Spatial Accessibility and Learning: Interior Design Considerations for Special Education Facilities

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ABSTRACT

Creating inclusive learning environments is essential in special education facilities to support individuals with diverse physical, sensory, and cognitive needs. This study investigates the relationship between spatial accessibility and learning, emphasising how interior design can shape educational experiences for students with disabilities. The research aims to (i) identify spatial barriers within existing special education environments, (ii) evaluate the effectiveness of current interior design standards, and (iii) propose practical spatial layout solutions tailored to the learning needs of individuals with disabilities. Adopting a mixed-method approach, this study involves structured non-participant observations, in-depth interviews, and a structured questionnaire conducted across selected disability-focused training centres in Malaysia. Preliminary findings highlight the importance of flexible spatial arrangements, tactile guidance elements, sensory-sensitive materials, and intuitive wayfinding systems in promoting engagement, comfort, and independence. The study contributes by offering design recommendations and a conceptual spatial layout model to guide future development of inclusive training hubs and educational centres. The conclusion underscores the necessity of integrating Universal Design principles to create equitable, safe, and effective learning environments for all learners.

Keywords— Inclusive Interior Design, Learning Environments, Spatial Accessibility, Special Education Facilities, Universal Design

In Malaysia, however, the integration of Universal Design (UD) principles into special education facilities remains inconsistent, with many environments prioritising compliance over genuine user experience. UD principles in educational settings have been widely acknowledged for improving the quality of life and participation of individuals with physical, sensory, and cognitive impairments (Usual, 2019). Universal Design advocates for environments that accommodate a broad spectrum of abilities without requiring adaptation, thereby promoting dignity and independence in learning spaces (Bowe, 2000). Despite growing awareness, significant gaps remain in the implementation of accessible and inclusive interior environments in special education settings, especially in relation to user navigation, spatial cognition, and sensory needs.

Accessibility in interior environments encompasses more than the absence of physical barriers; it also involves the provision of intuitive and multi-sensory wayfinding systems, appropriate lighting, acoustic conditions, and adaptable furniture arrangements. Key architectural elements such as hallways, staircases, nodes, and courtyards must serve as effective navigational aids, especially for students with visual or cognitive impairments (Jamshidi, 2023). For visually impaired users, features like tactile surfaces, directional sound, and contrast-based cues are essential, while hearing impaired users benefit from clear visual graphics and written instructions (Marston & Golledge, 2020). Digital wayfinding systems are becoming increasingly important in large institutional environments, as they facilitate orientation and reduce user anxiety (Allam, 2020). Yet, many special education institutions still lack integrated spatial planning and interior design strategies that address these diverse needs holistically. Despite these established needs, little empirical research has examined

how such elements are implemented in Malaysian special education facilities.

Globally, over 1.5 billion people live with some form of disability (The Lancet, 2019), with significant portions experiencing mobility, hearing, or vision impairments. These populations often face structural exclusion due to poorly designed environments that fail to consider their needs (Hanrahan, 2017). This is especially concerning in educational contexts where such exclusion limits both access to learning and social participation. Research shows that inclusive design not only supports health and well-being but also contributes to improved academic engagement and developmental outcomes for students with disabilities (Clark & Gallagher, 2022; Zahabi et al., 2022). Therefore, a critical examination of spatial accessibility and its implications on learning outcomes within special education facilities is both timely and essential. This global challenge underscores the importance of examining context specific barriers and solutions within Malaysian facilities, where inclusive design is still emerging as a priority in educational planning.

This paper investigates how interior design considerations, specifically through the lens of spatial accessibility and universal design, can enhance the learning experiences of students with disabilities in special education facilities. The study identifies key design elements that support effective wayfinding, safety, flexibility, and comfort factors essential for creating environments that accommodate diverse physical, sensory, and cognitive needs. By focusing on the spatial challenges faced by individuals with disabilities, this research contributes to the development of inclusive design guidelines that not only improve accessibility but also actively support learning, engagement, and independence in special education settings. To achieve this, the study adopts a mixed-methods approach, combining structured observations, questionnaires, and expert interviews to triangulate data and provide a holistic analysis. The outcome is the development of a conceptual spatial layout model that offers evidence-based recommendations for more inclusive interior design in Malaysian special education facilities.

