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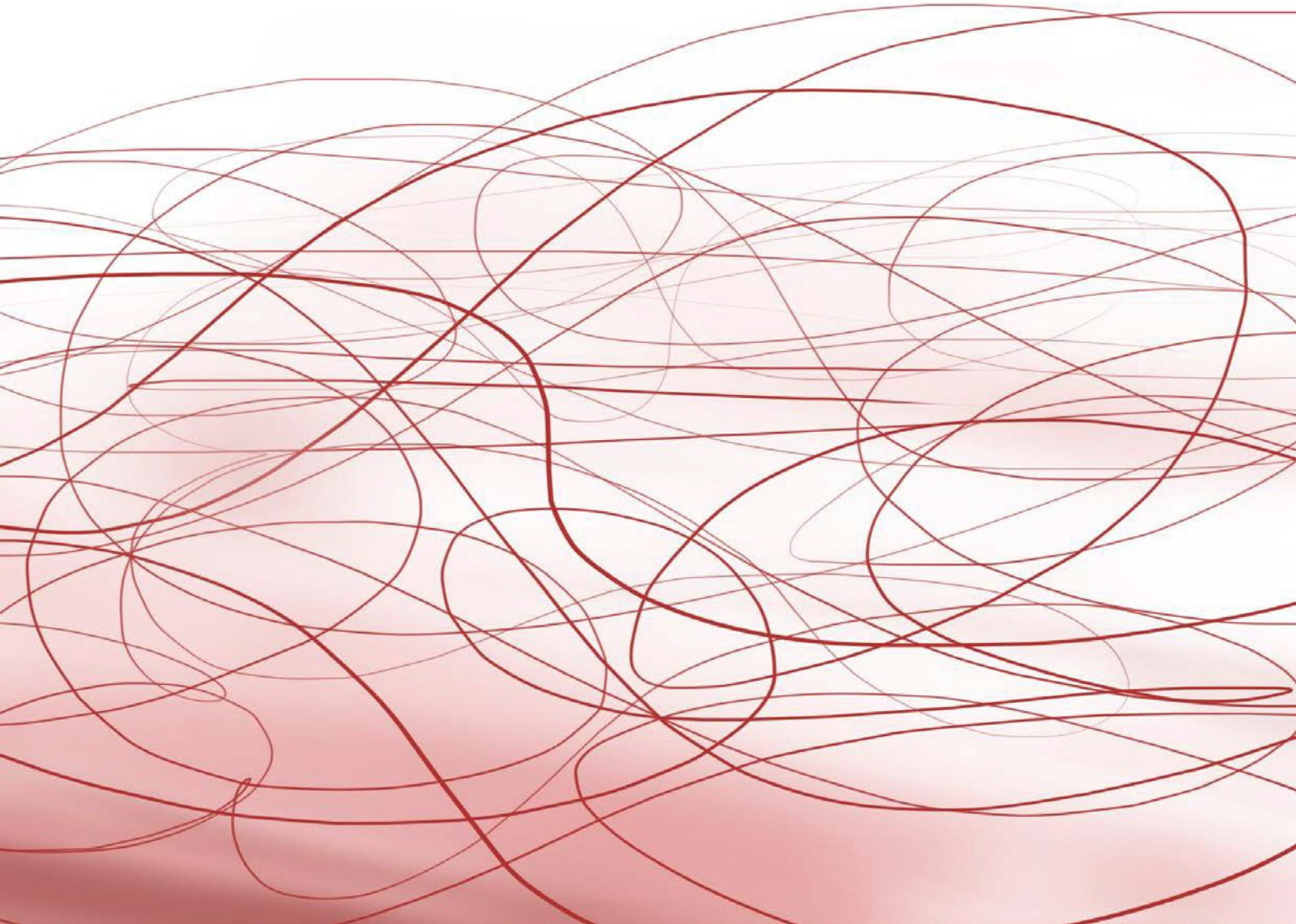

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Editorial Board

Editorial Office

Accessibility Chair of the Universitat Politècnica de Catalunya.
Av. Víctor Balaguer, 1. 08800 Barcelona. Spain.

Telephone. +34 93 896 7245
Web: https://www.jacces.org
Mail: jacces@catac.upc.edu
X: @Journal_JACCES

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Table of contents

Engineering

Architecture and Construction

Health and Medical Care

Education

Society and Economics

© Journal of Accessibility and Design for All (JACCES), Volume 16, Issue 1, 2026, ISSN: 2013-7087
DOI: https://doi.org/10.17411/jacces.v16i1.635

Towards accessible Thai typography

A multi-dimensional analysis of typography practices in Thai elementary textbooks and implications for Universal Design

Punsongserm R., Faculty of Fine and Applied Arts, Thammasat University, Thailand,
ORCID 0000-0002-2935-8052 , pruchapo@tu.ac.th

Suvakunta P., College of Interdisciplinary Studies, Thammasat University, Thailand,
ORCID 0000-0003-0733-4321, spittaya@staff.tu.ac.th

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Abstract: This study examines Thai elementary textbooks on typography (Years 1–3) published by 11 different publishers, focusing on accessibility and inclusive design. The study analysed 198 textbooks using a Python script, revealing that traditional fonts comprised 75–85 per cent of the material in textbooks, and the font sizes range between 14 and 26 points. Publishers exhibited a systematic approach to font size across year levels, with sizes decreasing from Year 1 (16–26 points) to Year 3 (12–23 points). Mathematics and Thai Language textbooks displayed unique size disparities by employing significantly larger typefaces (18–40 points for Mathematics and 17–35 points for Thai Language) compared with other subjects. The implementation of smaller font sizes at 9 points creates major accessibility barriers which become particularly problematic due to the widespread occurrence of uncorrected visual impairments amongst Thai primary students. This study recommends implementing the universal design framework in setting the minimum font sizes and suggests developing frameworks that balance visual interest and readability. The study also recommends routine analysis of typographic decisions and their effects on learning outcomes facilitate the design of accessible, evidence-based education.

Keywords: Typography in education, educational materials, Thai elementary textbooks, font analysis, visual accessibility, universal design, inclusive education

1. Introduction

Typography in learning materials plays a critical role in fostering reading ability amongst young children, particularly at the early elementary level (Abubaker & Lu, 2012; Bessemans, 2016; Halamish, Nachman, & Katzir, 2018; Perea, Panadero, Moret-Tatay, & Gómez, 2012; Reynolds & Walker, 2004). The legibility and clarity of text significantly affect learning outcomes by influencing discernibility and engagement, positively or negatively (Abubaker & Lu, 2012; Halamish et al., 2018; Hughes & Wilkins, 2000; Wilkins, Cleave, Grayson, & Wilson, 2009). Various typographic features, such as font type and size, can considerably affect the cognitive load required to read text, thereby shaping the learning process (Abubaker & Lu, 2012; Halamish et al., 2018; Katzir, Hershko, & Halamish, 2013; Masulli et al., 2018; Uysa & Düger, 2012; Wang & Ma, 2024).

Typography is an essential element of educational resources and, on an accessibility scale, it may enhance or limit fair learning processes. When typographic decisions fail to meet the needs of all students – particularly those requiring visual arrangement or those with learning disabilities –

they create unnecessary barriers to education (Punsongserm, 2024a; Richardson, 2022). Universal design (UD) principles advocate inclusive learning content for diverse abilities (Burgstahler, 2015; Dell, Newton, & Petroff, 2020). This approach supports disabled students whilst benefiting all.

In Thailand, both government and privately-owned publishers are involved in elementary textbook production under the supervision of the Ministry of Education. Although certain general standards for textbook production exist, clearly defined typographic guidelines from an accessibility perspective are lacking. This absence of standardisation has led to considerable variability in font styles and sizes across publishers, potentially compromising the reading efficiency and learning outcomes – particularly for students with visual impairments – particularly at this critical stage of literacy acquisition.

This study explores Thai textbooks specifically targeted at early elementary students, a critical demographic for developing primary literacy (in literacy acquisition) (Anwas et al., 2022; Demir & Öztürk, 2024; Tichnor, Garwood, Bratsch–Hines, & Vernon–Feagans, 2016). Compared with the abundance of literature on Roman-script typography, research on Thai typography remains limited, literature about Thai typography is limited especially the applied scope of Thai typography in elementary school textbooks and accessibility. The Thai script poses design challenges because of the very complex compound structure of characters and additional use of tone marks. This necessitates specialised research, particularly within a UD framework.

Although the importance of typography in reading materials has been well-established in prior research, only a few systematic studies have explored Thai typography in terms of accessibility. The present study aims to address this gap by conducting an empirical investigation of typographic features in Thai elementary textbooks, grounded in the principles of inclusive design.

A significant research gap exists regarding the systematic study of typography in Thai elementary textbooks, including trends in font styles and sizes, variations across publishers, year levels, subject areas and the relationship between typographic design theory and its practical implementation in facilitating comprehension. While evidence suggests that text structure can significantly impact performance (Tincheva, 2023; Tulaganova, 2022), minimal research has investigated which layouts and combinations of typographic features support reading performance, particularly amongst students with diverse visual abilities. This study examines these aspects in relation to the various formats and designs students encounter, focusing on how different typographic decisions affect information retention in young students with diverse visual requirements.

Evidence shows that poorly chosen typography may hinder the learning process in young readers (Hughes & Wilkins, 2000; Perea et al., 2012; Reynolds & Walker, 2004), and these challenges can be more severe in students with visual impairments or reading difficulties (Punsongserm & Suvakunta, 2022a; Uysa & Düger, 2012). Consequently, our research will examine how specific typographic decisions – such as font size, style and spacing – affect the learning experiences of early elementary students across a spectrum of visual abilities. Our findings will be contextualised within current research on UD to emphasise how these factors can either foster or impede student development.

Even though much educational material is available, few detailed studies have examined typographic choices in Thai education through accessibility. This study aims to address this gap by proposing evidence-based typographic frameworks that enhance legibility and inclusivity in educational content (Punsongserm & Suvakunta, 2022a, 2022b, 2024). The ultimate objective is

to identify typographic features that can improve the learning experience for students with diverse learning abilities, with a strong focus on accessibility and effective communication in any learning environment.

2. Literature Review

This review explores five key areas essential for understanding Thai typography in the context of accessibility: (1) studies on legibility and readability in Thai typography; (2) the effects of font size on learning; (3) design considerations for typefaces aimed at early readers; (4) visual health implications in textbooks; and (5) UD principles in educational typography. The analysis attempts to provide a baseline knowledge of the typography development in Thai education settings and what the main research needs should be so that more can be learned about it.

2.1. Studies of Thai Typography Legibility and Readability

Educational materials demand legible typefaces for novice readers (Bessemans, 2016; Bohm, 2014; Richardson, 2022). Building on this need, recent advances in Thai typography research have expanded knowledge of typeface design principles.

Punsongserm's pioneering work demonstrated how Thai UD typeface morphological features improve visual recognition for both normal and visually impaired readers (Punsongserm, 2019, 2020, 2023, 2024a; Punsongserm & Suvakunta, 2022a, 2022b; Punsongserm, Sunaga, & Ihara, 2017a, 2017b, 2018a, 2018b). However, most studies focused on adults rather than children.

Roman-influenced Thai typefaces lack empirical support for improved legibility over traditional designs (Punsongserm, Sunaga, & Ihara, 2018c; Punsongserm, 2024b, 2025), necessitating revised typographic standards in educational contexts – particularly for accessibility.

2.2. An In-Depth Discussion of Minimum Font Size in Thai Typography

Research indicates a wide variation in minimum font size requirements for Thai typography across various contexts and populations. Studies identify legibility challenges related to application type, viewing distance, and user age.

For digital displays, minimum font size requirements vary by font type and user age (Kamollimsakul, Petrie, & Power, 2014). Conservative Thai fonts require 12–14 points whilst Roman-like fonts need 14–16 points, based on 57 cm viewing distance.

Thai regulatory standards mandate 11–14 point sizes, which exceeds the international specifications of 6 points (Punsongserm & Suvakunta, 2022a). Thai orthographic complexity necessitates these elevated legibility thresholds relative to Roman scripts (Punsongserm et al., 2017a).

Empirical evidence establishes 14-point minimum for Thai typography across applications and user populations.

2.3. Font Size Research in Education

The relationship between font size and reading performance has been studied for over a century. Tinker (1963) established early groundwork, though methods were largely subjective (Bessemans, 2016).

Recent research demonstrates objective measurement of font size effects on reading performance. Studies show larger fonts improve reading speed (Beymer, Russell, & Orton, 2008; Tavakoli & Kheirzadeh, 2011) whilst smaller fonts can negatively impact comprehension (Katzir et al., 2013; Tavakoli & Kheirzadeh, 2011). These findings highlight the importance of appropriate font sizing in early reading.

However, children show greater sensitivity to font size variations compared with adults (Hughes & Wilkins, 2000), making adult-based standards unsuitable for paediatric populations. Researchers should therefore develop age-specific typographic guidelines.

This study provides empirical research on font size applications in Thai textbooks across years and subjects, addressing the visual needs of early readers.

2.4. Typeface Designs for Early Readers

Typeface design influences pediatric reading development (Bessemans, 2016), yet studies concentrate on Latin scripts. Optimal attributes – elevated x-heights, expanded spacing (Bigelow, 2019) – require modification for Thai orthographic complexity and tonal markers.

Accessibility-oriented typefaces demonstrate efficacy for visual impairments and dyslexia (Bohm, 2014; Uysa & Düger, 2012) through enhanced contrast, uniform stroke weights, and expanded spacing – core UD parameters.

2.5. Vision-Related Health in Educational Resources

Visual health has become increasingly important in education design due to high rates of eyesight disorders in primary schools. Thai research reveals concerning incidences of refractive errors amongst young students.

Visual impairment prevalence ranges from 0.46% in Khon Kaen Province (Sattabunjong, 2022) to 57.26% amongst Year 1 students in Nong Chok district (Ketmai et al., n.d.), mandating adaptive educational design.

Research conducted at Thammasat School indicated that 32.5% of primary students had uncorrected refractive errors (Vongkittirux & NG-Pooresatien, 2008). Such statistics explain the need to create educational materials that do not presuppose perfect vision, but rather enable the participation of all students despite the problems with eyesight.

Typography directly influences visual stress manifestation. Suboptimal typographic parameters intensify processing strain in paediatric populations with perceptual difficulties (Wilkins et al., 2009). Diminished font size and condensed spacing induce ocular strain (Hughes & Wilkins, 2000). Typographic parameters require integration of perceptual and ergonomic criteria.

2.6. Educational Typography and UD

UD concept has become widespread in the development of educational materials where designs important to all people without consideration of their ability or disability are thriving. This approach shifts the focus from accommodating individual needs to designing inclusively for everyone (Burgstahler, 2015). Major tenets of UD in typography involve:

1. Equitable Use

Typography should be practical and accessible to people of various capabilities. It implies that the text needs to be made possible to be read by visually impaired readers without special formats.

2. Flexibility in Use

Typography should address the diversity of individual preferences and abilities, and everything should be variable: font size and font style to meet various needs related to reading.

3. Simple and Intuitive Use

Typography must remain intuitive across user abilities through clear hierarchy, coherent styling, and systematic layout.

4. Perceptible Information

Typefaces must deliver essential information through environmental and sensory variations via adequate contrast, spacing, and character distinction.

5. Tolerance to Error

Typography should reduce the risk and adverse effects of inaccurate or unintended performance. This, in practice, means using fonts that minimize letter confusion.

6. Low Physical Effort

Typography should be designed for ease of use, minimising eye strain and promoting physical comfort.

7. Size and Space for Approach and Use

Readability and comfortable access should be enabled by sufficient size and spacing, and facilitated to meet the needs of users of all dimensions, attitudes, and skills. This involves proper inter-word, inter-letter spacing, and line spacing.

Punsongserm's Thai UD typeface demonstrates practical application of UD principles to Thai typography, which was developed through extensive testing with both normal and visually impaired readers (Punsongserm, 2019, 2020).

Dell et al. (2020) emphasise that UD creates fundamentally inclusive resources benefiting all users, not just those with diagnosed conditions. For example, larger fonts reduce fatigue for both the visually impaired and students with normal vision.

Applying UD principles to Thai elementary textbooks can accommodate learners with diverse visual abilities whilst improving learning for all students. This study examines typographic patterns that align with UD requirements, including font size, character distinction, and spacing.

2.7. Critical Research Gaps in Thai Typography

Current literature reveals significant gaps in Thai elementary educational typography, particularly regarding accessibility and UD principles.

Limited research exists on Thai typography compared to Western languages due to structural differences, including wordless spacing, tone marks, and character combinations that make Latin-based research inapplicable.

Quantitative research on Thai typography effects on reading performance amongst students with diverse visual abilities remains limited. Studies examining relationships between Thai script characteristics and visual processing abilities in young readers are particularly lacking.

Longitudinal research on Thai typography's effects across diverse learners remains limited despite cumulative developmental impacts.

Implementation of UD principles in Thai educational typography remains underdeveloped, lacking empirical validation. Current guidelines depend on Western standards without Thai-specific research foundations.

These gaps necessitate empirical research developing inclusive typographic guidelines for Thai education.

3. Research Objectives and Questions

The present study investigates typographic practices in Thai elementary textbooks, examining font styles and sizes. The research questions and objectives have been formulated to enable evaluation of various aspects of typographic choices in early primary school textbooks.

3.1. Initial Research Purpose

This research examines typographic practices in Thai elementary textbooks (Years 1–3) by examining font types and sizes to document current methods and develop evidence-based educational typography guidelines.

3.2. Specific Research Objectives and Questions

- RQ1: What are the most frequently occurring types of Thai fonts (text fonts and display fonts) in early elementary textbooks?
- RQ2: What precise point sizes of fonts are used, and how are they related to the educational reading level?
- RQ3: How do fonts used in textbooks from different publishers vary in terms of font styles and sizes?
- RQ4: How do font styles and sizes vary across year levels (1–3)?
- RQ5: What are the differences in font usage amongst different subject areas?

4. Methodology

Using automated extraction, this study analysed typography in Thai elementary textbooks (Years 1–3). Our study addressed 198 textbook exemplars from 11 publishers, focusing on (1) selective searches based on the Bureau of Academic Affairs database; (2) data extraction on typography using Python and the *pdfplumber* library; and (3) comprehensive quantitative and qualitative analysis of typographical patterns.

4.1. Sample Textbook Choice

This study employed systematic sampling for Years 1–3 textbooks using the Bureau of Academic Affairs and Educational Standards database (http://academic.obec.go.th/textbook/web/), which lists all approved textbooks under the Basic Education Core Curriculum B.E. 2551.

The sampling method ensured representation of both subjects and publishers whilst controlling bias through the use of standardised criteria. Multi-stage filtering isolated Ministry-approved materials for Years 1–3.

Technical measures assessed PDF accessibility and font characteristics to ensure data reliability. Textbooks with limited font information were excluded to maintain analysis validity, given the automated extraction using Python and *pdfplumber*.

The selection process included: (1) systematic filtering using predefined criteria for Ministry-approved core subjects; (2) defining scope to include eight disciplines: Thai Language, Mathematics, Science and Technology, Social Studies, Religion and Culture, Health and Physical Education, Arts and Occupations; (3) selecting Years 1–3 materials from all publishers; (4) refining categories and downloading textbooks.

Technical eligibility was determined through PDF accessibility assessment and font analysis capacity. Textbooks that contained insufficient font data were avoided for accuracy.

The number of final samples included 198 textbooks, representing 11 publishers in core subject areas, which were of adequate size to allow for extensive analysis.

4.2. Python Programming for Data Collection

To make data extraction highly accurate and effective, we developed a bespoke Python programme that used the *pdfplumber* library. This approach was selected because of its ability to extract and examine typographical information of PDFs and to analyse the font usage patterns in a large number of textbooks.

The programme incorporated data integrity and reliability measures. It also took into account preemptive steps to counter the possible problem with viewing or capturing data contained in PDF, and by so doing, promised uniform output when using diverse files and various structures. This strength was important for making reasonable conclusions about the collected data.

Key functionalities of the software included font extraction using the extract_words method of *pdfplumber*. This allowed this programme to save important details regarding the font names, font sizes on every document.

The programme established two main data structures to arrange the information methodically: a frequency counter (font_stats) which monitored each font's occurrence and a list (font_sizes) that documented the font sizes for each font family.

Additionally, the programme contained error-handling procedure s to solve possible extraction difficulties. This ensured consistency across PDF formats.

4.3. Data Analysis Methodology

Analysis proceeded through four stages using mixed methods: data extraction, processing, statistical analysis, and validation.

4.3.1. Quantitative Analysis

Python scripts analysed font frequencies across textbooks, revealing patterns by material type and publisher.

Font size distributions were statistically analysed using means, medians, and modes to determine ranges for body text, headers, and other components. Analysis revealed body text sizes of 14–26 points with variations across year levels and subjects.

Cross-tabulations revealed typographic patterns by year level and subject area. Font sizes decreased with each successive year level (1–3), an expression of the publisher's adaptation to the level of increasing literacy.

4.3.2. Data Processing

Data processing involved extracting raw typographic data (font type, size, location) using *pdfplumber*, followed by cleaning inconsistent font names and unit differences. The standardisation procedures for font names covered disparities in the PDF generating tools and the statistical confirmation aimed to detect and rectify the abnormalities.

4.3.3. Output Generation

Output generation produced frequency tables, proportional distributions, and visualisations of typographic patterns. Cross-tabulation analyses examined typography distribution across subject areas and year levels for different content types (headers, body text, captions).

4.3.4. Validation Procedures

Validation processes involved cross-checking extracted data against original PDFs, and the anomalies were automatically identified by the scripts, as well as statistical tests, which detected outliers. Manual spot-checking of random samples identified systematic issues and verified data credibility, distinguishing between deliberate design choices and extraction errors.

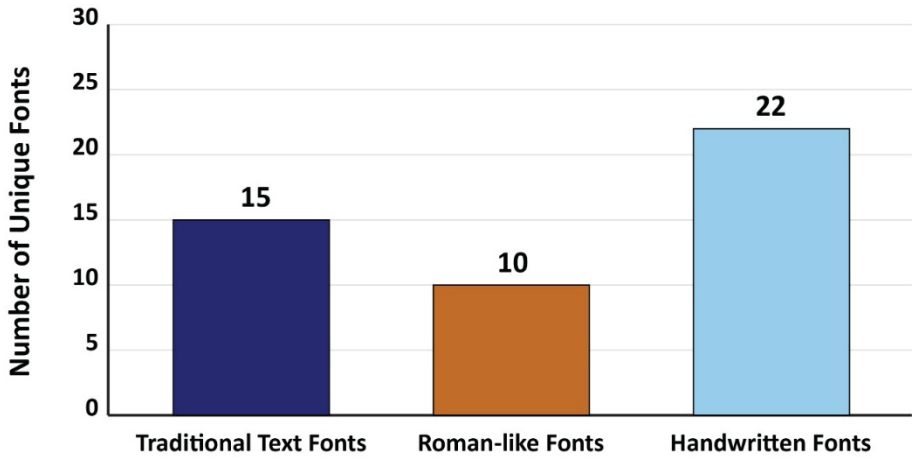
5. Results

5.1. Font Styles in Early Primary School Textbook Analysis

Analysis of Years 1–3 textbooks shows that text fonts (body fonts) are most commonly used for body text. These fonts feature legible letterforms with even stroke widths, proper spacing, and familiar shapes that make reading easy and reduce character confusion amongst young readers.

Such features reduce visual fatigue and enhance comprehension by eliminating letterform complexity.

Figure 1. Distribution of Thai font styles in Years 1–3 textbooks



Note: Distribution of Thai font types in early primary textbooks: traditional text fonts (n=15), handwritten fonts (n=22), and Roman-like fonts (n=10).

Conversely, some publishers use display fonts as body text. Display fonts are designed for attention at larger sizes (headings, promotional text), often compromising readability.

Thai fonts in early primary textbooks can be categorised into three types (Figure 1): traditional text fonts (15 types), handwritten fonts (22 types), and Roman-like fonts (10 types). Whilst traditional fonts dominate, handwritten fonts show the highest variety.

Two display font categories emerge: Roman-like Thai fonts that share Latin proportions but deviate from traditional conventions (e.g., *PSL Omyim Pro*, *IBM Plex Sans Thai*, *DB Helvethaica*, *Supermarket*).

The second category comprises handwritten fonts replicating calligraphy (e.g., *Mali*, *Layiji MaHaNiYom*, *PSL Isara Pro*, *JS Toomtam*). Nevertheless, the stylised fonts can impair legibility by being inconsistent in shape, poorly spaced, or extravagant.

These attributes negatively affect legibility for young learners developing basic literacy. Selecting an appropriate font is crucial for achieving optimal learning outcomes.

5.2. Comprehensive Analysis of Typography Sizes and Their Applications

5.2.1. General Font Size Distribution Patterns

Analysis of early Thai primary textbooks revealed that certain font size decisions were made in Thai educational publishing. More interestingly, the usage of the 14–26 points range in font usage seems to have become a norm in textbook design.

A systematic reduction of font size throughout the year levels is demonstrated in Figure 2. Year 1 uses larger fonts (40% in 17–20 points, a significant percentage in 21–26 points), indicating publishers' attention to early readers' visual needs.

The size distribution analysis indicates some significant trends. Year 1 materials have a high inclination to large fonts and the content here in more than 75% ranges between 16–26 points. Year 2 and 3 are characterized by the incremental diversification of font sizes, which mirrors the pedagogical approach based on the changing reading abilities of students.

Figure 2. Distribution of font sizes across Years 1–3 in Thai primary school textbooks

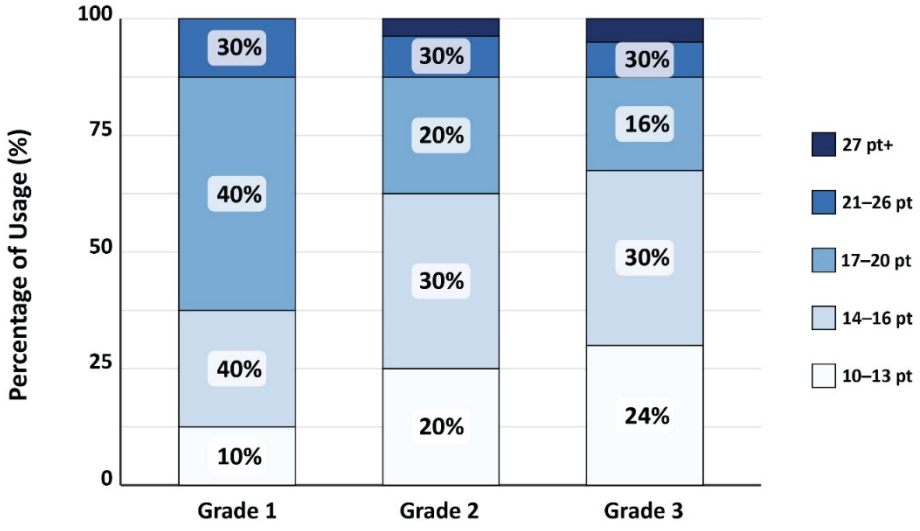


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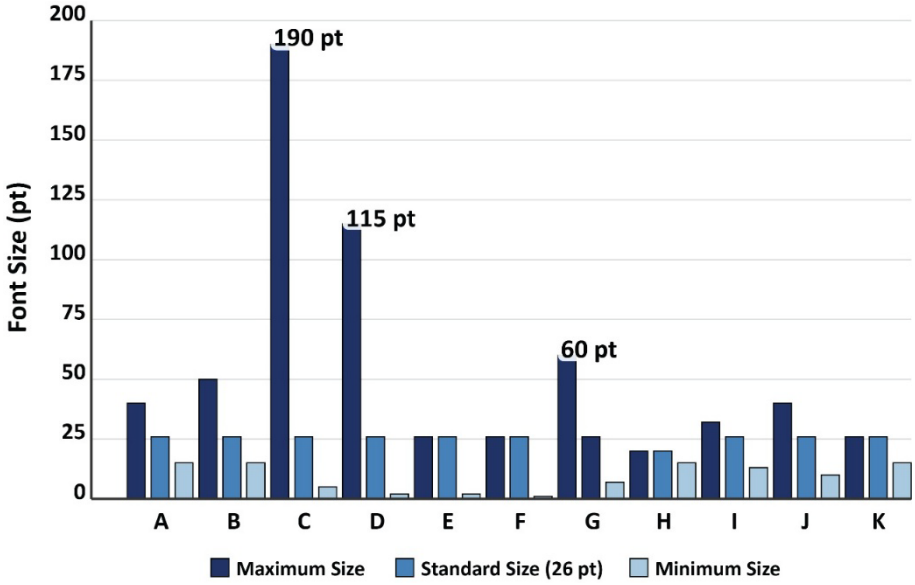
Figure 3. Font size ranges used by different publishers in Thai elementary textbooks (Years 1–3)



Note: Navy blue, royal blue, and light blue bars represent maximum size, standard size (26pt), and minimum size respectively across publishers A–K.

5.2.2. Contextual Analysis of Font Sizes

Font size selection varies by year level and subject area, reflecting publishers' consideration of specific learning requirements.

Year 1 commonly uses 16–26 points (most popular: 18 points), with 45% above 20 points. Year 2 narrows to 14–24 points (most popular: 16 points), with <30% above 20 points.

Year 3 shifts to 12–23 points (most popular: 14 points), with only 15% above 20 points, indicating progressive size reduction corresponding to developing reading fluency.

Subject-specific variations are evident: Mathematics and science use 14–26 points (up to 30 for key concepts), whilst language and literature span 12–40 points for varied formats. Arts subjects often utilise 14–30 points for readability and aesthetic appeal.

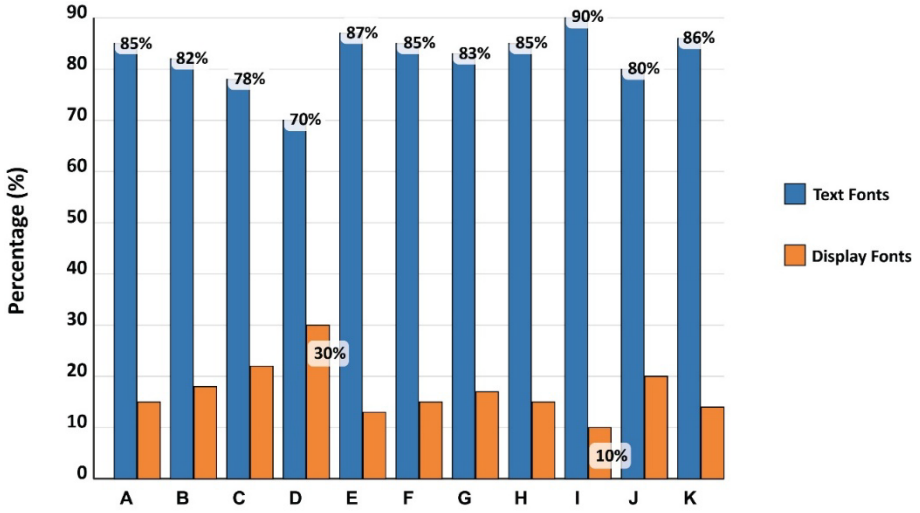
5.3. Font Usage Across Publishers: Comparative Analysis

We found that typography in Thai elementary textbooks is employed differently amongst various publishers.

The font size distribution amongst various publishers is shown in Figure 3, which indicates standardisation in font size as well as its variation within the Thai elementary textbook industry. Most publishers (85%) maintain typefaces within the standard body text range of 14–26 points, indicating broad consensus regarding basic readability norms. Nevertheless, significant variations can be seen in specialised content handling, and maximum font sizes differ widely amongst publishers.

Figure 4 shows a breakdown of the text and display font use by publishers, revealing a uniform industry trend where already 75–85% of text fonts often comprise the content.

Figure 4. Cross-publisher comparison of text and display font usage



Note: The stacked bar chart illustrates the percentage breakdown of each publisher's (A–K) font usage, with text fonts (royal blue) and display fonts (orange). Percentages are shown on the vertical axis.

The allocation of both text and display fonts demonstrates a balance between industry-wide averages and individual design preferences. Publisher I is the most determined to follow the conventional guidelines of readability, as the text font comprises 90% of the materials in this publisher. Conversely, Publisher D is more experimental, using text fonts for only 70% of its material. This variation reflects competing priorities between readability and visual appeal, as outlined in professional publishing norms.

Traditional publishers continue to use conventional typefaces, e.g., TH Sarabun or fonts from the DB family. Conversely, display fonts are increasingly popular amongst current publishers, indicating a change in typographic formats.

Although there is an inconsistency in the usage of decorative fonts, it is possible that most publishers do not start lower than 14–26 points in size. The application, however, differs especially in usage of the display fonts and emphasis styles. Changes in font size according to year level seem also unevenly used, according to the strategy of each particular publisher.

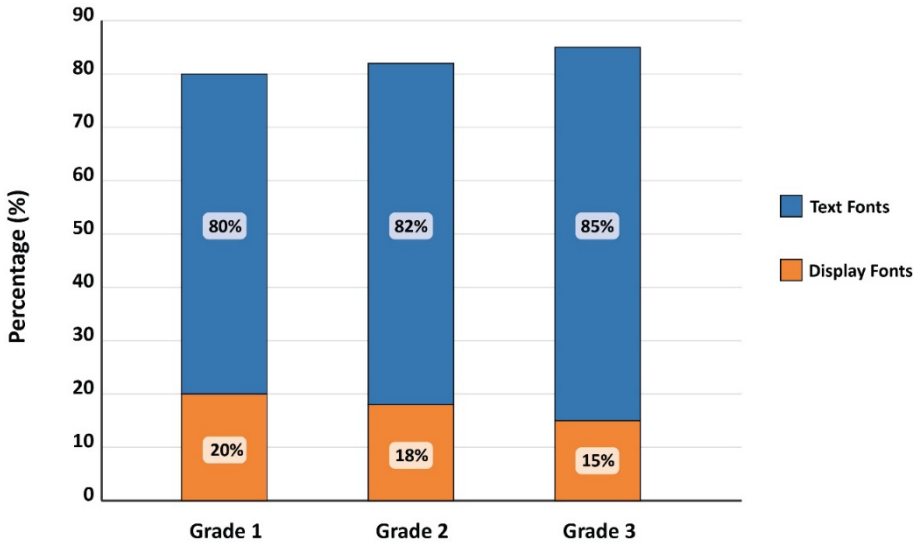
Typography in mathematics and science textbooks is typographically most uniform, with emphasis on clarity. In contrast, language arts resources employ a more diverse typography, and other subjects exhibit the greatest diversity, given their varied educational outcomes and content schemes.

To conclude, it is worth noting that although publishers choose the approaches to design, their preferences are based on the selected traditions of readability and accessibility. Standardisation and creative design come into balance, creating a typographically rich yet pedagogically coherent primary school learning environment in Thailand.

5.4. Comparing Font Choices Across Year Levels

The study confirmed definite tendencies in font sizes and types in primary school textbooks across Years 1–3. Despite year-level consistency, typographic variations indicate progression.

Figure 5. Percentage of display vs text font usage across year levels



5.4.1. Font Styles: Emphasising Consistency

Publishers maintain typographic consistency across year levels. Display font usage declines progressively – 20% in Year 1, 18% in Year 2, and 15% in Year 3 (Figure 5) – indicating a shift to standard typefaces as students advance academically.

For example, Publisher A consistently used UPC Dillenia across most subjects and year levels, whilst Publisher C favours WP Primary Unicode 2013. Similarly, Publisher J applies TF Chiangsaen as the principal typeface in early educational materials.

This consistency serves dual purposes: establishing brand identity and promoting cognitive familiarity. Familiar typographic design helps students read more easily and facilitates improved reading comprehension over time.

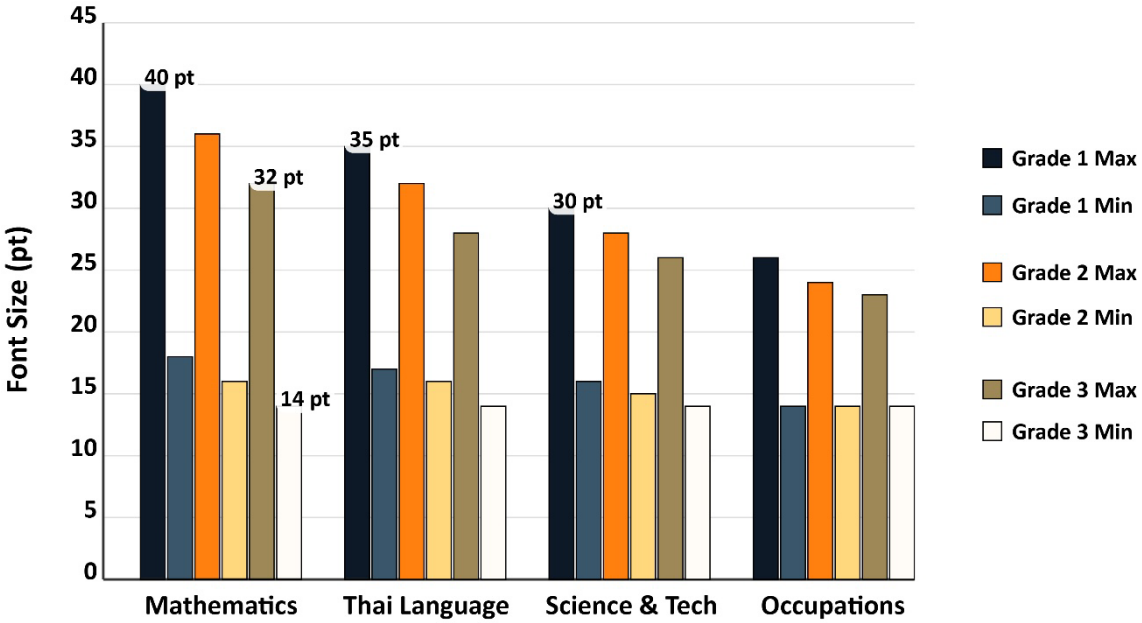
Publishers employ diverse typographic approaches. Publisher D uses UPC xF for Year 1 literature, then shifts to DB ThaiText X in Years 2–3. Publisher G begins with IPST-Script-Bold for Year 1 Science and Technology, switching to TH Sarabun IPST Beta subsequently. Such transitions indicate a pedagogical strategy: engaging typefaces for beginning readers and standard fonts for developing readers.

