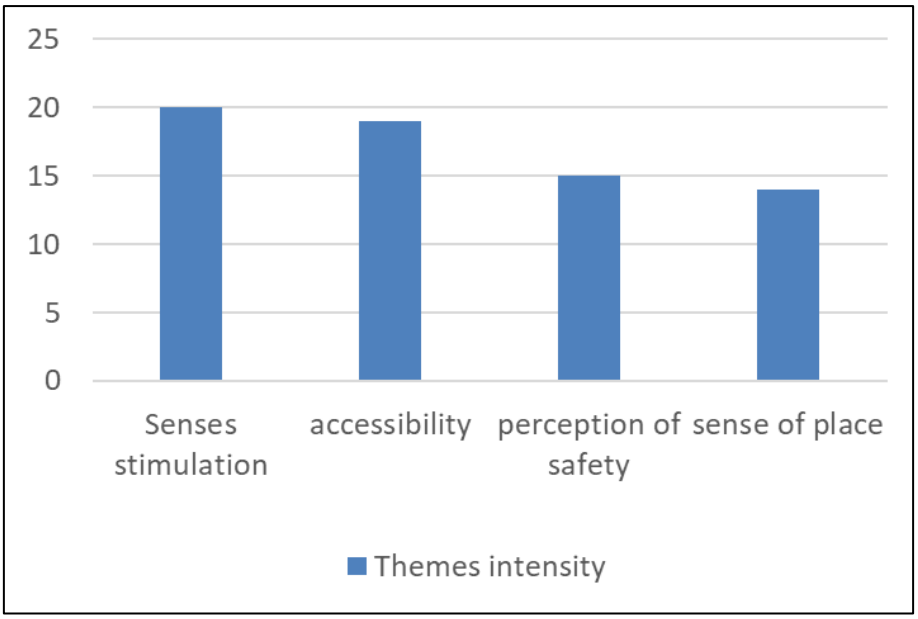

Figure 5. Intensity of emergent themes (by researcher)

2.2. Methodology Phase 2: Personal Experience and Engagement as Validity Check

Unlike quantitative research, which is considered measurable, in qualitative research, accuracy is crucial but not measurable.

The appropriateness of any research value, tools and techniques, and procedures, such as data gathering and validation, is referred to as validity. There are several techniques that ensure the validity of the research, in this paper, personal experience and engagement are used. In personal experience and engagement, researcher interacts closely with, and learns about the researched subjects. Their own experiences and perspectives play a significant role in the investigation and are essential to understanding the phenomenon and ensuring the validity of the extracted data.

2.2.1. The Experience

The personal experience was a personal blind experience in "Dialogue in the Dark" museum. The experience relies on the senses of touch, taste, smell, and sound in darkened rooms to discover the surrounding environments while being guided by a blind or visually impaired person using a white cane (fig. 6).

Figure 6. Dialogue in the dark museum in Egypt

The museum consists of five spaces or rooms, each space represents a certain experience. When entering each room, the experience is described using simple keywords, which will be later used to be compared to the extracted themes from the interviews conducted in phase 1. The fig. 7 represents the experience through personal interpretation.