LITERATURE REVIEW

This UD is a design approach that aims to create environments accessible to all individuals, regardless of age, ability, or status, without the need for adaptation (Usual, 2019). In the context of education, UD principles support the development of inclusive learning environments by integrating physical, cultural, cognitive, and sensory considerations into the design process. Jamshidi (2023) defined universal design for education as the preparation of curriculum, materials, and spaces that can be accessed and used effectively by a wide

variety of people. This philosophy not only removes physical barriers but also promotes equitable access to information and participation, which is especially vital for learners with disabilities.

The integration of UD in communication systems, spatial layout, and environmental features significantly improves navigation and autonomy within learning spaces (Jamshidi, 2023). For instance, employing visual images and universal symbols allows information to be more accessible for users with varying language proficiencies and cognitive abilities. Such inclusive strategies are essential in special education settings where learners often rely on multi-sensory cues to engage with their surroundings.

A. The Role of Spatial Accessibility

Spatial accessibility refers to the ease with which individuals can navigate, interact with, and utilize spaces. For students with disabilities, spatial accessibility directly impacts their learning potential, independence, and overall experience in educational settings. Key environmental features that aid wayfinding include hallways, landmarks, nodes, staircases, entrances, and open courtyards (Jamshidi, 2023). These components function as spatial cues that support orientation and mobility, particularly for those with visual, cognitive, or mobility impairments.

Clark and Gallagher (2022) emphasize that effective wayfinding systems must be intuitive, multi-sensory, and barrier-free to accommodate users with different functional limitations. In educational facilities, the clarity of spatial organization, accessibility of circulation paths, and availability of assistive elements such as tactile signage or visual guides contribute significantly to students' autonomy and safety.

B. Understanding Disabilities and Design Responses

People with disabilities (PWDs), also referred to as *Orang Kurang Upaya* (OKU) in Malaysia, include individuals with physical, mental, intellectual, and sensory impairments that may limit their ability to fully participate in daily life without appropriate support (Hanrahan, 2017). Disabilities can be permanent or temporary, and their prevalence continues to increase due to population growth and the rising incidence of chronic health conditions (United Nations Department of Economic and Social Affairs, 2020). According to the World Report on Disability (2019), individuals with disabilities experience poorer health outcomes, reduced access to services, and greater exposure to environmental and social barriers.

Visual disabilities encompass a spectrum ranging from low vision to complete blindness,

2 requiring design interventions such as tactile flooring, contrasting colours, and auditory navigation aids. Hearing disabilities, which may range from mild to profound, necessitate clear visual communication through graphic signage and written instructions (WHO, 2022).

C. Wayfinding and Digital Integration

Wayfinding plays a central role in how individuals interact with built environments, especially in complex institutional settings such as schools and training centres. For people with disabilities, unclear spatial layouts can result in disorientation, anxiety, and limited autonomy (Zahabi et al., 2022). Therefore, integrating accessible wayfinding systems into interior design is essential. Prandi et al. (2023) highlight that inclusive wayfinding not only facilitates physical navigation but also fosters psychological comfort by reducing spatial uncertainty.

The rise of mobile technologies further supports accessibility through digital wayfinding systems. These tools offer real-time navigation support, information on accessible routes, and location

specific instructions (Allam, 2020). For example, wheelchair users benefit from information on slopes and elevators, while visually impaired users may rely on audio prompts and tactile maps. Marston and Golledge (2020) assert that digital and physical systems must be synchronised to support users with diverse impairments, ensuring a seamless and inclusive spatial experience.

D. Special Education Facilities: A Focused Context

Special education facilities are distinct in their need to accommodate a wide range of learning, behavioural, and sensory differences. Interior environments must be designed not only for safety and accessibility but also to foster comfort, concentration, and engagement. Abdullah, Low, and Feng (2021) argue that when spatial elements are attuned to users' needs, they contribute positively to cognitive development and emotional well-being. Training centres and special education schools play a pivotal role in preparing individuals with disabilities for integration into society. As such, spatial and interior design in these facilities must go beyond compliance and actively support empowerment, participation, and learning.

