Evaluation of Building Material Finishes for Accessibility, Safety, and Usability in Special Educational Facilities in Southwest Nigeria

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Abstract- ***Access to inclusive, safe, and user-friendly educational environments is a fundamental right, particularly for persons with physical disabilities. However, many special educational facilities in Southwest Nigeria still exhibit significant physical and material-related barriers that compromise safety, mobility, and usability. While prior research has emphasized general accessibility elements like ramps and signage, little attention has been paid to the critical role of building material finishes in promoting inclusive education. This study addresses that gap by evaluating how building material finishes affect accessibility, safety, and usability for physically impaired students in special schools across Southwest Nigeria. The aim of the study is to assess the adequacy and impact of various building material finishes such as flooring, wall, ceiling, doors, windows, and sanitary installations on the safety, comfort, and usability of school environments for students with physical disabilities. An explorative and descriptive research design was adopted, using both quantitative and qualitative methods. Data were gathered through structured questionnaires administered to 332 respondents across six special schools in the region, supported by field observations and case studies. Statistical tools including Mean Weighted Values (MWV), Relative Importance Index (RII), and Spearman's Rank Correlation Coefficient were employed for data analysis. The study reveal that slip-resistant ramps, rubber flooring, and textured outdoor surfaces scored highest in safety, usability, and comfort (RII > 0.88). Preferred materials like rubber floors and non-slip ceramic tiles significantly enhanced movement and reduced fall risks. Door handles such as lever types and wide doorways also promoted ease of use. However, inconsistencies remain in the application of accessible finishes especially in sanitary areas, acoustic treatments, and tactile navigation aids. Roofing materials, often metal sheets, posed thermal discomfort due to poor insulation, while features like tactile wall finishes and acoustic ceiling panels were underutilized despite their known benefits. The Spearman correlation analysis demonstrated strong positive relationships between safety, usability, and comfort (ρ > 0.84), affirming that improvements in one aspect tend to enhance the others. This highlights the interdependence of inclusive design components in educational infrastructure. The study recommends the adoption of standardized guidelines that prioritize slip-resistant, tactile, thermally comfortable, and low-maintenance materials formulated for inclusive learning environments.***

I. INTRODUCTION

Health, safety, and well-being are essential to an individual's ability to live a productive and fulfilling life. For persons with disabilities, however, these fundamental aspects are often compromised by a range of physical, social, and environmental barriers that limit participation in everyday activities and hinder access to inclusive public services (Haruna, 2017). Disabilities may be physical, cognitive, sensory, emotional, or developmental in nature, and can either be congenital or acquired through illness, accidents, or the aging process (Badawy, Jawabrah, & Jarada, 2020). Regardless of their cause or nature, these impairments frequently prevent affected individuals from functioning on equal terms with others, negatively impacting their quality of life, social interactions, and capacity to contribute meaningfully to society. As Mohammed (2017) emphasizes, disability extends beyond physical

limitations, influencing personal well-being, social engagement, and equitable access to opportunities.

The built environment plays a critical role in either promoting or impeding the inclusion of individuals with disabilities. It directly influences their ability to navigate public spaces with safety, comfort, and dignity (Maingi-Lore, 2016). Accessibility, therefore, is not merely a design consideration but a basic human right, firmly established in international frameworks such as the United Nations Convention on the Rights of Persons with Disabilities (United Nations, 2021). This framework mandates that public spaces, including educational facilities, be designed and maintained in ways that adequately address the needs of persons with disabilities. Despite this, many educational facilities in Nigeria, particularly in the Southwest region, continue to fall short of meeting these essential standards. Consequently, persons with physical disabilities are routinely denied equitable access to quality education, mobility, and opportunities for social and intellectual participation, thereby perpetuating cycles of marginalization, inequality, and stigmatization (Oluwaseun, Damiana, & Chijioke, 2022).

Education is a vital driver of both personal development and national growth and must, therefore, be inclusive, providing equal opportunities for every member of society. In Southwest Nigeria, however, the physical environments of many educational institutions remain inaccessible to students with physical disabilities (Adegbola & Aina, 2023).Often overlooked fundamentally important aspect of creating accessible educational environments lies in the thoughtful selection and application of building material finishes. These include the various coverings and surface treatments applied to floors, walls, doors, and ceilings, which directly influence the usability, safety, and comfort of interior spaces. In schools designed for students with physical disabilities, appropriate material finishes can enhance mobility, safety, and the overall user experience.