5.4.2. Font Sizes: Minor, But Key Modifications

The font styles are relatively stable; however, font size has some gradual but significant variation within the year levels. According to Figure 6, font size ranges are well specified in relation to Year. Year 1 normally uses size 14 to 26 points, and the most used size is 16 points. This narrows in Year 2 to a range of 12 to 24 points, with 14 points prevailing, and contracts further in Year 3 to 10–23 points, again with 14 points as the standard.

For example, Publisher A's Occupations textbooks employ 14–26 pt fonts in Year 1, 14–24 pt in Year 2, and 14–23 pt in Year 3. Key terms and vocabulary utilise larger sizes – 40 points in Year 1, decreasing to 32 points by Year 3.

Figure 6. Font size ranges for different subjects across year levels



Note: Mathematics consistently uses the largest fonts, followed by the Thai language. In all subjects, maximum and minimum font sizes gradually decrease from Year 1 to Year 3.

Subject-specific variations are also evident. Mathematics uses the largest sizes overall, but with Year 1 being 18 to 40 points and Year 3 being 14 to 32 points, especially in numerical and formulaic text. The Thai Language uses large type, particularly in teaching vocabulary, which requires 17–35 points in Year 1 or 14–28 points in Year 3. Science and technology exhibit more moderate changes, with ranges narrowing to 14–26 points compared to 16–30 points.

5.4.3. The Outliers: Display Fonts and Extraordinary Sizes

Some publishers differ significantly from general trends. Publisher D makes heavy use of handwritten decorative fonts like Mali and Layiji MaHaNiYom across all year levels, particularly in Science and Technology materials.

Conversely, Publisher E uses fonts as small as 9 points, below educational standards and compromising readability.

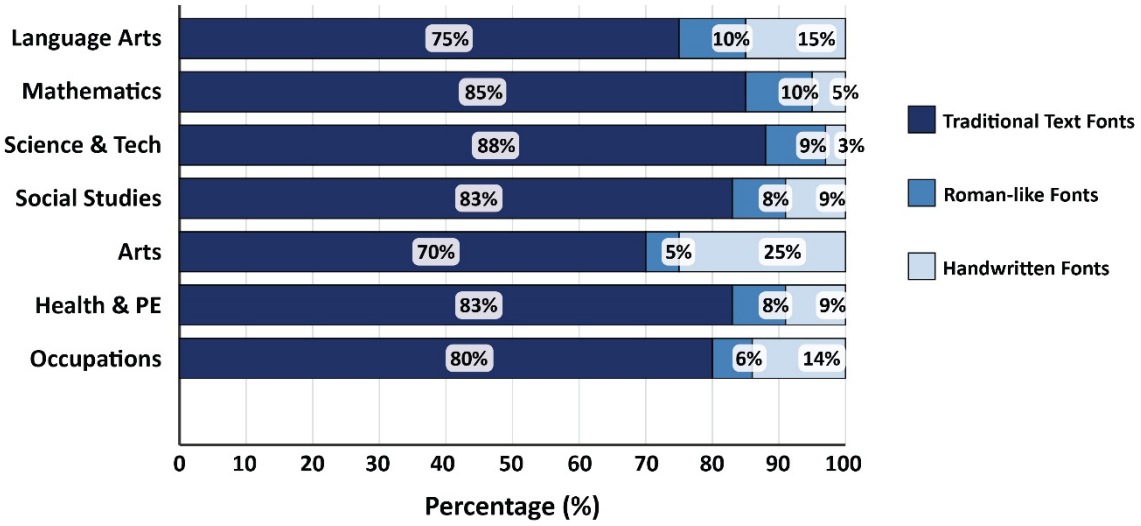
5.5. Comparing Font Choices Across Subjects

Comparison of font usage in Thai textbooks across Years 1–3 revealed several interesting trends in the typefaces selected by the respective publishers by discipline. Although general tendencies can be identified, specific typographic images originated in individual fields. In this section we consider the specific subject typography and how this typography may be important to young Thai readers.

5.5.1. The Core Subjects: Focus on Consistency

Key subjects that form the skeleton of the primary curriculum, especially Thai Language, Mathematics, Science, and Technology, are typically published in conservative fonts, where consistency is stressed. Such subjects strongly depend on conventional text fonts, as shown in Figure 7, with only slight stylisation.

Figure 7. Distribution of font styles by subject areas



Note: The distribution of font styles included in the major subject heading shows that the traditional fonts are dominant and the use of Roman-like fonts and the handwritten fonts are different.

Thai Language textbooks commonly use an antique-style font, including TH Sarabun and DB ThaiText, the fonts of which are commonly selected in a wide range of sizes between 12 and 40 points. The larger sizes may be applied to special characters or annotations. Occasionally, handwritten-style fonts are used in writing assignments, which constitute about 15% of the text, thereby adding both clarity and visual engagement.

Within the broader Language Arts domain, which includes Thai Language and Literature, typography is tailored to support language acquisition. Font sizes average 15 points, with a maximum of 40 points used to emphasise new vocabulary. The ratio of text to display fonts is approximately 80:20.

Mathematics textbooks favour regular text fonts such as DB ThaiText X. The subject demonstrates a highly organised typographic structure, featuring the largest average text size (16 points) and highest percentage of traditional text fonts (85%).

Science and Technology textbooks also prioritise readability, using font sizes between 14 and 26 points, with occasional use of 32 points for headings or key terms. However, the use of highly stylised display fonts is limited owing to potential legibility issues.

The Science domain, which encompasses both Science and Computing, maintains 88% usage of conventional text fonts and uses Roman-like styles for technical language. Similarly, Technology textbooks (especially in Computing Science) rely on 85% text fonts while incorporating stylised fonts to illustrate coding examples. Technical terms are frequently highlighted in larger font sizes.

In general, in core subjects, there are three main typographic goals: legibility, consistency and low visual distraction. The fonts developed aid and do not subordinate the information, allowing learners to fully concentrate on learning new or difficult concepts without being distracted by the typography.

5.5.2. The Expressive Subjects: More Typographic Variety

Conversely, arts and humanities subjects demonstrated greater typographic diversity and creative expression. These disciplines employed Roman-like and handwritten fonts more extensively (Figure 7), reflecting expressive design priorities.

Literature textbooks utilise a wide range of font sizes (12–40 points) and frequently include stylised display fonts for titles, quotations, and emphasis. The text-to-display font ratio in the Language Arts domain is approximately 80:20.

Visual and Performing Arts materials are particularly diverse, incorporating fonts such as Lanna, Angsana, and DilleniaUPC. Key terms often appear in larger sizes than in core subjects and are commonly set in display fonts. In Visual Arts textbooks, font variation is used to explain artistic techniques and project instructions, typically set at 14–16 points, with specialised fonts used for colour theory terminology.

In Music textbooks, different fonts distinguish musical notation, rhythm patterns, and technical vocabulary. Song lyrics are generally presented in 16–18 points for optimal readability.

The typography in Performing Arts determines the difference between stage directions and dialogue. The font sizes normally alternate between 14 and 16 points, and different formatting styles are adopted in order to emphasize performance notes.

Social Studies, Religion and Culture make use of expressive display fonts alongside traditional ones, with font sizes ranging across 14–26 points and occasionally reaching 35 points for emphasis. The Social Studies field, which includes History, Geography, Religion and Culture, maintains font sizes within 12–35 points and uses 82–85% conventional fonts alongside 10% handwritten styles.

To show reverence, religious studies will tend to use sacred text fonts. In Buddhism, specific fonts are used for Pali and Sanskrit terms to highlight Dhamma principles, with ceremonial instructions set in larger fonts (24–28 points). Islamic texts also follow different fonts in Arabic, verses in Quran use dual script typesetting and sizes of verses also differ between 18–24 points.

Typography according to content is proportional to history and geography. History uses larger fonts (20–24 points) to emphasise key dates, figures and eras, while Geography maintains 16–20 points for labels and uses precise fonts for scale and topographic terminology.

These expressive subjects make it possible for typography to augment the emotional and illustrative content. Fonts similar to writing make everything feel personal, and larger fonts make it easy to focus on keywords and design elements.

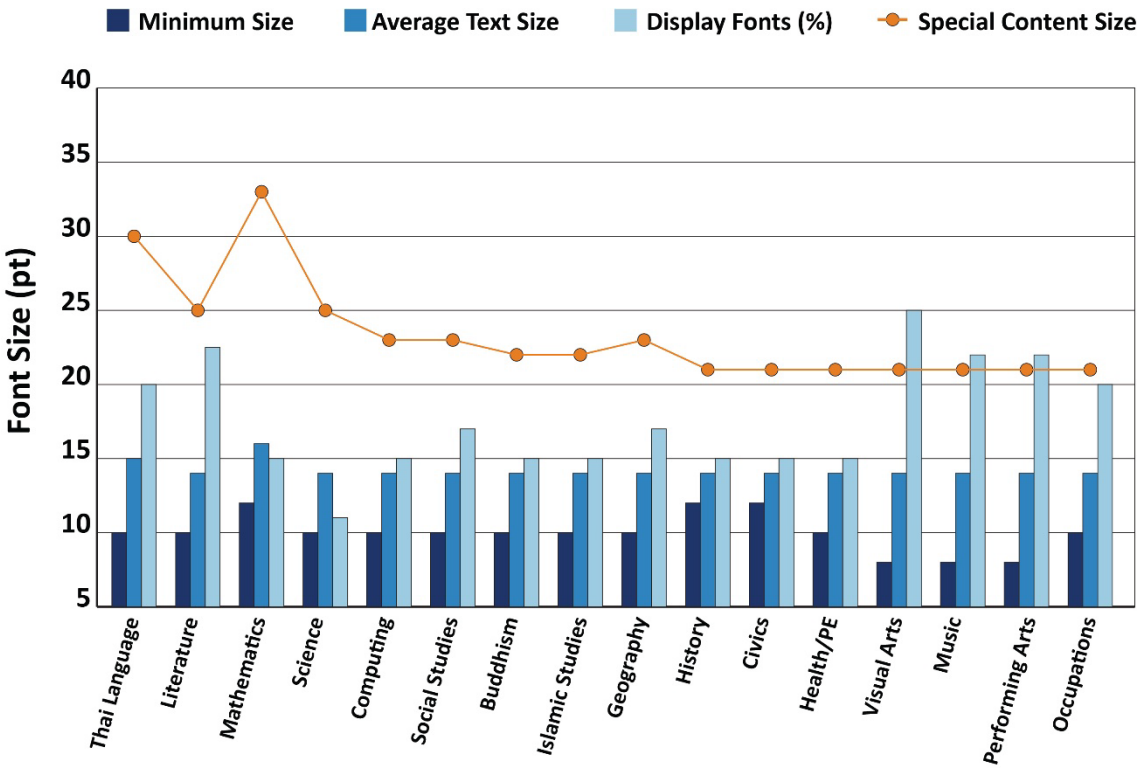
5.5.3. The Outliers: Bucking the Trend

Educational publishing has a unique symbiosis of content and publishing form, which is strikingly different from typical typographic norms. The stylised IPST-Script-Bold font is used frequently in textbooks published by Publisher G (and others) at Year 1 and at other levels in Science and Technology. This selection is quite contrasting to the more pristine, more common text fonts used with the rest of the STEM disciplines.

Likewise, the Mali handwritten font family is also widely utilized by Publisher D in its Health and Physical Education curriculum. This also underlines the difference in the standardised type of font used by most other publishers.

A common requirement has appeared in the case of Computing Science resources targeting young children to have an assortment of high-complexity display fonts. The Year 2 resources by publisher F, for example, follow the Supermarket font, which is an italic font of Roman type, designed to approximate the forms of the Thai script. Meanwhile, Publisher H adopts a distinctly playful approach, employing an ornamental display font called 2005_iannnnnGMO to enhance the appeal of their materials for younger audiences.

Figure 8. Font specifications by individual subject



Note: Detailed font specifications by subject, including differences in minimum size, average text size, percentage of display font and size of special contents.

These decisions may help publishers stand out creatively, but raise significant readability concerns, especially for STEM content. The effects on young readers' comprehension should be evaluated through empirical studies.

Figure 8 shows an overview of our quantitative data analysis of font specifications per individual subjects, and it provides a graphical description of typographic variation of Thai primary school textbooks. A few outstanding patterns can be picked out of this data.

Mathematics demonstrates the most structured typographic approach, with the largest modal text size (16 pt) and the highest proportion of conventional text fonts (85%). It makes sense given the focus of the subject on accuracy and clarity of concepts. In contrast, Visual Arts exhibits the greatest typographic diversity – 22% display fonts and multiple font sizes – corresponding to its creative content requirements.

Another issue that arises in this dataset is accessibility. Most of the subjects have font sizes of between 12 and 14 points, although Religion and the Thai Language are a bit more extensive at 14 points. Some subjects, though, especially Health Education and Computing, in places contain font size suggested to be as small as 9–10 points. These are far less than the recommended levels of legibility of Thai text, and questions are being raised concerning the visual accessibility of the text to young readers with a wide range of visual requirements.

Special content typography differs across subjects. Mathematics and Thai Language employ larger fonts (40 pt, 35 pt) for conceptual and lexical instruction. Social Studies and Arts implement reduced sizes (26–30 pt), demonstrating alternative pedagogical strategies.

Quantitative data corroborate qualitative analysis of subject-specific typography. Findings necessitate disciplinary best practices integrating pedagogical objectives with UD principles.

6. Discussion

This study makes substantial contributions to the understanding of typographic practices in elementary Thai textbooks and their implications for early education, particularly when viewed through the lens of accessibility and UD. The discussion is organised around five major themes that contextualise the findings in relation to existing literature.

6.1. Typography Practices in Early Education

Most publishers used traditional Thai text fonts to produce 75–85% of their content. Hughes and Wilkins (2000) stated that young students benefit from reading skill development through straightforward, consistent typography. However, Roman-like Thai fonts (10–15% of content) reduce legibility compared with traditional typefaces, compromising accessibility (Punsongserm et al., 2018c; Punsongserm, 2024b, 2025).

Display font usage decreases from Year 1 (20%) to Year 3 (15%). Bessemans (2016) advocates a developmental reading approach. However, even appropriate fonts can hinder comprehension when used decoratively, especially amongst learners who are not yet fluent readers or experience visual processing difficulties.

From a UD perspective, font style variation across publishers and subjects indicates a lack of standardisation. Although certain typographic decisions appear responsive to developmental needs, there exists no consistent application of UD principles for students with diverse learning needs.

6.2. Visual Considerations and Accessibility

The study found that font sizes in textbooks ranged between 14 and 26 points, whilst some publishers used fonts as small as 9 points. This created accessibility issues given that many Thai primary school students had undiagnosed visual impairments (Sattabunjong, 2022). This underscores the importance of addressing visual health in typography design, as highlighted by Vongkittirux and NG-Pooresatien (2008) and Ketmai et al. (n.d.).

Subject-specific variations in font size suggest responsiveness to diverse learning environments. Larger font sizes are consistently employed in mathematics (18–40 points) and Thai language (17–35 points) for technical material clarity.

Existing typographic practices may not address students with reading difficulties or visual differences. Punsongserm and Suvakunta (2022a) recommend a minimum visual angle of 0.200° for Thai text legibility. These contradictions clearly show that accessibility-focused typography guidelines are needed for broader visual abilities.

6.3. Educational Quality Standardisation

This study demonstrated wide disparities in typographic practices amongst publishers. Most standardise body text sizing, but specialised content varies significantly. This indicates the need for specific, evidence-based guidelines that focus on accessibility within UD frameworks. Reynolds and Walker (2004) note that uniformity in educational resources promotes better student learning.

Outlier practices – such as excessive decorative or diminutive fonts – necessitate standardisation. Inappropriate typography hinders reading acquisition, particularly amongst diverse learners (Wilkins et al., 2009).

Accessibility problems emerge when clearly defined minimum font size indicators are absent. Dell et al. (2020) emphasise that educational resources should be designed with diverse learners in mind. This highlights the necessity for well-defined UD-based guidelines.

6.4. UD Implementation in Educational Materials

This study provided information about the usage of UD in Thai primary school textbooks. The study suggests using fonts of traditional text size consistently, proportional sizing of fonts used in successive Year levels, and a large font style for technical content. Such practices align with the UD aspects of information perceptibility and accessibility.

Nevertheless, the significant variations and problematic practices identified in this study highlight inadequate UD implementation. Burgstahler (2015) emphasises that UD involves considering the needs of diverse users at the outset of the design process. The existing Thai textbooks at the elementary school level do not appear to adequately address the needs of the average learner or those with different visual impairments.

Applying UD to educational typography requires several considerations: establishing empirical evidence-based minimum font size criteria for users with visual disabilities; developing font choice policies that ensure readability for all readers with appropriate spacing and layout specifications; and ensuring consistent communication of guidelines across publishers and subjects to guarantee educational material effectiveness.

The results of the given study provide a great basis of the development of such guidelines, which have the potential to make Thai educational materials much more accessible.

6.5. Digital Transition and Future Prospects

Digital educational content requires adapted typographic practices to ensure readability and accessibility. Masulli et al. (2018) identify congruent cross-media reading experiences as essential. Present findings establish parameters for print and digital typographic standards.

UD issues are especially important for digital materials. Punsongserm and Suvakunta (2024a) emphasise that digital interfaces present distinct obstacles for Thai typography. The research delivers typographic design insights that allow educators to develop universally accessible digital educational materials.

6.6. Research Limitations and Future Directions

Four limitations constrained this research. Analysis of government-approved textbooks alone, excluding supplementary materials provided by teachers, limited generalisability. Secondly, without data comparing how typographic choices affect student performance – especially amongst visually impaired learners – differential impacts cannot be determined. Thirdly, the emphasis on print materials overlooks digital platforms, which are now central to education. Fourthly, documenting current typographic practices without conducting accessibility tests restricts practical applications. These limitations prevent comprehensive conclusions about educational typography accessibility.

Future research requires empirical comparisons of reading performance across fonts and sizes amongst students with different visual abilities. Digital learning resources need examination within Universal Design frameworks to assess typographic effectiveness. Longitudinal investigations should track how typographic choices affect reading development, whilst concurrent efforts develop testable Universal Design specifications for Thai educational typefaces.

7. Conclusion

A systematic analysis of the typography used in Thai primary school textbooks (Years 1–3) has revealed notable patterns in font styles, sizes and their variations across publishers, year levels and subject areas. The results provide evidence-based recommendations for developing educational materials based on UD principles.

Text sizes follow readability standards (14–26 points) despite significant variations affecting accessibility, with publishers reducing sizes across year levels as reading skills develop. Patterns of use by subject also suggest a pedagogical rationale, with increasingly consistent typographic conventions used in mathematics and science as compared to language arts.

The analysis highlights a fundamental understanding of typography principles accessible to publishers across the industry, as 85 per cent of publishers tend to maintain typical size ranges for body texts. However, individual preferences for specialised content and display typography indicate the potential for establishing more inclusive guidelines based on UD principles. The high prevalence of uncorrected refractive errors amongst Thai primary school children reinforces the need for accessible typography (Ketmai et al., n.d.; Sattabunjong, 2022; Vongkittirux & NG-Pooresatien, 2008).

The increasing digitalisation of educational materials raises additional issues regarding accessible typographic design. The impact of utilising screen-based reading environments on typographic needs incorporated by various learners should be explored in further studies, and the possibilities of how the readability of digital learning devices can be sustained without compromising the pedagogical benefits highlighted in this paper should be evaluated. Longitudinal studies would also be beneficial, especially in exploring the development of reading in learners with different visual abilities over a long period, due to any changes in type.

Three recommendations emerge from Universal Design analysis. Minimum font sizes should be standardised at 14 points or larger for body text to ensure accessibility. Educational policies must incorporate developmental and accessibility parameters into year and subject-specific typography guidelines. Display fonts should be restricted to pedagogically justified applications, maintaining adequate contrast and character legibility.

Universal Design typography requires clear character differentiation and consistent spacing to accommodate diverse visual needs. Digital educational texts require precise typographic specifications – font size and line height – within adaptable frameworks accommodating learner variability.

Finally, empirical assessment of typography's impact on learning outcomes remains critical, with the necessary inclusion of visually impaired learners in research samples.

The present study enhances understanding of educational typography's role in improving Thai primary school textbook accessibility through UD principles, enabling publishers to develop materials supporting all students' learning and engagement.

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Appendix: Font Usage Analysis Summary by Publishers

Appendix A: Primary Fonts by Publisher

Publisher	Primary Font(s)	Font Size Range (pt)	Usage Count Range	Subjects Coverage
A	UPC-Dillenia	10–40	146–2819	All subjects (13 subjects)
B	DBThaiTextX	14–51	2071–2995	Mathematics only
C	WPPrimaryUnicode2013, WPStandardNo1	6.8–190	560–4070	All subjects (12 subjects)
D	DBThaiTextX	2.3–115	306–3599	All subjects (11 subjects)
E	TFLanna	2–24.4	340–2523	8 subjects
F	THSarabunPSK	0.3–28	132–638	3 subjects
G	THSarabunIPSTBeta-Regular (primary), PSL-Text, DBThaiTextX (subject-specific)	8–59	96–4578	11 subjects
H	THSarabunNew, THSarabunPSK	16–20	158–593	Technology only
I	UPCxB, UPC-Browallia	10.4–33	459–1137	3 subjects
J	TFChiangsaen, THSarabunNew	12–40	469–2465	8 subjects
K	THSarabunPSK, THSarabunNew-Bold	14–24	340–632	Geography, Science and Technology

Appendix B: Traditional Secondary Fonts

Publisher	Traditional Secondary Fonts	Subjects Used	Usage Characteristics
A	UPC-Freesia-Bold, TFSrivichai, UPC-Orchid, TFSrivichai-Bold, UPC-Angsana, TFPimpakarn, UPC-Dillenia2, UPC-Dillenia-Bold, UPC-Cordia, THSarabunPSK-Bold, TFLanna-Italic, UPC-Eucrosia, UPC-Hyacinth, TFChiangsaen-Bold, CmPrasanmit, THSarabunPSK, TFArluck-Bold, Sarun's Manorah, TFUthong, UPC-Cordia-Bold, THSarabunNew	All subjects	Extensive usage
B	DBNaraiX, DBThaiTextX-Bold, DBPuiMakeX-Bold	Mathematics	Secondary support
C	WPPrimaryUnicode2013-Bold, ZapDingbatsNormal, WPRajbunditArrowASP, THKodchasal-Bold	All subjects	Secondary support
D	DBThaiTextX-Bold, THKodchasal-Bold, THKodchasal, JS-Saowapark-Bold, JS-Saowapark, JS-Prasoplarp, THFahkwang-Bold, UPCxF-Bold, 4805KwangMD_Influenza	All subjects	Extensive usage
E	TFLanna-Bold, PSLTextPro, TFUthong, THKDJuly-Bold, DBThongLorX-Bold, THSarabunPSK-Bold, UPCALight, UPCABold, UPC-Angsana-Bold, THKDJuly	8 subjects	Secondary support
F	THSarabunPSK-Bold, THSarabunPSK-Italic, THSarabunNew	3 subjects	Limited usage
G	THSarabunIPSTBeta-Bold, THSarabunIPSTBeta, SW-Suwit_DotUPC, PSL-Text-Bold, PSLTextPro, PSL-TextItalic, PSL-TextBold, PSL-Bundit-Bold, DBThaiTextX-Bold, PSLxText, EACPemai-Bold, UPC-Freesia-Bold, UPC-Freesia-BoldItalic, UPC-Freesia-Italic, UPCxF-Italic, UPCFLight, THSarabunPSK-Bold, UPC-Cordia-Bold	11 subjects	Extensive usage
H	THSarabunNew-Bold, THSarabunPSK-Bold, BrowalliaNew	Technology	Limited usage
I	UPCxB-Bold, UPC-Browallia-Bold, UPCH-Bold, PSLPaksinProBold	3 subjects	Secondary support
J	TFSrivichai-Bold, TFSrivichai, TFLanna-Bold, THSarabunNew-Bold, TFPimai-Bold, SW-SuwitUPC, XJS-Karabow, TFChiangsaen-Bold	8 subjects	Extensive usage
K	TFSrivichai-Bold, font0000000026088d10, font0000000026088d17	2 subjects	Limited usage

Appendix C: Roman-like Secondary Fonts

Publisher	Roman-like Secondary Fonts	Subjects Used	Usage Characteristics
A	PSLOmyimPro, IBMPlexSansThai-Bold	Occupations, History, Thai Language	Limited usage
C	PSLOmyimPro, PSLImperialProBoldItalic	Occupations	Limited usage
F	Supermarket, DBHelvethaicaX-55Regular	Computing Science, Science and Technology	Mixed usage
G	PSLEmpireExtraSP, PSLEmpireExtra	Islamic Studies	Limited usage

Appendix D: Handwritten Secondary Fonts

Publisher	Handwritten Secondary Fonts	Subjects Used	Usage Characteristics
A	Mali-Bold	Social Studies	Limited usage
B	Mali-Italic	Mathematics	Limited usage
C	LayijiMaHaNiYomV1.3, PSLIsaraPro, JSToomtam-Normal	Buddhism, Health	Limited usage
D	LayijiMaHaNiYomBAO, LayijiMaHaNiYomBAOOT, LayijiMaHaNiYomV1.5OT, THMaliGrade6-Bold, Mali-Regular, Mali-Medium, Mali-SemiBold, Mali-Bold, Itim-Regular	Most subjects	Extensive usage
E	THMaliGrade-Bold	Technology, Mathematics	Limited usage

Publisher	Handwritten Secondary Fonts	Subjects Used	Usage Characteristics
F	2005_iannnnnMTV	Computing Science	Limited usage
G	IPST-Script-Bold, 2005_iannnnnJPG, 2005_iannnnnGMO	Technology, Visual Arts, Science	Mixed primary/secondary
H	2005_iannnnnGMO	Technology	Limited usage
I	THMaliGrade-Bold, THKDJuly-Bold	Thai Language	Limited usage
J	LayijiMaHaNiYomBAO, LayijiMaHaNiYomBAOOT, THMaliGrade6-Bold	Most subjects	Secondary usage
K	PSLDoungkamolProBold	Geography	Limited usage

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A web content audit of accessibility and linguistic inclusivity for students with disabilities on SAARC countries university websites

Mahmood K., University of Management and Technology, Pakistan,
ORCID 0009-0003-8034-3950, teflmate@gmail.com

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Abstract: Disability-friendly university campuses and inclusive language play a pivotal role in smooth and motivated learning for students with disabilities (SwDs). This quantitative web content audit study aims at auditing the availability of disability support services information and person-first (inclusive) or identity-first (exclusive) language on official websites of universities in the member States of the South Asian Association for Regional Cooperation (SAARC). Official websites of eight universities (one public and private sector University each) from the capital cities of four SAARC countries (Pakistan, India, Sri Lanka, and Bangladesh), considering the demographics of disability, ranking of universities and geo-political locations have been selected through a purposive sampling technique. An adapted checklist of ten closed-ended questions has been used to collect data on the availability of disability support services. The data on the use of inclusive or exclusive language have been collected through a researcher developed data extraction sheet. The study found a dearth of disability support services information as 40% staple information focusing the building infrastructure and allied disability support services was missing from the websites of sampled universities. India has 50%, Pakistan 40%, however Sri Lanka and Bangladesh 30% information apiece flashed on university websites. The study has also found that sampled university websites have used both person-first (inclusive) and identity-first (exclusive) languages homogeneously. The study recommends uniformed availability of disability support services information on the websites of universities. Moreover, inclusive language is recommended instead of exclusive language. Global policy-makers, organizations, government stakeholders, universities, and web designers should ensure availability of disability support services at homepages of university websites for accessibility. Researchers should explore this novel field of research from different standpoints to contribute for higher education and rehabilitation of students with disabilities. The study will be aligned with SDG-4 *Quality Education* and SDG-11 *Reduced Inequalities.*

Keywords: Accessibility, disability support services (DSS), identity-first language, person-first language, SAARC countries university websites, students with disabilities (SwDs)

1. Introduction

According to the World Health Organization's report (2022), an estimated 16% (1.3 billion) of the global population is of people with disabilities. Out of which, 60% population with disabilities lives in the Asian Pacific regions. In 1975, for the first time at an international forum, the United Nations Organization (UNO) through UN General Assembly resolution number A/RES/30/3452 of December 9, 1975 raised the voice for provision and protection of the rights of persons with

disabilities. In 1982, UN General Assembly recognized the World Programme of Action for Disabled Persons advocating the inclusion of persons with disabilities in mainstream of life in the fields of education, health, and rehabilitation services. United Nations Organization through General Assembly resolution number 37/52 of December 3, 1982 declared 1983 to 1992 as UNO Decade of Disabled Persons. To ensure implementation on the policies, UNO Commission for Social Development (1994) initiated a three-year monitoring programme for the implementation of legislation and policies for persons with disabilities. International Convention on the Rights of Persons with Disabilities (2006) was a major milestone urging member states to provide physical mobility, technology, and support services access to persons with disabilities.

South Asian Association for Regional Cooperation (SAARC) was established on December 8, 1985 with its headquarters at Kathmandu, Nepal. The association is a regional body for cooperation among eight member states, Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Although, the scope of SAARC is very vast from education, health, social life, science, technology, and trade (Shaheen, 2013: 1). The association is committed to provide disability support services to persons with disabilities living in this region.

The SAARC member states have chalked out certain legislative Acts and ordinances for the rights of persons with disabilities. These policy guidelines warrant all stakeholders to ensure protection of the rights of persons with disabilities. Moreover, Higher Education Commissions of SAARC countries are bound to provide free and facilitated higher education to students with disabilities through disability support services at university campuses. Ahmed and Khan (2011) in a study argued that countries across the world have passed legislation for equal opportunities and rights to the persons with disabilities in compliance with the Convention on the Rights of Persons with Disabilities, 2006.

SAARC countries legislation for students with disabilities is homogenous to ensure reservation of quota for admission to higher education, provision of scholarships, fee concessions, the availability of wheelchair, the construction of disability-friendly campuses for smooth movement, and other allied disability support services. Moreover, from time to time policies and executive orders are issued to use inclusive language with person-first terms (persons with disabilities) instead of exclusive language with identity-first terms (disabled person). The use of person-first language for students with disabilities enhances the motivation, sense of inclusion, and will to progress. On the other hand, identity-first language demotivates, stigmatizes, and emotionally damages the students with disabilities. In a study (Sharif et al., 2022) concluded that disability studies is an interdisciplinary field of research but still scholars are not well aware whether to use person-first or identity-first language. The study recommended to use proper language for persons with disabilities and the preferred choice was person-first instead of identity-first language. Iqbal (2023) reports that Supreme Court of Pakistan has given a verdict that thenceforth, the identity-first term “Disabled Persons” would not be used in official correspondence of all departments of Pakistan and person-first term “Persons with Disabilities” would be used.

The advent of modern day technology and websites of universities have made it easy to upload information regarding availability of disability support services at campus using person-first language keeping in view of the sensitivity of the emotions of potent students with disabilities. This novel study is set to explore information regarding availability of disability support services for accessibility and linguistic inclusion of students with disabilities flashed on SAARC countries university websites. .

1.2. Purpose Statement

The purpose of this study is to audit the availability of disability support services and person-first (inclusive) versus identity-first (exclusive) language on the SAARC country universities' websites.

1.3. Objectives of the Study

The study has the following objectives to achieve:

1) To audit the availability of disability support services information on the official websites of SAARC countries' universities.
2) To explore person-first versus identity-first language on the official websites of SAARC countries' universities.
3) To align the study with Sustainable Development Goal (SDG)-4 *Quality Education* and SDG-11 *Reduced Inequalities* in compliance with the United Nations Organization agenda and betterment of students with disabilities, particularly in the South Asian region, and the world in general.

1.4. Research Questions

This study examined and answered the following questions:

1) What is the frequency of availability of disability support services information for students with disabilities on the official websites of SAARC country universities?
2) What is the tendency of official websites of SAARC country universities using person-first or identity-first language to display disability support services information?

2. Review of Literature

2.1. Global Context

UN resolutions and guidelines for the rights of persons with disabilities require signatory States to enforce these regulations. The higher education institutions around the world are also bound to display comprehensive details about disability services on their websites. Wilson and Meyer (2009) noted that contemporary prospective students possess greater technological proficiency as compared to previous generations. According to Coomes and DeBard (2004), today's global generation remains interconnected around the clock, relying heavily on information available on college and university websites. Therefore, it is obligatory upon universities to ensure their websites are designed to meet student needs effectively. These websites serve as the virtual face of an institution and must provide sufficient and pertinent information for prospective students. Meyer and Jones (2011) observed that many institutional websites prioritize publicity and marketing over student-related information, leading to dissatisfaction among students due to inadequate relevant content. Furthermore, students often become frustrated and abandon their search when required information is scattered across multiple pages from the homepage. Consequently, institutions should prioritize the provision of pertinent information on their websites to enhance student satisfaction and facilitate their access to necessary resources.

Jackson and Jones (2014) examined the official websites of 40 Public Community Colleges in the USA regarding the availability of disability services information. They emphasized that these

websites served as the virtual representation of educational institutions and should adhere to web policies to support students, particularly those with disabilities.

2.2. South Asian Context

The Population of South Asia (2024) data indicates that approximately 25.2% of the global population resides in South Asian countries. The National Survey on Persons with Disabilities (2021) reported a 2.80% disability prevalence in Bangladesh, whereas the Washington Group (2015) estimated 9.1%. Pakistan's census figures showed 2.49% in 1998, decreasing to 1.4% in 2017, with 6.2% estimated by the UNDP in 2022. India's 2015 census reported 2.2% disability prevalence. SAARC aims for inclusive education and rights for all genders and disabilities, though its official website only briefly mentions disability initiatives from 1993. The Review of Evidence on Disability Programmes in South Asia (2019) critically analyzes regional policies and laws safeguarding disability rights, emphasizing intellectual and developmental disabilities. The summary of these polices and laws is given below in Table 1:

The table 1 above illustrates that South Asian countries have enacted numerous laws to uphold the rights, privileges, employment opportunities, and inclusive education for individuals and students with disabilities. However, the lived experiences of persons with disabilities in this region reveal that the challenge lies in effectively implementing these laws, policies, and ordinances. The Higher Education Commission (HEC) Policy for Students with Disabilities at Higher Education Institutions of Pakistan, 2021 (Amended) outlines various benefits such as waiving upper age limits for admission, fee concessions, reserved seats in advanced programs, and infrastructure enhancements such as ramps and accessible facilities.

Table 1. Policies and Laws in the Six South Asian Countries

Country	Policies
Afghanistan	The comprehensive National Disability Policy in Afghanistan, submitted to the Ministry of Martyrs and Disabled in 2003 The Law on Rights and Privileges of People with Disabilities, n.d.
Bangladesh	National Policy of Disability, 1995 Disability Welfare Act, 2001 National Action Plan on Disability, 2006 Bangladesh Labour Law, 2006 National Education Policy, 2010 National Women Development Policy, 2011 National Health Policy, 2011 Child Act, 2013 Revised Persons with Disabilities' Rights & Protection Act, 2013 Revised Persons with Disabilities' Rights & Protection Act, 2015 National Plan of Action, 2018 (following above Act and Rules) Neurodevelopmental Disability Protection Trust Act, 2013 Neurodevelopmental Disability Protection Trust Rules, 2015 National Strategic Plan for Neurodevelopmental Disorders, 2016-2021 National Plan of Action, 2019 (following above Act and Rules)
India	National Health Act, 1987 The Rehabilitation Council of India Act, 1992 Persons with Disabilities Act, 1995 National Trust Act for the Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation, and Multiple Disabilities, 1999

Country	Policies
	National Policy on Disability, 2006 Department of Empowerment of Persons with Disabilities (Divyangian), 2012 The Rights of Persons with Disabilities Act, 2016 National Mental Health Program, 2017
Myanmar	Act on Job Opportunity for Handicapped People (1958) (Only paper, not enacted) Myanmar National Strategy for Development of Persons with Disabilities (2011-2012) The Rights of Persons with Disabilities Law, 2015 Bye Laws of The Rights of Persons with Disability (2017-2027) Myanmar National Strategy for Development of Persons with Disabilities (2016-2025)
Nepal	Disabled Persons Protection and Welfare Act, 1982 Disabled Protection and Welfare Regulation, 1994 National Policy Plan of Action, 1996 Disabled Persons Service National Policy, 1996 Special Education Policy, 1996 (2053 BS) Childhood Disability Management Strategy, 2008 (2064 BS) Guideline for Disability ID Card Distribution, 2006 National Plan & Policy of Action on Disability, 2006 Rights of Persons with Disability Act, 2017 First amendment on Guideline for Disability ID Card Distribution, 2017 10 year National Policy and Plan of Action, 2017 (2073-2082 BS) Regulation on Rights of Persons with Disability, 2018
Pakistan	Disabled Persons (Employment and Rehabilitation) Ordinance, 1981 Mental Health Ordinance, 2001 National Policy for Persons with Disabilities, 2002 National Plan of Action for Persons with Disabilities, 2006 Special Citizens Act, 2008 Disabled Persons (Employment and Rehabilitation) Ordinance, 2012 (Amended) Promotion and Protection of Persons with Disabilities Rights, 2020 Higher Education Commission Policy for Students with Disabilities at Higher Education Institutions in Pakistan, 2021 (Amended)

Naz, Akhtar, Nawaz, and Yasin (2010) found in a study that many parents in Pakistan encounter difficulties accessing information about disability support services for their children, and advocated for wider dissemination of such information through electronic media to empower parents to groom children with disabilities to become valuable members of society. Ahmed, Khan, and Naseem (2011) analysed the implementation of policies for persons with disabilities in Pakistan. They emphasised the role of the National Plan of Action (NPA) in enforcing the National Policy for Persons with Disabilities across public, private, and provincial sectors. The NPA identified seventeen critical areas for the effective delivery of disability services and proposed short and long-term measures for implementation from 2009 - 2025. Mahmood (2016) conducted a virtual face study of Pakistani university websites and found a dearth of information on disability support services. In the context of disability support services information on websites, private-sector universities outnumber public-sector universities. The study recommended policy guidelines for the stakeholders.

2.3. Person-first Language (PFL) versus Identity-first Language (IFL)

Person-first language (PFL) and identity-first language (IFL) are two approaches used to refer to individuals with disabilities. PFL, which places the person before the disability (e.g., "person with autism"), aims to prioritise the individual over their condition, emphasising their humanity (American Psychological Association, 2020). Conversely, IFL integrates the disability as part of the person's identity (e.g., "autistic person"), reflecting a perspective where disability is seen as integral to one's identity and culture (Autistic Self Advocacy Network, 2019).