TABLE I KEY INTERIOR DESIGN ELEMENTS FOR SPECIAL EDUCATION FACILITIES

Design Element	**Description**	**Benefits for Students with Disabilities**
Universal Design (UD)	Designing environments accessible to all	Promotes inclusivity, allowing students with diverse needs to

	individuals,	

	regardless of ability or disability.	navigate and use spaces independently.
Wayfinding Systems	Implementing clear signage, landmarks, and spatial cues to assist navigation.	Enhances orientation and reduces anxiety, especially for students with cognitive or visual impairments.
Multi-Sensory Cues	Using tactile, auditory, and visual stimuli to convey information.	Supports diverse sensory needs, aiding comprehension and interaction with the environment.
Flexible Spaces	Designing adaptable areas that can be reconfigured for various activities and needs.	Accommodates different learning styles, physical requirements, fostering versatile learning environment.
Acoustic Considerations	Incorporating sound-absorbing materials and minimizing background noise.	Creates a conducive auditory environment, benefiting students with hearing impairments or sensory sensitivities.

Lighting Design	Providing adjustable lighting levels and minimizing glare.	Enhances visual comfort and accessibility for students with visual impairments or neurological differences.

RESEARCH METHODOLOGY

This research adopts a mixed-methods approach to examine the relationship between spatial accessibility and learning outcomes in special education and rehabilitation facilities for PWDs. The study integrates qualitative and quantitative data collection to obtain a holistic understanding of user experience and spatial design challenges. The selected case study is Facility A, a government run facility offering education, therapy, and vocational training for individuals with varying disabilities.

A. Case Study

The selected case study was chosen through purposive samplings based on its comprehensive spatial planning, which includes classrooms, dormitories, therapy rooms, discussion area, and administrative areas. The selection was also guided by the centre's active engagement with adult PWDs in learning and training contexts. Structured non participant observations were conducted on site to examine spatial layout, circulation routes, signages systems, tactile elements, and sensory cues. This observation aimed to identify potential barriers and supportive design features that influences users' ability to navigate and utilise the facility independently.

Questionnaire Survey (Quantitative)

A structured questionnaire was distributed to 25 adult respondents with disabilities, including individuals with visual, hearing, and mobility impairments. The primary objective was to evaluate their perceptions of spatial clarity, safety, comfort, and overall accessibility withing that Facility A. The questionnaire comprised both closed ended questions such as multiple choice and Likert Scale items as well as a few open-ended prompts to gather qualitative input. The Likert scale ranged from 1 (strongly disagree) to 5 (strongly agree) allowing respondents to indicate their level of agreement with various statements to spatial design and user experience.

To accommodate the diverse needs of participants, the questionnaire was distributed both manually in printed form and digitally (online), based on the individual preferences and accessibility. The questions were slightly varied according to the type of disability visual, hearing, or mobility to ensure relevance and clarity for each respondent group. For respondents with visual impairments, assistance was provided through screen readers or guided verbal reading, while those with hearing impairments received clear written instructions and visual aids to support comprehension. Accessibility considerations were prioritised throughout the process to ensure each respondent could participate independently or with minimal assistance, depending on their comfort level. Although 25 questionnaires were distributed, only 15 were fully completed, representing the final dataset analysed. The responses were then analysed using descriptive statistics such as percentages, means, and standard deviations to identify recurring patterns, highlight common spatial challenges, and reinforce the findings from the qualitative phase of the study.

C. In-Depth Interviews (Qualitative)

Five professionals were selected for unstructured in-depth interviews including an access designer, welfare officers, and lecturers with expertise in inclusive design and disability support. The interviews explored spatial challenges faces by users with disabilities, best practices in Universal Design, and insights into the daily navigation experiences of individuals with diverse needs. Interviews were conducted either in person or online, depending on the preference and accessibility requirements of each participant. All interviews were audio-recorded (with consent), transcribed and analysed using thematic analysis (ATLAS.ti9) to identify key themes and recurring insights related to spatial usability, sensory accessibility, and independence.

D. Sampling Strategy

Purposive sampling was employed across all data collection methods to ensure the selection of participants with direct relevance to the study objectives. The sampling criteria included adults aged between 25-65 years, individuals with visual, hearing or mobility impairments either as users or professionals. Participants were also required to have direct experience navigating interior spaces within educational or rehabilitation settings. This approach allowed the researcher to gather rich, relevant, and context specific data from individuals most impacted by the spatial design of such facilities thereby enhancing the depth and applicability of the study findings. Although the sample size was relatively small (15 completed surveys and five expert interviews), this limitation reflects the accessibility challenges of engaging participants with disabilities in research. The aim was not statistical generalisation but to generate rich, context-specific insights that can inform inclusive design practices.