However despite increasing awareness among built environment professionals and educators of the importance of inclusive school environments, most educational institutions in Southwest Nigeria remain physically inaccessible. While numerous studies have explored general accessibility features such as ramps, signage, and mobility aids (Haruna, 2017; Mohammed, 2017; Maingi-Lore, 2016; Ogunjini, 2019; O'Sullivan, 2015), limited attention has been directed toward the specific role of building material finishes in enhancing accessibility, safety, and usability for persons with physical disabilities.

In response to these gaps in knowledge and practice, this study seeks to critically evaluate how building material finishes can be optimized to improve accessibility, safety, and usability in special educational facilities for persons with physical disabilities in Southwest Nigeria. The research focuses on systematically assessing the adequacy of existing building material finishes in meeting accessibility requirements and examining their impact on the safety, comfort, and overall usability of educational environments.

Study Area

The research focuses on Southwest Nigeria, covering Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo states. These states have distinct cultural, environmental, and infrastructural characteristics that influence educational accessibility. Key town having the school such as Lagos, Ibadan, ikare-Akoko ,ido-Ekiti, and Osogbo will be analyzed, considering climatic factors, cultural practices, and societal attitudes toward disability and inclusive education.

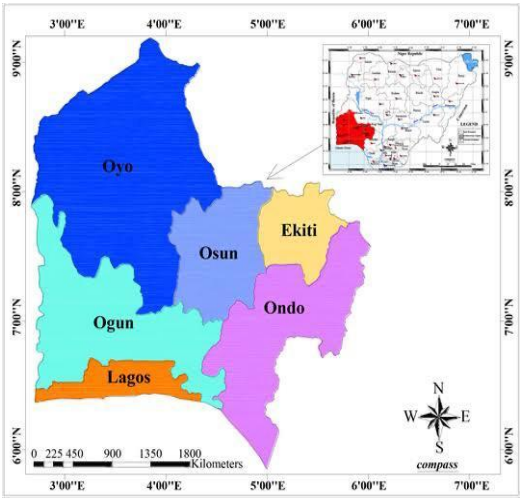

Figure 1: Map of South West, Nigeria

Source: United Nations cartograhic section (2024)

II. LITERATURE REVIEW

Creating accessible educational environments is fundamental to ensuring equitable learning opportunities for students with physical disabilities. Accessibility in schools transcends physical entry points to embrace usability, safety, and comfort through thoughtful material and spatial design. In Nigeria, the Discrimination Against Persons with Disabilities (Prohibition) Act (2018) and the Nigerian National Building Code (2006) both mandate accessibility provisions such as ramps, wide doorways, and barrier-free restrooms. However, the implementation of these standards remains inconsistent, particularly in rural and suburban areas like Osogbo (Oluwaseun, Damiana, & Chijioke, 2022). Accessibility challenges persist due to inadequate infrastructure, limited funding, poor policy enforcement, and minimal awareness of Universal Design (UD) principles, which promote creating environments usable by all people without the need for retrofitting (Maingi-Lore, 2016). Although considerable research highlights the importance of ramps, signage, and mobility aids, limited scholarly attention has been given to the role of building material finishes in enhancing accessibility within educational facilities for students with disabilities (Adams, 2018).

Material finishes play a critical role in determining the safety, comfort, and usability of educational spaces, especially for students with physical and sensory impairments. Essential factors include surface texture, which prevents slips and trips; color contrast, which aids visually impaired users in navigating spaces; and the selection of durable, hygienic, and low-maintenance materials suitable for high-traffic areas (Morris, 2019; Adams, 2018). For instance, non-slip vinyl, rubber floors, and tactile floor indicators improve navigation and safety for users of mobility aids like wheelchairs or crutches (Gülru, 2016). Matte and semi-matte wall finishes help reduce glare for visually impaired individuals, while color contrast between floors, walls, and fittings enhances wayfinding (Henderson & Smith, 2019). In addition, acoustic ceiling and wall materials improve speech intelligibility and auditory comfort for students with hearing impairments or sensory sensitivities (Shield & Dockrell, 2008). Together, these material choices contribute significantly to creating safer, more inclusive, and comfortable learning environments for students with special needs.

Universal Design principles further reinforce the importance of appropriate material finishes in accessible educational environments. Principles such as equitable use, perceptible information, and low physical effort advocate for material choices that meet the needs of diverse users without specialized adaptations (Steinfeld & Maisel, 2012). For example, lightweight doors with lever handles enhance ease of use for individuals with limited hand dexterity, while smooth, slip-resistant, and fatigue-reducing flooring benefits wheelchair users and those with mobility challenges (Ramirez, 2017). High-contrast color schemes and tactile wayfinding indicators assist students with visual impairments in navigating school facilities (Watson, 2020). Incorporating these material specifications at the design stage not only minimizes future retrofitting costs but also promotes independent, dignified, and safe access to educational environments (Preiser & Smith, 2011). International frameworks such as ISO 21542:2011 and the Americans with Disabilities Act (ADA) have established guidelines for these provisions, although their contextual adaptation and enforcement in Nigeria remain limited (United Nations, 2021).