Smith (2021) found that some individuals with disabilities prefer PFL for its emphasis on personhood and respect, while others advocate for IFL as it validates their identity and community belonging. In educational and healthcare settings, sensitivity to these preferences is crucial for fostering inclusive environments (Johnson & Martinez, 2023). In response to these preferences, organisations such as the American Psychological Association (2020) recommend using language that respects individual choice and context. This approach encourages dialogue and mutual understanding while promoting dignity and empowerment for individuals with disabilities.

The above literature review indicates abundant global and South Asian legislation for the rights of persons with disabilities. However, there remains a significant gap in auditing the availability of disability support services and inclusive language on the official websites of universities. This study will fill this gap by integrating the audit of the availability of disability support services on university websites, and to examining the linguistic inclusivity or exclusivity. The findings of this study are expected to provide valuable insights for policymakers, stakeholders, universities, web designers, researchers from linguistics, and special education. Ultimately, students with disabilities will benefit to be able to access necessary information on university websites without visiting campuses prior to admission.

3. Methodology

3.1. Study Design

This study has quantitative paradigm with exploratory research design. The analysis of data on disability support services information and person-first versus identity-first language on websites of universities is a novel approach. Website content audit (Jankovic, 2020) method has been used for analysis of the data. She describes websites content analysis, or content audit as the process of navigating all the content from website, pages, posts, videos, landing pages, and more. This method determines strengths, weaknesses, and current trends of website content. The website content audit performed effectively delivers key insights about current status and loopholes to address in future.

3.2. Population and Sample

Virtual face sampling technique of Meyer (2008a & 2008b) has been used to purposively sample eight official websites (one public and one private sector university) of four SAARC countries, Pakistan, India, Sri Lanka, and Bangladesh. The make sample homogenous, all the eight universities were sampled from the capital cities i.e., Islamabad, Delhi, Colombo, and Dhaka. The sample has been bifurcated into public and private sector universities under the different headings shown in Table 2. While selecting these universities, their rankings and reputation were given due consideration:

Table 2. Sample and Demographics of SAARC Country Universities Websites

Ser	Name of University	Country	Sector	Official Website Address
1.	Quaid – e – Azam University, Islamabad	Pakistan	Public	https://www.qau.edu.pk
2.	Riphah International University, Islamabad	Pakistan	Private	https://www.riphah.edu.pk
3.	University of Delhi, New Delhi	India	Public	https://www.du.ac.in
4.	Sharda University, New Delhi	India	Private	https://www.sharda.ac.in
5.	University of Colombo, Colombo	Sri Lanka	Public	https://cmb.ac.lk
6.	Asia Pacific Institute of Information Technology (APIIT), Colombo	Sri Lanka	Private	https://www.apiit.lk
7.	University of Dhaka, Dhaka	Bangladesh	Public	https://www.du.ac.bd
8.	North South University, Dhaka	Bangladesh	Private	http://www.northsouth.edu

3.3. Instrumentation

A virtual content analysis checklist (Mahmood, 2016) has been adapted for data collection (see Appendix A). The checklist consists of 10 items with information on availability of disability support services based on dichotomous statements (Yes or No). The instrument for collection of data on person-first and identity-first language has been developed by the researcher (see Appendix B). This instrument has two sections i.e., section one is for person-first and section two for identity first language items flashed on official websites of sampled universities. A total five person-first and identity-first terms space was provided for each websites of the sampled universities on the tool.

3.4. Data Collection

The data collection for this study spanned over two weeks to explore each and every click of the websites. In the first week, twenty-one hours (three hours per website per day) were consumed to explore the availability of disability support services on the official websites of sampled universities. To ensure validity of the data, only two websites per day were examined. Each and every link available on the website was clicked for information. Search option through keywords related to disability support services. “Admission”, “Registration”, “Inclusive Education”, “Diversity and Inclusion”, “Life at University”, “Rules & Regulations”, “Scholarships”, and “Facilities” links were navigated. Moreover, other popup menus were also thoroughly audited. It was ensured that no option, button or link on website was left unexplored. The responses were recorded in the ‘Yes’ column in case of availability of information and ‘No’ if not found.

In the second week, twenty-one hours (three hours per website per day) were invested to extract person-first and identity-first language terms from websites of sampled universities and recorded on researcher developed data extraction sheet (see Appendix B). Two hours for each website on daily basis were consumed to carryout review and veracity of data. In this round, discrepancies if any were observed and removed accordingly.

4. Results

The results and findings of this study have been associated with the past studies on the topic, like Irwin and Gerke (2004) and Quick et al. (2003). Irwin and Gerek (2004), in a study on Liberal Arts Colleges, found that information regarding disability services was "difficult or impossible to locate from several of the websites". This study has examined official websites of eight universities of four SAARC countries to explore the availability of disability support services information and use of person-first or identity-first language. The results and findings have been presented in prescriptive and descriptive form.

4.1. Availability of Disability Support Services Information on Websites of Universities

A rigorous exploration process of websites for information on disability support services was carried out to answer the first research question "What is the frequency of availability of disability support services information for students with disabilities on official websites of SAARC country universities?" The study found that none of the sampled universities have made disability support services information available on homepage of websites. 50% (n = 4) have made E-prospectus facility available on websites. Online admission facility is available at 62.5% (n = 5) websites of the universities. As far as reservation of seats for admission of students with disabilities is concerned, 37.5 (n = 3) universities have provided basic information of reservation of seats or quota. Only one university, 12.5% (n=1) has the information regarding fee concession to students with disabilities. No university, 0% (n=0) has displayed information of availability of fleet of manual/electric wheelchairs on campus. 12.5% (n-1) university has provided information about wheelchair ramps/ special pathways and accessible toilets for students with disabilities. 0% (n=0) university has the information on website about lifts/ elevators at campus. On the same, no university, 0% (n=0) has the information on websites whether special transport and hostel facility is provided to students with disabilities or not. Only two universities, 25% (n=2) has the virtual tour link of the campus building infrastructure. Item wise breakdown of availability of disability support services on official websites of sampled SAARC countries' universities is shown in Table 3. However, 40% staple information of disability support services on the following four items out of ten was missing from the websites of the universities:

- Homepage link for disability support services information.
- Availability of the fleet of manual/ electric wheelchairs at campus.
- Availability of lifts/ elevators.
- Provision of special transport and hostel facilities.

4.2. Country-wise Comparison of Disability Support Services Information on Official Websites

The study has found that situation in all the four sampled countries, Pakistan, India, Sri Lanka, and Bangladesh is almost homogenous with the slight difference. The information on five out of ten items was found on sampled official websites of Indian universities. Hence, 50% (n=5) information on disability support services was available on websites of Indian universities. On the other hand, Pakistan has 40% (n=4) information on disability support services on the sampled official websites of two universities. However, official websites of Sri Lankan and Bangladeshi universities have flashed 30% (n=3) information apiece. The above results have been tabulated in Table 4 and summarized in Figure 1:

Table 3. Breakdown of Disability Support Services on SAARC Countries University Websites

Ser	Disability support services information	Pakistan		India		Sri Lanka		Bangladesh		Total	%
		Pub*	Pvt#	Pub	Pvt	Pub	Pvt	Pub	Pvt		
1.	Is the link for disability support services for students with disabilities available on the website homepage?	-	-	-	-	-	-	-	-	0	0%
2.	Is the e-prospectus available on the website?	-	1	-	1	-	1	-	1	4	50%
3.	Is the online admission facility available?	-	1	1	1	-	1	-	1	5	62.5%
4.	Have seats been reserved for students with disabilities?	1	-	1	-	1	-	-	-	3	37.5%
5.	Is the fee concession/ scholarship granted to SwDs?	-	-	-	-	-	-	1	-	1	12.5%
6.	Is the fleet of manual/electric wheelchairs available on campus?	-	-	-	-	-	-	-	-	0	0%
7.	Are ramps / special pathways and wheelchairs accessible toilets available for SwDs?	-	1	-	-	-	-	-	-	1	12.5%
8.	Are lifts/ elevators available?	-	-	-	-	-	-	-	-	0	0%
9.	Are any special transportation and hostel facilities available for SwDs?	-	-	-	-	-	-	-	-	0	0%
10.	Does the virtual tour of the university building cover disability support services for SwDs?	-	1	-	1	-	-	-	-	2	25%

** Public Sector Universities*
 # Private Sector Universities

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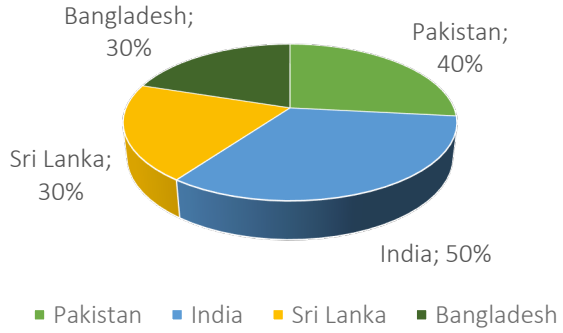
Table 4. Comparison of Disability Support Services Information on SAARC Countries University Websites

Ser	Countries	Public Sector[1]	Private Sector[1]	Total
1.	India	2	3	5
2.	Pakistan	1	3	4
3.	Sri Lanka	1	2	3
4.	Bangladesh	1	2	3

(1) Number of Disability Support Services Information available on University Websites

The above statistical results of country-wise comparison of disability support services items found on official websites of the sampled universities have been summarized in graphical form in Figure 1 below:

Figure 1. Percentile of Disability Support Services Information on SAARC Countries University Websites



4.3. Use of Person-first (Inclusive Language) and Identity-first (Exclusive Language) on Official Websites of SAARC Country Universities

A thorough navigation of the websites was conducted to address the second research question: "What is the tendency of official websites of SAARC country universities using person-first or identity-first language to display disability support services information?" In this phase, person-first and identity-first terms used for students with disabilities were sifted from the websites of sampled universities. The person-first terms were recorded under the relevant column of the instrument (see Appendix B), and identity-first terms were jotted down in the other section.

The result shows that five terms each for person-first and identity-first language have been used by five university websites out of eight. However, three universities have neither used person-first nor identity-first language on their websites. In the person-first language terms, like *students with disabilities, persons with disabilities, serving personnel and ex-servicemen disabled in action, defense personnel disabled in peacetime, and persons with disabilities* have been used by one Pakistani private sector and one Indian public sector university. On the other hand, university websites have used five identity-first language terms, like *disabled fee concession, wheelchair scheme for disabled students, disabled policy HEC, blind and differently abled candidates, and disabled students trust fund scholarship.* The results have been elaborated in Table 5 below:

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Table 5. Person-first and Identity-first language on SAARC Countries University Websites

Ser	Universities/Country/ Sector	Person-first (Inclusive Language)		Identity-first (Exclusive Language)	
		Words	Frequency	Words	Frequency
1.	Quaid – e – Azam University, Islamabad, Pakistan (Public Sector)	-	-	(i) Disable Fee Concession (ii) Wheelchair Scheme for Disabled Students	2
2.	Riphah International University, Islamabad, Pakistan (Private Sector)	(i) Students with disabilities (ii) Persons with Disabilities	2	Disabled Policy HEC	1
3.	University of Delhi, New Delhi, India (Public Sector)	(i) Serving personnel and ex-servicemen disabled in action (ii) Defence personnel disabled in peacetime (iii) Persons with Disabilities	3	-	-
4.	Sharda University, New Delhi, India (Private Sector)	-	-	-	-
5.	University of Colombo, Colombo, Sri Lanka (Public Sector)	-	-	Blind and Differently Abled Candidates	1
6.	Asia Pacific Institute of Information Technology (APIIT), Colombo, Sri Lank (Private Sector)	-	-	-	-
7.	University of Dhaka, Dhaka, Bangladesh (Public Sector)	-	-	Disabled Students Trust Fund Scholarship	1
8.	North South University, Dhaka, Bangladesh (Private Sector)	-	-	-	-
		Total:	5		5

5. Discussion

This study examined two major questions: the availability of disability support services and the use of inclusive versus exclusive language for students with disabilities on official university websites across four SAARC countries.

The findings have revealed significant accessibility shortcomings. Key resources such as links to disability support services, manual or electric wheelchairs, lifts/elevators, and special transport or hostel facilities were found missing. These results portray broader patterns as Cerilli et al.

(2025) demonstrated that top American universities often scored poorly on disability inclusion metrics, with critical information snubbed or omitted completely. Similarly, Bhuiyan et al. (2025) found that fewer than 40% of university and public-sector websites across the Global South met WCAG 2.1 checkpoints, particularly those affecting screen-reader and motor-impaired users. Region-specific research from Sri Lanka by Wedasinghe et al. (2023) further highlighted failures in semantic HTML structure, navigation consistency, and alt-text usage barriers consistent with this audit across SAARC websites.

In terms of linguistic inclusivity, the analysis revealed limited use of both person-first and identity-first language across the sampled university websites, triggering a lack of institutional language policy. This is particularly important considering evidence of nuanced language preferences. Taboas, Doepke, and Zimmerman (2023) reported that while autistic adults overwhelmingly preferred identity-first language, but professionals were inclined toward person-first. Further reinforcing this point, Grech, Koller, and Olley's (2024) study in Social Science & Medicine found that respondents used identity-first language when referring to themselves, but rated person-first language as more appropriate when referring to others, particularly in healthcare or educational contexts.

This social model of disability is explained by Harpur et al. (2025) that university websites frequently use identity-based or exclusive language that may not be appropriate for prospective applicants with disabilities. Such linguistic framing can unintentionally marginalise students with disabilities, leading some prospective students with disabilities to perceive institutional spaces as socially distant. Resultantly, this identity-first language may function as a psychological barrier to enrolment and participation. Within the social model of disability, these barriers emerge from institutional and communicative structures that shape access and belonging.

These observations suggest that universities in the SAARC region fall short of international norms for both digital accessibility and inclusive language practices. Beyond legal compliance, these gaps may deter prospective students with disabilities, limit institutional outreach, and reinforce exclusion. Addressing these deficiencies requires regular web accessibility audits, adoption of WCAG 2.1 or 2.2 standards, the development of evidence-based learning, and co-created language policies involving students with disabilities and advocacy groups.

6. Conclusions

Based on the results of this study, it is evident that there are significant gaps in the provision of disability support services and the use of inclusive language on official university websites across SAARC countries. The analysis revealed that information crucial for prospective students with disabilities, such as links to disability support services, availability of wheelchair-accessible facilities, lifts/elevators, and special transport/hostel facilities were frequently absent or inconsistently presented on the sampled university websites.

Moreover, while general information like online admissions and e-prospectus availability was more commonly found, specific disability support services such as reserved seats for admissions, fee concessions/scholarships, and accessible infrastructure were notably underrepresented. This discrepancy highlights a concerning lack of adherence to government policies aimed at promoting accessibility and inclusivity in higher education institutions.

In terms of linguistic practices, the study found a consistent use of both inclusive (person-first) and exclusive (identity-first) language across the sampled websites, albeit with limited

representation. The need for more inclusive language practices that prioritise personhood while acknowledging disability is underscored by the findings. The study recommends:

- **Enhanced Accessibility and Transparency.** Universities should prioritise updating their websites to ensure comprehensive and transparent information about disability support services. This includes clear links to disability resources, detailed description of accessible facilities, explicit guidelines on admissions, and accommodation for students with disabilities.
- **Promotion of Inclusive Language.** There should be a concerted effort to adopt inclusive (person-first) language across all communications related to disability support services. This approach fosters a more respectful and inclusive environment for students with disabilities, reflecting a commitment to diversity and equity.
- **Adherence to Government Guidelines.** Institutions must align their practices with national and international policies promoting disability rights and inclusion. This entails regular audits of website content to ensure compliance with accessibility standards and the provision of mandated support services.
- **Capacity Building and Awareness.** Training programs for university staff involved in website management should be implemented to enhance awareness of disability rights and effective communication strategies. A core course: *Disability Support Services* should be introduced at the undergraduate level across all disciplines to train students to facilitate persons with disabilities in the society. This will facilitate the creation of more inclusive societal and digital environments for all students.

By addressing these recommendations, universities in SAARC countries can significantly improve their support for students with disabilities, ensuring equitable access to higher education and fostering a more inclusive academic community. This study has been aligned to SDG-04 *Quality Education* and SDG-11 *Reduced Inequalities* as envisioned by the United Nations Organization for global impact and implementation.

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Appendix A

Web Content Audit Instrument/ Checklist

Name of University: _____ Country _____

Public / Private Sector: _____

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Ser	Disability Support Services Information	Availability of Disability Support Services Information on University Websites	
		Yes	No
1.	Is the link for disability support services for students with disabilities available on the website homepage?		
2.	Is the e-prospectus available on the website?		
3.	Is the online admission facility available?		
4.	Have seats been reserved for students with disabilities?		
5.	Is the fee concession/ scholarship granted to SwDs?		
6.	Is the fleet of manual/electric wheelchairs available on campus?		
7.	Are ramps / special pathways and wheelchairs accessible toilets available for SwDs?		
8.	Are lifts/ elevators available?		
9.	Are any special transportation and hostel facilities available for SwDs?		
10.	Does the virtual tour of the university building cover disability support services for SwDs?		

Appendix B

Web Content Audit Data Extraction Sheet for Person-first and Identity-first Language

Ser	Universities/Country/ Sector	Person-first (Inclusive Language)		Identity-first (Exclusive Language)	
		Words	Frequency	Words	Frequency
1.	Quaid – e – Azam University, Islamabad, Pakistan (Public Sector)	(i) (ii) (iii) (iv) (v)		(i) (ii) (iii) (iv) (v)	
2.	Riphah International University, Islamabad, Pakistan Private Sector)	(i) (ii) (iii) (iv)		(i) (ii) (iii) (iv)	

		(v)	(v)
3.	University of Delhi, New Delhi, India (Public Sector)	(i) (ii) (iii) (iv) (v)	(i) (ii) (iii) (iv) (v)
4.	Sharda University, New Delhi, India (Private Sector)	(i) (ii) (iii) (iv) (v)	(i) (ii) (iii) (iv) (v)
5.	University of Colombo, Colombo, Sri Lanka (Public Sector)	(i) (ii) (iii) (iv) (v)	(i) (ii) (iii) (iv) (v)
6.	Asia Pacific Institute of Information Technology (APIIT), Colombo, Sri Lanka (Private Sector)	(i) (ii) (iii) (iv) (v)	(i) (ii) (iii) (iv) (v)
7.	University of Dhaka, Dhaka, Bangladesh (Public Sector)	(i) (ii) (iii) (iv) (v)	(i) (ii) (iii) (iv) (v)
8.	North South University, Dhaka, Bangladesh (Private Sector)	(i) (ii) (iii) (iv) (v)	(i) (ii) (iii) (iv) (v)
		Total:	Total:

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Access audit of orange line metro train

For barrier free mobility of persons with Disabilities (PWD's) using universal Design principles (UDP)

Tamsal K., Lahore College for Women University, Pakistan,
ORciD 0009-0003-2495-3375 , khunshatamsal@gmail.com

Sultan M., Lahore College for Women University, Pakistan,
ORCID 0009-0007-6933-1456 , maham22.sultan2002@gmail.com

Mateen W., Lahore College for Women University, Pakistan,
ORCID 0009-0000-7549-7945 , wardamateen21@gmail.com

Tahir K., Lahore College for Women University, Pakistan,
ORCID 0009-0006-5733-5604, kashmalacrp@gmail.com

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Abstract: Persons with Disabilities (PWD's) in Pakistan face significant mobility barriers that exclude them from participating as equal citizens. This exclusion increases their vulnerability, making them dependent and trapping them in a vicious cycle of poverty, keeping them marginalized in society. Hence, an accessible environment is important for an inclusive society. To improve accessibility to services, accessible transportation is necessary. Accessible transport services increase accessibility to essential facilities for everyone, including PWD's. The research aims to improve accessibility for PWD's by utilizing Universal Design Principles (UDP). The study used a questionnaire to assess existing features and recommend areas for improvement. Ten Orange Line Metro Train (OLMT) stations were selected as case studies. The results revealed issues such as street vendor encroachment, insufficient ramp slopes, poor public restroom maintenance, inaccessible ticket counters, and unreliable emergency evacuation systems. Recommendations include awareness campaigns, implementing programs for stakeholders, relocating street vendors, providing accessible ramps, lowering ticket counter heights, and adopting bottom-up approach for policy implementation.

Keywords: Persons with Disabilities, Orange Line Metro Train, Stations, Universal Design Principles, Accessibility, Mobility

1. Introduction

According to the Disability Details from the National Database and Registration Authority (NADRA), there are an estimated 724,767 Persons with Disabilities (PWD's) in Pakistan (Pakistan Bureau of Statistics, 2025). Accessibility in public transportation is not just a matter of convenience but a key aspect of social inclusion and equity. Accessibility of the built environment is also mentioned in Sustainable Development Goal (SDG) Goal 11, which is "*to make cities and human settlements inclusive, safe, resilient and sustainable*", which includes improving road safety through expanding public transit and giving particular attention to vulnerable populations like women, children, the elderly, and PWD's.

In the context of Lahore, Pakistan, no planning considerations for PWD's have been done in the past while planning for new towns and cities. Even the Integrated Master Plan - 2021 of Lahore Division has not yet included any provision for PWD's of Pakistan (Hameed & Nadeem, 2008).Lack of accessibility in the transport system can result in marginalization, limiting opportunities for PWD's and hindering their full participation in society. It restrains their ability to fully explore their potential and avail opportunities (Hotor, 2024). Recognizing this, there is an increasing focus on development of a more inclusive transportation system, designed with all users in mind. The Orange Line Metro Train (OLMT) is one such projects and has improved urban transportation and enhanced connectivity. To ensure that a site, building, or facility can be easily reached, navigated, and used by PWD's, accessibility is an essential feature that requires it to be developed in line with established codes and standards. This covers not only the utilization of these services but also their accessibility and approach. It also includes the ability of people to leave the building without assistance unless there is an emergency (Accessibility Code of Pakistan, 2006).

In 1985, architect Ronald Mace introduced the Universal Design Principles (UDP). He was associated with architectural community; Fellow of the American Institute of Architects (FAIA) (UNICEF Disability Team, 2022). He provided this concept to improve the conditions for PWD's. In 1989, Raleigh's North Carolina University established the Centre for Universal Design with the goal of spreading this concept globally. The following are the Universal Design Principles: 1. Equitable Use, 2. Flexibility in Use, 3. Simple and Intuitive Use, 4. Perceptible Information, 5. Tolerance for Error, 6. Low Physical Effort, 7. Size and Space for approach and use-

There is a need to integrate UDP, as the accessibility of public transportation systems directly affects the access to education, employment, healthcare, and social activities. PWD's are significant minority group, starved of service and equal opportunities. There is a vicious cycle of poverty caused by a lack of opportunities, which leads to a poor quality of life (The Department for International Development, 2000).Inclusive Planning is required under UDP and SDG Goal 11 especially within the transportation sector, this involves development or improvement of facilities that benefit PWD's (Vanderschuren & Nnene, 2021).By enhancing accessibility to transport systems, we can increase the degree of self-reliance and independence of PWD's (Pocuc et al., 2021). As seen in sociocultural norms, people place higher value on self-independence than on being dependent on others (Simon & Burke, 2018). Despite the existence of laws and organizations related to disability rights and accessibility, there are limited policies for PWD's within the transportation sector. To assess the OLMT facility, services and infrastructure and make sure they fulfil the various needs of all users, an access audit mechanism is necessary. Previous studies on mobility consist of a wide range of approaches that reflect the intersection of built environment and socio-cultural aspects. They emphasized barriers such as physical, psychological, or technical. They provide perspective and a need for a more inclusive environment. Recent digital transport innovations such as Mobility as a Service (MaaS), offer a more seamless mobility experience and new opportunities to increase accessibility. MaaS combines various modes of transportation into a single digital platform (Hoess et al., 2025). It offers flexible, tailored mobility services such as car sharing, bike sharing and ride hailing that accommodates diverse user needs (An & Shen, 2025). MaaS can reduce the risk of social exclusion of PWD's. (Dadashzadeh et al., 2024). It can facilitate progress towards accessible transportation, especially for the elderly and people with physical and cognitive impairments. It should also be taken into account that PWD's are consumers who are capable of decision making, weighing their options and requesting customer service when interacting with transport service providers further emphasizing the need for society to recognize that transportation is a vital link to improve their social welfare (Mogaji et al., 2023)

2. Literature Review

In recent years, there has been research on the utilization of public transport by PWD's with a focus on the barriers and challenges they face. While advancing research efforts aim to address these issues and maximize the accessibility and inclusivity of public transportation for PWD's, additional efforts are required to fully address these challenges and achieve greater inclusivity in public transportation for PWD's.

In developed countries such as Germany, the German Disability Discrimination law established in 2000-2002 aims to prevent unfair treatment of PWD's by ensuring equal opportunities and easy access to public services. The Law obliges the Federal Government and its authorities to ensure a large degree of barrier-free mobility (Kock, 2004). The General Equal Treatment Act of 2006 aimed to ensure equal treatment for all individuals. It provided allowances, tax deductions, and subsidies for workers with qualifying disabilities to enhance their mobility. The European Parliament and Council reached a preliminary agreement on the European Accessibility Act in 2018. Barrier-free environments are essential for PWD's to live without external assistance. New government buildings and public transportation must be made accessible for everyone, with tax relief and special parking spots provided for PWD's. The Carriage of Passengers Act ensures PWD's can use public transportation. Usually, individual states oversee planning and provision of local public transportation. Therefore, it is important to find a solution that makes sense and considers the unique circumstances of each case.

The accessibility of public spaces, public transportation, and the difficulties faced by PWD's in arriving, boarding, and utilizing are still under researched (Unsworth et al., 2021). PWD's often face inconvenience because of transportation infrastructure inaccessibility which may influence their decision to use public transportation because of insecurity and doubt regarding freedom of movement (Mun et al., 2019). A 2012 study conducted in Malaysia, on the Kelana Jaya Line LRT stations for blind people found that platform design, including island and side platforms, can affect their navigation. The Access Audit was conducted at Light Rail Transit (LRT) Stations. The evaluation was based on site observation and interview research. Accessibility for PWD's to public buildings was standardized using a checklist drawn from the Malaysian Standards Code of Practice. Blind people typically depend on their prior knowledge and experience to navigate the built environment (Passini & Proulx, 1988). A study found that a person's self-assurance during navigating a human-centred built environment is consequently enhanced by their record of successful travel. It was found that clues in the built environment can affect blind people's navigation, which is relevant to this topic. Materials, sensory signals, and spatial layout are all part of it (Finkel, 1999). Although Malaysia has gazette laws mandating accessible public spaces, the enforcement of these regulations remains a question.

In Great Britain, the Disability Discrimination Act of 1995 made it illegal to mistreat PWD's. Starting in October 1999, service providers were required to change discriminatory rules and aid PWD's, such as providing information in accessible formats such as audio tapes or signboards. New policies were implemented on October 1st to improve accessibility for PWD's on new buses, with bus drivers responsible for assistance. Guidance was published to comply with Disability Discrimination Act requirements to remove "*physical barriers*" to access the pedestrian environment and transport infrastructure (rail and bus stations, etc.). By 2004, service providers must make changes to help PWD's use their services more efficiently, such as removing barriers and providing permanent loops at work. Over 10% of people in Britain have a disability that makes it difficult for them to take the bus, and about 20% of bus riders are older than retirement age.

To improve bus services, UK should make its disability discrimination laws stronger by including rules that stop transportation companies from mistreating PWD's.

In Pakistan, the current situation of accessibility of stations for PWD's in transportation systems requires closer examination. As a result of increased awareness, barriers to mobility have been recognized to some extent (Cengiz, 2016). Restricted mobility is a major barrier for development that is inclusive of PWD's (Nahar, 2019). Further research and assessment are needed to determine the progress in implementing accessibility measures and addressing the barriers. Following Table 1 shows a brief history of Pakistan accessibility legislative framework.

Table 1:Accessibility Legislative Framework in Pakistan

Year	Legislative Framework	Development
1947	-	Pakistan became an independent Nation and was underdeveloped. Buildings and transportation available in this period are mostly not accessible.
1950 -1970	-	The government was still focusing on developing the country in various fields in urban and rural areas.
1981	Disabled Persons (Employment and Rehabilitation) Ordinance	Provided employment and rehabilitation services for PWD's in Pakistan.
2002	National Policy for Disabilities	Introduced the "Accessibility Code of Pakistan 2006".
2006	Accessibility Code of Pakistan	Outlined the accessibility standards for inclusive environments.
2006	National Plan of Action	Outlines strategies to implement National Policy for Persons with Disabilities. Aims to ensure equal opportunities, protection of rights.
2008	UN Convention on the Rights of Persons with Disabilities	Emphasized Equal rights for everyone and promoted full inclusion of PWD's in all aspects of life.
2008-2019	-	Marks a period of Localized interventions at local levels.
2020	ICT Rights of Persons with Disabilities Act	Affirms the rights of PWD's in Islamabad focusing on accessibility, equality, and empowerment

Source: Disability Framework in Pakistan

In 2006, the Islamabad Declaration on Accessibility for PWD's was organized by Special Talent Exchange Program in collaboration with Sight Savers International, Handicap International, and the Ministry of Social Welfare and Special Education. It was two-day seminar that called on the government, architects, and town planners to ensure new developments meet accessibility standards (Special Talent Exchange Program & Sightsavers). It is the social duty of local government representatives to ensure inclusion by eliminating barriers to mobility in road infrastructure and built environment (Nwachi et al., 2023). While Architectural Design considers a range of factors including aesthetics, functionality, durability, privacy, and security, it is only in

recent years that significance of inclusivity has been recognized (Sulman, 2023). It is also important to note that barriers may be experienced differently when using public transportation by PWD's depending on their type of disability e.g. physical, intellectual, cognitive, sensory (Mwaka et al., 2024). Further research and assessment are needed to determine how to implement accessibility measures and ensure comprehensive facilities and services for PWD's in Pakistan.

3. Methodology

Physical surveys of selected stations of Orange Line Metro Train (OLMT) were carried out using the Access Audit Checklist. After the survey, data was collected according to the given standard criteria. This study uses pictures to highlight the significant problems related to physical accessibility for Persons with Disabilities (PWD's) within the selected stations.

Milestone organization was consulted to become familiar with mobility barriers faced by PWD's in their day-to-day lives. In depth discussions were held with PWD's to understand mobility challenges they encounter. Milestone facilitated a training session for the authors on comprehensive access audit procedures, ensuring that the audit process was grounded in both professional expertise and lived experiences of PWD's, resulting in more relevant and effective accessibility assessments. A toolkit was designed that consisted of a set of questions designed to collect data from OLMT. This toolkit was considered a questionnaire for access audit, and it was based on technical information about the provision of an internal and external built environment following universal design principles.

The questions written in the toolkit were developed utilizing the Accessibility Code of Pakistan 2006 and ADA Standards 2010, which are based on Universal Design Principles (UDP). It consisted of open and close-ended questions and the degree of action required to improve that feature. The communication section of the questionnaire was developed by authors following standards and UDP. The following indicators and sub-indicators were selected based on the Accessibility Code of Pakistan 2006 and accessibility requirement of transportation terminals.

1. Alighting Point of Stations

- Alighting Points
- Accessible Path
- Ramp

2. Internal Environment
    - Staircase
    - Escalator
    - Handrail
    - Lobby/Corridor
3. Ticketing Area
    - Accessible Counter
    - Signage
    - Ticketing Vending Machine
4. Public Toilet
5. Rail Platform
    - Lift
    - Platform

- Rail Carriages

6. Communication
7. Emergency Evacuation

3.1. Case Study

The Orange line Metro Train (OLMT) is 27.1km long and runs along Multan Road from Dera Gujran to Ali Town on GT Road. There are twenty-six stations along the line including 24 elevated and 2 underground stations. Chinese standards were used in the overall technical plan. Chinese standard Type B train with 5-car formation is used. Headway in rush hour is designed as 2 minutes in the long term (CR-Norinco, 2016). Out of 26 stations in the OLMT, a sample of 10 stations was selected for the access audit as illustrated in Figure 1 : *Ali Town Station, Thokar Niaz Baig Station, Salahudin Road Station, Band Road Station, Chauburji Station, Anarkali Station, G.P.O Station, Railway Station, UET Station and Shalamar Garden Station.*

This study categorized stations by station layout. Type A is an elevated station with two access points, type B is an elevated station with four access points, type C and D are underground stations as shown in Figure 2. The selection of stations was based on factors such as crowded ridership, diversity of station type (e.g., underground, elevated), geographical distribution, etc. The fewer access points there are, the higher the demand on each to be fully equipped with accessibility features such as elevators, ramps, and tactile paving.

With more access points, it is important to ensure that accessibility features (e.g. ramps, and elevators) are evenly distributed and easily reachable. Any failure or inadequacy may affect impact the station's overall accessibility. Regardless the number of access points, it is important that each access point provides a consistent level of accessibility. Regular maintenance is essential to keep all the points operational and safe.

All elevated stations have a width of 22.5 metres, and are 102 metres in length. In contrast underground stations vary in size. The length of G.P.O station is 161.6 metres whereas the width of station is 49.5 metres. The length of Anarkali station is 121.5 metres and the width is 16 metres (NESPAK, May 2015).

Figure 1.Route Map of Orange Line Metro Train

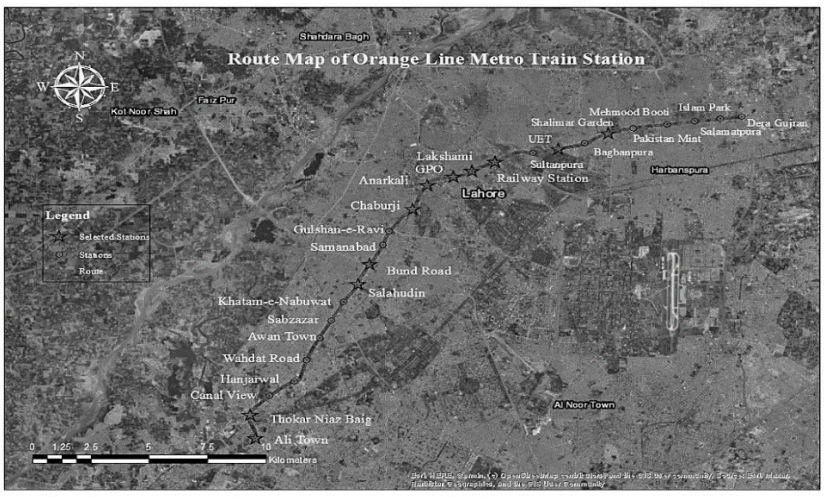

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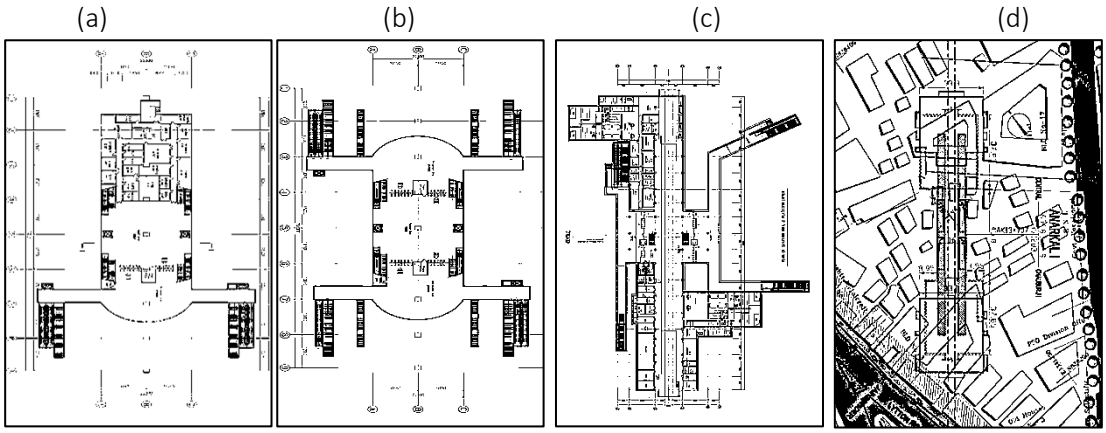
Figure 2. Station Types: (a) Elevated Station, Type A, (b) Elevated Station, Type B, (c) Underground Station, Type C, (d) Underground Station, Type D



Source: (CR-Norinco, 2016)

4. Analysis and Findings

The access audit checks the building and surroundings with the help of a checklist to see what needs to be changed to make it easier for people to get in and out (National Disability Authority, 2005). The access audit involves observational assessments and surveys. An on-site assessment of each selected station was done according to the toolkit: access audit checklist. As mentioned earlier, observations were made regarding the physical infrastructure against each indicator. The combination of walk, talk and design appraisal audit is used to conduct access audit. It involves walking and talking about the area and checking the planned design of a building to see its accessibility. The Key findings of observational analysis are mentioned below in Table 2.

Table 2.Key Findings

No	Station Type	OLMT Stations	Key Findings
1	Type A	Ali Town Station	Replacement required for colour contrasting strip at platform, restroom was poorly maintained, gap between the train door and platform is not as per standard.
2	Type B	Thokar Niaz Baig Station	Entrance to lift was not properly maintained, inaccessible pathway, inaccessible ticketing counter.
3	Type A	Salahuddin Road Station	Missing elements on accessible path, gap between the train door and platform is not as per standard.
4	Type A	Bund Road Station	Lift was poorly maintained, protruding object in lobby, inadequate ramp.
5	Type A	Chauburji Station	Uneven accessible path, inadequate ramp, inaccessible ticketing counter.
6	Type C	Anarkali Station	Inaccessible counter height, external handrails have a dark colour that absorbs more heat, external staircase has no tactile warnings.

No	Station Type	OLMT Stations	Key Findings
7	Type D	G.P.O Station	Restroom facility for disabled unavailable, complex layout, tactile guidance is not provided along pathway.
8	Type B	Railway Station	Access point was encroached, inadequate ramp, gap between the train door and the platform is not as per standard
9	Type A	U.E.T Station	Alighting point is not levelled, inaccessible ticketing counter, public restroom is not maintained
10	Type A	Shalamar Garden Station	Missing elements on accessible path, inaccessible ticketing counter

4.1. Observational Analysis

Visual surveys in Orange Line Metro Train (OLMT) station showed that the infrastructure provides adequate amenities for Persons with Disabilities (PWD's). The planning specifically addressed their needs. However, maintenance was required e.g. replacement of colour contrasting strip at Ali town station, control panels of lift at Bund Road, change of external handrail colour at Anarkali to meet their requirements fully. The alighting point of all stations were levelled and out of the traffic lane with no parking sign as shown in Figure 3. The accessible path provided was well connected with the entrance gate and other amenities like lift and escalator.