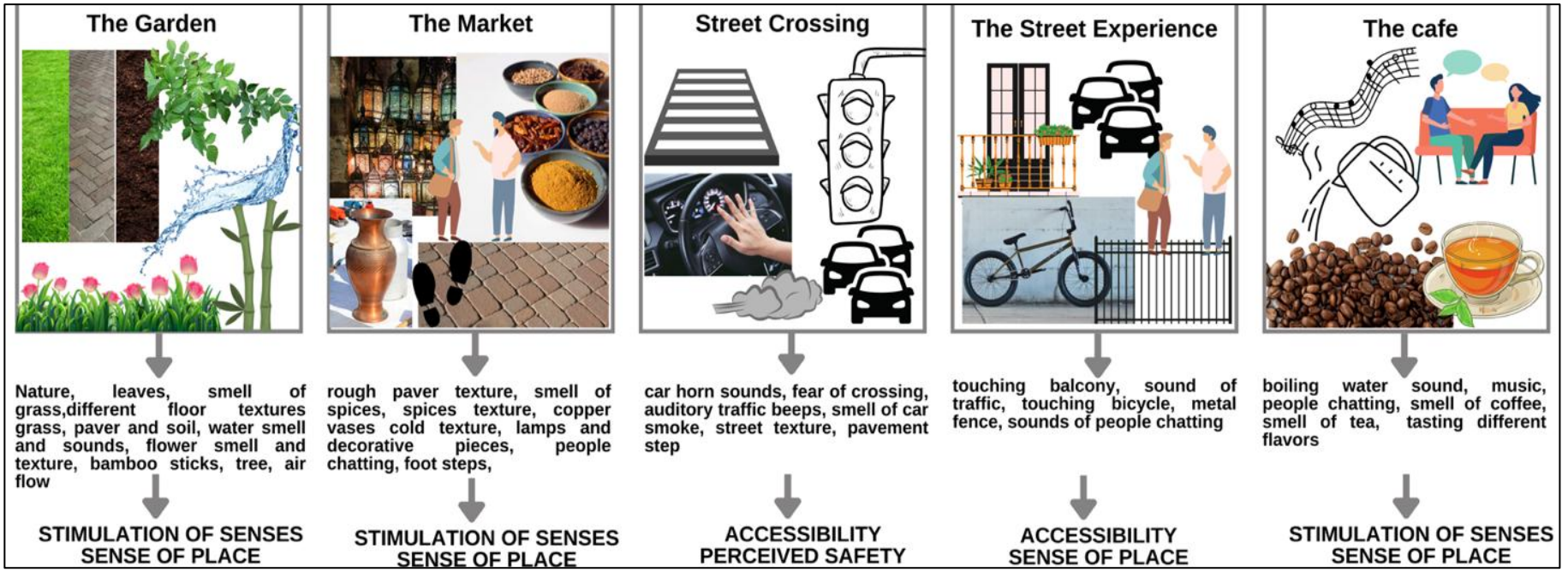

Figure 7. Dialogue in the dark experience illustrated (by researcher)

2.3. Themes Verification

The multi-sensory experience in each space represented a different theme from the personal experience; the themes were also confirmed by asking the visually impaired guide about the purpose of the experience in each room visited.

1. The first room, which was the garden walk, indicated and validated the theme extracted in phase 1 about stimulation of senses and sense of place by integrating with nature and feeling the different textures, sounds, and smells.
2. The second room was an experience in the market known as "Khan El Khalili" in Egypt, with the fusion of spices, scents, sounds of people chatting and footsteps, feeling the market, and touching the sold items like copper vases and glass lamps. This room verified stimulation of senses and sense of place as well.
3. As for the third room, which was an experience of crossing a street, the sound of car horns, car traffic, the sound of beeps from the traffic lights, and the whole experience affected the feeling of safety and triggered thinking about accessibility.
4. The fourth room, which represented a walk down the street with different sounds, textures, and feelings, validated the accessibility and sense of place
5. Finally, the final room, which represented the cafeteria, with the different scents of coffee and tea, hearing the kettle boiling water, people chatting, and music, stimulated the senses and helped enhance the sense of place.

3. Results and Discussion

The five common themes extracted from the phenomenological study can be used as a guide for inclusive designs through the transcribed lived experience.

3.1. Subthemes: The Important Design Considerations

The following table 6 summarizes the relationship between the main themes and the emerging subthemes. The table shows how each emerging subtheme, which is translated into design consideration, can be related to the main extracted themes.

Table 6. Summary of the extracted themes in relation to the sub-themes

Themes / Sub themes	Senses stimulation	Accessibility	Sense of place	Perceived safety
Integration with nature				
Tactile/interactive walls				
Grab-railing				
Tactile pavers				
Sensory games				
Tactile labels				
Scented landmarks				
Auditory landmarks				
Eliminating noise				
Shaded areas				
Minimize distances and guidance				
Furniture arrangement				
Fences and boundaries				
Recreational space				
Temperature adjustment				
Special entrance				

The following design considerations are considered the most repeated across the transcriptions, thus, those are the ones that should be available when designing inclusive schools.