E. Data Integration & Analysis

To ensure reliability and validity, this study adopted a triangulation approach. Observations provided insights into spatial use and behavioural patterns, questionnaires captured user perceptions and experiences, and experts interviews offered professional perspectives. Bu integrating these three datasets, the analysis was able to cross verify findings and provide more holistic understanding of how interior architectural features influences accessibility and learning in special education facilities.

Findings from the observations were used to identify environmental barriers and supportive features which were then compared with patterns in questionnaire responses. Themes from expert interviews were subsequently employed to interpret both sets of data. This triangulation ensured the spatial layout model was grounded in lived experiences, user perceptions and professionals' expertise thereby increasing robustness of the analysis.

FINDINGS

Findings from each method were compared and synthesised to identify converging themes and discrepancies. This triangulated analysis ensured that recommendations for the conceptual spatial layout model were supported by multiple sources of evidence. The study adopted a convergent mixed

methods approach, in which qualitative and quantitative data were collected and analysed concurrently to triangulate results and provide a deeper understanding of spatial accessibility in special education facilities. The findings are 4 presented in three parts: (i) observation-based case study findings at Facility A, (ii) quantitative results from the structured questionnaire, and (iii) qualitative insights from expert interviews. These data streams were then integrated to inform a proposed spatial layout plan drawing.

A. Case Study Findings – Observation

Direct observations conducted at Facility A highlighted several physical and environmental challenges that affect spatial accessibility for PWDs. While the facility included some inclusive features such as rams, lift access, wide corridors and circulations, these were inconsistently applied across spaces. Wayfinding was significantly hindered by in adequate signage, lack of tactile floor indicators, and absence of auditory or

visual navigations aids, particularly in transitions area between dormitories, training rooms, and shared facilities. Communal areas such as toilets and cafe lacked proper zoning and arrangements, while furniture design was mostly fixed and did not cater to diverse body types or assistive devices. In several zones, lighting was insufficient or overly harsh, causing discomfort, especially for visually impaired users. These findings reflect existing literature which emphasises the importance of sensory sensitive design in education environments.

B. Quantitative Findings – Questionnaire Results

A total of 15 adult respondents with disabilities participated in the survey. The majority (53.3%) were aged between 45-54 years, followed by 33.3% aged 35-44. In terms of gender, 66.7% of the respondents were male, while 33.3% were female, showing a higher male representation in study sample. Regarding the type of disability, 93.3% had visual disabilities, 13.3% had hearing disabilities, and 20.1% had mobility disabilities. As for employments status, 53.3% of respondents were employed, while 46.7% were not. This balance allows for comparative insights into how accessible design features affect users both within and outside the workforce.

1) Key Quantitative Findings

The table below presents the mean scores for key accessibility indicators, derived from respondents' Likert-scale ratings (1 = Strongly Disagree to 5 = Strongly Agree). These indicators reflect users' perceptions of critical spatial features within the facility.

TABLE II MEAN SCORES AND USER PERCEPTIONS OF KEY SPATIAL ACCESSIBILITY INDICATORS

Item	**Indicator**	**Mean Score (out of 5)**	**Remarks**
Accessibility of Ramps and Corridors	Physical mobility access	4.1	Generally accessible, with minor limitations noted.
Clarity of Signages	Visual communication and effectiveness	2.6	Inconsistent and often unclear
Presence of	Sensory	2.1	Mostly

tactile or Braille elements	navigations aids		absent or poorly implemented
Visual alerts for emergencies	Emergency communication	2.4	Lacking visual alerts for hearing impaired users
Comfort and safety in circulation areas	General environmental experience	3.2	Moderately acceptable with room for improvement
Ease of wayfinding	Overall navigability	2.7	Challenging especially for vision impaired users

Respondents with visual impairments consistently reported difficulties in locating and interpreting signage due to the absence of braille elements and poor colour contrast. For individuals with hearing disabilities, the lack of visual alerts like emergency scenarios posed a high risk. These participants also pointed out about display based or digital signage for everyday navigation.