Figure 1. Alighting Points of Stations: (a) Alighting Point (Anarkali), (b) Accessible Path (Anarkali), (c) Accessible Path (Bund Road)

(a) (b) (c)

The surface of the ramp was in satisfactory condition at most stations except at Thokar Niaz Baig making it inaccessible as shown in Figure 4. Direct access of PWD's to OLMT was blocked by street vendors, particularly at the Railway Station.

Figure 2.. Ramp Condition: (a) Inaccessible Ramp (Thokar Niaz Baig), (b) Ramp (Shalimar Garden), (c) Surface of Ramp (Bund Road)

(a) (b) (c)

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As illustrated in Figure 5, all stations had handrails provided on both sides of the stairs. The dimensions of the staircase and escalator were as per standards. The corridors were well-illuminated, and their width was adequate. They were marked with tactile plates and free from protruding objects except at Bund Road, where a sliding gate protruded 215 mm within the corridor. Handrails were slip-resistant and turned downwards at the ends.

Figure 3.Internal Environment: (a) Entrance Staircase (Ali Town), (b) Protruding Object (Bund Road), (c) Handrail (Anarkali)

(a) (b) (c)

Station reception counters were identifiable from the entrance. A queue was specified for old age people and PWD's. A visual system was provided to convey ticket details, and staff was available to assist PWD's in buying tickets, but staff members did not know how to communicate in sign language. The height of the ticketing counter was 1.1 m, which was not accessible to a wheelchair user without aid as shown in Figure 6. A separate ticket vending machine is available for PWD's. It is located adjacent to adequate clear floor space. It is designed in a way that does not require significant effort but minimal force to operate.

Figure 4.Ticketing Area: (a) Inaccessible Ticket Counter (Anarkali), (b) Ticket Vending Machine (Anarkali), (c) Ticket Information (GPO)

(a) (b) (c)

One Unisex toilet restroom was available within every station for PWD's except at G.P.O Station. Additionally, due to complex structure and layout, no area for erecting accessible toilets could be identified. As illustrated in Figure 7, directional signs were provided and the restrooms were poorly maintained, there was water leakage as well.

Figure 5.Public Restroom: (a) Directional Signage (Anarkali), b) Public Restroom (Anarkali), (c) Public Restroom (Chauburji)

(a) (b) (c)

As shown in Figure 8, lifts were maintained according to standards except at Bund Road Station where lift controls were found missing and at Thokar where one of the lifts had missing front tile.

Figure 6..Lift: (a) Accessible Lift (Shalamar), (b) Accessible Lift (UET), (c) Missing Controls on Lift (Bund Road)

(a) (b) (c)

The railway carriage and the platform are at the same level and the gap between the train door and the platform is as per standard except at Thokar Niaz Baig Station. All edges of the Platform and other places of hazard were marked with the tactile warning as shown below in Figure 9. Colour contrasting strip needs replacement especially at Ali Town Station. At every station waiting areas were without proper seating arrangements. Public Display of Information was available at every station.

Figure 7.Rail Platform: (a) Colour Contrasting Strip (Ali Town),
(b) Tactile Plates Missing (Anarkali), (c) Public Display Information (Anarkali)

(a) (b) (c)

As shown in Figure 10, rail carriages were accessible by wheelchair users, priority seats are available for PWD's, and wheelchair spaces are easily identified. The route and destination signs are provided within train. The directional signage was provided throughout station. The signage is directed to various building facilities at the reception. The loop hearing system is only provided at the platform and on the train but not at the reception ticketing counter. Audio orientation tools and public display information are provided within the station to inform passengers about the arrival and departure of the train. The emergency evacuation system in OLMT is unreliable for wheelchair users despite the presence of alarm systems, visual alarms, and fire hydrants because a wheelchair user can only exit through a lift. During a discussion with staff members, OLMT experienced no power outage during an electricity shortfall.

Figure 8.Accessibility: (a) Accessible Rail Carriage,
(b) Emergency Evacuation (Chauburji), (c) Secondary Access Point (GPO)

(a) (b) (c)

In Summary, alighting points were present at all surveyed stations with no parking signs however, street vendors blocked PWD's direct access to OLMT, particularly at the railway station. Staircases were accessible, and dimensions were according to standards. The entire pathway length had tactile warning blocks in satisfactory condition from the entrance to the ticketing counter. Tactile warning was provided along the shortest route within the train station, leading to accessible rail carriage but was missing on the rear side of station. Colour contrasting strips were available on rail platforms near doorways to access the train and keep a safe distance between the train and passengers. The ramps of elevated stations were not smooth and had uneven surfaces. The ticketing counter was readily identifiable from the entrance, with separate queues for the elderly and PWD's. A visual system and a rate list were displayed for information. The height of the ticketing counter was inaccessible. Thokar Niaz Baig station is one of the busiest stations in OLMT and required thoughtful consideration regarding maintenance, as tactile warnings were missing at the platform and even at the stairs. The landing in front of the lift from the entrance side required maintenance. At Bund Road station, the lift required maintenance. The elevator control button and audio orientation system from the entrance were absent. The only alternative for wheelchair users to evacuate in an emergency was a lift, which was unreliable. The alerting system is provided, which is visual and audible.

The following Table 3 provides the systematic evaluation of internal and external environment of the surveyed stations. It presents qualitative findings drawn from visual surveys, assessing the existing level of accessibility of internal and external environment of each station. The external environment assessment focuses on alighting point, ramp, and accessible path. The internal environment assessment focuses on ticketing area, public toilet, rail platform, communication, and emergency evacuation. Observations are systematically categorised to illustrate the degree of accessibility noted during on-ground inspection.

Table 3: Qualitative Assessment of Each Station

Station	Existing Level of Accessibility	a	b	c	d	e	f	g	h
Ali Town	Is not provided								
	Is present but not accessible				☒				
	Is present but not maintained					☒			
	Is present in satisfactory condition	☒	☒	☒			☒		☒
	Is present in good condition							☒	
Thokar Niaz Baig	Is not provided								
	Is present but not accessible				☒				
	Is present but not maintained		☒	☒		☒	☒		
	Is present in satisfactory condition	☒							☒
	Is present in good condition							☒	
Salahuddin	Is not provided								
	Is present but not accessible			☒	☒				
	Is present but not maintained					☒			
	Is present in satisfactory condition	☒	☒				☒		☒

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Station	Existing Level of Accessibility	a	b	c	d	e	f	g	h
	Is present in good condition							☒	
Bund Road	Is not provided								
	Is present but not accessible				☒				
	Is present but not maintained					☒			
	Is present in satisfactory condition	☒	☒	☒			☒		☒
	Is present in good condition							☒	
Chauburji	Is not provided								
	Is present but not accessible				☒				
	Is present but not maintained		☒	☒		☒			
	Is present in satisfactory condition	☒					☒		☒
	Is present in good condition							☒	
Anarkali	Is not provided								
	Is present but not accessible				☒	☒			
	Is present but not maintained								
	Is present in satisfactory condition	☒	☒	☒			☒		☒
	Is present in good condition							☒	
GPO	Is not provided					☒			
	Is present but not accessible	☒			☒				
Station	**Existing Level of Accessibility**								
	Is present but not maintained								
	Is present in satisfactory condition		☒	☒			☒		☒
	Is present in good condition							☒	
Railway	Is not provided								
	Is present but not accessible	☒			☒				
	Is present but not maintained					☒			
	Is present in satisfactory condition		☒	☒			☒		☒
	Is present in good condition							☒	
UET	Is not provided								
	Is present but not accessible	☒			☒				
	Is present but not maintained					☒			
	Is present in satisfactory condition		☒	☒			☒		☒
	Is present in good condition							☒	
Shalamar	Is not provided								
	Is present but not accessible				☒				

Station	Existing Level of Accessibility	a	b	c	d	e	f	g	h
	Is present but not maintained			☒		☒			
	Is present in satisfactory condition	☒	☒				☒		☒
	Is present in good condition							☒	

Note: (a) Alighting Point; (b) Ramp; (c) Accessible Path; (d) Ticketing Area; (e) Public Toilet; (f) Rail Platform. (g) Communication;(h) Emergency Evacuation

5. Conclusion

Orange Line Metro Train (OLMT) has transformed the urban mobility landscape of Lahore. It has provided people with dependable and cost-effective way to commute hence it is important to ensure that the benefits are accessible to all community members, including PWD's. Even though there is enough legal groundwork to support them there is little implementation. For example, legislation such as ICT Rights of Persons with Disabilities Act, 2020 creates geographical discrepancies i.e. implementation will only be conducted in specific zones rather than whole which results in imbalanced developmental works for PWD's especially in rural areas. These findings show that nationwide approach is required to ensure uniform standards are applied throughout urban and rural areas. Within transportation sector limited regulations are available for PWD's. According to the results of this study, investments have been made in more comprehensive accessibility features to ensure social inclusion of PWD's. This includes providing features such as ramps, tactile paving, audio orientation tools and public display of information also making sure that signage is clear and easy to understand however, there is a need to develop a reliable emergency evacuation option for PWD's, alternative to lift. Incorporating Universal Design Principles (UDP) is necessary to build more inclusive transport systems that enable PWD's to travel independently. It is also important to note that mobility of PWD's vary according to their disability type and the financial resources as well as support of family members at their disposal.

6. Recommendation

Until now efforts have been made to make public buildings such as restaurants and schools accessible, but it is also to be noted that access should be barrier-free so that PWD's can move independently. Although this study provides important findings, further studies are required to comprehensively examine mobility issues faced by PWD's within built environment to ensure access to their basic rights i.e. education, employment opportunities as well as recreational activities. To address psychological barriers, programs should be implemented to sensitize public to meet the needs of Persons with Disabilities (PWD's), promoting a more inclusive and supportive environment. Beyond awareness campaigns, direct involvement of PWD's is necessary to address psychological barriers. Further research can be directed towards accessibility of bus stops, origin-destination study, behavioural pattern or examining systematic gaps in legislative works and enforcement mechanisms for PWD's related to different subject areas such as housing, schools, transportation, and public buildings. As providers of public service, transport staff play a vital role. Training sessions must be conducted for staff of Orange Line Metro Train Station (OLMT) assisting PWD's, especially in the case of sign language. The height of the ticketing counter needs to be lowered so that it can be accessible to the physically challenged. Street vendors need to be relocated, especially at Railway Station. Regular accessibility audits need to be conducted to ensure that all access points, facilities, and paths within and outside of the station meet the required standards and are free of obstacles. They should be made mandatory by the

government, with strict penalties for non-compliance. Authorities should establish regular feedback mechanism with PWD's to ensure that facilities provided meet their needs. Gathering feedback from PWD's can identify practical challenges and areas for improvement. Bottom- up approach should be adopted for policy implementation (Park & Chowdhury, 2021). Policies should be created to ensure that future projects such as Blue Line and Purple Line are more accessible. Policymakers should create a plan that involves PWD's as co-designers and evaluators in planning and development of public transportation to remove barriers and improve services as well as transit experiences.

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During the writing of this article, the authors used Grammarly to improve the language and grammar of the manuscript. After using this tool, the authors reviewed and edited the content as needed and assume full responsibility for the publication's content.

OpenAI was used to assist in the organisation of the manuscript structure. The technical content, data interpretations, and conclusions were generated entirely by the human authors, who verified all sources.

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Pedestrian accessibility complementation assessment in historical urban environments: Kadhimiya historical city, Iraq as a case study

Ismail M.T.M., Collage of Applied Art, Middle Technical University, Iraq,
ORCID 0000-0002-0158-6379 , mustafa-tahsin@mtu.edu.iq

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Abstract: Temporally, contemporary and historical cities respond to challenges. This response varies between positive and negative, which makes them suffer from multiple urban problems. It requires appropriate and effective solutions to solve these problems by complementing the morphological system that has changed and transformed. This research aims to assess accessibility Complementarity in the northern and northwestern parts of Kadhimiya city through an analysis of the morphological structure of the urban fabric, and to focus on walking as a primary mode of transportation in organic cities. Accessibility within the study area was assessed using Space Syntax and Geographic Information System methods.

Initially, maps representing the open areas of the city were prepared from satellite imagery and then digitised and scaled using AutoCAD 2021 software. Then, the axial and sectoral analysis was carried out in the depthmapX 0.8. Some geometric and topological metrics were calculated using the Space Syntax Tool Kit with depth map X. The main results were discussed in terms of spatial cognition and morphological characteristics. The urban problems arising from these transformations were diagnosed, as this will provide a new approach to design strategies for intervening in and complementing the case study fabric to address deficiencies and weaknesses in the studied urban area, ensuring equitable accessibility of all users and visitors.

Keywords: accessibility, complementation, space syntax, Urban Morphology.

1. Introduction

Urban environments have faced several difficult and complex challenges, ranging from economic, social, political, ecological, cultural and technological challenges. (Ali Madanipour, 2001) These challenges range from urban expansion, population growth, and migration to increasing poverty and inequality, to the impact of crime and violence, to natural disasters and climate change. (Kanchana, 2022) The city will continue to face these increasing challenges at different levels, which it responds to by addressing the shortage through changes in the deep structure and transformations in the surface structure, using urban design theories, strategies, and tools. (Ismail, 2023) Historically, the city has been shaped by its powerful contexts. Today, it is the turn of the service community to shape the city in its image, transforming it into a centre for the exchange of ideas, goods and services through new technologies. (Madanipour, 2003)

Urban researches aims to explore the link between effective urban design and the value it adds to cities. Good urban design is a critical component of the urban development process, as it can generate benefits for all stakeholders involved in creating and utilising the built environment. (Bastida, 2021) The benefits of good urban design are divided into direct benefits (usually

economic) to those responsible for investing in and sustaining development (whether from the public or private sectors); and indirect benefits (social and environmental) that accrue primarily to others and to society as a whole. (Graham Bannock, 1998) Urban design provides the opportunity to revitalise and make better use of historical heritage, through contextual Complementation with important structural and natural features, greater attention to environmental features - especially in accessibility, walkability and heritage revitalisation - complements social value. (Matthew Carmona, 2002)

The common feature of qualified urban spaces is to provide an environment that is rich in living standards, protects and preserves elements of identity, and flexibility and diversity compatible with current conditions (Senthilkumaran Piramanayagam, 2019), So The basic condition for creating such qualified and successful urban spaces is the reflection of urban design work on urban spaces, and discussing and evaluating the quality of urban design is the (level of success) for cities within the scope of urban management. (Doğan, 2019) Re-assessment of historical urban environments provides a good starting point for developing future visions and plans by identifying strengths that must be built upon, as well as gaps and weaknesses that must be investigated further to reach a complete problem diagnosis and remedy. (Salvatore Fundarò, 2022) Historical environments in Iraq were exposed to many forces (political, economic, and unbalanced modernisation) that pushed them towards physical transformation, which calls for a re-evaluation of urban environments that have undergone new morphological changes. (Sabeeh Farhan, 2020)

This research aims to assess accessibility complementarity in the northern and northwestern parts of the historic Islamic city of Kadhimiya. This is particularly relevant after the fourth morphological transformation occurred in the last decade. The study will focus on diagnosing deficiencies and weaknesses related to ease of access in this urban area.

2. Urban complementation

The notion of complementation appears in various philosophical and scientific fields, including African philosophy, medicine, mathematics, statistics, physics, genetics, economics, law, and the psychological and social sciences. It is a fundamental principle of human nature. Any system striving for an ideal state requires complementarity, and this is how the degree of complementarity within that system is measured. There are degrees of complementarity that vary according to the principles and ideals the system seeks to achieve.(Kimmerle, 2016)

Complementarity is governed by relationships among the parts of systems, mediated by influences such as intervention, substitution, stimulation, construction, change, and transformation, to reach an ideal systemic state (or at least a better one). At the same time, complementarity is characterised by its comprehensiveness and the multiplicity of therapeutic and preventative methods and approaches. This is achieved by focusing on the active and supportive relationships between the elements of systems in order to enhance, concentrate, strengthen, and improve quality. Complementation is the product of evolving social tendencies resulting from control, adaptation, community participation, interaction, and social cohesion, leading to an advanced or ideal state. (Mustafa T. M. Ismail, 2023)

The idea of complementation suggests the need for a new system that takes the context in which it operates, transcending mere completion and union with its surroundings. This symbiotic relationship can be seen in the thinkers of African philosophy and their environment. (Asouzu, 2004)

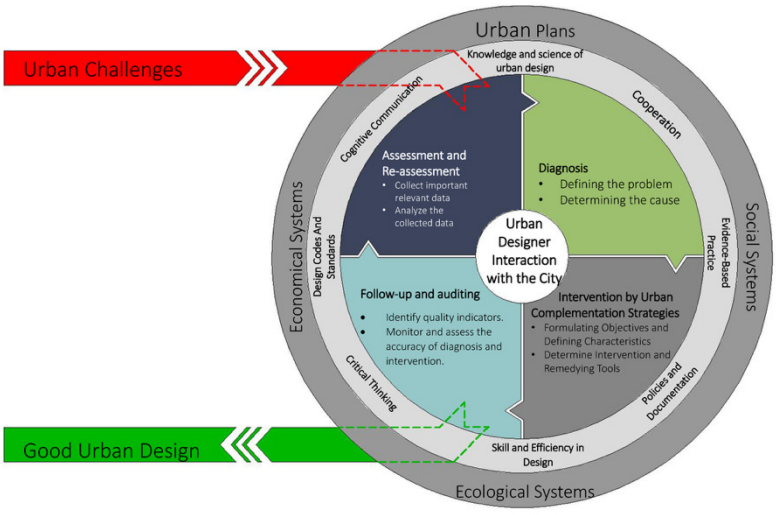
Complementary architecture results from blending local design languages. A pattern language is a collection of formal directions for how humans interact with constructed spaces. These rules come from practical solutions that have been sophisticated over time, shaped by local culture and natural conditions. (Lev, 2019)

Complementary architecture involves analysing traditional techniques in the context of vibrant urban environments to rediscover sustainable, accurate, and environmentally appropriate solutions for the present. The vast majority of traditional vernacular architecture and formal architecture produced before the twentieth century is complementary architecture, as are many works inspired by contemporary movements such as contextual architecture, indigenous architecture, organic architecture, or new urbanism. (Speck, 2021)

In urban planning and design, the term complementarity appeared directly and implicitly. The concept of complementarity emerged in the writings of Everett Majors on polycentric regional cities at the functional level of urban land uses. (Meijers, 2008) The concepts of hierarchy and Complementation were given particular emphasis in this study, as they relate to different aspects of urban development. The study highlighted that the various sectors of a city are complementary, and that their organisation can provide insight into socio-spatial dynamics. (Lambooy J. G., 1969) The functional interconnectedness of city areas depends on differences in layers of Complementation, or sectors in the hierarchy. The presence of these hierarchies does not necessarily imply a hierarchy of centres. Complementation may include spatially different hierarchical patterns, as there is both Complementation within and between job. (Lambooy J. , 1998).

Urban Complementation is the process of responding to urban challenges to complete and fulfil the changing systems that make up the city (see Figure 2). It is a fundamental principle that governs the city's formative nature. Advanced human social tendencies drive this process toward a better systemic state (see Figure 1). Urban Complementation involves effective, supportive relationships among the system's elements. It is contextual, comprehensive, multi-layered, and uses therapeutic and preventive methods and approaches. It has both quantitative and qualitative characteristics that can be measured and observed. (Ismail, 2023)

Figure 1: urban Complementation Methodological framework



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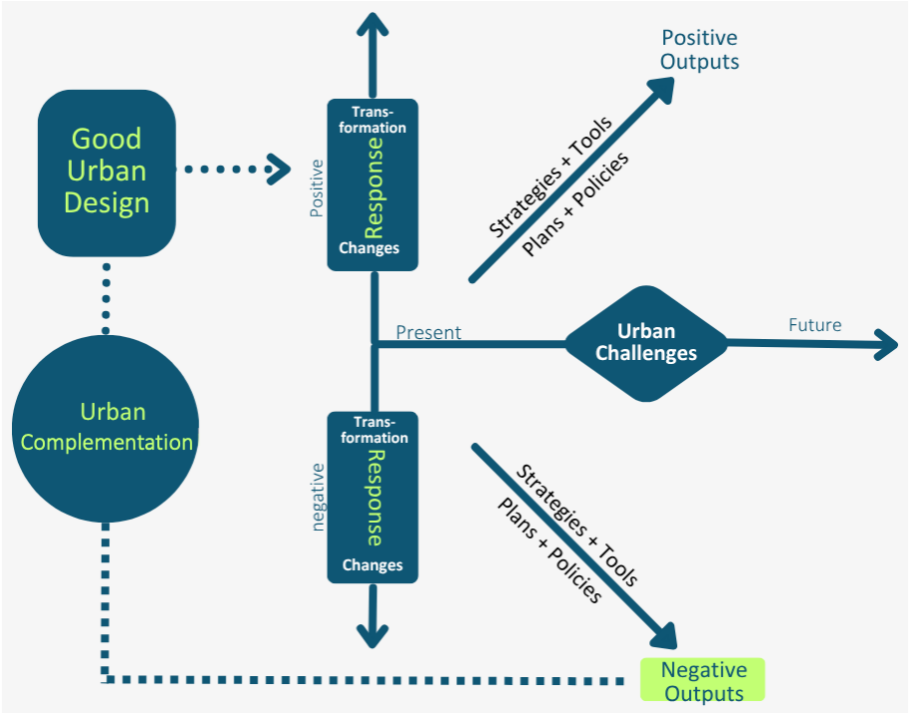
The notion of urban Complementation is distinct from the concept of urban Infill in: Urban Infill occurs at the physical dimension of the built environment, i.e. filling with buildings, while urban Complementation occurs at several layers in the city; Urban infill occurs by demolishing and rebuilding used-up parts or adding to vacant lands in the built urban environment, while Complementation seeks to compensate for the existing deficiency in the urban environment. (AlHasany, 2018)

Urban Infill policies aim to increase density in urban areas, while complementation policies seek to improve the quality and efficiency of the urban environment. Urban Infill requires proactive trust from residents to develop, whereas Complementation relies on the community's efforts and participation. (NLC, 2021)

There is a possibility that urban infill policies will have a negative impact if they are subject to an unregulated political-economic context (Nancy Brooks, 2011). When we trace the roots of Complementation, we see it as the reciprocal of the characteristics of the ideal urban image or urban quality.

According to the "Nursing Care Plan" Methodology, which adapted from treatment processes in complementary medicine, appeared as one of the foundations of urban Complementation at several layers (Spatial organisation and urban network, Urban Transportation, Urban Spaces, Urban land use, Urban Ecology, Urban infrastructure, Historical Urban environments, Artistic and cultural creativity, Urban legislation) within the city. (Ismail, 2023).

Figure 2: urban Complementation Response



3. Urban Spaces Accessibility Assessment

Urban life is humanity's most incredible experience to date. Cities are constantly evolving and adapting to their climates and economies. The cities we see today are not necessarily the ones we imagine, but innovation pushes us to rethink our visions of urbanisation. Therefore, future-oriented urban design values that complement the quality of life must be proposed to make our

urban areas more vibrant. (Bastida, 2021) Public urban spaces are the fundamental element and backbone of any city. They represent the city's identity and are the open spaces accessible to the general public. It represents the core of daily urban events and social and economic interactions. (Caves, 2005) A common feature of well-designed urban spaces is the provision of a rich environment that supports high living standards. The basic condition for creating such qualified and successful urban spaces is the reflection of urban design work in urban spaces; discussing and evaluating the quality of urban design are the indicators of the level of success for cities designed within the scope of urban planning. (Doğan, 2019).

Urban assessment is a valuable tool that can help us better understand and address challenges and unique opportunities in any urban area. Unlike other types of assessments, urban assessment focuses on forward-looking processes that can guide urban design strategies. (URBAN, 2019)

Assessing the physical characteristics of the built environment is a fundamental requirement for complementing, improving, and enhancing the functional, spatial, cognitive, and social dimensions. The assessment is achieved through standards and indicators related to the characteristics of the built environment, the study of human behaviour, interaction, and urban activity, as well as qualitative values and user satisfaction. (Ward, 2026)

Assessment involves analysing the elements and interactions of urban systems in the context of urbanisation, decentralisation, and local governance. By monitoring the dynamic factors that drive urbanisation, we can better understand the impacts, implications, and opportunities for strategic activities and programs that can help to mitigate challenges confronting urban areas. (USAID, Urban Links, n.d.) Moreover, urban assessment can help create an enabling environment for local economic development and job creation, while providing high-quality, locally-funded public services that protect the environment. It also aims to ensure that urban systems are flexible, integrated, and responsive, and works to mobilise local resources in urban areas. (USAID, URBANLINKS, 2019)

Assessing the physical features of the built environment is a basic condition for complementing, improving, and enhancing its functional, spatial, social, and cognitive dimensions, through standards related to the characteristics of that environment, studying human behaviour, interaction, and urban activity, with a focus on qualitative values and population satisfaction. (Stephanie Gamache, 2017)(Mustafa T. M. Ismail, 2023) Assessing urban public spaces and modifying and complementing them to meet contemporary needs is necessary because public spaces significantly affect community and public psychological health. (Mehta, 2014)

Through the values that urban design adds to complement the quality of life in the city, several trends have emerged among contemporary urban design theorists and practitioners regarding the contributions that constitute good urban design.

Kevin Lynch presented seven concepts that represent the ideal picture of the performance of the city and urban space, as follows: Vitality (designing attractive events); the sense of place; security and safety; The suitability and degree of matching of the place between the form and patterns of behavior; access to people, services and events; The control or degree to which those who use or occupy the space create easy access to places and events; Efficiency that related to the costs of making and maintaining the place; fairness, which is the distribution of resources among users. (Abbas, Lectures in Urban Design Trends, 2019)

In 1985, Bentley and McGlinn summarised the attributes of good urban design with seven concepts: character, continuity, enclosure, quality of public realm, ease of access, clarity, adaptability, and diversity. (Ian Bentley, 1985) Gehl developed 12 concepts or principles for the

ideal urban image of open public spaces, which he classified into three principal axes: protection, Comfort, and Delight.(Seema Praliya, 2019).

Thus, characteristics of public spaces discussed by urban theorists and practitioners, including ease of access, give the place a high quality, which creates greater opportunities for residents to be attracted to it.

Accessibility refers to the idea that every individual should have the right to access public spaces; these spaces should be designed so that they are usable by everyone. (Tutal, 2018) People should be able to move around freely in their daily lives and take part in all public activities. In other words, accessibility is the ease of reaching a particular destination. (Jefferson Hishiyama, 2012)

The methods used to evaluate accessibility are crucial in shaping mobility and urban development, as they influence people's decisions about where to locate and how to travel. (AK, 2018) When accessibility is low, mobility to the destination requires travelling long distances, taking up a lot of time, incurring high costs, and facing other obstacles and limitations.(Awada, 2007)

Based on the above, we can define Accessibility Complementation as a process of responding to the challenges people face in completing and fulfilling the transforming, changing system of mobility and access to urban amenities, as this process is the product of evolving social and human tendencies to achieve an accessible, fair, efficient, and sustainable urban environment.

Assessing and re-assessing accessibility is crucial for transportation, planning, and urban design studies, especially in historical urban environments that are still subject to morphological transformations. (Pereira, 2021) At the same time, there is pressure to expand community services and accelerate technological development while avoiding negative impacts on physical, social, and ecological infrastructure. (Ismail, 2023).

Assessing and re-assessing the accessibility process reveals the impact of emerging interactions among mobility, development, and urban land-use policies. (Gregório Luz, 2022) It shows how well individual and community needs, cohesion and social integration are met through people's access to community services. (A Church, 2000) It also indicates the range of options for obtaining the services required to achieve well-being and increase people's satisfaction. (Karen Lucas, 2016) Furthermore, it explains the extent of equal opportunities and the achievement of social justice by extrapolating the spatial dimensions of urban space. (Wee, 2022)

Taking into consideration that individuals' ability to access and obtain urban amenities and services varies according to their physical and mental health condition - healthy people, people with chronic diseases, people with disabilities or special needs, or according to age groups - the ageing, youth and children. (Cristina Sampedro, 2024)

Therefore, achieving ease of access is a joint integration between people's ability to use means of transportation, the spatial distribution of activities and population, and the spatio-temporal connections of the mobility network. (Miller, 2018)

There is a set of techniques and theories for analysing spatial planning and patterns of human activity in urban areas; that is, through analysis, a link is made between space and society. We can divide these metrics into Place- based measures, Person-based measures, Distance-based measures, Time-based measures, Gravity-based / Hansen-type measures, Topology /Infrastructure-based measures, Isochrone Mapping, and Space Syntax theory. (Martin Dijst, 2002)

Space syntax analyses how people use and move through different spaces, and how they develop and talk about them. It is based on two primary principles: first, that space is not just a backdrop for human activity but an integral part of it. (UCL, 2024); and second, that space is primarily determined by its configuration. This means that what happens in any given space, whether a room, a corridor, a street, or a public space, is fundamentally shaped by the relationships between that space and the next space connected to it. (Akkelies van Nes, 2021)

The space syntax method involves calculating configurative spatial relationships in the built environment and provides methods for finding spatial answers to questions. (Bill Hillier J. H., 1984)

Space syntax can provide a spatial perspective on how buildings and settlements shape social relations, demonstrating the social organisation of settlements across different cultures. (Bill Hillier A. T.-P., 2010) Space syntax is a powerful method that accurately measures the relationship between every public space and street segment in a built environment. It confidently calculates the to-movement potential (closeness) of each street segment to all others, as well as the through-movement potential (betweenness) of each segment. These accessibility potentials are precisely weighted by three distance definitions: metric, topological, and geometrical. Each type of relation can be confidently calculated at different radii from each street segment to provide an accurate understanding of the city's street and road network. (Bill Hillier S. I., 2005)

Space Syntax analysis empowers urban practitioners and designers to effectively diagnose existing issues, evaluate accessibility strengths and weaknesses, and proactively implement remedial urban tools and strategies

4. Methodology

This research aims to assess pedestrian accessibility -As a fundamental element of the spatial organisation layer- in the northern and northwestern parts of the Kadhimiya Historical City, see Figure (5a).

Analysing the choice, integration and connectivity of the transformed urban fabric (the fourth transformation) see Figure (5b). The analysis is based on information imported from the geographic information system using GIS ArcMap 10.8 software. The maps were arranged by scale, digitised in AutoCAD 2021, and then analysed in DepthMap 0.8.

Space syntax theory evaluates the numerical relationships between the spatial structure of the urban fabric and how people use and interact with it. It analyses pedestrian movement and its role in establishing social interactions within the fabric. (Bill Hillier J. H., 1984)

Depth Map software creates axial lines within movement areas, and axial maps measure the lengths of these axes. At the intersection points of the axes, each axis is segmented at a specific angle to form an angular segment map. Integration, choice, and connectivity values are then analysed to classify the results from the highest to the lowest level, such as thermal image.

The correlation between integration and choice values determines accessibility, and this relationship is calculated using NAIN (normalised angular integration) and NACH (normalised angular choice). (B. Hillier, 1987)

Whereas: $NACH = \frac{\log(Choice(r)+1}{\log(\text{Total depth(r)} +3)}$, N$AIN = \frac{\sqrt[1.2]{Node\ count\ (r)}}{\text{Total depth(r)} +2}$ (Bill Hillier T. Y., 2012)

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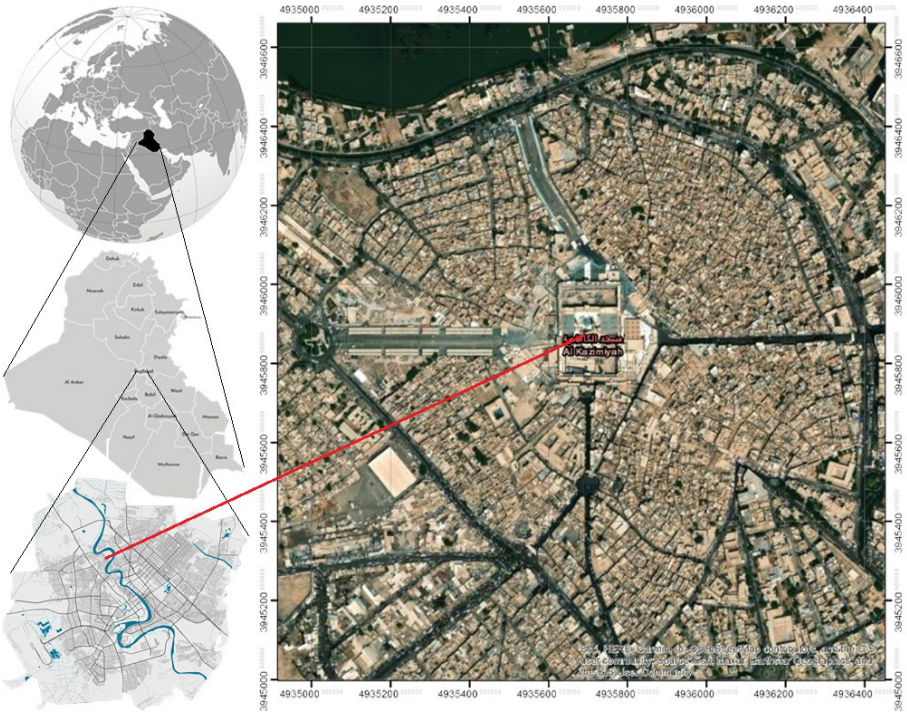
Where:

Normalised Angular Choice (NACH) is a metric used by Bill Hillier, according to Space Syntax Theory, for measuring urban spatial networks by identifying segments that act as major connectors, specifically formulated to eliminate the bias where segregated (peripheral) designs appear to have more "choice" than integrated (central) ones. It calculates the logarithmic ratio of angular choice to total depth, providing a more accurate, scale-independent assessment of traffic flow potential. (W. Hillier, 2012)

Normalised Angular Integration (NAIN) is a Space Syntax key metric used in Urban spatial analysis. This metric quantifies how connected or accessible each street segment is within the entire urban system by considering the total number of direction changes required to reach all other segments and normalising this measure to allow comparisons across different urban systems or cities of varying sizes. (W. Hillier, 2012)

One-step connectivity analysis is crucial for assessing the level of connectivity of selected streets to their nearby ones. Main paths are the definitive routes people select for travelling through and between urban areas. This analysis reveals the interconnected relationship between main routes and local path networks (Nes, 2009).

Figure 3. case study (Al-Kadhimiya) geographical location.



5. Case study

Al-Kadhimiya Historical City is an urban area located on the Karkh side of the capital, Baghdad. It was named after the shrine of Imam Musa Al-Kadhim, the seventh grandson of the Muslim's Prophet. Positioned 5 km north of Baghdad, it sits on the western side of the Tigris River, adjacent to Al-Karkh, as Figure 3. The founding of Al-Kadhimiya dates back to the fourteenth century. The area is characterized by two-story dwellings surrounding the Al-Kadhimiya shrine, see Figure (6b), along with small mosques, schools, shops, baths, workshops, Khans and modern hotels, see Figure (6a). This historical center has maintained its physical form relatively well compared to

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other parts of Baghdad, with an organic, tree-like layout. It is circular with a radius of approximately 500 meters, covering an area of around 60,000 square meters, and a population density of 600 people per hectare (Al-Dalawi, 1975).