Despite the proven benefits of inclusive material finishes, significant barriers hinder their adoption in Nigerian schools. The high cost of accessible materials like slip-resistant flooring and acoustic ceiling panels, combined with the requirement for skilled labor during installation, often discourages school administrators from implementing them (Adegbola & Aina, 2023). Additionally, regular maintenance demands, coupled with limited funding for special education infrastructure, result in material selections that compromise safety and comfort for students with disabilities (Oluwaseun, Damiana, & Chijioke, 2022). Many special schools continue to rely on conventional, non-inclusive materials due to budgetary constraints and a lack of awareness regarding their long-term safety and usability implications.

III. METHODOLOGY

The study adopted an explorative and descriptive research design using a quantitative approach supported by qualitative insights through case studies and direct observation. Primary data was collected via structured questionnaires administered to students in selected special schools for the physically impaired across Southwest Nigeria, while secondary data was obtained from journals, official reports, and institutional records. A multi-stage sampling technique was employed, beginning with the purposive selection of the Southwest zone for its high concentration of special schools. One physically challenged school was randomly selected from each states in Southwest Nigeria making a total of six with a total population of 664. 50% of population of these selected school were selected for question making a total of 332 respondents as the sample size. Data collection tools included questionnaires designed to gather information on types of building material finishes, their adequacy for accessibility, and their impact on safety, comfort, and usability for physically impaired students.

IV. DISCUSSION AND FINDINGS

An assessment was carried out to evaluate the adequacy and accessibility of building material finishes in educational facilities for persons with physical disabilities in Southwestern Nigeria. Data were obtained via structured questionnaires and direct field surveys, focusing on key architectural elements such as ramps, doors, flooring, wall finishes, sanitary facilities, and outdoor areas. The responses were analyzed using Mean Weighted Values (MWV) and Relative Importance Indices (RII) to determine the perceived performance and importance of each material in enhancing accessibility.

The findings revealed that features supporting circulation and mobility, such as outdoor flooring and ramps, were rated most critical by respondents, both achieving an RII of 0.87. Textured concrete and non-slip ceramic tiles were preferred for ramps and outdoor areas due to their durability and slip resistance. While some institutions had upgraded to anti-slip tiles in pathways and assembly zones, others continued using asphalt surfaces, which posed hazards during wet weather. Handrails, primarily made of stainless steel for durability, recorded a lower RII of 0.80, highlighting inconsistencies in design, placement, and overall provision, which undermines their intended accessibility support.

In terms of entry and interior finishes, door materials and handles also received high accessibility ratings (RII 0.87). Lever handles were widely preferred for their ease of use by individuals with limited grip strength, though round knobs persisted in a few facilities, limiting universal access. Classroom flooring materials, predominantly non-slip ceramic tiles, achieved an RII of 0.82, ensuring safety and ease of movement. Wall finishes, generally painted plaster, sometimes incorporated tactile markers and textured surfaces to support visually impaired users, with an RII of 0.83. However, the application of acoustic panels and tactile cues remained limited, indicating the need for wider adoption of sensory-enhancing finishes.

The assessment further identified notable deficiencies in the provision of accessible sanitary facilities. While some schools provided wide doorways, slip-resistant floors, and accessible sinks, many lacked essential features like grab bars, raised toilet seats, and adequate turning space for wheelchair users. Roofing materials, mainly aluminum and metal sheets, scored an RII of 0.81. Although affordable and easy to install, these materials offered poor heat insulation, affecting the comfort of users, with only a few schools adopting polycarbonate or concrete roofing for improved thermal conditions. Sensory accessibility features, such as tactile indicators and textured wall cues, were inconsistently available across institutions, limiting the navigational support essential for visually impaired learners. In summary, while significant progress has been made in certain areas, critical gaps persist in sanitary facilities, sensory accessibility provisions, and thermal comfort, warranting the implementation of standardized, enforceable accessibility guidelines to ensure inclusive learning environments for physically challenged students.