Respondents with mobility impairment highlighted concerns about inadequate circulation paths, non-adjustable furniture, training spaces, and limited access to ergonomic toilets, all of which affect their independence and comfort. Overall, the mean scores suggest that while some physical facilities like lift or ramps, lacks critical sensory and informational accessibility features.

These findings align with earlier research emphasising the importance of multisensory design, universal signage and clear wayfinding in inclusive build environments (Prandi et al. 2023).

C. Interview Insights – Expert Triangulation

In depth interviews were conducted with five experts including consultants, designers, and lecturers in inclusive design, also welfare officers. These interviews were intended to triangulate data from observations and questionnaires and to provide additional professional perspectives on design practices for inclusive environments.

5 Recurring themes identified through thematic analysis included:

1. Lack of sensory zoning: Most existing facilities group spaces functionally but fail to provide sensory separation, which can cause discomfort for vision impaired users.
2. Inadequate signage systems: Signages is often non-inclusive, lacking in braille, icons or auditory features.
3. Redesign the planning: Experts strongly emphasised integrating Universal Design principles during the early design planning phase instead of relying on the retrofits.
4. Lack of user feedback: Minimal involvement of actual users in post occupancy evaluations. These insights validate the issues reported in the questionnaire and support the observed gaps at Facility A. Moreover, they reflect broader reference in research, user centred design process in educational settings for PWDs.

D. Proposed Space Planning for Inclusive Learning Facility

Based on the triangulated data, a spatial zoning proposal was developed for future inclusive training centres. The zoning strategy supports universal design, aiming to promote accessibility, multisensory wayfinding and equitable learning environments. The detailed zoning is summarised Table 3, with each zone tailored to specific functional and sensory needs.

TABLE II ZONING AND SPACE FUNCTIONS

Zone / Area	Primary Users	Function / Inclusion Strategy
Lobby / Lounge Area	All users	Open, welcoming entrance with natural lighting, tactile floor lines, auditory signage, and seating
Reception Area + Client Information	All users	Centralised, visual and tactile signage; counters at varied heights.
Accessible Toilet (multiple)	Mobility, visual, deaf	Equipped with grab bars, tactile signs, and emergency alerts (visual and audio).
Information Board, Lift, Wudhu Area	All users	Clear navigation aids; lift with braille buttons and audio feedback; ablution area with inclusive design.
Hologram Area	Deaf, mute, all	Interactive wayfinding or educational content using visual holograms to assist deaf and non-verbal users.
Inclusive	Deaf and hearing	Hands-on interactive space with visual cues and videos

Learning Zone – Sign Language	impaired	promoting communication and language skills
Inclusive Learning Zone – Blind People	Visually impaired	Equipped with braille books, audio resources, tactile displays, and orientation pathways.
Resource Area, Computer Lab, Study Area	All users	Height-adjustable desks, screen readers, high-contrast
		visual interfaces, noise-controlled environment.
Mini Library / Reading & Santai Area	All users	Sensory-controlled reading zone with varied seating types and lighting adjustments.
Collaboration / Breakout / Discussion Room	All users	Flexible furniture for group work; soundproofing to aid concentration; accessible for all users.
Training Area 1 – Baking	Mute individuals	Visual instruction panels, picture-based recipes, colour-coded tools, and quiet appliances.
Training Area 2 – Embroidery	Visually impaired	High-contrast tools, magnifying lamps, and tactile guides for detailed manual work.
Training Area 3 – Craft Woodworking	Deaf or hearing impaired	Visual safety instructions, well-lit environment, vibration-based alert systems.
Retail Area, Cafeteria	All users	Practice space for sales; signage with visual, tactile and auditory features. Inclusive seating, clear food labels, wide aisles, and tray guides.
Office, Meeting Room, Head Office, Staff	Staff and trainers	Equipped with inclusive communication tools, ergonomic furniture, and accessibility features.

Lounge		
Sensory Room	All users	A calm, multi-sensory environment for relaxation, prayer, or emotional regulation; includes soft textures, dimmable lighting, and aromatherapy options.
Public Area for Events	All users	Modular space for exhibitions or community events with ramps, portable seating, and real-time captioning for presentations.