3.1.1. Integration with Nature

The integration with nature is the most common aspect that affects the perception of the visually impaired.Nature was mentioned several times and was also mentioned within other descriptions like using scented landmarks, auditory landmarks, and shaded areas. Nature is known for its multisensorial effect, and thus, using nature in designing inclusive schools is very important for stimulating senses and thus enhancing the experience of the visually impaired, as well as enhancing the sense of place, as mentioned by P1:

"I love gardens. Nature makes me feel so good, especially during play time. It is where I feel free, with no restrictions. I love the smell of grass, the sound of running water, and the smell of flower"

Other respondents emphasized the importance of integration with nature, as mentioned by P9:

"We have a small garden in our school playground, and this is where I loved playing the most. I love the feeling of grass and the smell of flowers, and it is usually nice to play there"

Using olfactory landmarks was mentioned as including certain smells in natural elements that can act as a landmark, as P8 mentioned:

I suggest using the different smells to mark places. Usually because the smell makes me remember easily, so I can easily know my location through a smell of a certain flower for example"

Other respondents mentioned the importance of including natural elements in their experiences, mentioned in Appendix 1.

3.1.2. Using Sensory Walls

Sensory walls provide a way to interact with children, even if they suffer from sensory disabilities, so that they can interact through their other senses. Sensory walls are walls specially designed to support sensory preferences and needs. It was mentioned several times how important tactile and interactive walls are for sense stimulation, accessibility, and improving a sense of place and attachment. As mentioned by P4:

"Navigating in my school was usually very easy; what helped me the most were the posters hung all year long on the walls. They were like landmarks that led me to where I wanted to go"

Also, P8 thought wall hangings and decorations made her more attached to her class, as they helped her engage and interact:

"*I love classroom decorations. Having wall hangings for every module we are taught, arts and crafts, sensory charts, and games made me engage more and get more attached to my classroom"*

Previous literature supported the presence of sensory walls and how they promote a positive culture and climate, especially to those students who have special sensory needs, like the visually impaired. Creating sensory walls in classrooms, corridors, or school yards can support students' participation in play and social and emotional learning

3.1.3. Grab-railing

The importance of using handrails and different grab railings when needed was emphasized and proved to have a great effect on the perception of safety of the visually impaired, along with the help it provides in accessibility and sensory stimulation it provides. It is important to consider the design of the rail itself, its height, and its presence on each side. As mentioned by P3, who commented on the handrail design, which affected its safety measures:

"In my school, the staircase handrail had voids, and this made me very cautious while using it. It was hard navigating, and I was usually scared of falling"

The presence of grab railings is also important, as mentioned by P1:

"The stairs in the building entrance did not have a handrail, so I was usually scared to use them. I prefer having a handrail while using the stairs, and it is better to have a change in floor pattern before and after the staircase".

The presence of Grab railings in corridors was also mentioned by P11:

"I have to walk a long distance between my classroom and music room, the walls did not have any guides, so the navigation was hard and confusing, especially when there is a crossing corridor"

3.1.4. Tactile Pavers

The research emphasizes the importance of tactile pavers and changes in textures for visually impaired people who actively seek out and exploit tactile information underfoot, especially noticeable contrasts in surface texture, when navigating the pedestrian environment. It was concluded that it is important to use different floor textures and tactile pavers when needed. The importance of texture change was emphasized by P4 when talking about open spaces:

"The large playground fields without boundaries make me feel lost. It is nice to have open spaces, however, having boundaries is important even if it is just a change in the floor texture"

While P9 emphasized the importance of changing floor texture before change in levels and in landings and how this affects the safety in schools:

"If there is something I would recommend, it would be having a change in the ground texture before stairs and

on the landings. This will help avoid accidents like falling off the stairs because any change in floor texture can be detected by my cane"

Having a change in tactile pavers on stairs as well as handrails was also mentioned by P1:

"The stairs in building entrance did not have handrail, so I was usually scared to use it. I prefer having a handrail while using the stairs and it is better to have a change in floor pattern before and after the staircase"

3.1.5. Other Design Considerations

Other concluded design considerations include offering sensory games, eliminating noise so as not to affect attention, the presence of labels and signage that can guide the visually impaired person to reach the places he or she wants, correct furniture arrangement, minimizing distances between areas, reducing obstacles, having a specially designed entrance to avoid collisions and accidents, providing recreational spaces with shaded areas, and using non-visual landmarks like scented features. Safety perception is very important when designing inclusive environments. It was concluded that using grab rails makes the blind person feel safer while walking around and navigating from one place to another. Other features include using tactile pavers, fences, and boundaries in large spaces, and minimizing distances between areas.