Table 1: Material Accessibility Ratings

S/N	Material/Feature	Very Accessible (5)	Accessible (4)	Neutral (3)	Somewhat Accessible (2)	Not Accessible (1)	Total Weighted Value (TWV)	Weighted Value (MWV)	Relative Importance Index (RII)	Rank
1	Outdoor flooring (playgrounds, sports)	120	100	70	25	6	1228	4.35	0.87	1st
2	Ramp materials	180	90	40	15	7	1442	4.34	0.87	2nd
3	Door materials and handles	160	120	30	15	7	1417	4.33	0.87	3rd
4	Wall finishes	140	120	50	15	7	1382	4.16	0.83	4th
5	Flooring materials in classrooms	150	100	50	20	12	1354	4.08	0.82	5th
6	Roofing Materials	100	150	50	20	12	1340	4.03	0.81	6th
7	Handrails and grab bars	180	110	25	10	7	3445	4.01	0.80	7th

4.1 Evaluating the Impact of Building Material Finishes on Safety, Usability, and Comfort

To evaluate the impact of various building material finishes on the safety, usability, and comfort of physically challenged individuals in educational environments in Southwestern Nigeria, data were analyzed using descriptive statistics, Relative Importance Index (RII), Mean Weighted Values (MWV), and Spearman's Rank Correlation Coefficient.

4.1.1 Flooring Materials

The analysis revealed that slip-resistant ramps and rubber flooring consistently received the highest ratings for safety, usability, and comfort. In terms of safety, rubber flooring offers excellent traction and minimizes fall risks, though it is costly and less readily available. Non-slip tiles were also rated highly for safety but were considered slippery when wet, while untreated concrete was ranked as unsafe due to its hardness and poor traction. For usability, rubber flooring was favored for its comfort and ease of use, especially for individuals using mobility aids, while non-slip tiles were appreciated for low maintenance. Concrete, however, was seen as challenging due to its hardness and need for additional surface treatments.

Regarding comfort, rubber flooring was again preferred for its soft, shock-absorbing surface, which reduces fatigue and physical strain. Conversely, hard surfaces like concrete and tiles were considered less comfortable for prolonged use.

4.1.2 Wall Finishes and Tactile Features

Tactile wall markers and high-contrast finishes were highly valued for enhancing safety and aiding navigation for visually impaired users. However, they require consistent maintenance to remain effective. Acoustic wall panels were underutilized but praised where available for improving auditory conditions, thereby enhancing comfort. In terms of usability,

smooth painted walls were prevalent but lacked tactile aids necessary for independent navigation by the visually impaired. Textured surfaces could improve navigation if appropriately applied without being overly abrasive.

Summary: The integration of tactile features and acoustic treatments offers significant safety and comfort benefits but remains limited in most surveyed educational settings.

4.1.3 Ramps and Staircases

Slip-resistant ramps and high-contrast stair edges were essential in preventing accidents and improving usability. Handrails, particularly stainless steel or aluminum, were vital for mobility support. Comfort-wise, gently sloped ramps reduced physical effort for wheelchair users and individuals with mobility impairments.

4.1.4 Ceiling Finishes

Acoustic ceiling panels significantly improved safety by reducing background noise, aiding students with hearing difficulties, and improving speech clarity. Fire-resistant ceilings added to overall safety. Usability was enhanced through better ventilation and lighting, while comfort improved due to acoustic and thermal insulation.

4.1.5 Door Finishes

Automatic doors and lever handles were recognized as safer and more usable for persons with limited hand strength or dexterity. However, their availability was inconsistent due to high installation costs and unreliable electricity supply in many schools. Wide, lightweight doors offered enhanced accessibility and reduced physical strain, contributing to overall comfort. Notably, while automatic doors represent best practice, financial and infrastructural constraints currently limit their deployment in most educational settings in Southwestern Nigeria.

4.1.6 Window Finishes

Shatter-resistant glass and well-positioned, adjustable handles improved safety and usability. Comfort was enhanced through better ventilation and natural lighting, contributing to healthier, more comfortable classroom environments.

Summary: Safety-oriented window finishes are highly effective but not widely implemented, often due to cost.

4.1.7 Outdoor Materials

Slip-resistant outdoor surfaces and rubberized play areas scored highest for safety and comfort, significantly reducing injury risks. Tactile paving facilitated navigation for the visually impaired but was inconsistently installed across institutions. Conventional smooth pavers were criticized for becoming hazardous when wet.

4.1.8 Combined RII Scores

When combining the RII scores for safety, usability, and comfort, slip-resistant ramps, rubber flooring, and rubberized outdoor flooring achieved the highest combined averages (0.88–0.90). These materials consistently provided superior performance in creating accessible, safe, and inclusive learning spaces. In contrast, concrete flooring, pavers, and uninsulated metal ceilings performed poorly, reaffirming the need for their replacement or enhancement.