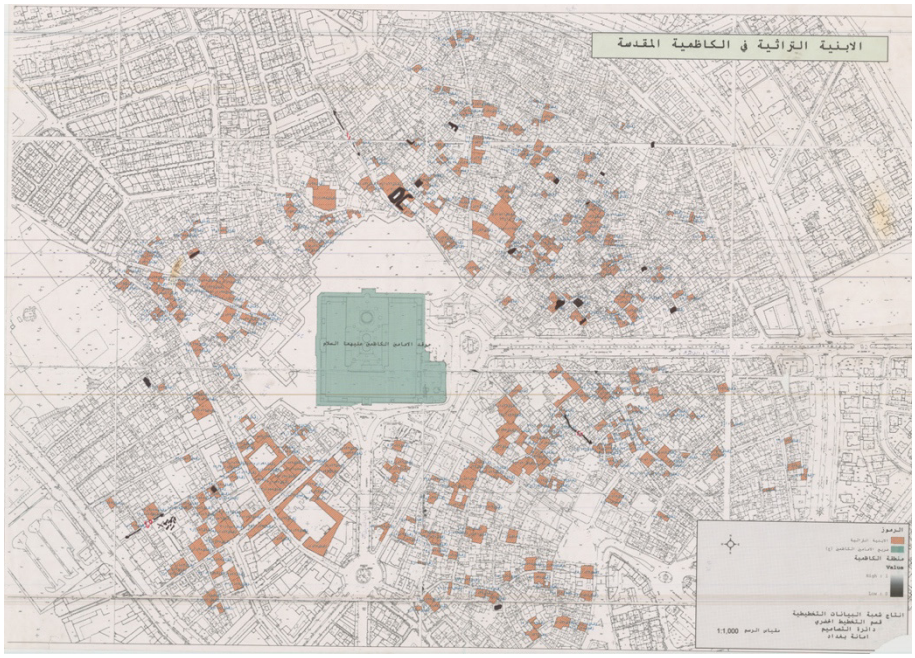
Old Kadhimiya has undergone several morphological transformations in the 20th century due to urban challenges, reflecting different stages of change. See Figure 4a, Figure 4b, Figure 4c, and Figure 4d :

- The first morphological stage, which extends until 1940:

Al Kadhimiya underwent modernization processes that began in 1869 when it was connected to (Al Karkh)-the western side of Baghdad- by a tram, which led to clear radical morphological changes in the southern edges. (Al-Kaissi, 2017, p. 671)

Figure 4a. Maps of morphological transformations of case study in 20th century

Figure 4b. Map of Al-Kadhimiya in 1980, Ref: (Mayoralty of Baghdad)



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• The second morphological stage: It extends from 1940-1975:

Al-Kadhimiya was connected to the north-eastern side of Baghdad (Al-A'dhamiya side) by a permanent bridge in 1957. In addition, traffic axes were created towards the east (Bab Al-Murad Street) and the south (Bab Al-Qibla Street) by demolishing parts of the urban fabric, especially in the Al-Shuyukh, Al-Qatana neighborhoods and on the eastern side of the Holy Shrine. As a result, clear commercial and residential developments occurred, especially in the southern and eastern sectors. (Al-Kaissi, 2017, p. 672)

Figure 4c. Satellite imagery of Al-Kadhimiya in 2007, Ref. (Mayoralty of Baghdad)

Figure 4d. Satellite imagery of Al-Kadhimiya in 2022, ref: http://www.chengfolio.com/google_map_customizer

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Figure 5a. Study Area Boundaries

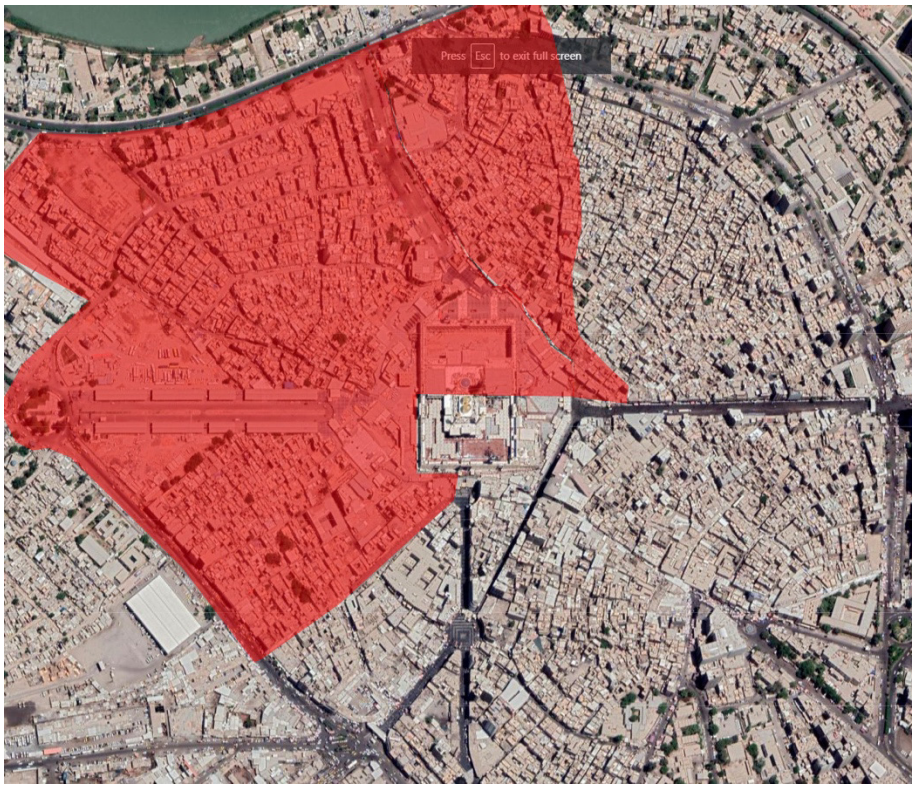

Figure 5 b. Transformed Fabric in 4th Stage

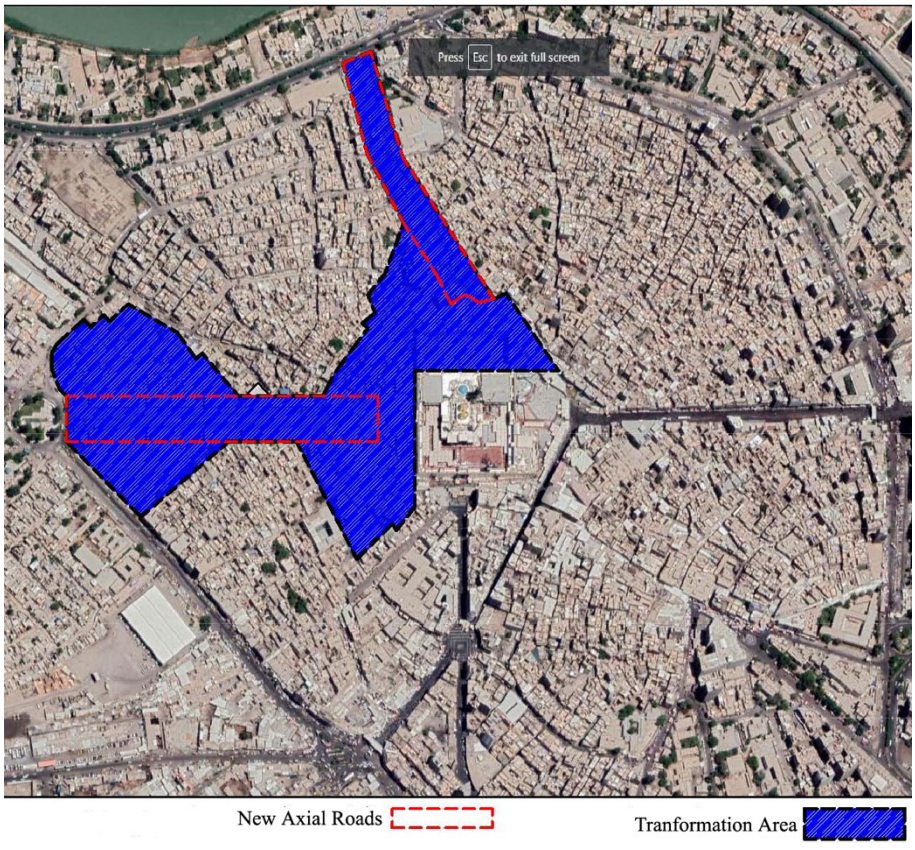

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Figure 6a. study area land use

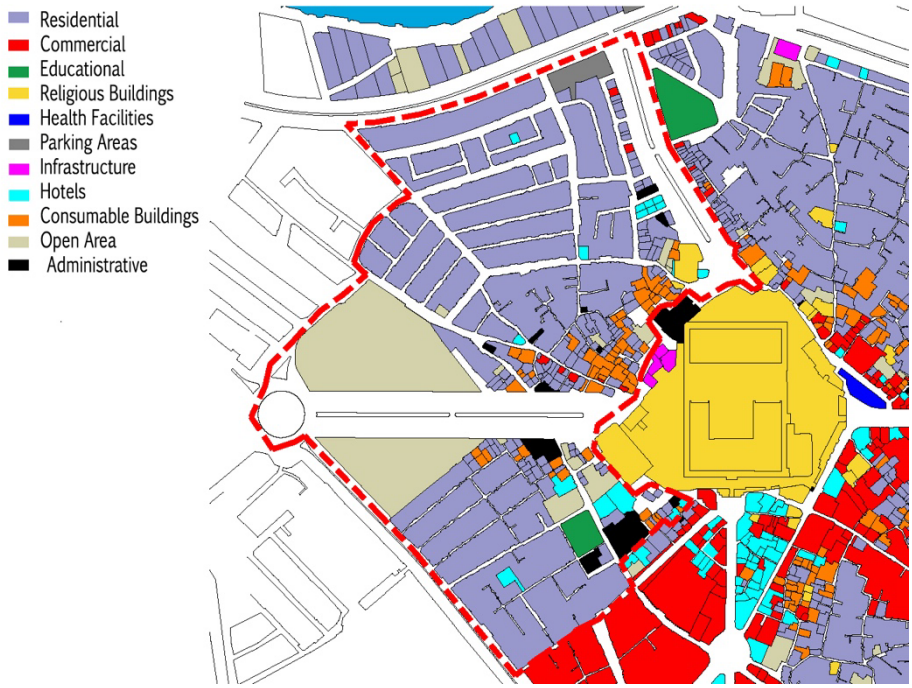
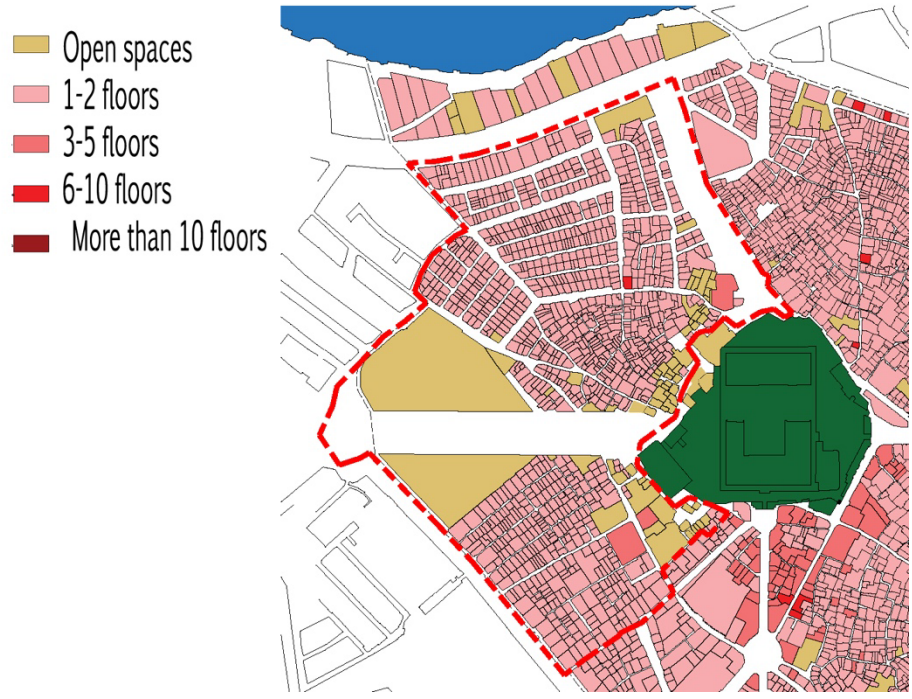


Figure 6b. study area Building Heights



• The third morphological stage: It extends from 1976-2003:

During the 1980s, the planning concept of Al Kadhimiya underwent a radical change due to demolition operations around the Al-Kadhimi Shrine. As a result, 9 hectares of the old urban fabric were demolished, giving way to the construction of modern multi-storey buildings that did not harmonize with the urban historical context. This demolition created a large open space around the shrine, making it difficult to discern the place and its identity. Furthermore, the open space destroyed the human scale of the urban fabric. The new roads built in this area altered

the spatial and movement systems, giving precedence to car traffic over pedestrian movement. Additionally, these roads disrupted the boundaries between semi-private, private, and public spaces, impacting the residents' privacy. (Warren, 1980).

The old city responded in an uncontrolled morphological transformation to the security challenges, and the Pluralism of visions for new development projects and proposals that were not completed, which made the old city what it is now

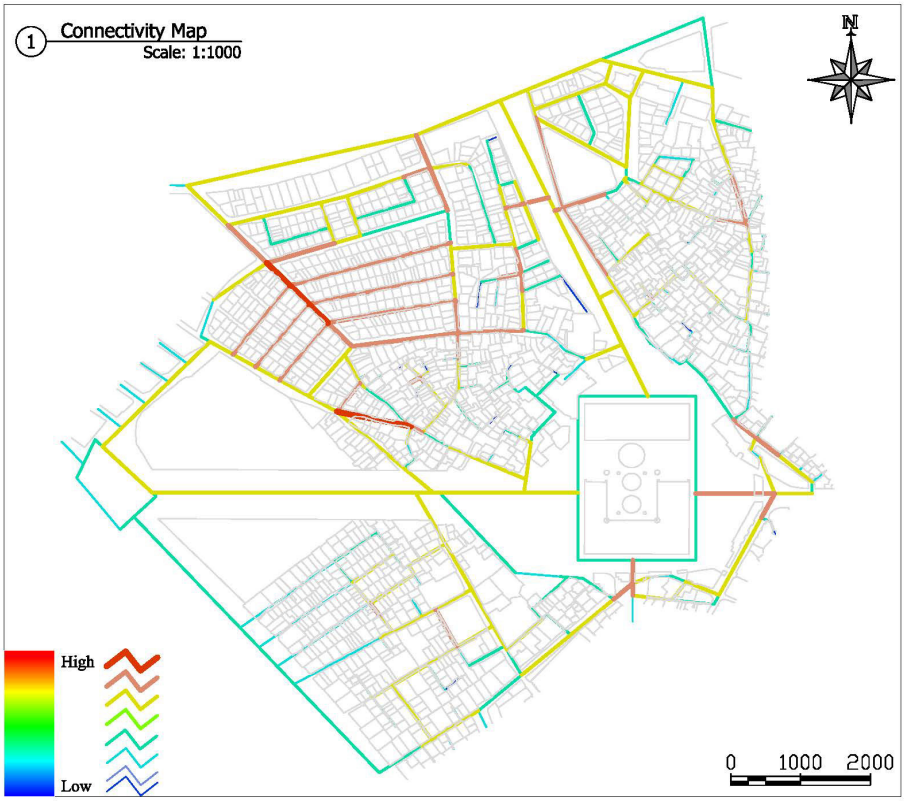
- Fourth morphological stage: after 2003:

In recent years, Iraq has witnessed changes in the political and economic context, which have a clear impact on the transformation of the context of the urban fabric of Iraqi cities in general and the city of Kadhimiya in particular, this impact is due to the city's religious significance and the ongoing expansion around the holy shrine.

6. Results & Discussion

The integration, choice, and connectivity values were calculated by analysing the metric segment map within a radius of Rn. It is observed that these values are concentrated along the main movement axes linking the main core (Holy Shrine) with the main transportation routes (outside the organic fabric). According to the results, the integration value is highest at axis 42, average at axis 100, and lowest at axis 377. The choice value is highest at axis 45, average at axis 380, and lowest at 0. The connectivity value is highest at axes (6, 33, 34, 35) and lowest at the dead-end axes. There are 426 line strings and 427 node counts in the study area. Figure 7a, 7b, 7c, 7d depict the maps created based on the integration, choice and connectivity values of the pedestrian pathways network of Al kadhimiya.

Figure 7a. Connectivity Map



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According to the research methodology, to represent the accessibility in the north and northwest of Al Kadhimiya city, we should understand the level of accessibility in the study area. The correlation matrix of NACH (Rn) and NAIN (Rn) had been interpreted in the star graph model in figure. 8a and scatter plots in Fig. (8b), which showed the value of intelligence (R2) according to the equation (y=ax + b) given in the depthmap X software with the coefficient and constant (b).

Figure 7b. NACH Map

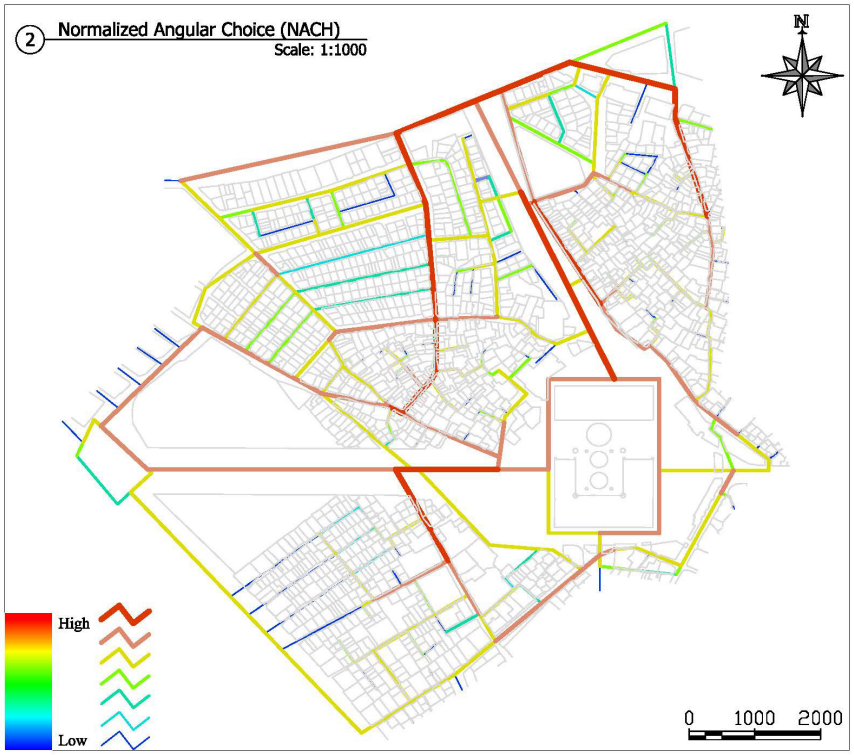

Figure 7c. NAIN Map

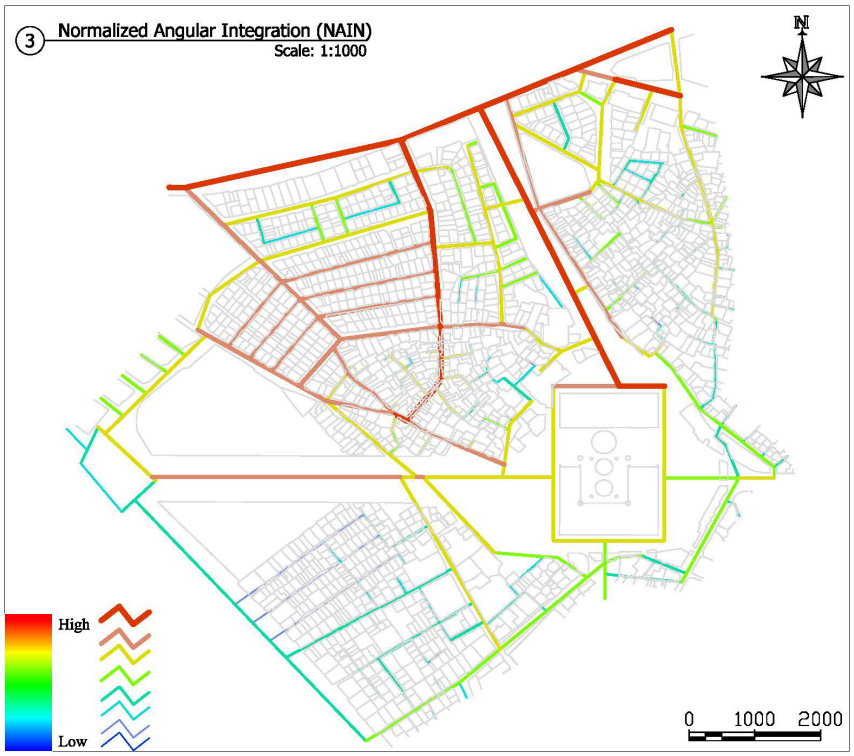

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Figure 7d. T1024 Total Depth 400 metric map

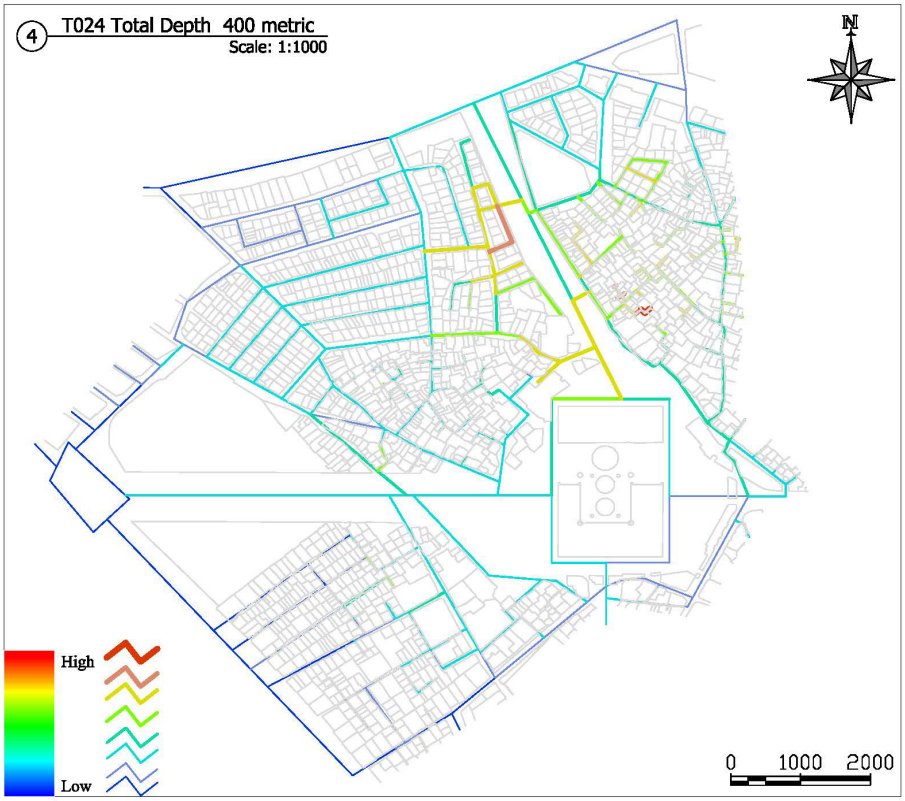
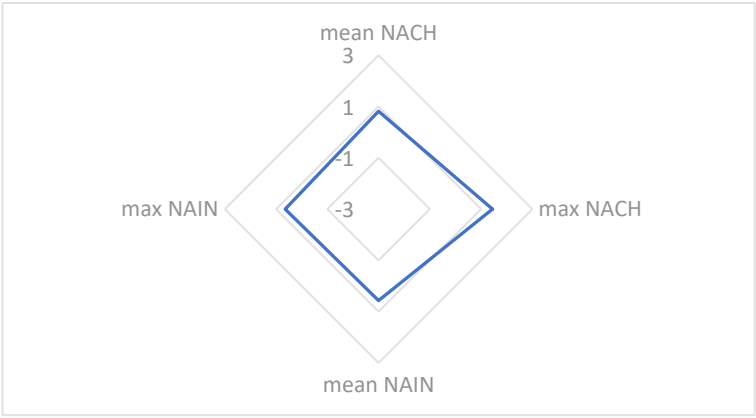


Figure 8a. Star Graph Model, and scatter plot of Correlation matrix between NAIN & NACH



As shown in Tables 1 and 2 below, the range of the intelligence value was between 0 and 0.5, indicating that the ability for spatial recognition is generally weak. The study revealed that the value of (R2) is 0.43, despite a positive relationship between integration and choice, i.e. the study area has a weaker accessibility from within the fabric than from outside.

To investigate the relationship between NAIN and NACH, a Pearson product-moment correlation coefficient (R) was computed. Preliminary analyses were performed to ensure that the assumptions of normality, linearity, and homoscedasticity were not violated. (Cohen, 1988).

The results revealed a statistically significant positive correlation between the two variables (r = 0.656, n = 426, p < .001). According to Cohen's (1988) guidelines, this represents a moderate to strong effect size. The extremely low p-value (1.06 \times 10^ {-39}) indicates that the probability of this correlation occurring by chance is virtually zero, thereby providing robust evidence for the hypothesised relationship.

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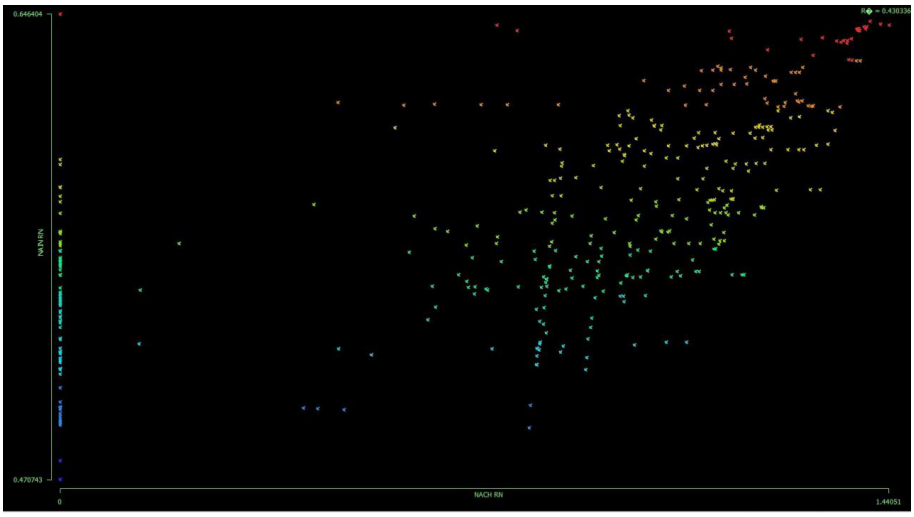
Figure 8b. Scatter plot of Correlation matrix between NAIN & NACH



In Figure 8a, the vertical axis represents the mean NACH (top) and mean NAIN (bottom) at a specific distance from the city centre. In contrast, the horizontal axis represents their maximum NACH (right) and maximum NAIN (left). Each measure is a standard score on the same scale, with a range of about 0, where the negative minimum is at the centre, and the positive maximum is at the edge. Since most areas in cities are part of the background network, the mean values reflect the potential for movement within the background (integration with little through-movement). In contrast, the maximum values represent the potential for movement within the foreground network. The mean and maximum NAIN measures tend to co-vary, meaning the angle between them remains fairly constant, whereas the mean and maximum NACH measures do not co-vary and reflect the city's pattern.

The above analysis indicates that the creation of a new northern movement axis connecting the holy shrine to the city's circular car movement axis has significantly enhanced global integration. Nevertheless, this axis has unfortunately led to the isolation of the eastern and western regions in the city's genetic system, as it has cut off connections with the rest of the axes, enforced by a security fence that restricted movement and land-use changes on both sides. At the same time, the new, highly integrated western movement axis isolated the urban areas on the northwestern side from those on the southwestern side. At the same time, this axis became a backyard for the city centre (the holy shrine) and served specifically its movement and logistical supplies. That caused isolation in the north-east, north-west, and south-west residential areas within the city's genetic system. In conjunction, the new axes have significantly limited the range of choice from the outer fabric to the Centre, while simultaneously streamlining choices from within the fabric. The new movement axes reduced connections between parts of the old fabric, affecting movement and access within the old city.

Table 1. shows the values of normalised choice, integration and connectivity.

Radius	*Value*	*Mean*	*Minimum*	*Maximim*	*STD. Dev.*	*Correlation coeffi-cient*
n	*NACH*	*0,81389*	*0*	*1,44051*	*0,46846*	0,656
n	*NAIN*	*0,57053*	*0,47074*	*0,6464*	*0,03869*	0,656
n	*Connectivity*	*3,28806*	*1*	*6*	*1,09669*	

*Note: *** p< 0.001*

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Table 2a. Demonstrates a Pearson product-moment correlation coefficient between NAIN and NACH.

Regression Statistics	
Multiple R	0,656
R Square	0,430336
Adjusted R Square	0,428995
Standard Error	0,354409
Observations	427

Table 2b. Shows the Analysis of Variance of normalised choice, integration and connectivity.

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*			
Regression	1	40,32613	40,32613	321,0532	6,89E-54			
Residual	425	53,38244	0,125606					
Total	426	93,70858						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-3,71733	0,253468	-14,6659	1,07E-39	-4,21554	-3,21913	-4,21554	-3,21913
X Variable 1	7,942201	0,443254	17,91796	6,89E-54	7,070959	8,813444	7,070959	8,813444

7. Conclusions

This study found the structural variation patterns as a small organic urban fabric. It exhibits a stronger focus on choice than on integration, and a more pronounced foreground than background structure. Based on the assessment and diagnosis conducted by the research, it has been determined that the study area requires an urban complementary intervention strategy to solve the problems of deficiency and weakness in pedestrian mobility, integrated with the whole historic urban fabric of the city, and compatible with the laws and urban plans established for that area.

These strategies must have comprehensive, applicable, and practical characteristics that are encouraging, intelligent, and sustainable, employing innovative, interactive, and contextually dynamic approaches. These strategies aim to enhance public understanding of urban form, provide visual, spatial, and psychological cues, localise ideas and symbolic images of place, and strengthen urban management and governance. Specifically, these strategies include:

- Preserving, organising, and maintaining roads and public spaces by raising security fences, maintaining facade finishes, walkways, pathways, and roads in accordance with the heritage context, and reconnecting and modernising existing urban transport networks.
- Enhancing the city's mental image through mechanisms that activate reference maps and signage, integrate them into spatial representations, and utilise Geographic Information Systems (GIS) technologies.
- Employing smart governance through mechanisms that adopt sustainable behaviour and design practices and utilise information and communication technologies (ICTs).

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8.1. AI disclosure

During the writing of this article, the author used Grammarly to improve the language and grammar of the manuscript. After using these tools, the authors reviewed and edited the content as needed and assume full responsibility for the publication's content. The technical content, data interpretations, and conclusions were generated entirely by the human authors, who verified all sources.

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Perspectives and challenges of physiotherapists, special educators and other healthcare workers in implementing eco-integration for persons with disabilities

Arsovski D., St. Kliment Ohridski Bitola University, Higher medical School Bitola, North Macedonia, ORCID 0000-0003-4992-686X, denis.arsovski@uklo.edu.mk

Chichevska Jovanova N., Ss. Cyril and Methodius Skopje University, Institute of Special education and rehabilitation, ORCID 0000-0001-9324-8117, natasac@fzf.ukim.edu.mk

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Abstract: Eco-integration, as a multidimensional model of inclusive rehabilitation is designed to bring together environmental, social, and institutional domains to stimulate participation and quality of life for persons with disabilities. Despite its conceptual acceptance, the practical application of eco-integrative in clinical environment is insufficiently researched. This research investigates the perceptions and challenges experienced by 64 healthcare workers and special educators in North Macedonia in implementing eco-integration. With structured questionnaire, the study assessed familiarity with the concept, viewed implementation levels, and factors contributing to social isolation among persons with disabilities. Descriptive statistics and one-way analysis of variance were used to compare perceptions among the professions. Results indicate that while 78.1% of participants reported familiarity with eco-integration, only 7.8% believed it was fully implemented in their workplace. Significant interprofessional differences were observed ($F = 4.031$, $p = 0.022$), with physiotherapists more likely to report partial implementation. Key barriers were inaccessible environments, social stigma, and lack of interdisciplinary cooperation. The definitions of eco-integration from the participants included community-based services, assistive technologies, and family-centred care. On the other hand, institutional adoption of these components was limited. The results showed a gap between awareness and operationalization of eco-integration in practice. Responding to this requires strategic policy adjustments, capacity building through interprofessional education, and the development of context-sensitive models to enable systematic implementation. The study contributes new knowledge on eco-integrative rehabilitation and points to the need for a more structured, inclusive, and collaborative approach in disability care.

Keywords: eco-integration, rehabilitation, disability, inclusion, physiotherapy, interprofessional collaboration.

1. Introduction

Over the past few years, the concept of inclusion evolved, showing wider societal change in diversity, equity and accessibility (Hayes & Bulat, 2017). The aim of the inclusion as basic human right in rehabilitation is to provide equal opportunities, eliminating challenges that prevent persons with disabilities fully participating in society (Long & Guo, 2023); (Saran, Hunt, White, & Kuper, 2023). For this evolution, healthcare workers are important since they have become main

characters in promoting eco-integration and reducing social isolation among this population (West, et al., 2021); (Khan, Addo, & Findlay, 2024).

The concept of eco-integration according to some authors is about the harmonization of persons with disabilities within different environments, whether natural or social (Lopatynska, Omelchenko, Deka, Protas, & Dobrovolska, 2023); (Caragiani, 2020). However, this definition increases in addition to include the needs for accessible spaces and adaptive technology usage that meet the needs of the different abilities of all persons with disabilities (Persson, Åhman, Yngling, & Gulliksen, 2015). Rehabilitation and other healthcare workers are important for eco-integration because they implement rehabilitation that improves mobility, increase functional independence and motivate active community participation (Khalid, Sarwar, Sarwar, & Sarwar, 2015). With the gap between persons with disabilities and their environment, physiotherapists and other healthcare workers helps through exercises, assistive technology and ergonomic interventions (Vitoulas, et al., 2022).

Social isolation is common problem for persons with disabilities that results with decreased quality of life and negative psychological outcomes (Emerson, Fortune, Llewellyn, & Stancliffe, 2020), and physical barriers, stigmatization, limited social skills and fewer opportunities for meaningful everyday interactions are some contributing factors (Brandt, Liu, Heim, & Heinz, 2022). Rehabilitation and other healthcare workers are impactful for reducing social isolation by focusing on comprehensive care that is not limited only to physical rehabilitation, but goes beyond it (Connaughton & Gibson, 2016). These professionals work to improve communication skills, social confidence and to create ways for social participation through group therapy sessions, community or government programs and different initiatives with other healthcare workers and social services (ShahAli, et al., 2023). The integration of these healthcare workers and special educators in the inclusion is more than showing physical limitations - it requires knowledge about the complexity of physical, social and environmental factors that influence the activities of daily living (Maharaj, et al., 2018). Through individualized approach, the rehabilitation and other healthcare workers are customizing their interventions for satisfying each goal, preference and social context for persons with disabilities (Killingback, Green, & Naylor, 2022).

Healthcare workers, especially those in rehabilitation are recommended for changes that support all levels of inclusion (Narain & Mathye, 2019). This involves working with teachers, helping them understand the concept of eco-integration in rehabilitation, urban planners that are responsible for architectural needs for persons with disabilities and organizations that aim to increase inclusivity, design accessible public spaces and promote awareness about the importance of inclusion for persons with disabilities (Sahoo & Choudhury, 2023). With those solutions, these professions can help to deconstruct the challenges from the exclusion, promoting more inclusive society that shows diversity and inclusivity (Layton, Rachelle, Bourke, & Kayes, 2024); (Mahon & Cusack, 2002); (Haldane, et al., 2019). With their expertise and commitment, they can help building a more inclusive world, where people can live with dignity, autonomy and a sense of belonging (Deshmukh & Harjpal, 2024). Evaluating these contributions and their impact, this research aims to analyse the practices, perceptions and barriers by rehabilitation workers, especially physiotherapists and special educators focused on disability in promoting eco-integration and inclusion for persons with disabilities.

2. Methodology

2.1. Participants

This research included 64 respondents, healthcare workers in the medical and rehabilitation fields with 23 physiotherapists, 21 special educators and 20 healthcare workers from other related fields to rehabilitation. Initially, the questionnaire was distributed to 150 rehabilitation and other healthcare workers, but only 64 of them fulfilled all the answers. The participants were selected through purposive sampling and this sampling guaranteed that the participants had direct experience with eco-integration and preventing social isolation for persons with disabilities. The demographic distribution of this research included 36 males (56.25%) and 28 females (43.75%).

In order to be included in this research, participants had to be healthcare workers, rehabilitation or special educators and rehabilitators working with persons with disabilities. Also, participants had to have the experience in eco-integration and social inclusion in the healthcare system or other rehabilitation institutions, and participants had to be capable to provide the informed consent anonymously and to participate in electronic platforms, so they had to have computers.

The exclusion criteria were persons which did not work in the healthcare system, rehabilitation centres or any other kind of institution where workers are in the field of special education, or they had minimal knowledge in implementing eco-integration in their everyday work. The exclusion was also chosen if participants didn't had experience with persons with disabilities or were unable to understand the purpose of the research or if they didn't complete the questionnaire, failed to submit all the answers or didn't gave the informed consent.

2.2. Measures

For the aim of this research, structured questionnaire was developed to collect data from the participants, made up of five main sections. The first section of the questionnaire was basic demographic information such as age, gender, profession and years of experience. The second section of the questionnaire focused on assessing the familiarity with the concept of eco-integration of the participants and their perceptions of its importance in reducing social isolation. Participants rated their familiarity on a Likert 5-point scale. The third section examined perspectives on the length to which eco-integration is being implemented into the healthcare system. Participants also rated the implementation level on a Likert scale from 5 to 1. The aim of this section of the questionnaire was to find any challenges and opportunities that could improve the eco-integration in the healthcare system and rehabilitation centres. The fourth section of the questionnaire assessed the perceptions of the participants for social isolation among persons with disabilities in their communities and everyday life activities. The participants were asked to assess the social isolation and identify its primary causes such as lack of accessible environments, social stigma, discrimination, limited social support networks and insufficient healthcare services. Participants were also asked whether they observed any direct impacts of social isolation on the mental or physical health of persons with disabilities. The last section of the questionnaire assessed the role of healthcare workers in promoting eco-integration and reducing social isolation. Respondents rated the length to which they believed physiotherapists and other healthcare workers could influence eco-integration and any challenges they face in promoting eco-integration for persons with disabilities. For qualitative purposes and its interpretation some of the questions were open.

2.3. Procedure

The questionnaire was electronically distributed through email and online platforms for wider participation. Participants were informed about the purpose of the research and their responses were strictly anonymous and confidential. Data collection took several weeks and all responses were stored for maintaining data integrity and confidentiality. Prior to participation, all of the participants were required to provide informed consent electronically, in accordance with ethical standards.

2.4. Statistical analysis

The collected data were analysed with descriptive and inferential statistics. For the descriptive part of the statistics, it was used frequencies, percentages, means and standard deviations for summarizing the demographic characteristics and responses. For inferential analysis, chi-square tests were used to examine associations between categorical variables, such as gender and year of experience. One-way analysis of variance was used to evaluate differences in perceptions of the implementation of eco-integration among various professional groups included in this research. Effect sizes were calculated with eta-squared for analysis of variance and Cohen's d for post hoc comparisons to quantify the strength of observed differences. Open-ended responses were thematically analysed to identify recurring patterns in the perceptions of eco-integration from the participants. Responses were grouped into key theme such as environmental accessibility, interprofessional collaboration, and social stigma.

3. Results

The results section shows the findings of the study in two main segments - descriptive statistics that summarizes the demographic characteristics and general perceptions of participants, and inferential analyses examining the relationships between profession, gender, experience, and perceptions of eco-integration. These results show the primary aim of this study: to evaluate how healthcare workers view, understand, and apply the concept of eco-integration in their practice, and to identify perceived barriers to its implementation. At the end, qualitative interpretation of several open questions was analysed. The demographic profile of the participants is summarized first to contextualize their professional and experiential background, which is relevant to interpreting their perspectives on eco-integration.

Table 1 shows the analysis of gender of participants in this research. From the total participants, 56.25% were male (n=36) and 43.75% were female (n=28). This table shows a slightly higher representation of male participants compared to female participants, but generally the sample maintains a balanced gender distribution.

Table 1. Gender distribution of participants.

Count	Percent
36	56.25%
28	43.75%

Table 2. Profession distribution of respondents.

Profession	Count	Percent
Physiotherapists	23	35.94%
Special educators	21	32.81%
Other healthcare workers	20	31.25%

Figure 1.Gender distribution across included professions.