4. Conclusions

Understanding the needs of the visually impaired students by "including" them and by data explication through their own words can benefit designers to create inclusive designs that can truly accommodate their needs. The loss of sight does not increase the effectiveness of other non-visual senses, however, visually impaired people tend to place more emphasis on information received through other senses, such as sound and touch. The sub-themes extracted from this research can be translated into design guidelines that should be considered when designing inclusive schools.

Sensory stimulation, the main extracted theme is an important aspect of inclusive school design for visually impaired children because it helps to compensate for their lack of visual information. According to the interviews conducted, the visually impaired rely heavily on their other senses to gather information and make sense of their environment. By incorporating sensory stimulation into the design of a school, the learning environment can be more accessible and meaningful to these children. The use of contrasting colors, textures, and patterns can help visually impaired children distinguish between different surfaces and objects. In addition, the use of sounds, scents, can also help to provide information about the environment. This can help in the orientation process as well, understand their surroundings, and feel more confident in the built environment. In summary, the importance of sensory stimulation in inclusive school design for visually impaired children lies in its ability to provide them with information about their environment, enhance their learning experiences, and promote a sense of belonging and independence.

As for the accessibility, the second emergent theme, it is an important aspect of inclusive school design for visually impaired children as it helps to ensure that they can move around the building safely and confidently. A visually impaired child may require a different form of navigation in order to find their way around a school building, such as using tactile flooring to indicate changes in direction or using audio cues to indicate the location of doorways and other important features. Designing the layout of a school with clear and consistent access cues can help visually impaired children to become familiar with their surroundings and to move around the building with ease. Having a clear and accessible navigation system in place is important for visually impaired children as it helps to promote their independence and to reduce the risk of disorientation or accidents. When a school is designed with accessibility in mind, it creates an environment that is supportive, empowering, and safe for visually impaired children.

Enhancing the sense of place, which is the third concluded theme from this study, is an important aspect of inclusive school design for visually impaired children as it helps to create a welcoming and familiar environment that supports their learning and well-being. A strong sense of place can help visually impaired children to feel comfortable and confident in their surroundings, which can have a positive impact on their academic performance and overall satisfaction. Sense of place can be created using different sensory cues, such as distinctive sounds, scents, textures, and tactile elements. For example, the use of distinctive textures on walls or flooring to help identify different areas of the school and to orient themselves. When a school is designed to enhance the sense of place, it can have a positive impact on visually impaired children's academic performance, independence, and overall happiness.

Perception of safety is an important consideration in inclusive school design for visually impaired children, as it can have a significant impact on their well-being and ability to learn. When visually impaired children feel safe in their school environment, they are more likely to be confident, relaxed, and engaged in their learning.

Designing an environment that helps make the children feel safe is considered very important when designing inclusive schools. A number of design elements can contribute to a perception of safety for visually impaired children as concluded from this research, for example, the use of clear and consistent navigation cues, using different textures, adding tactile pavers and grab railing, in addition to audio cues. This can help to reduce the risk of accidents and disorientation and help enhance the children feeling of safety. When a school is designed to promote a perception

of safety, visually impaired children are more likely to feel confident, relaxed, and engaged in their learning, which can have a positive impact on their academic performance and overall well-being.

The guidelines extracted can be considered an addition to the existing design guidelines but addressing aspects that are extracted from the visually impaired people themselves, and addressing themes that targets certain experiences. The subthemes extracted in this research are design recommendations that can be used by designers that aim to design inclusive schools while enhancing the experience of the disabled students who suffer from visual impairment.