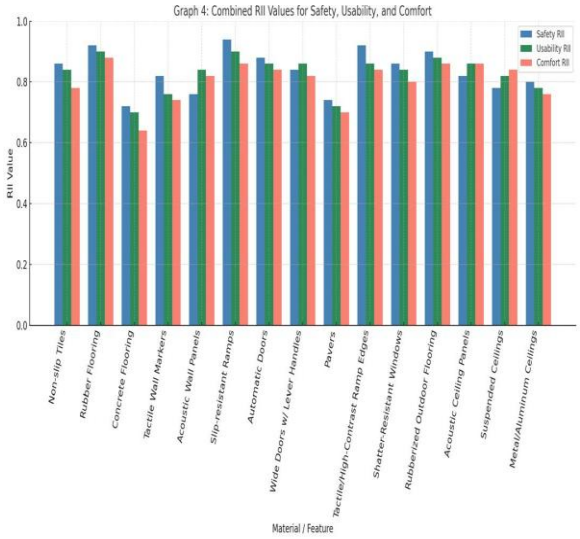

Figure 1: Underscores a clear trend showing materials values for safety, usability and comfort

Source: Author's Compilation, 2025

4.2 Spearman Correlation Matrix for Safety, Usability, and Comfort

The analysis of the Spearman Correlation Matrix reveals very strong, statistically significant positive

relationships between safety, usability, and comfort in the selection of building material finishes for inclusive educational environments. The strongest correlation exists between safety and usability ($\rho = 0.912$), indicating that materials prioritized for safety such as slip-resistant ramps and rubber flooring also enhance ease of use for physically challenged individuals. A similarly strong correlation between usability and comfort ($\rho = 0.872$) suggests that features facilitating easier access and operation, like wide doors with lever handles and automatic doors, also improve physical and sensory comfort within learning spaces. The correlation between safety and comfort ($\rho = 0.848$), though slightly lower, remains significant, affirming that safer environments typically offer greater physical and psychological comfort, as demonstrated by materials like rubberized outdoor flooring that both reduce fall risks and soften walking surfaces. These findings emphasize the high interdependence between safety, usability, and comfort in inclusive design, confirming that interventions improving one aspect will likely enhance the others. The matrix underscores the importance of integrated material selection strategies in creating universally accessible educational spaces.

Table 6: Spearman Correlation Matrix for Safety, Usability, and Comfort

	Safety MWV	Usability MWV	Comfort MWV
Safety MWV	1.000	0.912	0.848
Usability MWV	0.912	1.000	0.872
Usability MWV	0.848	0.872	1.000

All correlations significant at $p < 0.05$

Safety and Usability ($\rho = 0.912$)

Note: All correlations are statistically significant at $p < 0.05$, indicating strong positive relationships between the parameters.

The Spearman Correlation Matrix analysis illustrates that enhancing one dimension of accessibility (e.g., safety) often positively influences the others (usability and comfort). This reinforces the principle that integrated, inclusive design strategies not only improve safety but simultaneously elevate ease of use and overall user comfort in educational facilities.

CONCLUSION AND RECOMMENDATIONS

This study examined the impact of building material finishes on accessibility, safety, and usability in special educational facilities for physically challenged students in Southwest Nigeria. The findings highlight that thoughtful material choices such as slip-resistant ramps, rubber flooring, lever handles, and tactile wall surfaces significantly enhance mobility, reduce injury risks, and promote comfort and independence. These materials support easier navigation and interaction within learning spaces, especially for students using mobility aids or with visual impairments. However, the study also identified several critical gaps. Many schools still use unsuitable finishes, including untreated concrete, smooth asphalt, and poorly insulated metal roofing, which negatively affect safety and thermal comfort. Accessible sanitary facilities are often inadequate, lacking essential features like grab bars, wide turning spaces, and raised toilet seats. Additionally, sensory-friendly elements such as acoustic panels and tactile cues are inconsistently applied or entirely absent, limiting inclusive participation for students with sensory impairments.

Based on these findings, the study recommends the establishment and enforcement of standardized design guidelines for material finishes in special schools. These guidelines should prioritize non-slip, tactile, and thermally comfortable materials that cater specifically to the needs of physically challenged students. Schools should focus on installing rubberized surfaces, wide accessible doors with lever handles, tactile indicators, and safe, user-friendly sanitary fixtures. Investment in acoustic ceiling panels and shatter-resistant windows will also improve sensory comfort and learning outcomes. Furthermore, capacity building is essential educators, school managers, and construction professionals must be trained on inclusive design principles and the functional roles of material finishes. Lastly, government bodies and development partners should allocate targeted funding to support upgrades in under-resourced schools. Addressing these material deficiencies is a critical step toward achieving safe,

accessible, and inclusive learning environments that uphold the rights and dignity of all students.

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