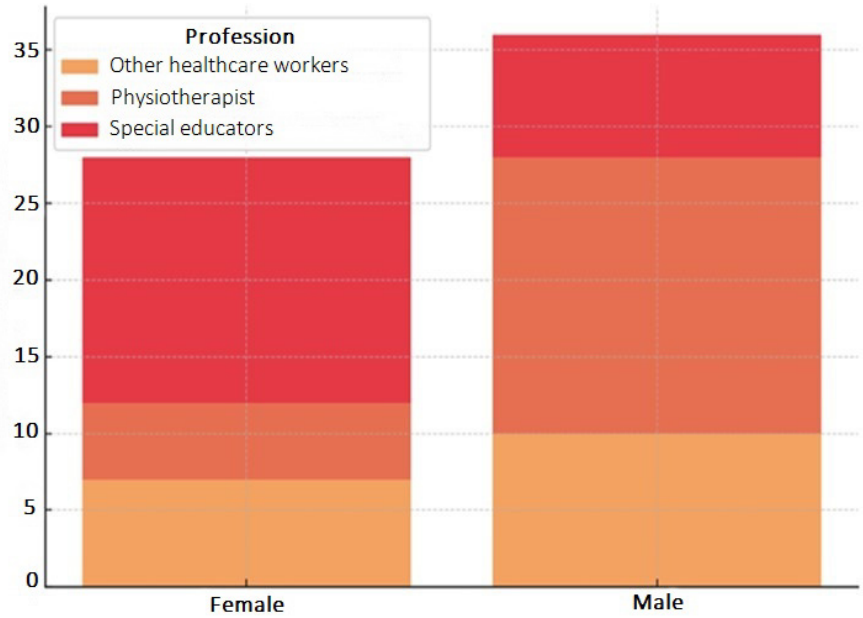

Table 2 shows the administration of profession of the respondents. Physiotherapists represent the largest group with 35.94% of the total sample (n=23). Special educators followed with 32.81% (n=21), while other healthcare workers such as doctors, nurses and radiology technicians with 31.25% (n=20).

Figure 1 visualizes the distribution of male and female participants in different professional categories. The results show clear gender representation patterns with a higher proportion of males in physiotherapy and more females in special education. Other healthcare workers show a relatively balanced gender distribution. It was supposed that this trend may be affected by societal norms, career preferences or access to education in these fields in North Macedonia.

Table 3. Years of experience of participants

Years of experience	Count	Percent
4-6 years of experience	21	32.81%
1-3 years of experience	19	29.69%
7-10 years of experience	15	23.44%
Less than 1 year	9	14.06%

Table 3 shows the administration of years of experience of the participants. The largest group is formed of participants with 4-6 years of experience, then came participants with 1-3 years of

experience. A smaller sample of participants had 7-10 years of experience, while the least experienced group consists of those with less than 1 year of experience.

Table 4. χ^2 for gender and years of experience.

Variable	χ^2	df	p-value	Interpretation
Gender versus years of experience	43.88	3	< 0.001	Significant association

Table 4 shows the results of the chi-square test that assessed the relationship between gender and years of experience. This analysis shows a statistically significant relationship ($\chi^2 = 43.88$, with $p < 0.001$), showing that experience levels vary between male and female participants. The results show that male participants are more concentrated in the lower experience levels and female participants tend to have more years of experience.

To assess how professional background affects the views of the implementation of eco-integration, analysis of variance was conducted. The analysis compared perception scores among three professional groups: physiotherapists, special educators and other healthcare workers.

Table 5. Analysis of variance for profession versus perception of the implementation of eco-integration among participants.

Source	Sum squares	ofdf	Mean square	f-value	p-value	η^2
Profession	17.30	2	8.65	270.19	<0.001	0.291 – large
Residual	1.95	61	/	/	/	/

Table 5 shows the analysis of variance that assessed the relation between profession and the perception of the implementation of eco-integration. This analysis shows a statistically significant effect of profession on the perception scores ($F(2,61) = 270.19$, $p < 0.001$). The effect size ($\eta^2 = 0.291$) shows that profession explains 29.1% of the variance in perception scores, with a large effect. This confirms that profession plays important role in the perception of eco-integration meaning that different healthcare workers recognize eco-integration implementation in different ways. Additionally, from Table 6 the post hoc analysis shows that physiotherapists have a higher perception scores than both special educators and other healthcare workers, showing that training, exposure and successful application of practice influence the perceptions of eco-integration in the different professional groups in this study.

Table 6. Post hoc analysis for differences in perception of eco-integration implementation by profession.

First group	Second group	Mean difference	p-value	Significance
Physiotherapists	Special educators	0.71	<0.001	Significant
Physiotherapists	Other healthcare workers	1.42	<0.001	Significant
Special educators	Other healthcare workers	0.71	<0.001	Significant

After the analysis of variance, it was conducted post hoc analysis and based on Table 6 it was shown that physiotherapists have higher perception scores compared to both special educators ($p < 0.001$) and other healthcare workers ($p < 0.001$). It is worth mentioning that special

educators reported higher perceptions of eco-integration than other healthcare workers ($p < 0.001$). These results showed that profession plays important role in the point of the view about the implementation of eco-integration. Physiotherapists may be more focused on rehabilitation, while special educators might include eco-integration into the broader education. In contrast, other healthcare workers outside these fields have less training in the principles of eco-integration.

Figure 2. Perception of the implementation of eco-integration in the healthcare system.

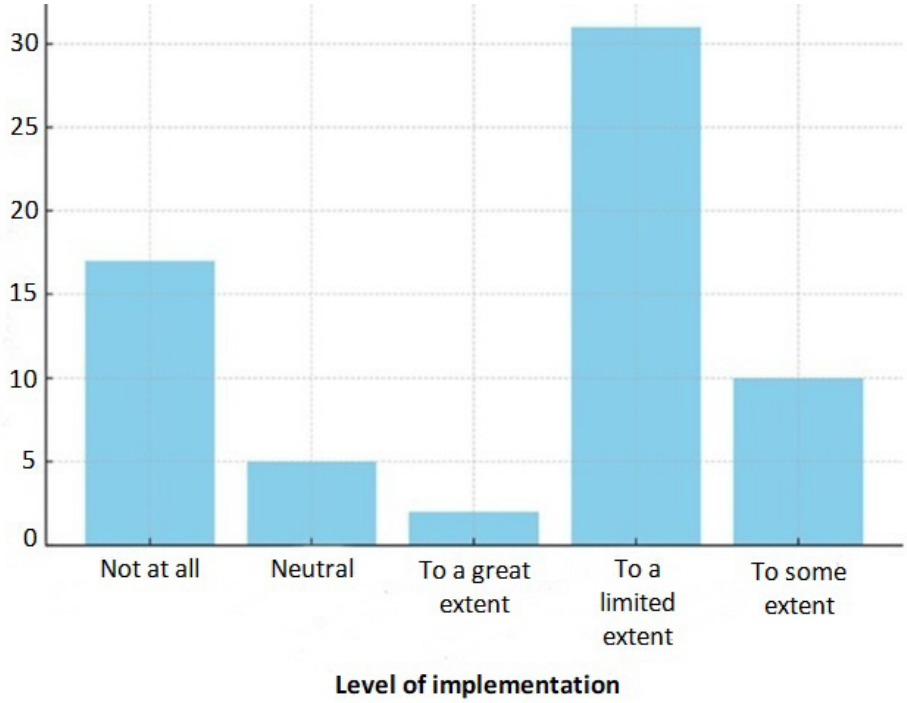

Figure 2 shows the distribution of the perceptions of the participants about the level of eco-integration implementation in the healthcare system. The majority of participants note that eco-integration is implemented to a limited extent or not at all and with this answer it was suggested that awareness or visibility of these kind of practices may be low. A smaller proportion of participants believe that eco-integration is implemented to some extent and very few participants view it as being incorporated to a great extent.

Table 7. Eta-squared for profession versus perception of eco-integration implementation.

Source	Sum of squares	df	Mean square	f-value	p-value	η^2	Effect size interpretation
Profession	27.229	2	13.614	25.499	<0.001	0.291	Large effect
Residual	66.208	61	1.085	/	/	/	/

Table 7 shows the effect size analysis obtained from the one-way analysis of variance, assessing the influence of professional background on perceptions of the implementation of eco-integration. The eta-squared value was 0.291, showing a large effect size and this suggests that 29.1% of the variance in perception scores can be attributed to the professional group of the participants. The substantial effect shows that profession influences how the implementation of eco-integration is viewed.

Table 8 presents Cohen's d values quantifying the magnitude of differences in perception scores across the included professional groups. According to standard interpretation, values above 0.8 indicate a large effect, and values exceeding 2.0 are considered extremely large. The analysis shows that physiotherapists reported higher perception scores than both special educators (d = 3.41, very large effect), and other healthcare workers (d = 7.14, extremely large effect). On the other hand, special educators scored higher than other healthcare workers (d = 3.93, very large effect).

Table 8. Cohen's d for post hoc comparisons of perception scores by profession.

Comparison	Mean difference	Cohen's d	Effect size interpretation
Physiotherapists versus special educators	0.71	3.41	Very large effect
Physiotherapists versus other healthcare workers	1.42	7.14	Extremely large effect
Special educators versus other healthcare workers	0.71	3.93	Very large effect

In addition to statistical comparisons, participants were asked about their familiarity with eco-integration, viewed levels of implementation in the healthcare system, and views on causes and consequences of social isolation among persons with disabilities. The following tables summarize these descriptive findings.

Table 9. Familiarity with the concept of eco-integration.

Response option	Frequency	Percent
Very familiar	18	28.1%
Somewhat familiar	32	50%
Not familiar	14	21.9%

Table 9 shows the distribution of the familiarity of the participants with the concept of eco-integration. The majority of respondents showed a positive orientation toward the concept, with 50% reporting being somewhat familiar and an 28.1% answering very familiar. Only 21.9% indicated no familiarity. These results show a strong conceptual awareness of eco-integration among rehabilitation workers either physiotherapists or special educators which may serve as a foundation for future efforts aimed at promoting its practical implementation. However, the gap between familiarity and institutional application showed elsewhere in the data defines the need for personalized strategies to translate this awareness into consistent, real-world practices.

Table 10. Viewed level of eco-integration implementation in healthcare.

Response option	Frequency	Percent
Fully implemented	5	7.8%
Implemented to some extent	18	28.1%
Minimally or not implemented	41	64.1%

Table 10 shows the perceptions of the participants of the level of the implementation of eco-integration within their healthcare institutions. While 28.1% recognized partial implementation

and only 7.8% viewed full integration, majority (64.1%) reported that eco-integration is either minimally implemented or entirely absent. This disparity between conceptual familiarity (as shown in Table 9) and viewed practical application show a critical implementation gap. The results show the need for systemic institutional support, clearer operational frameworks, and interprofessional collaboration to ease the translation of eco-integrative principles into routine rehabilitation.

Table 11. Viewed primary causes of social isolation among persons with disabilities.

Cause of social isolation	Frequency	Percent
Lack of accessible environments	38	59.4%
Social stigma and discrimination	44	68.8%
Limited social support networks	31	48.4%
Insufficient healthcare services	27	42.2%

Table 11 shows the perceptions of the participants of the primary contributors to social isolation among persons with disabilities, allowing for multiple responses per participant. The most frequently cited causes were social stigma and discrimination (68.8%) and lack of accessible environments (59.4%), indicating that both societal attitudes and environmental barriers are viewed as major obstacles to inclusion. Additionally, nearly half of the respondents identified limited social support networks (48.4%) and insufficient healthcare services (42.2%) as contributing factors.

Table 12. Observed impact of social isolation on persons with disabilities.

Impact observed	Frequency	Percent
Decreased mental health	46	71.9%
Reduced physical activity	39	60.9%
Social withdrawal	51	79.7%

Table 12 presents the observations of the participants regarding the effects of social isolation on persons with disabilities, with multiple responses allowed per participant. The most frequently reported impact was social withdrawal (79.7%), followed by decreased mental health (71.9%) and reduced physical activity (60.9%). These results show that social isolation is viewed as having a profound, many sided effects on well-being, limiting not only emotional and psychological health, but also physical engagement and participation in everyday life.

3.1. Perceptions and practical understanding of eco-Integration

Although 78.1% of participants reported being somewhat or very familiar with the concept of eco-integration (Table 9), the qualitative content within the questionnaire showed various interpretations. When asked to describe what eco-integration means in practice, several themes appeared based on the multiple-choice and open-ended sections. Participants most frequently associated eco-integration with modifying physical environments to improve accessibility such as ramps, and wide corridors (47 of them). 42 respondents answered that eco-integration is associated with assistive technology such as adaptive seating, walkers, electronic communication devices, 39 of the respondents associated the eco-integration with engaging persons with disabilities in community-based rehabilitation activities, and 36 of them associated eco-

integration involving families and caregivers in the rehabilitation process. The participants could choose multiple answers. On the other hand, 12 participants indicated that eco-integration was formally addressed or included in their institutional protocols. Many respondents reported a lack of guidelines, insufficient interdisciplinary collaboration, or organizational support as barriers. Open responses also showed limited time and training opportunities, unclear institutional responsibility for implementing eco-integration, and eco-integration being treated as a theoretical concept, not applied practically.

4. Discussion

This research showed that most healthcare workers are familiar with the concept of eco-integration, but see its implementation as minimal or absent. Some differences were observed among the included and divided professional groups, with physiotherapists reporting the highest awareness and engagement. The results imply that eco-integration is influenced by professional training and practice environment. The higher perception of the physiotherapists scores shows their routine involvement in mobility, environmental adaptation, and patient-centred care as key elements of eco-integration. In contrast, other healthcare workers may lack the exposure or institutional support to apply eco-integrative principles. These findings call for systematic efforts to incorporate eco-integration into clinical protocols, interdisciplinary education, and institutional policy. A comprehensive strategy should include interprofessional workshops, modifications in healthcare infrastructure, and improved collaboration between rehabilitation workers, urban planners, and community organizations.

In addition to some researches similar to our study, one research is focusing on the importance of integrating ecological principles in rehabilitation for improving functional outcomes. According to the International Classification of Functioning, Disability, and Health, effective rehabilitation should not only focus on minimizing pathological conditions, but also on promoting the activity of the persons in their relevant contexts. The authors in this research show information with ecological approach, which considers the interactions between the performer, task and environment to a more comprehensive framework that understands and improves rehabilitation compared to some theories for traditional motor control that focus on the organism (Vaz , Silva, Mancini, Carello, & Kinsella-Shaw, 2017). Our results further support this ecological perspective, showing that professionals who integrate environmental and contextual factors into rehabilitation, particularly physiotherapists show a stronger perception of eco-integration.

Another research shows the factors that influenced attachments of the physiotherapists to some evidence-based care practices, especially in regional areas. This research shows that while physiotherapists accept the importance of evidence-based care, their clinical decisions are often affected by many factors. This research focuses on barriers like time constraints and administrative problems that limits the ability of physiotherapists to access and apply evidence-based practices effectively (Gleadhill, et al., 2022). In alignment with our results, this study shows that institutional and systemic barriers such as time constraints and administrative burdens also restrict the effective implementation of eco-integration, despite widespread recognition of its importance among physiotherapists.

One study shows the challenges and support for implementing behaviour change-informed exercise intervention with aim to prevent repetitions of low back pain among the patients. With focus groups and a framework informed by the Behaviour Change Wheel and the COM-B model, this research shows some barriers. Supports were positioned of intervention rationale with existing practices and the perceived benefits for both patients and physiotherapists (Moniz, et

al., 2024). Comparing these results to our research, we can tell that both studies focus on similar challenges faced by physiotherapists and other rehabilitation workers in implementing new practices. In addition to this, another research explores gender differences within healthcare workers for promoting patient-centred care, person-centred care and family-centred care. Through scoping review among multiple medical specialties, this research finds that fields with a higher proportion of female physicians (paediatrics specialists and gynaecologists) more frequently reference patient centred care. This research indicates that these differences may be affected by cognitive differences between genders, with female physicians showing higher levels of empathy (Lim, Khorrami, Wassersug, & Agapoff, 2023). This finding connects with our results, where gender differences also showed in the perceptions of eco-integration, suggesting that female healthcare workers may be more sensitive to comprehensive and patient-centred rehabilitation approaches.

Another research with its results well connects with our research (Rimmer, et al., 2023). Both studies focus on the important role of environmental, social and systemic factors in improving the inclusion of persons with disabilities. This research found some community engagement challenges, resource constraints and defined the importance of informed, compassionate leadership in promoting inclusive environments within low-resource environments. Another research shows data that connects closely with the results from our research. Both studies focus on the importance of community and family support in promoting social inclusion for persons with disabilities. This research shows some key factors as very dominant in easing the social integration of children with disabilities in Saudi Arabia (Medabesh , Malik, Shafi, & Rashid, 2024). Our research recognized the role of healthcare workers, especially physiotherapists for creating supportive environments through eco-integration aiming to reduce social isolation for persons with disabilities.

One review shows eight types of social support that improves participation for persons with disabilities in community gyms. These kinds of supports include direct supervision, peer support, specialist guidance, orientation, education, logistical support, motivational encouragement and organized social activities. This review suggests that structured support from trained staff and peers can promote social connection and increase participation, making gym more accessible and welcoming for persons with disabilities (Kennedy , McKenzie, Holmes, & Shields, 2023). Another research uses Bronfenbrenner's ecological systems theory for exploring perspectives on the social inclusion of children with intellectual disabilities. Interviews with parents, guardians and teachers showed some significant challenges (Hervie, 2023). Our study found that environmental inaccessibility and social stigma remain main barriers to eco-integrative rehabilitation, showing the continued relevance of ecological models in understanding inclusion-related challenges. Another review examines how perceptions of disability develop from early childhood through adolescence with focus on the impact of societal, familial, school and individual factors. The research applies a developmental approach, defining the perception of disability through an in-group versus out-group lens, where persons with disabilities may be viewed as out-group members, often leading to social exclusion (Babik & Gardner, 2021). Our research revealed that social stigma continues to obstruct the practical implementation of eco-integration, validating the demand for early and sustained educational interventions to reform attitudes toward disability across systems.

One qualitative study (Shakya, et al., 2024) showed multilevel barriers and facilitators for physiotherapy development in Nepal using a socio-ecological framework. Their findings showed challenges at the individual, interpersonal, community, organizational and policy levels. Our study revealed systemic gaps between eco-integration awareness and practice in North Macedonia,

with barriers such as environmental inaccessibility, institutional fragmentation, and limited interdisciplinary coordination. Both studies underscore the lack of public and professional awareness of physiotherapy's role as a foundational issue. However, while Shakya et al. emphasized policy-level and structural system barriers in a low-resource setting, our study placed greater focus on differences in perception and implementation among professional groups. Notably, physiotherapists in our study demonstrated higher eco-integration perception scores, suggesting that training and professional identity strongly influence implementation, a layer less emphasized in the Nepalese context.

Our research contributes to the growing domain of eco-integration in rehabilitation by quantitatively connecting professional roles to viewed implementation. Unlike previous studies that focused only on barriers or qualitative narratives, this research provides statistical evidence of disparity in perception and implementation across healthcare roles. Future studies should consider intervention designs that evaluate how targeted eco-integration training influences clinical practice.

4.1. Future research and limitations

While this research focuses on the perceptions of eco-integration implementation in the healthcare system, several limitations should be accepted. This research included 64 participants and while this number is sufficient for statistical analysis may not fully represent all healthcare workers working with eco-integration and social inclusion. This research relied on self-reported perceptions, which may be subject to social disadvantages or subjective interpretation of eco-integration practices. Also, this research used a cross-sectional design, representing the views of participants at one point in time. As future direction, longitudinal study could track changes in perceptions over time, especially if eco-integration programs are expanded or improved. This study confirmed some statistical associations, but some relationships were not tested. Future research should seek several specific directions such as intervention studies to design and evaluate training programs on eco-integration principles for different healthcare professions and assess their impact on practice and patient outcomes, longitudinal tracking to follow changes in perception and implementation of eco-integration over time, especially in institutions adopting inclusive strategies, qualitative depth to conduct in-depth interviews or focus groups to explore how eco-integration is defined and experienced in various environments, interdisciplinary approaches to include occupational therapists, psychologists, and urban planners to study collaborative eco-integration models and system evaluations to assess how institutional policies, infrastructure, and funding structures affect the translation of eco-integration from concept to clinical reality.

5. Conclusions

This study shows new information about how physiotherapists and other healthcare workers view and implement eco-integration within rehabilitation practice. The findings show that while awareness of eco-integration is relatively high, its practical application remains limited, particularly among special educators and other healthcare workers. Significant differences were observed across professions, suggesting the need for focused educational and institutional strategies to improve implementation. Identifying the perception-implementation gap and quantifying how profession and experience shape these attitudes, this research shows the need for interdisciplinary training, systemic support, and clearer integration of eco-integration principles in clinical and educational environments.

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Perception of users with visual impairments regarding adverse events in the use of technologies for diabetes

Ribeiro Brandão M., Institute of Biomedical Engineering, Federal University of Santa Catarina, Brazil, ORCID 0000-0002-3642-0723, marianaribeirobrandao@gmail.com

Vitor Fogaça J., Institute of Biomedical Engineering, Federal University of Santa Catarina, Brazil, ORCID 0009-0007-7625-9130. jvsf2003@gmail.com

Brum Marques J. L., Institute of Biomedical Engineering, Federal University of Santa Catarina, Brazil, ORCID 0000-0001-8910-4735, jefferson.marques@ufsc.br

Garcia Ojeda R., Institute of Biomedical Engineering, Federal University of Santa Catarina, Brazil, ORCID 0009-0007-7625-9130, renato.garcia.ojeda@ufsc.br

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Abstract: The lack of usability in diabetes technologies can lead to adverse user events. Currently, the literature provides limited insight into the perceptions of individuals with diabetes and visual impairments who use blood glucose monitors. The objective of this research is to analyze the experiences of people with visual impairments in using diabetes technologies, to identify the occurrence of adverse events, and to propose strategies to mitigate risks. This exploratory study consisted of interviews with 10 visually impaired individuals with diabetes living in Brazil. The data were categorized according to adverse events, accessibility problems with the devices were identified, and strategies were proposed to improve usability. All participants consistently reported not using blood glucose monitors due to usability and accessibility challenges. Instead, they required support from another person to perform measurements or had to rely on health services, as they did not have access to technologies with audio features or tactile indicators for glucose monitoring. Involving users in comprehending technology-related problems is essential to generate evidence of challenges with real world data and establish strategies for technological improvements. The adverse events reported by participants were categorized as difficulties in use, inefficient design, and problems with the reliability of measurement results. Suggested improvements included audible feedback, higher display contrast, and tactile indicators on the device to enhance accessibility. Considering accessibility from the beginning of the project, developing technologies that consider inclusive design, involving users in a collaborative environment, and working in an interdisciplinary team in the Living Lab ecosystem aim to develop safer and more inclusive technologies for all people.

Keywords: Diabetes, Blood Glucose Monitoring, Accessibility, Usability, Medical Devices.

1. Introduction

Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces. People with diabetes have an increasing risk of health problems, including heart attack, stroke, neurological conditions and kidney failure, and can lead to permanent vision loss by damaging the blood vessels in the eyes (World Health Organization, 2024). In 2020, 1.07 million (95% UI: 0.76, 1.51) people became blind due to diabetic retinopathy, and approximately 3.28 million (95% UI: 2.41, 4.34) had moderate or severe visual impairment (Curran, 2024). Visual impairment occurs when an eye condition affects

the visual system and its functions (World Health Organization, 2023). It can be classified into different categories, including mild, moderate, severe visual impairment, and blindness (Dandona, 2006; Pan American Health Organization).

Technologies are used in health care delivery to improve quality of life for populations. However, it is necessary to understand accessibility and safety barriers in medical devices used for all types of exams and procedures by populations to reduce disparities in providing health services to people with disabilities (Story, 2009; Yee, 2010).

Several medical devices are used for diabetes management: blood glucose monitors (BGM) and continuous glucose monitoring (CGM) or therapeutic systems for insulin administration, such as pens and insulin infusion pumps. In these technologies, all users must be able to adjust settings and operate independently, thus characterizing them as accessible devices (Burton, 2012). However, visually impaired patients with diabetes often encounter barriers that prevent access to available health care (Heinemann, 2016).

A study conducted by Burton et al. presented some criteria that characterize a BGM as accessible, including audible data output, a high contrast screen with larger fonts, control buttons that can be identified by touch and are distinct in color contrast, accessible test strip calibration (e.g., automatic), an operating manual in an electronic format readable by screen reader software, and accessible software (Burton, 2012).

Another study evaluated the accessibility of five glucose monitoring systems (Heinemann, 2016). The following features were considered: backlight on the monitor screen, test strip light, different audible features such as beeps or reading, tactile markings, and Bluetooth capability. None of the monitoring systems analyzed were fully accessible (Heinemann, 2016). A study conducted by Burton et al. showed that all of the BGMs analyzed had low-contrast displays that are difficult to see for people with impaired vision. Furthermore, none of the devices with audible resources are the most popular today or among the best-selling technology (Burton, 2012). Another study conducted by Uslan et al. analyzed 17 BGMs, but none were fully accessible (Uslan, 2003). Thus, individuals may use the devices inappropriately, leading to adverse events and even the development of other health conditions (Nguyen, 2024).

The use of diabetes technologies aims to improve the management of diabetes; however, its use can be challenging for visually impaired patients with diabetes and can cause serious health consequences. Insulin delivery and monitoring devices, such as pens, pumps, and BGMs, are often not designed with the needs of this population in mind (Akturk, 2020).

The availability of accessible medical devices for visually impaired patients is scarce. Some of the issues faced with BGM include low-contrast displays that are difficult for people with low vision to see (Burton, 2012), testing equipment lacking colour contrast (Macdonald, 2017), lack of speech output, small visual displays, and high levels of reflection (Blubaugh, 2012). Current literature on this topic is scarce and provides little insight into the perceptions of patients with both diabetes and visual impairment who rely on these technologies. Without a clear understanding of these barriers, it becomes difficult to propose effective strategies to improve usability and accessibility, and consequently the quality of care, for this population.

The lack of accessibility to medical devices is a major concern. Due to barriers, individuals with disabilities are less likely to obtain routine preventive health care than people without disabilities (Ada, 2022). More accessible health solutions are essential to promote equity and achieve health promotion, prevention, and safety. Consequently, it can help reduce disparity, increase inclusion, and make health spaces more equitable (Brandao, 2024).

The objective of this study is to explore the main difficulties and perceptions of people with visual impairment in using currently available diabetes technologies, with a particular focus on BGMs. By doing so, it seeks to support the development of technological solutions that make device use

safer and more reliable. In addition, strategies to enhance the accessibility of medical devices and mitigate adverse events will be discussed.

2. Methodology

This study is exploratory and applied, as it aims to provide more information on the subject to be investigated and generate practical knowledge for solving specific problems on the use of medical devices by people with diabetes and visual impairment. It consists of a qualitative approach, as it seeks to explore and understand the problems of a group of users based on an inductive process. So, the researcher generates results from the data collected (Creswell, 2010; Malhotra, 2001).

The research was realized using the PDCA (Planning, Execution, Control and Action) quality tool. In the first stage, the population and the usability technique to be applied were determined, the protocol for the application of the technique was developed, and the mapping and recruitment of participants were realized. The exploratory research consisted of the application of the usability technique interview with 10 visually impaired people who have diabetes, realized in the city of Florianópolis, Brazil, during the year 2024.

Of the total participants, one person had partial vision loss, and the others were blind, with total vision loss. The inclusion criteria were people over 18 years of age who have diabetes. The recruitment of participants was carried out through contact with an association for the blind. It was conducted in the form of an interview so that the visually impaired participants would not have difficulty filling out the form with the questions. The responses were transcribed, and the problems reported resulting from the use of the glucose monitor were categorized.

After the analysis, a graphic representation was created summarizing the adverse events reported by users involving the glucose monitor. The research to understand the problems in diabetes technologies was approved by the ethics committee for research involving humans of the Federal University of Santa Catarina with project number 74674323.3.0000.0121 and the participants agreed to participate in the research as presented in the consent form. The guide of the questions asked is explained in Table 1.

Table 1. Interview Guide with visually impaired and diabetic users

Research Guide with visually impaired and diabetic users
1. Initial presentation: Welcome, introduction 2. Which technology(ies) do you use (or have you used) in diabetes care? 3. How were you instructed to use this equipment? How do you use the device? 4. Have you ever experienced any problems while using it? Which ones? 5. Do you consider the results generated by the equipment reliable? 6. If you were to change something about the glucometer to make it easier to use, what would you change? 7. Final presentation

The variables analyzed during the interview were: which medical devices users use (or have had contact with) to monitor diabetes; how they were instructed to use the technology; whether they use the technology, and if so, how; problems they have faced using the technology; accessibility barriers and recommendations for improvements to the device interface. Participants were residents of Florianópolis, Santa Catarina, Brazil, over 60 years old.

3. Results and discussion

A total of 10 visually impaired and diabetic participants agreed to participate in the study. Of the total, three people reported that diabetes had caused their vision loss. One of the participants claimed that in addition to being blind, he also had one of his legs amputated due to diabetes. Of the total of 10 participants, one reported having severe visual impairment, and the others were blind. All participants reported at least one adverse event associated with the use of the glucose monitor. These adverse events are explained in Table 2.

Table 2 - Adverse events reported by users with visually impaired and diabetic

Adverse Event	Description of the report
Unable to perform the measurement, dependence on another person to perform the measurement	"Currently, I do not monitor myself very often. Before, when I had help, I was able to record the results. However, now I do not have anyone to help me, so I end up not doing it." "I have a visual impairment and cannot see the results on the device." "When I feel something is wrong, I go to the health centre." "When I could see, I used regular devices. I could see the results by myself. Nevertheless, after I lost my vision, I always needed someone's help to take the measurements." Since I live alone and cannot see, it is impossible. Unfortunately, the technologies are not accessible at this point."
Health consequences due to lack of measurement	"I have had serious crises and needed medical attention." "I try to guide myself by symptoms, such as dizziness or weakness. However, the ideal would be to have accurate records for the endocrinologist to evaluate." "I have devices, but I only use them when I notice that something is very out of the ordinary. Sometimes I am at 35, sometimes at 290 mg/dL."
Discomfort during measurement	"I find it uncomfortable to prick my finger every day." "They need something more modern that does not prick my finger. I do not have enough blood to prick so many times!" "I find it uncomfortable to prick my finger every day."
Lack of glucose value trend alert	"For example, if it is at 70, I get desperate thinking it is going to go down further, but sometimes it is going up, and I do not even need to worry. This causes much confusion." "It should indicate the trend, whether glucose is going to go up or down, and not just the momentary value."
Dirt on the hands interferes with the result	"Especially when hands were not clean before measuring. This situation can alter the results."
Battery problem	"The batteries ran out quickly, and sometimes the devices did not work properly."

Regarding diabetes monitoring and control, all blind participants reported that they were unable to monitor their blood sugar alone, needed other people or needed to go to a health service to take the measurement. The need to go to a health service to take the measurement also raises awareness regarding accessibility in health spaces to ensure mobility. In addition to the lack of continuous monitoring due to the absence of accessible technology, other adverse events were reported: worsening of clinical health conditions (such as hypoglycemia and hyperglycemia) due

to lack of measurement, discomfort during use, discrepancies in measurement results due to incorrect use because of the lack of visualization and tactile indications, dirt on the hands interfering with the results, and battery problems.

The lack of diabetes monitoring can lead to serious health problems. Participants use the BGM only when they detect a problem, which implies potential health damage to the patient, as explained in Table 2.

Regarding the perception of people with visual impairments about the BGM, they claimed that the lack of accessibility makes it impossible to use it. All participants reported that the devices should have audible resources. In addition to the problems highlighted by the lack of auditory feedback, participants reported the absence of tactile indicators and lack of contrast in the devices. These technology accessibility problems are presented in Table 3. One of the research participants had severe visual impairment but did not have total loss of vision. She claimed to use a magnifying glass to view the results and recommended that the devices have a more contrasting interface.

Table 3 - Accessibility Problems reported by users with visually impaired and diabetic

Accessibility Problems	Description of the report
Lack of audible resource that impacts the lack of use of technology	"It would be essential to have a voice program that would inform the results. That way, I could have the autonomy to monitor my glucose levels." "It would be great if there was a device that would prick your finger and tell you the glucose level. For example, "It is 120" or "It is 200 mg/dL and a bit". That would make things much easier for people who cannot see." In the case of a blind person, how would they interpret the information? I think it would be essential to have something with auditory feedback."
Lack of indicative resources in the device impacts non-performance of measurement or incorrect use of measurement	"When you can see, it is easy to know where to put the drop of blood, where the light comes on. However, without sight, you have to depend on someone to guide you, and that does not always work. I have already gotten the wrong place to put the blood, and the measurement did not work." "But the device can give an error if there is not enough blood. This is a problem for it since it cannot see if it is working correctly." "The device would sometimes fail, especially if there was not enough blood. It was also common for the health centre to run out of test strips, so we ended up having to buy them ourselves." "I have a visual impairment, and I cannot see the result on the device."
Lack of contrast on the display to view the results	"I use insulin pens and a glucose meter. I need to use a magnifying glass to see the numbers." "Because in the confusion of hypoglycemia, it is impossible to distinguish things. I have taken too much insulin by mistake. That is very dangerous." "I remember one time when I took the same dose three times. I felt really sick and only realized it later." "They could be more contrasting and even emit audible warnings."

Participants highlighted that they are familiar with technologies that continuously CGM through the use of a subcutaneous sensor and that have built-in voice capabilities. However, they claim that the cost is high. Due to financial conditions, they cannot afford to purchase the technology. Another advantage of CGM is related to monitoring glucose trends. When using a BGM, the result is available at the time of measurement, but there is no progress. Another technology mentioned by participants was the insulin pen. They see it as an alternative to using syringes, allowing for greater autonomy in administering insulin. "It is the best method ever invented. Very practical.

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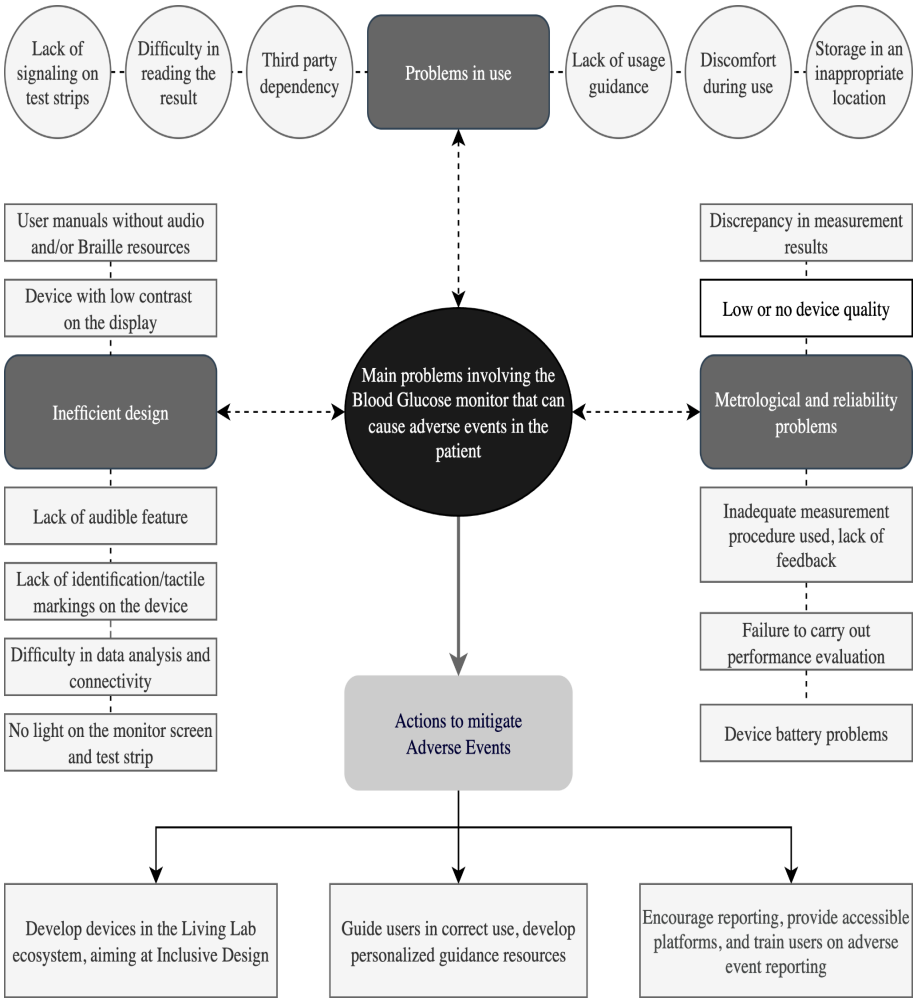
Before, syringes were very complicated for people who cannot see", reported one of the participants.

Participants also reported the reliability of the measurement results. They mention that the value of the measurement result often differs from clinical conditions or when comparing measurements taken by a relative at home and the health service. Inadequate use can also interfere with measurement results. A participant presented this topic when her hands were not properly cleaned before measuring, reporting that dirt can alter the results.

The adverse events reported were categorized as problems in use, inefficient design, and metrological and reliability problems. A diagram with a visual presentation is presented in Figure 1.

Figure 1. Main Causes of Adverse Events involving the Blood Glucose Monitor.



Note that this diagram illustrates the issues with using blood glucose monitors and actions to mitigate adverse events. The diagram highlights several usage issues, such as lack of labeling on test strips, difficulty reading results, and reliance on third parties. The diagram organizes these issues and their consequences, such as discomfort during use, discrepancies in measurement results, and poor device quality. Actions to mitigate these issues include developing devices within the Living Lab ecosystem, guiding users on correct use, and providing personalized guidance resources. The diagram also highlights the importance of reporting adverse events, including accessible platforms and user training.

One of the actions to mitigate the occurrence of adverse events consists of developing medical devices inserted in a Living Lab ecosystem with a focus on Inclusive Design. This environment aims

to integrate industry, health professionals, academia, government, and final users to identify the problems and develop user-centred technologies. In addition, providing users with accessible and personalized guidance on correct device use, as well as encouraging the reporting of adverse events, are key strategies to reduce risks associated with medical devices.

The lack of accessible medical devices leads to disparities in the healthcare services available to people with disabilities. This study highlights the challenges faced by individuals with visual impairments in using diabetes-related medical devices and underscores the importance of advancing technological development within an interdisciplinary and collaborative Living Lab ecosystem.

Considering patients with visual impairments in the development of BGM is essential. As highlighted in the user survey and as discussed by Heinemann et al., it is necessary to implement strategies to ensure that the patient can remove the test strip from the box, identify the drops of blood that should be applied to the correct location on the test strip and in sufficient quantity so that the measurement can be initiated. In addition, it must ensure that the patient does not contaminate himself or the surrounding environment with blood. Another factor of concern is the reading of the result generated by the equipment (Nguyen, 2024).