Appendix 1: The transcriptions

Transcription	Name	Theme generation
"Inclusive schools should be prepared to accommodate us; I think teachers need to learn how to deal with blind children like me and to adapt to our needs"	P2	Adaptation
"What I loved the most about my school is "acceptance". I never felt odd. Teachers knew how to deal with me, and it was easy to adapt"	P8	
"Navigating in my school was usually very easy, what helped me the most is the posters hung all year long on the wall. They were like landmarks that leads me to *where I wanted to go"*	P4	Senses stimulation Accessibility
"*I love classroom decorations. Having wall hangings for every module we are taught, arts and crafts, sensory charts and games made me engage more and get more attached to my classroom"*	P8	Senses stimulation Sense of place
"It will be great to have a chart or kind of sign board on each classroom or activity room with protruded printed label that represents the room or with braille language to be able to identify the places without having to ask. For example, if it is a music room, a musical instrument can be added to the sign in 3D form to be able to identify the place"	P4	Senses stimulation Accessibility
"The stairs in building entrance did not have handrail, so I was usually scared to use it. I prefer having a handrail while using the stairs and it is better to have a change in floor pattern before and after the staircase"	P1	Perception of safety accessibility
"In my school, the staircase handrail had voids, and this made me very cautions while using it. It was hard navigating, and I was usually scared of falling	P3	Accessibility Perception of safety
"I have to walk a long distance between my classroom and music room, the walls did not have any guides, so the navigation was hard and confusing, especially when there is a crossing corridor"	P11	Accessibility Perception of safety
"I love gardens. Nature makes me feel so good, especially during play time. It is where I feel free, with no restrictions. I love the smell of grass, the sound of running water and the smell of flower"	P2	Senses stimulation Sense of place
"Walking outside and staying at the playground was usually hard because of the sun. It was so sunny, and the heat was intense. My favourite place was around the food-outlet area. It was shaded and had some grass. I loved the weather there"	P4	Sense of place Senses stimulation
"We have a small garden in our school playground, and this is where I loved playing the most. I love the feeling of grass and the smell of flowers"	P9	Senses stimulation Sense of place
"I suggest using the different smells to mark place. Usually because the smell makes me remember easily, so I can easily know my location through a smell of a certain flower for example"	P8	Accessibility Senses stimulation
"Moving from a class to the other was usually a long and hard trip for me. It is very important to minimize the distance between classrooms. I think having something like a rope or handrail on the walls, connecting classrooms and other areas would have made navigating much easier"	P7	accessibility
"The large playground fields without boundaries make me feel lost. It is nice to have open spaces, however, having boundaries are important[25] even if it is just a change in the floor texture[26]"	P4	Accessibility Perception of safety
"What makes me very happy is the large open courts. I usually feel comfortable in large open spaces like soccer courts, they do not make me feel restricted in movement, especially when there is change in pavers between areas. Having large spaces in general where we can run and play freely	P2	Sense of place Perception of safety accessibility
"I always thought that using the normal school entrance with everyone was hard. The problem	P3	Accessibility

is that students can sometimes run to school, and I usually felt scared of accidents that might occur. I wanted to have a special entrance to avoid accidents from that kind"		Perception of safety
"We did not have direct access from campus to the buses parking area. We had to cross a narrow street, so I had to go with my friend to reach the bus. Still, even when I am walking next to him, it was never a pleasant experience. I was so scared until the moment I reach my bus".	P6	Accessibility Perception of safety
"High ceilings, wide spaces with high echo sometimes become very distracting. Noises become disturbing. I did not like going to the school theatre because of the high sound echo"	P2	Senses stimulation Sense of place
"I don't usually feel comfortable around noise. It is very distracting while trying to follow the sounds I truly need"	P8	Sense of place accessibility
"I remember playing with a bell ball, this was my favorite school game. It allowed me to play soccer with my other friends by following the sound of the ball"	P1	Senses stimulation
"Having a comfortable temperature is important. Adjusting the temperature is important for the comfort of people in general and the visually impaired person specifically." M.A	P2	Sense of place
"Easy and clear desks and chairs arrangement is usually very important in navigation. The problem with having an overly furnished classroom is that it creates many obstacles for me that movement becomes hard, this makes me very cautions while walking around"	P8	Accessibility Perception of safety
"If there is something I would recommend, it would be having a change in the ground texture before stairs and on the landings. This will help avoid accidents like falling off the stairs because it any change in floor texture can be detected by my cane"	P9	Accessibility Perception of safety

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