Spatial design strategies play a vital role in creating inclusive and adaptive environments. Wayfinding is enhanced using tactile floor guides, colour-coded zones, braille signage, and innovative digital or holographic navigation aids, ensuring that all users can navigate spaces independently and confidently. Flexibility is achieved through modular furniture and adaptable spatial layouts that can be reconfigured to accommodate varying user needs and activities, supporting long term usability. In terms of safety, designs incorporate emergency strobes, alerts based on sound and vibration and wide, accessible escape routes to ensure secure evacuation for all, including those with sensory or mobility impairments. Lastly, engagement is fostered through the inclusion of specialised training rooms tailored to users' abilities, promoting skill development, and personal growth in a respectful and empowering manner.

E. Draft Spatial Layout

A three-storey conceptual layout was designed for a proposed centre; each level accommodates serving distinct yet complementary functions. The 6 ground floor priorities public interaction, featuring a welcoming lobby and reception area, a retail or cafe space, accessible toilets and digital information boards to enhance visitor experience and accessibility. The first floor dedicated to skull building activities, housing practical training zones for baking, embroidery, and woodworking, alongside inclusive learning rooms designated to cater to diverse user needs. On the second floor, the focus shifts to reflection and academic engagement, offering quiet spaces such as mini library, a prayer or sensory rooms, staff offices, and dedicated resource centres to support personal and professional development.

The conceptual layout as can be referred at Figure 4.1, it reflects current findings and embeds practical solutions for multisensory navigation, adjustable furnishings, and sensory zoning. The proposal directly addresses the gaps identified through the case study, survey, and expert feedback.

The triangulated results reveal that basic infrastructure is in place, significant gaps exist in the sensory, navigational, and functional accessibility of special education facilities. These deficiencies affect user confidence, learning engagement, and overall safety. By incorporating user feedback and expert insight, this study offers evidence-based recommendations for more inclusive and effective interior environments that align with UD principles.

CONCLUSION

This study set out to explore how spatial accessibility shapes the learning experiences of students with disabilities in special education facilities, with particular attention to how interior design strategies based on universal design principles can support inclusivity, independence, and well-being. By bridging the gap between regulatory compliance and actual usability, the research adopted a convergent mixed-methods approach combining site observations, user questionnaires, and expert interviews to capture both physical and sensory accessibility challenges.

Findings revealed that while basic inclusive features such as ramps and lifts existed, their inconsistent

application and lack of multisensory integration limited autonomy and participation. The proposed spatial zoning strategy and conceptual layout aimed to address these gaps by introducing differentiated learning zones, inclusive signage, adaptable furniture, and multisensory wayfinding tools, thereby advancing accessibility beyond compliance.

The implications of this research extend to practice, policy, and scholarship. For design practice, it provides evidence that interior designers should move beyond minimum standards and embed multisensory, flexible, and user-centred strategies as integral to spatial planning. For policy, the findings