Visually impaired patients with diabetes need to know how to interpret the results to aid in decision-making. However, as shown in this study, none of the participants performed the glucose measurement alone, and this can lead to serious adverse events. In line with what was discussed by Heinemann et al. and Nguyen et al., patients cannot perform their daily diabetes care autonomously and are totally dependent on external assistance. This is not only associated with substantial additional costs for the health system but also leads to massive restrictions on patients' independence (Heinemann, 2016; Nguyen, 2024; Uslan, 2003).

The lack of autonomy in diabetes management by visually impaired people was found in this study since users depend on others to perform the measurement. This data converges with the study by Heydarian et al., which found that, compared to non-visually impaired people, visually impaired people were less likely to report high self-efficacy in diabetes management (Heydarian, 2021).

Having voice resources available, having tactile indicators on the devices, having backlighting on the monitor screen and on the test strip, and having connectivity with external applications for cell phones or notebooks are some recommendations to improve the accessibility of monitoring systems.

In addition to improving the device, the importance of metrology is highlighted to ensure the metrological reliability of measurements and provide adequate guidance on the correct use of technology to avoid adverse events. Having usage instructions in Braille and other alternative formats, such as audio recordings and electronic text of information, is a recommendation to improve the usability of devices.

This research demonstrated the relevance of involving users in the perception of usage problems within a living lab healthcare ecosystem, which consists of an interdisciplinary and collaborative healthcare ecosystem. A living lab is defined as a user-centred research methodology for developing, testing, and implementing complex healthcare innovations in a real-life context based on the following pillars: user-centeredness, co-creation, real-life context, test innovation, and open innovation (Zipfel, 2022; Santonen, 2022).

In line with Brandão et al., further research is needed that incorporates the diversity of user profiles into the development process, thereby making technology management more inclusive and accessible to the population (Brandao, 2024).

Continuing training with the entire team, including accessibility parameters in the adoption of the medical devices and developing standard operating procedures,represents additional strategies

that clinical engineering and other stakeholders can implement to foster a more accessible healthcare environment. At the pre-market stage of medical device development, excluding diverse user profiles from the design and validation processes can lead to performance issues for certain populations, thereby perpetuating structural inequalities in healthcare. Existing evidence emphasizes the need to include diverse patient populations in device design and validation, as biased data used during technology development is a common root cause of performance variation across different population groups.

A key issue reported by all survey participants was the cost of more accessible technologies. Access to affordable medical devices often does not extend to the entire population that requires these resources. Beyond accessibility barriers, financial costs further prevent a large portion of the population from using many technologies. Given the significant health impact associated with the lack of affordable medical devices, it is recommended to establish a collaborative Living Lab ecosystem involving stakeholders such as government agencies, manufacturers, end users, healthcare professionals, and universities.

4. Conclusions

This study highlighted accessibility issues involving medical devices used by people with visual impairments and diabetes. Main adverse events reported included difficulties in operation, inefficient design, and problems with the reliability of measurement results. To analyze the perception of users with visual impairment and diabetes, interviews were conducted and accessibility barriers were identified in medical devices that make it impossible for blind people to use medical devices for diabetes monitoring. Through user research, it was shown that none of the participants performed continuous glucose monitoring due to the lack of accessibility in the technologies, requiring an external person or a visit to the health service to monitor glucose. The research converges with other studies that show a lack of accessibility in medical devices.

The application of usability techniques inserted in a Living Lab ecosystem, such as the interviews conducted in this study, has the potential to serve as a hub for integrating various stakeholders in healthcare, integrating academia, industry, government, and society. Involving people with visual impairments in the development of devices is essential to guarantee accessibility. In addition, it is important to have public policies that encourage equality in technological access for all people. Making medical devices accessible enhances healthcare quality, reduces the occurrence of adverse events, and increases patient safety.

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During the writing of this article, the authors used AI tool to improve the language and grammar of the manuscript. After using this tool, the authors reviewed and edited the content as needed and assume full responsibility for the publication's content.

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I don't need sympathy, I just need accessibility:
The impact of accessibility in creating welcoming environments for wheelchair users on campus.

Barrett S.,Taylor University, United States of America
ORCID 0009-0005-8266-6977, scott_barrett@taylor.edu

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Abstract: Students with disabilities are attending college in increasing numbers (Pavan & Shore, 2015). This includes students who use wheelchairs on campus (Hoover, 2022). Students' experiences with wheelchair accessibility vary greatly and accessibility can be experienced as an afterthought. The physical environment of campus impacts a student's ability to learn and communicates inherent messages of belonging (Strange & Banning, 2001). Strange and Banning's (2001) hierarchy of learning environments frames the movement from a safe and inclusive campus to one in which all members are part of the community. Using this framework and a qualitative content analysis methodology, this research project explores the features of campus that help to create welcoming and unwelcoming experiences for students who use wheelchairs. The findings include the importance of working accessibility features in creating a welcoming environment and a desire for campus leaders to consider the needs of all students.

Keywords: accessibility, mobility, wheelchair, belonging

1. Introduction

Increasing numbers of students with disabilities are attending institutions of higher education (Ingersoll, 2016; Pavan & Shore, 2015). Aided by better support during their K-12 educational experience and utilization of transition services, students are better prepared to gain admission into the higher education setting (Leake & Stodden, 2014). This increased participation includes students with mobility impairments. "Research from 2011 found that about 7 percent of students reporting a disability have a mobility impairment." (Hoover, 2022, para. 3).

While virtual options exist, in-person education remains a staple of the American higher education system. In person education provides opportunities for college students to interact with professors and peersand allows individuals to learn through their experiences outside of the classroom with this space serving as a laboratory for the in-class learning that is happening. For individuals who have a mobility impairment or use a mobility aid like a wheelchair, equal access to education must involve ensuring physical accessibility to all of campus.

Passed in 1990 and amended in 2008, The Americans with Disabilities Act (ADA and ADAAA) prohibits discrimination based on an individual's disability. This prohibition against discrimination includes requirements to provide physical access to public spaces. In combination with the Architectural Barriers Act (ABA) of 1968 and Section 504 of the Rehabilitation Act of 1973, these laws form the legal foundation for access expectations at institutions of higher education across the United States. Thirty-five years after the passage of the ADA, obstacles remain, especially on college campuses that typically have older buildings. "Finding a campus that is 100% accessible is

a rarity" (Gilmer, 2020, p. 4). The physical accessibility required by the ADA should be seen as the floor not the ceiling when considering access (Hoover, 2022). While a campus may meet the legal requirements of equal access, it can fail to provide an opportunity for a wheelchair user to have an equal college experience.

As higher education leaders look to recruit and retain students, a student's sense of belonging on campus plays a significant role in this process (Strayhorn, 2019). For students with mobility impairments, physical accessibility can play an important part in creating this sense of belonging (Strange & Banning, 2001). In order to better understand student experiences, this research project investigated, what aspects of the physical environment on a college campus help to create a welcoming experience for students who use a wheelchair?

2. Literature Review

2.1. Defining Disability and Mobility Impairment

There is no single definition of disability (Erickson & von Schrader, 2022). How one defines disability may depend on the model through which they view disability (e.g. moral, medical, rehabilitation, or social). "Definitions and conceptualization of Disability presented in models reflect the worldview of specific time periods and cultures" (Evans et. Al, 2017, p. 54). Depending on the definition of disability, the prevalence of disability with a population or group may also change. Narrowly defined definitions of disability reduce the prevalence of students with disabilities on campus simply by altering the definition. Prevalence statistics can be beneficial in developing an understanding of the number of individuals who are impacted by a lack of physical accessibility on college campuses. Therefore, we must consider how disability is defined as we consider the presence of students with disabilities on campus.

When measuring prevalence of ambulatory disabilities, the American Community Survey (ACS) asks, "Does this person have serious difficulty walking or climbing stairs?" (Erickson & von Schrader, 2022). According to ACS, 6.8% of the U.S. population reported having an ambulatory impairment. According to Center for Disease Control (CDC) data, 13.7% of individuals have serious difficulty walking or climbing stairs (CDC, 2022). The CDC defines this functional limitation as a mobility impairment. The Americans with Disabilities Amendments Act of 2008 (ADAAA) defines an individual with a disability as someone who has an impairment that sustainably limits a major life function. For the purposes of this research, mobility impairment was used, utilizing the language of the CDC and ADAAA definitions. Individuals with mobility impairments use a variety of mobility aides to access their environment. These mobility aids can be divided into two main categories, "wheelchairs (manual or power-driven) and manually powered devices" or "other powered options, such as golf carts" (ADA.gov, n.d.)

2.2. Accessibility in American Higher Education

Accessibility describes the opportunity for an individual to receive benefit or participate in a program or experience to the fullest extent possible. The DO-IT Center at the University of Washington (2012) describes how accessibility can refer to both physical access and to accessing materials or information.

Accessibility expectations are impacted by a variety of laws that provide legal requirements for accessibility at institutions of higher education. The Architectural Barriers Act (ABA) of 1968 "requires that buildings or facilities that were designed, built, or altered with federal dollars or

leased by federal agencies after August 12, 1968 be accessible" (U.S. Access Board, n.d.). Section 504 of the Rehabilitation act of 1973 "protects qualified individuals from discrimination based on their disability" (U.S. Department of Health and Human Services, n.d.). The Americans with Disabilities Act of 1990 (ADA) and subsequent Amendments Act of 2008 (ADAAA), "prohibits discrimination against individuals with disability in state and local government services, programs, and activities (including public schools), regardless of whether they receive Federal financial assistance" (U.S. Department of Education, 2020, para. 3). Whether an institution is public or private, new or old, these laws along with subsequent case law and findings by the Office of Civil Rights have implications on the requirements for access for students with disabilities.

The field of research on and about college students with disabilities is significant and growing. Numerous studies about the experiences of students with disabilities have been conducted and published in recent years. These include studies about sense of belonging (Vaccaro et al. 2015), identity development (Broido et al., 2023; Forber-Pratt et al., 2017; Forber-Pratt & Zape, 2017), and overall barriers in higher education (Evans et al. 2023; Hong, 2015). These studies often include participants with mobility impairments but are not typically focused on the experiences of students with mobility impairments, a few examples not withstanding (Battalova et. al, 2022).

Published by the student newspaper at the University of Maryland "Disability on Campus: Life navigating accessibility and accommodations at UMD" (Vuttaluru et al., 2022) is a detailed, multi-part story published by the University of Maryland student newspaper where reporters interviewed students, faculty, and disability experts to write a multipart story. This UMD project describes how physical accessibility on campus has often involved retrofitting campus buildings to meet legal expectations rather than anticipating this in new builds. Another recent look at college campuses was conducted by New Mobility and The United Spinal Association. Titled "Wheels on Campus," this list of the top 20 wheelchair friendly campuses utilized a survey sent to campus leaders at 400 institutions of higher learning. Researchers used responses to calculate overall scores utilizing wheelchair-inclusive criteria, including programs, services, and community support. While initially created through institutional survey responses, the guide also includes the voices of many wheelchair users on its editorial staff and specific students enrolled at many of the campuses that are mentioned.

Evans et al. (2017) wrote that the physical environment of a campus can be difficult: "Individuals with mobility impairments may have difficulty traversing the campus, negotiating entrances to building, and moving through spaces that contain stairs or non-movable seating" (p. 226). Physical accessibility is not the only barrier individuals with mobility impairments face. "The greatest obstacles we all face are mostly cultural. In the world of higher education, we must upend long-held assumptions by others who think our abilities are severely limited because our bodies work differently" (Gilmer, 2020, p. 4). Breaking down the obstacles as Gilmer (2020) describes requires campuses to move beyond the medical model and to view disability through the social model where an individual's disabilities are a result of the environment and culture they live in more than impairments the individual possesses.

2.3. Sense of Belonging

Framed as a basic human need and connected to the work of Maslow's (1954) Hierarchy of needs (Strayhorn, 2019), sense of belonging for college students is a "students' perceived social support on campus, a feeling or sensation of connectedness, the experience of mattering or feeling cared about, accepted, respected, valued by, and important to the group (e.g., campus community) or others on campus (e.g. faculty, peers)" (Strayhorn, 2019, p. 4). Experienced by individuals in a

wide variety of settings (e.g. work, social, spiritual), a sense of belonging has the potential to impact many areas of a college student's life. Many scholars connect sense of belonging to Tinto's (1993) model of student retention (Freeman et al., 2007; Hurtado & Carter, 1997; Vaccaro et al.; 2015). Sense of belonging may be particularly important for students who believe they are on the margins of mainstream college life (Hurtado & Carter, 1997; Strayhorn, 2019); this includes students with disabilities. Vaccaro et al. (2015), identified three tasks as critical in the development of sense of belonging for students with disabilities: self-advocacy, social relationships, and mastering of the demands of the role of a college student. Vaccaro et al.'s (2015) theory illustrated how these three critical tasks for students with disabilities positively impacted sense of belonging and how sense of belonging had a positive impact on these tasks.

2.4. Research Framework

In order to better understand the experiences of students with mobility impairments on college campuses, this research utilized the framework proposed by Strange and Banning (2001) in their book *Educating by Design* and also articulated by Strange (2000) in a journal article. Strange and Banning (2001) identified four components of environments that impact the experiences and outcome for students. Strange (2000) describes these key components as (1) "physical design and layout," (2) characteristics of people who inhabit them," (3) "the organizational structures related to their purposes and goals," and (4) "inhabitants' collective social constructions of the prevailing press, social climate, and culture" (p. 20). Each of these elements impacts the learning environment and a student's ability to learn and develop within the environment. Strange and Banning (2001) framework is titled a "Hierarchy of Learning Environments." A campus climate must progress through each level of the hierarchy to create the type of environment where every member of the community is able to learn and develop.

Strange (2000) describes three tiers of cultures or environments in the hierarchy when considering the experience of students with disabilities on campus. The first and lowest level of this hierarchy is titled *Safety and Inclusion*. "Provision of physical accessibility and accommodation is the bottom line in addressing the attraction, satisfaction, and stability of these students. Limits in either of these conditions can compromise the learning experience in fundamental ways" (Strange, 2000, p. 24). Through these safe and inclusive environments, students are able to pursue education and learning (Strange, 2000).

The second tier, *Involving Environments*, looks to move beyond the physical presence of individuals with disabilities and towards active participation in the learning experience (Strange, 2000). In this level of the hierarchy students are not just passive participants but are invited into membership. Members of the campus engage in "meaningful roles and responsibilities so that each is afforded appropriate opportunities for individual growth and development" (Strange, 2000, p. 26).

The third and top tier, *Community*, occurs when community or communal learning environments are created. "Conditions of community become evident as individuals assume significant roles over time and contribute to the very ethos and culture of the setting" (Strange, 2000, p. 27). Strange and Banning (2001) describe this top category of the hierarchy as a place where individuals are encouraged and invited to participate, take on roles, and be decision makers.

2.5. Researcher Positionality

I do not currently have a mobility impairment or use a wheelchair. I serve as the Disability Resource Officer on a small liberal arts campus in the Midwest in the United States. The desire to

conduct this research was born out of my experiences with students exploring my own campus. I undertook this project with a desire to amplify the voices of those impacted by inaccessibility and unwelcoming environments through data collection and analysis that could be presented to decision makers and other stakeholders with a desire for meaningful change.

3. Method

3.1. Research Design

The purpose of this research project was to understand what aspects of the physical environment of a college campus help to create a welcoming experience for students who utilize wheelchairs. This research question was explored using a qualitative content analysis methodology. Qualitative content analysis (QCA) is used as a research method for a systematic, detailed analysis of non-numerical data (Kuckartz & Rädiker, 2023; Mayring, 2022; Schreier, 2012). By using open coding and inductive category formation researchers are able to develop categories directly out of the material.

Data were collected through an online survey. This questionnaire was developed by the researcher using experience working in the American higher education environment as a disability services provider. Questions included both numerical ratings based questions and open ended questions that would allow individuals to communicate broadly about their experiences. In addition to specific questions related to the research question, demographic information was collected. Both the study broadly and the data collection tool were reviewed and approved by the Institutional Review Board at the researcher's institution.

The questionnaire was piloted with a population of wheelchair users to gather feedback and further understand the effectiveness of the tool at providing meaningful data in response to the research question. The online survey method allowed for the potential of increased participation across a wide variety campuses and geographies. Additionally, a digital survey was intended to limit barriers to participation in this exploratory study that could include availability and time required for in-depth interviews. Participation criteria included individuals age 18 or over, currently enrolled in college, self-identifying as having a mobility impairment that impacts the accessibility of their campus, and who use a wheelchair or powerchair for mobility on campus.

This study utilized purposeful sampling to collect meaningful data. “Purposeful sampling focuses on selecting information-rich cases whose study will illuminate the questions under study” (Patton, 2002, p. 230). As Patton (2002) describes, “information rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry” (p. 230). An online data collection tool was designed to gather participant responses. To increase the potential population of participants meeting the criteria for the sample, the researcher connected with an organization that provides scholarship opportunities to individuals with spinal cord injuries. This organization then connected me with individuals (gatekeepers) at institutions of higher education who participate in the organization’s scholarship program. These gatekeepers were informed of the nature of the study and invited to share the opportunity to participate with members of their community. Gatekeepers were sent an email that could be utilized as an invitation to participate and gate keepers communicated with individuals on their campuses. Potential participants were directed to an online form to complete the survey. In the initial email invitation, potential participants were notified that the first 50 individuals who met the participation criteria and participated in the survey would receive a $20 gift card to Amazon.

Individuals were provided an informed consent notification and asked to affirm that they met the eligibility criteria for the study before they began answering questions.

3.2. Data Analysis

Four hundred and eighty-one responses were initially received; however, most of these responses did not meet the criteria of the study or were not completed by a human (e.g. incomprehensible responses or ten of the exact same responses were received within seconds of each other). The remaining data were analysed in Microsoft Excel using inductive category formation. Inductive category formation uses the material to develop categories in a data-driven way (Mayring, 2022; Schreier, 2012). "It aims at an authentic description without bias owning to the preconceptions of the researcher, and an understanding of the textual material in the language of the material, using formulations and concepts from the material" (Mayring, 2022, p. 81-82). Open coding and then analytical coding were used to create these categories. Open coding is the initial process of "identifying any segment of data that might be useful" (Merriam & Tisdell, 2015, p. 205). Analytical coding is the process of assigning these open codes to categories or themes (Merriam & Tisdell, 2015). These themes are the basis for the findings that follow. Some quantitative descriptive analysis of the findings was utilized to share numerical frequency and to further illustrate the phenomenon.

Of the responses collected, 33 met the criteria of being over 18, currently enrolled in college, self-identifying as having a mobility impairment, and reporting that they were a wheelchair or powerchair user. These 33 respondents are the basis for the findings of this study.

3.3. Participants

Demographic information was collected to better understand the participants in this study. Most of the 33 participants (n = 27) reported being enrolled at a campus with more than 10,000 students and the remaining six participants reported not knowing the size of their campus. About half (n = 17) of the participants reported living on campus at their university. Participants varied in the amount of time in which they had been enrolled at their current university with the greatest number being first year students (n = 11), but at least three students reported being enrolled for each time period of two, three, four, and more than four years. Participants identified as men, women, transgender/trans man, non-binary, and gender-queer. The greatest number of responses were received from men (n = 16) and women (n = 12). Almost two thirds of participants (n = 20) reported that White/Caucasian was the race or ethnicity that best described them. Participants reported a variety of race or ethnicities including African American, Asian, Hispanic or Latino, Multiracial, and NZ European.

Participants were given the opportunity to share about their mobility impairment to the level that they felt comfortable. The decision to allow participants to describe their own situation in an open-ended way was intentional given the diverse reasons for wheelchair use. The reason for a student's mobility impairment was not the focus of this study. Given the open-ended nature of this question, responses varied significantly. Therefore analysis, and classification of this information was broad Responses included descriptions of both congenital and acquired impairments, nerve damage, paralysis, and Duchenne Muscular Dystrophy.

4. Findings

4.1. Experience of Accessibility

Participants were asked to respond to several questions about the accessibility of their current campus. Almost all participants said that they were able to access all of the places that you need to go on their campus (*n* = 28) When asked "Are you able to access all of the places you want to go?" Fourteen participants responded "Yes," while 19 participants responded that they were not able to access all of the places on campus that they wanted to.

Participants were asked to rate the overall accessibility of their campus on a one to ten scale with one being "Not accessible at all" and ten being "Extremely Accessible." When considering this overall accessibility of their current campus, 24 participants rated their campus as a seven or higher on a one to ten scale. No participants rated their campus lower than four. The average rating among the 33 participants was 7.36.

Participants were asked to explain the reason for the rating that they chose. These responses were coded and themed for understanding. Most responses fit into two main themes. Aspects of the physical environment like campus terrain, landscape of their campus, snow clearing were mentioned 11 times. Aspects of the built environment of campus like ramps, elevators, door buttons, sidewalks, and accessible entrances were mentioned 68 times. As participants described aspects of their campus, items were named by participants making positive and negative comments about the element. The physical environment and built environment both added and detracted from campus accessibility.

Several items consistently appeared in participant comments. These most consistently mentioned items were elevators (2), ramps (16), sidewalks (7), accessibility door buttons (7), and building entrances (6). In this open-ended portion of the question, each of these items was mentioned as both a reason for a higher or positive rating and as a reason for a lower or negative rating. One participant who rated their campus at a four of ten said, "Many buildings don't have door buttons, the sidewalks are in shambles and I cannot get my wheelchair over them…". While another participant who rated their campus as a nine out of ten said, "Every building has an accessible entrance as well as accessible classrooms. The school takes good care of their sidewalks and the handicapped buttons for doors work a majority of the time." The presence or absence of working methods of access led to both positive and negative ratings from participants.

Participants who rated their campus highly (nine or ten) described positive overall feelings about their campus with responses like, "Everywhere that I have been is accessible," "[University Name] is one of the most accessible campuses," and "[University Name] is very much accessible from all aspects."

4.2. Physical environment as welcoming or unwelcoming for wheelchair users

Participants were specifically asked what aspects of the physical environment of their campus they found to be most welcoming and which they found to be least welcoming. Like the responses about overall campus accessibility, response themes were present on both the lists of welcoming and least welcoming aspects of the campus environment. Participants mentioned the location of accessible entrances, the presence or absence of working accessibility door buttons, and elevators as both welcoming and unwelcoming.

“Most of the ramps and elevators on campus are in easily accessible places, the elevators work, campus facility workers are quick to shovel snow off the sidewalks.” Another student stated, “Just being able to go from building to building and being able to access the front of the building most of the time is quite nice.” When considering what aspects of the physical campus they found least welcoming, a participant said, “I can get in to all the building for class buts [sic] really annoying because the wheelchair access entrance is all the way on the other side of the building.” Another participant said, “Areas with stairs that require a special side elevator make me feel like an after-thought.” A third student stated, “Some buildings are not truly accessible because the automatic door openers don't work, and some you have to search the back or side entrances to find an accessible entrance.” These responses identify similar elements (entrances, door buttons, and elevators), but describe them differently as both welcoming or problematic.

Two unique items were mentioned several times as unwelcoming in participant responses that did not show up in the positive responses. First, a few students mentioned classroom spaces as unwelcoming. A participant said, “Classrooms with tiny spaces in between desks, I can't get around my own classroom without making a racket or having to have other students move the desks.” Another participant said, “Some classrooms don't have any accessible seating, so I have to ask for a table to be added, or I am stuck at the top of lecture halls with no way to go down the stairs to talk to the professor.”

A second area that was noted in the least welcoming responses is student’s experiences in extracurricular programming. This is not an aspect of the campus physical environment as the question asked; however, several participants mentioned it. One student said, “utilizing extracurricular activities is not welcoming.” Another student said, “A lot of events targeted at students are inaccessible, like skating at the ice rink or walking in the park, and it makes me not want to participate in those events.” A third participant wrote that the element that was least welcoming to them was, “Campus events that is [sic] created by students.” While the question specifically asked about aspects of the physical environment students found least welcoming as wheelchair users, their experiences at campus events were significant enough that participants desired to express their negative experience.

4.3. Campus leadership

In the final area of the data collection, participants were asked what they wished campus leaders knew about their experience as a student with a mobility impairment.

Many students had a desire for campus leaders to seek more feedback. A participant wrote, “Get more disabled students involved in the planning aspects of the campus and accessibility in general.” Another student said, “Asking wheelchair users for direct feedback would make them feel more included in the conversation.”

Students also expressed a desire for campus leaders to consider the experience of everyone. One participant wrote, “I wish they would go around campus in a manual wheelchair to feel how difficult it is so they understood what structural challenges we face everyday.” Students were asking that leaders see and consider their experiences.

Several participants expressed that they believe there are simple solutions that can help improve accessibility. One participant wrote, “Easy fixes can be made to help us.” Another said, “A little goes a long way. A simple curbcut at the end of a sidewalk might make a stretch of road much more pleasant. Another participant said, “It's easy to fix if you try hard enough.” Students see

fixes and do not believe that campus leaders are doing enough. There is a desire for leaders to act with a student writing, “I don't need sympathy, I just need accessibility.”

5. Discussion

The purpose of this research study was to understand what aspects of the physical environment on a college campus help to create a welcoming experience for students who use wheelchairs. The information and responses that participants offered are rich with data and speak from personal experience that is critical to listen to for individuals who desire for their campuses to be not only accessible, but welcoming for wheelchair users. As I conducted this research, I was hopeful to find new or innovative solutions that could be implemented broadly on campuses. I anticipated that there were unexpected elements that would improve sense of belonging and provide hospitality and accessibility for all students. In coding and theming the data from student responses, these new and novel ideas did not present themselves. Students described simple elements like working elevators or working accessibility door buttons; they mentioned using the same entrance as their peers, and they described being able to get to all of the places they desired as welcoming and conversely, they named the inability to do the above-mentioned actions as unwelcoming. This presence of similar items in responses about both welcoming and unwelcoming aspects of campus should be informative. When accessibility items like door buttons or elevators are present and working, this is welcoming for students. When these same items are not present or are broken, it impacts a student’s ability to access a location, and this is not welcoming. The methods for creating a welcoming environment already exist, they need to be intentionally utilized.

As I considered the data further, the participant’s statements to campus leaders appeared to be instructive and descriptive of why at first glance the data lacks the innovative solutions I had been hopeful for. One participant appropriately wrote, “Easy fixes can be made to help us.” There are simple solutions that campus leaders can take if they desire to create accessible campuses for wheelchair users. The methods towards accessibility are not unknown; however, they are not always utilized or sometimes they are simply broken. As the previously mentioned quote states, students don’t desire sympathy, they desire accessibility.

5.1. Hierarchy of learning environments

Strange and Banning’s (2001) framework for learning environments can be seen throughout the responses of participants. Level one of the hierarchy of learning environments is safety and inclusion. Given both their functional and symbolic effects, it is obvious that the physical components of campus environments are relevant to the safety and inclusion of students with mobility, sight, and hearing disabilities. Provision of physical accessibility and accommodation is the bottom line in addressing the attraction, satisfaction, and stability of these students. Limits in either of these conditions can compromise the learning experience in fundamental ways (Strange, 2000). When this "bottom line" of physical accessibility is not met, a student's sense of belonging and therefore their learning experience is clearly impacted.

Level two of Strange and Banning’s (2001) hierarchy is involvement. In this stage, individuals are active in the creation of the learning environment. Through creating opportunities for students with disabilities to actively take part in creating their learning environment, students are members of the community who are seen to have a level of expertise. In their responses, students expressed a desire for their experience to be seen, understood, and valued.

Finally, we can see level three of Strange and Banning's (2001) hierarchy in student's calls for inclusion in community events and experiences. "Conditions of community become evident as individuals assume significant roles over time and contribute to the very ethos and culture of the setting" (p. 27). Campus events that were not accessible did not demonstrate that all students were woven into the "ethos and culture of the setting." Additionally, the design of buildings and location of accessible options made individuals feel as though they were an afterthought. A physical environment that communicates inclusion and community helps to create this culture in which individuals who use wheelchairs are not only considered in the physical environment of campus but campus events as well.

Table 1. Mapping of Hierarchy of Learning Environments (Strange, 2000) and Results

Hierarchy of Learning Environments	Findings
Level I: Safety and Inclusion (Sense of Security and Belonging)	Physical Features of accessibility like ramps, elevators, and automatic door buttons are present and functioning. Wheelchair users can physically access the locations they need to on campus.
Level II: Involvement (Participation, Engagement, Role Taking)	Students with disabilities participate in the planning and creation of learning environments. Wheelchair users are viewed as having expertise about their needs and experiences.
Level III: Community (Full Membership)	Physical features of campus and campus events anticipate the presence of students with disabilities communicating that they are valued members of the community.

Our physical environment communicates nonverbal messages to those in the environment (Strange and Banning, 2001). University leaders need to understand that when environments are not accessible or require a special or different entrance, this communicates a message to students that they have not been considered in the planning or design of a physical environment. Strange and Banning (2001) also articulated that a physical environment may actually contradict the messages given verbally. Institutional leaders should be mindful of these realities as they create and design campus physical environments. As one participant suggested, leaders should "practice what they preach." This student has heard the message of the value of diversity and inclusion, but their experience as a wheelchair user has communicated a different message. University leaders should utilize the physical structure of campus to emphasize the message they are trying to articulate.

These three levels have direct alignment with the theory of belonging proposed by Vaccaro et al. (2015). In the "Theoretical Model of Belonging for College Students with Disabilities" (Vaccaro et al., 2015), self-advocacy, social relationships, and mastery of the role of a student emerged as critical to the development of as sense of belonging. The findings of this study affirm these three critical tasks. When level one of the hierarchy (safety and inclusion) is not met and students are not able to attend their classes or university events because of physical barriers, students with disabilities will find challenges in mastery of the roles of a student. When level two of the hierarchy (involvement) is not met, students have not been able to practice self-advocacy in ways that help to form a sense of belonging. And finally, when level three (community) is not met, student's social relationships are not able to develop in the same ways that their peers without

disabilities experience. As Vaccaro et al. (2015) propose, the ability to practice these skills is critical in forming a sense of belonging.

5.2. Implications

Conducting research is valuable to develop knowledge and understanding, but hopefully it also leads to action and practical change in response to new information. The following practical responses align with each level of Strange's hierarchy.

Level I: Safety and inclusion

One potential step is to ensure that the features of campus specifically intended to increase accessibility on campus are in working order. Students gave positive ratings and reported feeling that their campus was welcoming when accessibility door buttons worked and when elevators allowed them to get to the places they needed to go. Similarly, when these items were not working, students gave negative ratings and reported feeling unwelcome. This may require funding to make broken items work or to install new items; but the methods of creating accessibility are already utilized on campus. Increasing their availability and usability will create a more welcoming environment. Practically, facilities services teams could develop a regular preventative maintenance routine in which they can review and fix these accessibility items when needed. Methods could also be created for users to report issues and concerns in a timely way and these methods could be promoted through a Disability Resource Office. Noting the importance of working accessibility features for student experiences, fixing broken items should be a high priority for facilities services when this work is needed. Students believe that there are easy fixes. When we believe something is an easy fix and yet these fixes are neglected, it can lead to us feeling like an afterthought. Maintaining working accessibility features could appear to be an obvious and oversimplified idea; however, the repeated mentioning of these issues by respondents highlights that it is both a problem and potential solution to creating a sense of belonging on campus for wheelchair users.

5.2.1. Level II: Involvement

A second important response to these findings is that university leaders and campus planners should consider the experiences of all students, including wheelchair users, as they develop, build, and remodel campus buildings, outdoor elements like sidewalks, and physical structures around campus. Strange (2000) describes involving environments as ones where "individual differences are appreciated, participation is expected, interactions are personal rather than functional, and risk taking is encouraged (Strange, 1983)" (p. 27). Participants communicated that they did not feel like their experiences were understood and they asked campus leaders to seek student feedback and put themselves in a student's experience by using a wheelchair. Campus leaders should be careful not to participate in performative theatre by using a wheelchair when it is not needed but asking for and listening to the voices of students who are wheelchair users could be a valuable step towards creating a physical campus environment that leads to involvement of its members.

Participation of all users in the design process increases the probability of eliminating negative and unintended nonverbal messages. In fact, the likelihood that a campus design will meet the needs of the community may be a direct function of the extent to which community members participate in the design process (Strange & Banning, 2001).

A disability resource office could facilitate this connection or the collection of this information. However, there is likely value in campus leaders outside of those with a job title or responsibilities

related to disability services being actively engaged in the process of understanding accessibility needs. Campus leaders should be cautious that they do not communicate a desire to help with their words and something different with their actions.

5.2.2. Level III: Community

"Conditions of community become evident as individuals assume significant roles over time and contribute to the very ethos and culture of a setting" (Strange, 2000, p. 27). To reach this level of community, the expectation of the presence of students in wheelchairs must be woven into the fabric of campus culture. "When school is inaccessible then students don't come to class, which is why you don't see many disabled people. So please don't say 'why bother with accessibility, we have barely any disabled students?', wrote one participant. University leaders must proactively plan for the presence of wheelchair users rather than only reacting to concerns when they arise.

Students communicated the value of easily apparent and available accessibility options, highlighting the value of shared or central accessible entrances. One participant said, "Areas with stairs that require a special side elevator make me feel like an after-thought." This same student wrote, "ramps alongside stairs give me all the serotonins and make me feel included." While renovating older buildings on campus may be a challenge as noted in The Diamondback (2022) article, prioritizing the visibility and centrality of accessibility options should be considered for new projects and renovations. When students have to work to find alternative entrances to their destination, this creates an alternative experience for students who may already feel marginalized. "Proximity establishes the ground from which the community's agenda can grow" (Strange & Banning, 2001, p. 165). This proximity can be found through shared experiences and shared spaces that are readily accessible to everyone.

One method for prioritizing shared or similar user experiences is Universal Design (UD). Universal Design is intended to make "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Center for Universal Design, in Burgstahler, 2014, p. 38). Originally created through the design and architecture process (Evans et al., 2017), the seven principles of universal design intend to respond to access and usability. Institutional leaders attempting to create welcoming environments for students with mobility impairments should consider prioritizing universal design in the planning and construction of physical spaces. Utilizing a checklist like the one created by UD expert Sheryl Burgstahler (2020) could be a proactive approach to being welcoming and accessible.

5.3. Global Context

This research study was conducted in the United States with students on American higher education campuses. While there may be some generalizability to a global context, the research context limits this generalizability. United States law helps to guide practice on American campuses. With variance in law from country to country, there could be significant variance in practice.

5.4. Limitations

Like any research study, this investigation into the physical aspects of campus that create a welcoming environment has limitations. One specific limitation is that the vast majority of responses came from wheelchair users on campuses that enrol 10,000 or more students. This type of campus is dramatically different in size and resources than a campus of 5,000 or one of

1,000 students. Participants in this survey generally rated their campus accessibility experience positively; however, this response is not generalizable.

6. Conclusion

Leaders at institutions of higher education should expect students who use wheelchairs to enrol on their campuses. Creating environments in which all students feel safe, involved, and part of the community is critical to creating learning environments that are conducive to the educational experiences our institutions hope to provide. Universities must move beyond simply meeting the legal standards of Section 504 and the ADAAA to create educational environments in which students with disabilities are welcomed onto campus and experience a sense of belonging.

Through a qualitative content analysis study, students who are currently enrolled in college and are wheelchair users reported elements of their experience that lead to feeling welcomed or unwelcomed on campus. This included elements of both the natural physical environment like weather and terrain, but more importantly it also contained elements of the built environment that campus leaders have the capacity to impact. Students viewed these natural and built elements as possessing the capacity to have both a positive or negative impact on their experience of feeling welcomed on campus.

In response to these findings, University leaders can find reasonable and simple solutions to enhancing wheelchair users' sense of belonging on campus. Through taking steps to ensure accessibility features on campus are present and working, involving students in planning and development of the campus physical environment, and working to ensure that the culture of a campus anticipates and plans for the presence of everyone, institutions can move from simply being safe and secure (compliant) to creating a community of learning and being truly welcoming.

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What makes housing inclusive? Multi-stakeholder perspectives on inclusion and well-being for people with intellectual disabilities

Quesada-Cubo M.A., Department of Social Work and Social Services, Pablo de Olavide University, Spain, ORCID 0000-0002-3138-7426, maquecub@upo.es

Díaz-Jiménez R.M., Department of Social Work and Social Services, Pablo de Olavide University, Spain, ORCID 0000-0003-3289-6393, rdiajim@upo.es

Iáñez-Domínguez A., Department of Social Work and Social Services, Pablo de Olavide University, Spain, ORCID 0000-0002-9860-0404, aiadom@upo.es

De la Fuente-Robles Y.M., Department of Psychology, Area of Social Work and Social Services. University of Jaén, Spain, ORCID 0000-0002-2643-0100, ymfuente@ujaen.es

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Abstract: Inclusive housing for people with intellectual disabilities has increasingly replaced institutional models in policy discourse. However, less attention has been paid to how housing becomes inclusive in practice and how accessibility principles translate into everyday living environments. This qualitative study explores what makes housing inclusive from a multi-stakeholder perspective, drawing on five focus groups conducted in Spain with people with intellectual disabilities, family members, professionals, policymakers and community representatives (n = 36). An inductive thematic analysis identified five interrelated environments shaping residential inclusion: physical, social, supportive, community and symbolic. Findings show that inclusive housing cannot be reduced to compliance with architectural standards or small-scale provision. Instead, it emerges from the interaction between accessible and adaptable design, cognitive and sensory accessibility, personalised and flexible support, meaningful social relationships and active connection to the surrounding neighbourhood. Participants emphasised the importance of spatial personalisation, privacy, life-course adaptability and continuity of support as central to experiencing housing as home. At the same time, rigid funding schemes, housing market barriers and gendered inequalities limit real choice and the effective implementation of independent living. The study conceptualises inclusive housing as a lived, relational and place-based process aligned with Design for All principles, linking built environment design, support systems and structural conditions in the production of wellbeing.

Keywords: inclusive housing, Design for All, accessibility, intellectual disabilities, community inclusion, built environment, independent living.

1. Introduction

In recent decades, there has been a shift away from institutional residential models towards more inclusive forms of housing for people with intellectual disabilities, grounded in principles of autonomy, independent living and community inclusion. This shift has been influenced by the *Convention on the Rights of Persons with Disabilities* (United Nations, 2006), which establishes the right to live independently and be included in the community as a fundamental human right.