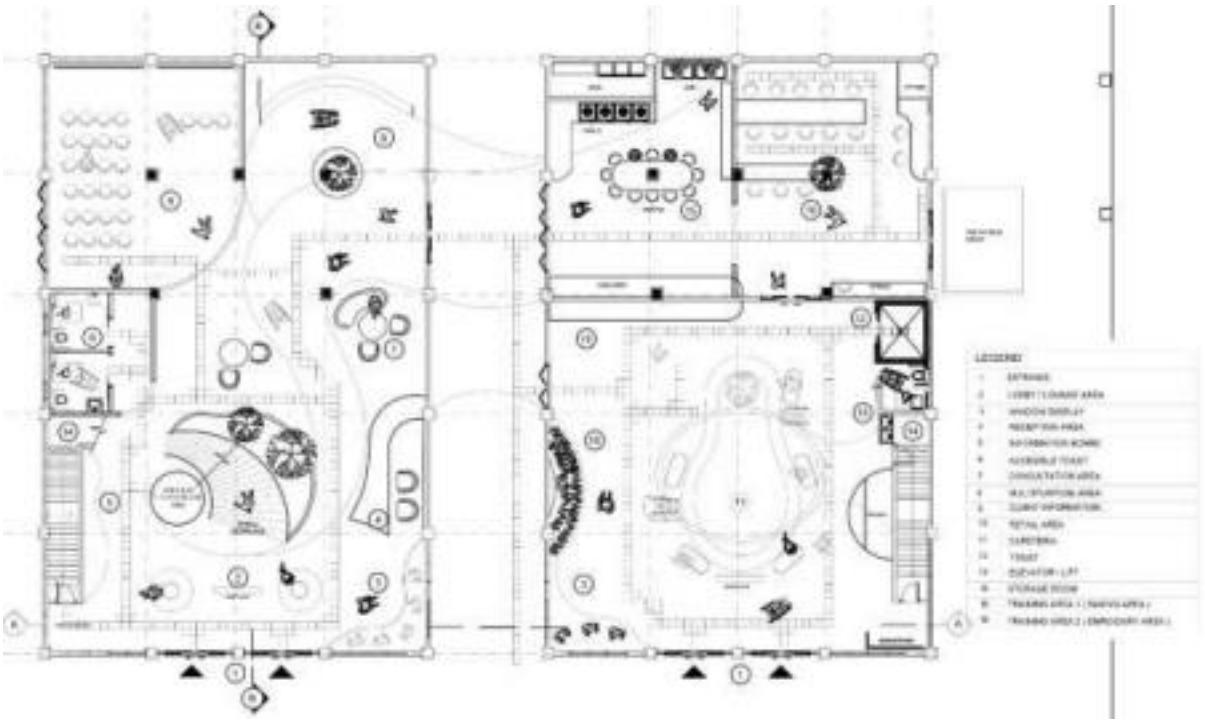

Fig 1 Conceptual spatial layout sketch of the proposed Disability Equality Training Centre (draft for reference only).

highlight the need for regulatory frameworks that measure the usability and lived experiences of people with disabilities, rather than relying solely on prescriptive compliance. Finally, for future research, this study underscores the importance of post

occupancy evaluations and participatory methods 7 that engage users directly, as well as opportunities to explore emerging technologies such as AR or digital wayfinding in inclusive education settings.

Ultimately, this study contributes to the discourse on inclusive design by showing that educational spaces for people with disabilities must not only remove barriers but also actively foster equity, independence, and dignity. By reframing accessibility as an enabler of learning and participation, the research offers guidance to designers, educators, and policymakers committed to creating more inclusive learning environments.

REFERENCES

1. Accessibility-Scotland. (2024). Wayfinding and signage: Making the environment accessible for disabled people. https://accessibility.scot/wayfinding-and-signage/
2. Al-Sharaa, A. M., Boussaa, D., Alkass, S., & Moselhi, O. (2022). Wayfinding performance and design in complex healthcare facilities: A conceptual framework. Frontiers of Architectural Research, 11(2), 267–284. https://doi.org/10.1016/j.foar.2022.01.005
3. Boarin, P., Davoli, G., & Buda, P. (2021). Enhancing healthcare facilities wayfinding through environmental graphic design: A methodological approach. Frontiers of Architectural Research, 10(4), 840–857. https://doi.org/10.1016/j.foar.2021.03.004

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4. Chidiac, M., Reda, A., & Marjaba, G. (2024). Evaluating accessibility in the built environment for people with sensory disabilities: A review of
5. the literature. Sustainable Cities and Society, 99, 104801. https://doi.org/10.1016/j.scs.2023.104801
6. Clark, H., & Gallagher, S. (2022). Designing inclusive wayfinding systems for public spaces: A universal design approach. Design Studies, 79, 101060.
7. https://doi.org/10.1016/j.destud.2021.101060 [6] Imrie, R. (2021). Disability, Space and Society: Re-examining Inclusive Environments. Space and Culture, 24(2), 231–243. https://doi.org/10.1177/1206331220951379
8. Jamshidi, S., Ensafi, M., & Pati, D. (2020). Wayfinding in interior environments: An integrative review. Health Environments Research & Design Journal, 13(3), 171–186. https://doi.org/10.1177/1937586720916256
9. 0World Health Organization. (2022). Global report on health equity for persons with disabilities. World Health Organization. https://www.who.int/publications/i/item/9789240 063600
10. Yau, M. K.-S., Chan, C. C. H., & Chan, C. (2021). Inclusive design for wayfinding systems: A case study of the visually impaired in urban environments. Journal of Design Research, 19(1), 55–77. https://doi.org/10.150 4/JDR.2021.113207
11. Zahabi, M., Zheng, X., Maredia, A., & Shahini, F. (2023). Design of navigation applications for people with disabilities: A review of literature and guideline formulation. International Journal of Human–Computer Interaction, 39(14), 2942– 2964.
12. https://doi.org/10.1080/10447318.2022.20888838