Despite this growing international consensus, access to adequate, sustainable and genuinely inclusive housing remains a structural challenge. Shortages of accessible housing, rigid service models and persistent institutional logics continue to restrict real opportunities to develop life projects within the community (Eley et al., 2009; Wright et al., 2017; Verseghy et al., 2019). Research has shown that relocation from institutional settings to community-based housing does not, in itself, guarantee inclusion or that housing will be experienced as home, a process often described as transinstitutionalisation (McConkey et al., 2005).

This requires attention to the everyday logics through which housing arrangements may reproduce or challenge institutional forms of control. From this perspective, institutionalisation is not only a matter of building type, but also of routines, rules and normalising practices that regulate daily life (Foucault, 1977). Similarly, stigma and labelling processes shape whether housing is socially recognised as an ordinary home or as a marked and exceptional setting (Goffman, 1963). These perspectives are consistent with relational approaches in health and social geography, which understand wellbeing as produced through interactions between people, material environments, social relations and available resources (Duff, 2011).

Beyond material and support-related conditions, housing also has a symbolic dimension that helps explain how a dwelling becomes a home. This dimension refers to the personal, social and cultural meanings that people assign to the spaces they inhabit, which shape identity formation, sense of belonging and emotional wellbeing (Quesada-Cubo et al., 2025). In this sense, home can function as a space of refuge, self-expression and self-realisation, supporting holistic wellbeing across social, physical, emotional, material and spiritual domains. For people with intellectual disabilities, however, this symbolic dimension may either support dignity, agency and recognition, or reproduce stigma, dependency and exclusion when choice, privacy and self-expression are limited. This understanding resonates with recent work on ontological security in housing, which links home to stability, control, belonging and the relational conditions that make everyday life feel secure (Plage et al., 2023).From a health and social geography perspective, housing should therefore be understood not merely as a physical space, but as a key social determinant of biopsychosocial wellbeing, with direct impacts on physical, psychological and social health (Wright et al., 2017). When physical, social or relational barriers are present, residential environments may become disabling, reproducing experiences of control, dependence or isolation (Yuzwa et al., 2025). This place-based perspective is particularly relevant for people with intellectual disabilities, whose experiences of housing are shaped not only by accessibility or support provision, but also by recognition, choice, relationships and participation in everyday life.

Previous studies have identified factors associated with positive residential experiences, including smaller-scale living arrangements, personalised support and opportunities for social participation, highlighting the role of housing context in everyday living environments (Bowey et al., 2005; Stainton et al., 2011; Friesinger et al., 2019). However, there remains limited clarity about how these factors interact in everyday life to enable housing to be experienced as inclusive and meaningful, particularly from the perspective of people with intellectual disabilities themselves. Their voices have often been mediated through professional or family discourses, shaping how residential needs and preferences are interpreted and acted upon (Rapley and Beyer, 1996; McConkey et al., 2004).

People with intellectual disabilities are a heterogeneous group, characterised by diverse life trajectories, aspirations and support needs. This diversity challenges standardised residential solutions and reinforces the need for flexible and personalised approaches that can adapt across the life course (Randell and Cumella, 2009; Ellis et al., 2020). In line with Design for All principles,

inclusive housing therefore cannot be conceived as a uniform technical solution, but as the outcome of environments that are accessible, adaptable and responsive to diverse users.

In this article, Design for All is understood as the integration of physical, cognitive, sensory and social accessibility into housing and neighbourhood environments from the outset, together with adaptability across the life course and compatibility with personalised support. This approach links accessibility and wellbeing by making everyday environments more legible, manageable and emotionally secure, thereby supporting autonomy, orientation and self-determination (Barnes, 2011; Yong et al., 2023).

The aim of this study is to explore the factors that shape inclusive housing —understood not as a specific residential model but as a lived place shaped by material, social and relational conditions— as experienced by people with intellectual disabilities, drawing on the perspectives of multiple stakeholders. To do so, the analysis applies the five-environment framework developed by Quesada-Cubo et al. (2025) —physical, social, supportive, symbolic and natural environment— to examine how these dimensions interact in everyday living environments.

2. Methodology

2.1. Design and approach

The study adopted a qualitative phenomenological and interpretative approach, from a constructivist perspective, suitable for exploring subjective and contextual experiences related to social and attitudinal barriers (Taylor and Bodgan, 1987; Kitchin, 1998). Discourses were understood as situated expressions linked to specific social positions. Collective identities are shaped by processes of categorisation of social reality, through which groups develop shared meanings, delimiting boundaries between "us" and other social groups (Berger and Luckmann, [1966] 1984; Águila, 2023, 2024).

The study formed part of a R&D&I national research project FRI-HOUSING (Friendly Housing) "Inclusive and sustainable environments for people with intellectual disabilities. Diagnosis and evaluation of items for the identification of 'friendly housing'", involving 11 universities and more than 35 specialist researchers with expertise in intellectual disability, housing, and/or social inclusion.

2.2. Participants and sampling

Participants were recruited in Spain through intentional, heterogeneous sampling stratified by stakeholder group. Thirty-six participants took part in five focus groups: 1) people with intellectual disabilities; 2) family members; 3) neighbours and community agents; 4) policy and institutional stakeholders; 5) professionals and researchers with expertise in the field.

Group composition ensured sociodemographic and residential context diversity to guarantee heterogeneity, but these were not used as analytical categories, as the analysis focused on the stakeholders as analysis units, understanding their discourses as expressions of meaning schemes, collective habitus, and differentiated social positions (Martín-Criado, 1997). Detailed characteristics are presented in table 1.

2.3. Technique and instrument

Focus groups were selected for their suitability in exploring interactional dynamics and facilitating collective construction of meanings in context with limited prior knowledge. In the field of intellectual disability, it facilitates collective expression and reduces barriers associated with written communication (Kitzinger, 1994; Sim, 1998).

A semi-structured script with open-ended questions was used, organised around seven thematic areas: space and infrastructure, economic and management aspects, political and institutional aspects, social relations, personal development, and gender.

2.4. Procedure and data analysis

Sessions were held between January and March 2025 and led by two researchers.

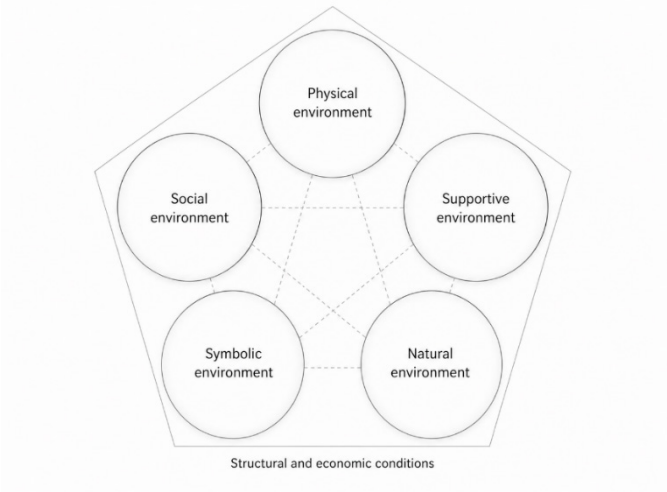
Participants completed a sociodemographic questionnaire and signed an informed consent form. The study was approved by the Ethics Committee for Studies Involving Human Subjects (CEIH) at Pablo de Olavide University (Protocol Code: 24/4-5). Inclusive research adaptations were incorporated to support the participation of people with intellectual disabilities. Information and consent materials were provided in accessible language, and the study aims were explained orally before the session. The discussion guide used short, clear and open-ended questions, avoiding technical terminology. Participants were given sufficient time to respond, and facilitators used clarification and reformulation when needed.

Data were analysed using inductive thematic analysis supported by Atlas.ti (v. 25), combining inductive and abductive logic. Credibility was strengthened through intersubjectivity discussion among researchers, the systematic review of emerging codes and themes, and the inclusion of representative quotations (Ruiz-Ruiz, 2009).

3. Results

The findings show that inclusive housing is produced through the interaction of five interconnected environments shaping the residential experience. A complementary section addresses the structural and economic conditions influencing independent living, with gender inequalities considered across the analysis. This conceptual structure is synthesised in Figure 1.

Figure 1. Conceptual model of inclusive housing: five interconnected environments shaped by structural and economic conditions.



3.1. Natural environment

This dimension was mentioned less frequently than other domains, but was valued for its therapeutic, and emotional role. Access to green spaces or contact with nature and animals was associated with more pleasant and balanced living environments.

One neighbourhood participant summarised this idea by pointing out: "*The connection with nature, animals [...] It connects you more with who you are than with what you think" (P5, neighbourhood).*

Overall, this dimension was understood as a complementary facilitator of wellbeing rather than a central element of residential inclusion.

3.2. Physical environment

3.2.1. External infrastructure: scale, model and environment

Criticism of institutional models was widespread, particularly among families and professionals. Traditional residences were described as rigid environments organised around functional logic that subordinate individual needs. As several professionals point out: "*The organisation of a macrostructure always prevails over daily needs, which are evolving and changing*" (P1, professional).

This criticism was not directed not at the size of facilities but at their underlying logic, as institutionalisation was understood to depend less on buildings than on how support is organised: *"It's not the walls that make the institution... you can care for three people in a small space and still be an institution*" (P3, professional). Deinstitutionalisation therefore requires transforming service logics.

Families expressed ambivalence, combining mistrust of large facilities with concern about the lack of alternatives, especially in situations of ageing carers or care-related crises, such as health deterioration or loss of informal support. This resulted in limited real choice and reinforced socioeconomic inequalities: "*If I want a residence closer to my home, I have to wait four or five years*" (P3, family member).

Across groups, there was consensus that no single residential model is appropriate for everyone, highlighting the need for flexible solutions tailored to individual life projects: "*Generalising a model is repeating the institutional model. Each person should live in a different home*" (P4, professional).

Participants across stakeholder groups identified location as crucial for autonomy and inclusion, particularly access to transport, health centre and everyday services. However, tensions arise between centrality and periphery, giving rise to the rural-urban debate, as some value the tranquillity of less dense environments and closer relationships.

Residential continuity and familiarity with the neighbourhood were seen as protective: "*It gives them more security... knowing the place perfectly"* (P5, family member); while forced moves were experienced as disruptive and distressing: *"At the end of your life, you are in an unfamiliar place... that you have not chosen"* (P4, professional).

Neighbourhoods could function either as sources of informal support —*"If you have a question, you go to the shopkeeper"* (P3, family member)— or as sites of stigma — "*Because they classify us. It seems that we are inferior to them"*— (P2, person with an intellectual disability), indicating that inclusion depends on active community mediation rather than physical presence alone.

Environmental accessibility was understood in broad terms across stakeholder groups, encompassing physical, cognitive and procedural dimensions. Cities were widely described as still largely inaccessible, highlighting the need for improvements in transport, signage and everyday access.

Clustered housing elicited ambivalent views. Most families, professionals and neighbours agreed that a high concentration of housing units for people with disabilities in the same location can generate segregating dynamics, often described as “ghettos”. This is not due to proximity itself, but to the risk that such concentration may limit interaction with the wider community and a lack of social diversity. As one participant explained: *"It is important to live with other people with disabilities but isolating them in specific groups goes against their integration into society... you need diversity to grow"* (P6 and P4, neighbours). More nuanced positions emerged mainly among policy and institutional stakeholders, who accepted small-scale or limited forms of clustering-understood as a relatively small number of housing units located in proximity-when clearly linked to community connection and the sustainability of support.

Tensions also emerged around the visible identification of residential resources for people with intellectual disabilities (e.g., through signage or external markers). While professionals and policy actors tended to avoid explicit identification due to its potential stigmatising effects, some neighbourhood participants supported more standardised forms of identification as a way to promote visibility and mutual understanding. The central dilemma lay in how to make housing recognisable without reinforcing labels.

3.2.2. Internal infrastructure: spatial design and material and technological resources

With regard to the interior of the home, there was abroad agreement that accessibility should be understood in a comprehensive way and not limited to the removal of architectural barriers. Across stakeholder groups, participants emphasised the need to incorporate cognitive supports, clear signage, accessible instructions for domestic appliances and predictable spatial organisation. The adequacy of many existing resources was questioned: *"Are residences for people with disabilities really adapted so that they feel comfortable there? No. Most are not"* (P2, family member).

Physical accessibility was identified as essential. Elements such as lifts, ramps, wide doors, adapted bathrooms and ground-floor dwellings were repeatedly prioritised. From a technical and institutional perspective, participants advocated a combination of universal design and personalised adjustments, recognising that needs vary depending on the individual and their stage of life.

The personalisation of space emerges as a central condition for housing to be experienced as home. Age, level of support needs and life stage were seen to shape different requirements, calling for flexible designs that can adapt over the life course and take into account sensory accessibility and changing levels of dependence. As one professional stated: "*Decisions about space will be defined by the person, not by the resource*" (P3, professional).

Regarding interior layout, there was broad consensus on the need to balance privacy and shared living. The preference for single bedrooms was almost unanimous, associated with privacy, rest, control and personal and even religious practice. "*In my house, my room alone, just as I like it*" (P6, person with intellectual disability). At the same time, participants valued the presence of sufficiently large, shared spaces that enable interaction and shared activities.

Participants from different stakeholder groups identified the internal scale of cohabitation as another relevant factor. Positive assessments of small-scale arrangements (typically three to four residents) predominated, as these were seen to promote closer relationships and reduce overcrowding. However, professionals warned of the risk of reproducing institutional dynamics in small homes if numerical reduction is not accompanied by changes in how support is organised.

Finally, material and technological resources were viewed as potential facilitators of autonomy. Home automation and other domestic technologies were valued when intuitive and accompanied by appropriate training for both residents and staff. However, participants also identified cost and complexity as potential sources of inequality or stigmatisation. This reinforces the view that technology should complement, rather than replace, human support.

3.3. Supportive environment

3.3.1. Support conditions and sustainability

The working conditions of support staff emerges as a cross-cutting concern, particularly among professionals and institutional managers. Participants from different stakeholder groups described a sector characterised by low pay, high staff turnover and difficulties in recruiting and retaining qualified personnel, all of which undermine continuity of support and its overall quality. As one institutional manager noted: "*We face a significant challenge: retaining the professionals who are leaving us*" (P4, political-institutional).

This precariousness was linked to the low social value attributed to care work and to the feminisation of the sector, especially in direct support roles. Insufficient staffing ratios and contractual instability were described as generating overload and discontinuity, negatively affecting trust and the development of meaningful relationships. Across groups, there was a shared call for the dignification of support, including formal recognition of professional roles, employment conditions commensurate with responsibility, and an understanding of support as a guaranteed right rather than a voluntary service.

3.3.2. Intensity, flexibility and organisation of support

One of the central debates concerned the intensity of support required. Families and some community members tended to favour intensive and sustained support over time, reflecting a protective perspective, whereas professionals and policy actors emphasised the need for flexible support that can be adjusted across different life stages. As one institutional representative summarised: "*support never diminishes, but its intensity changes depending on the moment*" (P2, political-institutional).

People with intellectual disabilities expressed specific needs for practical everyday support—such as household tasks, organising daily routines or accompaniment—and particularly valued staff availability and proximity: "*I would need someone to be looking out for us", " someone who helps us cook and answer our questions*" (P3 and P5, people with intellectual disabilities). At the same time, tensions were evident between aspirations for autonomy and the practical constraints of the environment, especially in areas such as health care and administrative procedures.

Organisational rigidity within many services was identified as a *significant* barrier. Rules relating to visits, schedules or the use of shared spaces were seen to reproduce institutional logics that limit control over one's own home and generate frustration: *"I'd like to be talking in the living room, but they won't let me"; "I think that's unfair"* (P5 and P7, people with intellectual disabilities).

Families highlighted the value of gradual transitions towards new living arrangements to reduce anxiety, adjust expectations and support skill development. Stable support figures—such as personal or professional assistants and community connectors—were seen as particularly important for ensuring continuity.

3.3.3. Professional competencies and support approach

Person-centred support was consistently identified as the ethical and operational framework guiding practice. Across all groups, there was agreement that support should adapt to individual needs rather than individuals adapting to services, shifting the focus from the resource itself to the person's life project. "*We have to provide support in an individualised way*" (P2, professional).

The ability to choose support was particularly valued, in line with emerging self-directed support approaches. Across stakeholder groups, participants described this as a profound cultural shift: moving from doing for to supporting to and recognising the home as a space of privacy and decision-making. As one professional explained: *"If you're going to be in my home, which is my private space, I'm the one who decides"* (P1, professional). However, participants acknowledged that implementing such approaches remains constrained by persistent structural limitations.

Professionals also stressed the importance of creating safe contexts for self-determination and informed decision-making, providing accessible information, supporting risk assessment and respecting the right to make mistakes as part of learning. *"We must respect people's right to make mistakes"* (P3, professional). In parallel, they emphasised the need to manage expectations realistically without undermining aspirations for autonomy, addressing frustration through emotional support rather than prohibition. Empowerment was thus described as a relational process grounded in listening, horizontality and respect.

Developing skills for independent living was identified as another core competency. Both professionals and people with intellectual disabilities highlighted the value of practical, gradual and context-based learning—such as cooking, shopping, managing appointments or household tasks—that enables progressive gains in autonomy. *"You can give me the push, but I have to carry on to the end"* (P4, person with intellectual disability).

Financial management emerged as one of the most debated areas of support. While people with intellectual disabilities called for greater control over their own money —"*having my money available*" (P5, person with intellectual disability)— families expressed concerns about everyday financial security, reflecting ongoing tensions between protection and autonomy.

3.3.4. Families, care and respite

Families continued to play a central role in support, particularly where residential alternatives were limited. Family narratives were shaped by concerns about future respite and continuity of care, influencing both residential decisions and practices of overprotection. These concerns were especially pronounced for women with intellectual disabilities, who were subject to greater restrictions linked to safety.

Professionals and institutional actors questioned the sustainability of the family as the primary provider of care, pointing to extreme situations associated with ageing carers—"*a 60-year-old man cared for by a 90-year-old woman has been told he's better off with his family, and that's simply not true*" (P5, professional)—and to the implicit transfer of responsibility to siblings. Participants agreed on the need for housing models to include clear respite strategies, supported by stable formal services that complement, and when necessary, replace informal care.

There was also broad consensus that progress depends on effective coordination between public administrations, service providers, academia and families. The lack of practical coordination was identified as a structural barrier: *"the lack of bridges between administrations is a huge obstacle*" (P1, professional). Participants called for shared strategies that combine political commitment, specialised training and networking, in order to reduce the gap between policy frameworks and everyday practice.

3.4. Social environment

The findings highlight that residential inclusion depends not only on internal living arrangements but also on the quality of social relationships and effective connection with the wider community.

3.4.1. Coexistence and compatibility among residents

The possibility of choosing with whom to live emerged as a central criterion. For many people with intellectual disabilities, living with friends or a partner was associated with relational continuity and a sense of belonging. For families, this choice also represented a source of security and social fit. However, practical limits were recognised, as certain relational or behavioural difficulties could make some living arrangements unviable.

Across all profiles, participants agreed that age and life stage were key criteria for compatibility. From this shared position, divergent perspectives emerged. Families expressed ambivalent views: some valued heterogeneity—including cohabitation with people without disabilities—as an enriching experience, "My daughter has suffered from her sister's condition, but it has enriched her enormously" (P5, family member), while others called for greater homogeneity in type of disability or level of support. In these cases, homogeneity was framed as a condition for appropriate support rather than segregation, often grounded in negative experiences within generalist services.

People with intellectual disabilities clearly prioritised prior relationships and personal choice over diagnostic categories, expressing resistance to being classified through labels: "*It seems like they are classifying us*" (P5, person with intellectual disability). In some cases, particularly among women, preferences were expressed for non-mixed living arrangements, linked to feelings of emotional safety and everyday wellbeing.

From a professional perspective, a more functional approach was adopted, emphasising the compatibility of support needs rather than diagnosis. Participants warned that unplanned heterogeneity could lead to fragmented activities and the reproduction of institutional dynamics. They stressed that choice should be supported through prior processes of getting to know one another and appropriate preparation: "*There have to be programmes so people can get to know each other*" (P6, professional). With regard to cohabitation with people without disabilities, discourses reflected a tension between its potential integrative value and the risk of turning it into a moral obligation that fails to generate meaningful relationships.

Taken together, positive coexistence was understood to depend on basic elements such as mutual respect, communication, shared responsibilities and agreed norms. However, these dynamics were described as fragile in the absence of stable support or when the composition of the living group was poorly matched.

3.4.2. Social network and meaningful relationships

Peer relationships emerged as a key resource for social life. Participation in associations, community groups or inclusive university programmes was seen as facilitating the development

of meaningful relationships and informal support networks. Nevertheless, participants consistently highlighted the limited nature of relationships with people without disabilities, which were often characterised by subtle forms of social segregation. As one family member explained: "*They help you, they're kind to you, but they don't go out with you*" (P6, family member).

Romantic relationships were valued by people with intellectual disabilities as an important source of autonomy and intimacy. However, family discourses revealed ambivalence, shaped by protective concerns and fear of losing control, exposing a gap between formal recognition of affective life and its practical acceptance. "*Sometimes he says he wants to go out with his girlfriend… it's nice that he has his dreams, his fantasies, but…"* (P5, family member).

Experiences of sexuality were clearly gendered. Male sexuality tended to be more readily normalised, whereas female sexuality was framed through discourses of risk, particularly in relation to pregnancy. These perspectives were seen to limit women's effective exercise of the right to choose and to reinforce protective restrictions.

The family remained the main relational and support network, acting as a source of care and mediation with services. At the same time, this centrality generated internal tensions linked to overprotection, fear of future responsibility transfer and the distribution of care among siblings, particularly in narratives shaped by the ideal of the "good mother".

Neighbourhood and community networks were identified as potential protective factors when based on proximity and trust. However, their existence depended strongly on neighbourhood social capital, housing location and active mediation. Without deliberate support and follow-up strategies, there was a risk that social life would remain confined to the home. As one professional noted: "*The key is the support network you have and the community environment you move in*" (P2, professional).

3.4.3. Community, participation and connection

Participation in neighbourhood life and in cultural, sporting or religious activities was described as a condition for citizenship and wellbeing. Such activities not only structured everyday routines but also strengthened self-esteem, social skills and natural support networks. However, participants warned of the risk of creating micro-institutional settings when support was concentrated within the home without meaningful links to the surrounding community: *"If we put a person in a home and don't connect them, we've created a mini-institution*" (P1, professional).

Inclusion was widely framed as a shared community responsibility rather than the sole task of people with disabilities or services. This view underpinned the perceived importance of roles such as the community connector and of strategies aimed at distributing responsibility across local actors. As one family member explained: "*Knowing that you, as a community member, as a librarian or a shopkeeper, also have a responsibility in this*" (P1, family member).

Effective participation was further shaped by structural conditions, including accessibility, transport and the availability of inclusive community services. Lack of knowledge was repeatedly identified as a source of stigma and rejection, whereas everyday contact and mutual understanding were seen as key to normalising coexistence. Examples of temporary cohabitation experiences and contexts involving prior community preparation illustrated how inclusion develops through shared experiences and recognition of people with intellectual disabilities as active community members rather than passive recipients of support. As one participant

summarised: "*The main goal of social change is to change the way we look at things*" (P3, neighbourhood).

3.5. Symbolic environment

3.5.1. Identity, self-perception and recognition

Access to one's own home and to more autonomous living experiences had a strong symbolic impact on the identity and self-perception of people with intellectual disabilities. Families, professionals and people with intellectual disabilities themselves agreed that processes of emancipation—even when partial or supported—reinforced self-esteem, a sense of competence and recognition of adult status. As one family member noted: "*I saw her as more autonomous; she took buses and went out with her friend*s" (P6, family member).

Concurrently, family discourses revealed significant tensions around the meaning of autonomy. For some families, autonomy was defined in basic functional terms (e.g. personal care or eating), while others set firm limits on what they considered possible or desirable: *"He will never be independent… he won't live alone or manage his own finances"* (P2, family member). Although framed as protective, these narratives could crystallise dependent identities and anticipate restricted life trajectories.

In contrast, people with intellectual disabilities articulated aspirations aligned with normative life projects—employment, relationships, housing and family—and demanded greater control over time, privacy and everyday decisions, including schedules, visits and personal routines. Excessive rules or constant supervision were experienced as forms of infantilisation that undermined adult identity: *"We are adults now and we also need to go out and enjoy ourselves" (P2, person with intellectual disability). Autonomy was thus understood as a gradual process, grounded in personal effort and appropriate support: "What I can't do in one day, I do in two*" (P4, person with intellectual disability).

From a gender perspective, the findings showed that women with intellectual disabilities were more frequently associated with roles of dependence and care within the family context, which constrained residential emancipation. These trajectories did not always reflect personal choice, but rather gendered expectations that limited access to experiences of autonomy, risk-taking and self-determination.

The possibility of choice and access to understandable information emerged as key components of empowerment: *"If you have a choice… a range of possibilities (…) and you know what you're choosing"* (P2, political-institutional). Self-perception was also shaped by experiences of stigma and social isolation. Stereotypes and the gaze of others generated discomfort, self-monitoring and withdrawal, while being known and recognised in one's environment acted as a protective factor against social judgement. Feelings of loneliness were recurrent, linked both to limited meaningful relationships and to a lack of social recognition.

Collectively, the symbolic environment extended beyond housing as a physical space and functioned as a framework for identity validation or denial. Living with support could either foster empowerment or reinforce dependence, depending on the power relations, norms and meanings embedded in everyday life.

3.5.2. Rights, independent living and equality

Beyond individual experiences, the symbolic environment was strongly shaped by a discourse of rights. Professionals and policy actors emphasised that independent living was neither a

concession nor a methodological approach, but a matter of dignity and citizenship: "*It's an ethical issue… a person shouldn't be institutionalised"* (P2, professional). Housing was thus framed as a universal right rather than a special or differentiated resource.

From this perspective, housing for people with intellectual disabilities should be *"the same as any other citizen's*" (P1, professional), avoiding segregating logics and labels that reinforce exceptionality. Equality was articulated in terms of shared rights and responsibilities, including the right to decide, to make mistakes, to participate and to contribute to the community.

However, this rights-based framing coexisted with more conditional discourses, particularly among neighbourhood participants, where the right to housing was sometimes qualified by degree of disability or economic autonomy. This tension highlighted the gap between formal recognition of rights and their practical realisation, shaped by expectations of self-sufficiency and normality.

Professionals also warned of the risk of reproducing paternalistic models under inclusive rhetoric, resulting in "inclusive" housing that functioned as mini-institutions, characterised by limited participation in decision-making and predetermined life pathways. In response, self-determination was reaffirmed as a core principle, involving access to accessible information, decision-making support, tolerance of risk and recognition of the right to choose non-normative options. As one participant stated: *"It's about each person having their own project (…) the possibilities they have and what they can do"* (P3, political-institutional).

From a rights-based perspective, several participants from different stakeholder groups explicitly referred to the double discrimination affecting women with intellectual disabilities. Alongside disability-related inequality, gender-based factors increased vulnerability, particularly in relation to gender-based violence, sexual violence and secure access to housing—issues that remain largely invisible within existing policies and support systems.

3.6. Structural and economic conditions

Across all the environments analysed, structural and economic conditions emerged as a determining—and often limiting—factor in the realisation of independent living projects. There was broad agreement that residential autonomy does not depend solely on personal or family will, or on the quality of support, but on an interrelated set of factors including employment, income, access to housing, public funding and a regulatory framework that remains insufficient and fragmented.

3.6.1. Precarious employment and economic fragility

People with disabilities described employment trajectories characterised by precariousness, including part-time contracts, low wages and instability. As one family member explained: *"They are 20-hour contracts… paying 600€*" (P3, family member). This situation generates structural dependence on non-contributory pensions, minimum income schemes or family support, resulting in deeply unequal access to independent living. Families also emphasised how socioeconomic status shapes life opportunities from an early age, reproducing cumulative inequalities over time.

3.6.2. Access to housing and market barriers

Participants from different stakeholder groups identified access to decent housing as one of the main obstacles. Professionals, families and neighbours agreed that the rental market is restrictive and exclusionary, discriminating on the basis of income, profile and disability: *"To rent a flat, they*

put you through a casting process" (P2, neighbour). This is compounded by limited housing adaptation and the reluctance of many landlords to make reasonable adjustments. In response, some families resorted to private solutions, such as purchasing housing with their own savings—strategies that are not widely replicable and that reinforce the privatisation of risk.

3.6.3. Financing: rigidity of the system

There was widespread agreement that supported housing models are not necessarily more expensive than traditional residential provision when support levels are equivalent: *"It has been empirically proven that it is not more expensive"* (P3, political-institutional). Nevertheless, funding remains tied to rigid places and service models, limiting the personalisation and portability of support. Participants criticised the fact that refusing a residential placement often entails losing access to public funding and called for models in which individuals receive a financial allocation linked to their personal support plan: *"The citizen should be the one with the money and the decision-making power*" (P1, professional). At the same time, it was acknowledged that a substantial proportion of actual support continues to fall on families, without explicit recognition by the system

3.6.4. Public policies: fragmentation and territorial inequality

Public policies were identified as a key yet problematic area. Families expressed a persistent sense of institutional abandonment —"fend for yourself"—while professionals and policy makers highlighted the dispersion of competences and lack of inter-administrative coordination as *significant* structural barriers. Regulations were perceived as outdated in relation to current practices and innovation within the third sector —"*people are ahead of what administrations are capable of offering*" (P1, professional)—and significant territorial inequalities between autonomous communities were emphasised. In parallel, some regulatory advances were noted, such as the inclusion of the Home Care and Support Service in the reform of the Dependency Law, which formally recognises the right to develop independent living projects with support.

4. Discussion

The findings indicate that inclusive housing should be understood as a relational and situated experience rather than as a residential resource in itself. Living in the community does not guarantee inclusion or experiences of home unless everyday organisational practices are transformed (McConkey et al., 2005; Bigby et al., 2017; Quesada-Cubo et al., 2026). This finding is consistent with Article 19 of the Convention on the Rights of Persons with Disabilities, which frames independent living and community inclusion as rights that require not only residential placement in the community, but also real choice and access to the supports and services necessary to participate on an equal basis (United Nations, 2006). From a Health & Place perspective, inclusive housing emerges as a lived, place-based determinant of wellbeing, produced through everyday practices, relationships and access to social and material resources (Duff, 2011).

The main theoretical contribution of this study is to conceptualise inclusive housing as a lived, relational and place-based process produced through the interaction of five environments: physical, social, supportive, symbolic and natural. In doing so, the model extends supported housing and deinstitutionalisation literature by shifting the focus from the type of residential provision or the transition away from institutional settings to the everyday conditions through which housing becomes, or fails to become, inclusive. This framework moves beyond approaches that focus primarily on housing type, size or physical accessibility, and instead shows how

inclusion depends on the articulation of design, support, social relationships, community connection and rights-based recognition. In practical terms, the findings suggest that architects, urban planners and housing providers should design housing environments that support neighbourhood integration, proximity to everyday services and transport, cognitive and sensory accessibility, adaptable layouts, privacy, voluntary interaction and flexible person-centred support. These implications are particularly relevant to the social and supportive environments, as spatial design alone cannot generate inclusion if housing remains socially isolated or if support is rigid, discontinuous or organised according to institutional logics.

A further finding concerns the differentiated ways in which housing and inclusion are understood across stakeholder groups. While people with intellectual disabilities prioritised choice, privacy and control over everyday life as key markers of adult identity, families and professionals tended to manage these aspirations within frameworks shaped by protection and risk perception. This tension between autonomy and protection is widely documented in previous research (Rogers et al., 1994; McConkey et al., 2004). In this study, it is reflected in residential decisions and support practices that may either enable or constrain self-determination. In this context, the findings reaffirm the existence of limited real choice, restricting opportunities to decide where, how and with whom to live (Eley et al., 2009), and highlight how such constraints are frequently produced through institutional, organisational and spatial arrangements rather than individual capacity.

The results also challenge standardised residential models and reinforce the heterogeneity of people with intellectual disabilities, characterised by diverse life trajectories, preferences and aspirations. This underscores the need for flexible and personalised housing solutions (Verseghy et al., 2019; Ellis et al., 2020). In this regard, research on technologically enhanced housing environments, such as smart homes, suggests that design innovations may support autonomy, safety and social connection when integrated with community-oriented and person-centred approaches (Ellis et al., 2020; Turnley et al., 2023). However, our findings indicate that technological solutions alone are insufficient to guarantee inclusion if not accompanied by supportive, relational and community-based conditions.

Although preferences for small-scale and adaptable housing align with earlier studies (Bowey et al., 2005; Stainton et al., 2011), this pattern further reinforces the idea that neither technological innovation nor changes in physical scale alone are sufficient to ensure inclusive living. The analysis shows that reducing scale alone does not prevent the reproduction of institutional dynamics if the underlying logic of support remains unchanged. Supporting informed, non-delegated decision-making and enabling residential choice across the life course therefore emerge as key conditions for inclusive housing (McConkey et al., 2004).

The social environment emerged as a particularly fragile dimension. Coexistence, social networks and community participation were shaped by the compatibility between residents, the stability of support arrangements and the social capital of the surrounding environment. The persistence of limited social relationships and endogamous networks is consistent with earlier findings on the weakness of relational inclusion (Rapley & Beyer, 1996; Bailey et al., 2024). From a spatial perspective, the findings suggest that physical proximity to the community does not necessarily translate into meaningful social connection, as neighbourhood context and built environment play a critical role in shaping everyday wellbeing and participation (Bigby et al., 2017; Friesinger et al., 2019; Verseghy et al., 2019; Stoeckel et al., 2022).

From a symbolic perspective, housing functioned as a space of identity validation. Living with support could strengthen self-esteem and social recognition, but it could also reinforce dependent identities when decision-making was substituted or overly supervised. These findings

are consistent with research linking residential self-determination to adult identity and subjective wellbeing (Bigby et al., 2017; Douglas et al., 2023). A gender perspective is particularly salient, as women with intellectual disabilities appeared more exposed to residential trajectories marked by overprotection and restricted autonomy, reinforcing patterns of double discrimination (Traustadóttir & Johnson, 2000).

Finally, the findings indicate that the viability of inclusive living is deeply shaped by structural and economic conditions, including employment insecurity, housing market barriers and rigid funding systems, which contribute to spatially uneven opportunities for inclusion (Fisher et al., 2010; Douglas et al., 2023; Blood et al., 2024).

The qualitative and contextual nature of the study limits the generalisability of the findings. In addition, the perspectives of people with intellectual disabilities with higher or more complex support needs were underrepresented. Although inclusive adaptations were used during data collection, the study did not include validation or co-interpretation of the findings with people with intellectual disabilities. Future research should incorporate participatory analysis or member-checking strategies, alongside complementary and longitudinal methods, to capture a wider range of support needs and examine how experiences of inclusive housing and wellbeing evolve over time and across different territorial contexts.

5. Conclusions

This study highlights that inclusive housing for people with intellectual disabilities is not merely a physical resource, but a lived, relational and place-based social process that shapes autonomy, identity, wellbeing and community participation. Drawing on the perspectives of multiple stakeholders, the findings show that independent living does not fail due to a lack of individual aspirations, but because physical, social, support and economic environments often fail to sustain it (Wright et al., 2017; Quesada-Cubo et al., 2026).

By conceptualising inclusive housing as a lived place produced through interactions across domestic, neighbourhood and structural levels, the study underscores the need to move beyond rigid residential models towards flexible, personalised and sustainable solutions that can respond to diverse life trajectories. Strengthening direct participation in residential decision-making and the advancement of rights-based approaches, consistent with the principle of “nothing about us without us”, are central to this process.

The findings also reveal how formal equality continues to coexist with practical inequalities, particularly affecting women with intellectual disabilities, highlighting the importance of integrating a gender perspective into housing, support and policy frameworks. These inequalities are not only social but also spatial, reflected in differential access to housing options, support networks and opportunities for independent living.

Taken together, promoting inclusive and independent living requires moving beyond dwelling-level solutions towards the development of health-promoting places, supported by coordinated housing, care, accessibility and community policies. From a Design for All perspective, this involves embedding physical, cognitive and social accessibility within planning and design processes from the outset, ensuring that housing environments anticipate diversity and remain adaptable across the life course. Recognising people with intellectual disabilities as full citizens with diverse and legitimate life projects requires sustained attention to spatial, social and structural conditions. It also requires attention to how design decisions shape equal opportunities in everyday life.

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8. Appendix

Table 2. Sociodemographic characteristics of the focus groups.

Profiles	N	Gender	Age (range/mean)	Level of education	Specific selection characteristics
Persons with intellectual disabilities	7	4 male 3 female	23–61 years ($\bar{x}$ = 36.42)	Primary education (1); secondary education (2); vocational training (2); degree from the University of Training for Employment and Independent Living (2).	Degree of disability: mild (3), moderate (3) and severe (1). Residents in: supervised housing (3), family homes (3) and institutionalised residence (1). Occupation: employed (1), unemployed and seeking employment (4), pensioner (2).
Family members	7	3 male 4 female	56–62 years ($\bar{x}$ = 59.57)	Secondary education (3); university studies (4)	Parents or guardians with varying levels of support needs: extensive (1), limited (3), intermittent (3). Employment status: active (3), inactive (4). Monthly income: between €583 and €1,500 ($\bar{x}$ = €1,038)
Neighbourhood and community environment	7	2 male 4 female	28–66 years ($\bar{x}$ = 46.3)	Primary education (1); secondary education (2); university studies (4)	Neighbours living in different types of housing (2), members of community associations (3) and volunteers from community organisations (2). Employment status: active (3), inactive (4). Monthly income: between €1,800 and €3,250 ($\bar{x}$ = €2,533)

Profiles	N	Gender	Age (range/mean)	Level of education	Specific selection characteristics
Political agents and representatives of organisations	7	3 male 4 female	45–65 years ($\bar{x}$ =56.28)	Secondary education (1); university studies (6)	Political representatives with responsibilities in housing and/or disability (3), representatives of the boards of directors of public and private organisations (4). Territorial scope: regional (3), local (4)
Professionals and research staff	8	2 male 6 female	36-65 years ($\bar{x}$ = 49.37)	University studies (5); PhD (3)	Regional directorate of national disability association network (2) professionals from private entities (3), university lecturers and researchers specialising in the fields of psychology, sociology and sports science (3).

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