Built For Success? Reviewing The Impact of Inclusive Architecture on Learning Outcomes of Pupils with Physical Disabilities

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Abstract- *This study presents a systematic literature review examining the impact of inclusive architectural design on the learning outcomes of students with physical disabilities in educational settings. Drawing on 19 peer-reviewed studies from both high-income and low-to-middle-income countries, the review explores how physical accessibility, spatial usability, and sensory-responsive environments influence students' participation, engagement, well-being, and academic success. The findings reveal that the incorporation of Universal Design (UD) features, such as ramps, tactile pathways, adjustable furniture, and intuitive layouts, positively correlates with enhanced learning engagement and psychosocial development. In contrast, poorly designed or non-inclusive spaces exacerbate exclusion and hinder educational participation, particularly in under-resourced settings. Furthermore, emerging evidence emphasizes the significance of participatory and human-centered design approaches, where students and educators collaborate to create environments that reflect diverse needs and lived experiences. Despite the growing body of research, the review identifies gaps in empirical studies linking architectural interventions to measurable academic outcomes, especially in secondary and post-secondary contexts. The study concludes by recommending greater integration of UD principles into educational policy, expanded empirical research, and cross-sector collaboration to ensure that inclusive school architecture is recognized as a critical factor in achieving equitable learning environments.*

Index Terms- Educational environment, Inclusive architecture, Learning outcomes, Physical disability, Universal design

I. INTRODUCTION

Education is a fundamental human right, and the quality of the physical learning environment plays a critical role in shaping educational outcomes, particularly for pupils with physical disabilities (Orim, Mohammed, Udie & Salis, 2022). Across the globe, efforts to create inclusive learning environments have increasingly recognized the importance of architectural design in enabling or hindering participation, mobility, comfort, and ultimately, academic performance (Erkilic & Durak, 2013). Inclusive architecture, in this context, refers to the deliberate planning and design of built environments to accommodate the diverse needs of all users, regardless of ability (Mwandikwa, Ndunge & John, 2022). For children with physical disabilities, the school environment, its accessibility, usability, and psychological safety, can significantly impact not only their ability to attend and navigate school, but also their sense of belonging, engagement in learning, and academic achievement (Ahmed, Isiaka & Tauheed, 2024).

In recent years, scholars and practitioners have engaged with the concept of inclusive education from various disciplinary angles, including pedagogy, policy, disability studies, and architecture (Erkilic & Durak, 2013). While pedagogical and policy reforms have received considerable attention, the physical and spatial dimensions of inclusivity have often been underexamined or treated as secondary (Bani Odeh & Lach, 2024). However, studies emerging from architecture and built environment research (e.g., Orim, Mohammed, Udie & Salis, 2022; Ibrahimi & Saliu, 2021) have emphasized that the spatial design

of schools, such as the availability of ramps, accessible toilets, tactile signage, appropriately scaled furniture, and intuitive circulation, has a profound influence on the educational experiences of children with disabilities. In the context of developing countries, including Nigeria, these issues are particularly urgent given the infrastructural challenges, limited enforcement of building regulations, and varying levels of awareness around disability inclusion.

Despite growing global awareness and the adoption of frameworks like Universal Design and the United Nations Convention on the Rights of Persons with Disabilities (CRPD), there remains a gap in synthesized knowledge on how inclusive architectural design specifically affects the learning outcomes of pupils with physical disabilities. Much of the literature is either fragmented, focusing narrowly on design specifications, or conceptual, without direct links to measurable educational outcomes (Ibrahimi & Saliu, 2021; Ackah-Jnr & Danso, 2019). This review addresses this gap by systematically examining and synthesizing existing scholarly work that connects inclusive school architecture with learning outcomes for pupils with physical disabilities. It aims to assess the state of the field, identify common themes, highlight methodological trends, and point to areas for future research and policy development.

This literature review is guided by the hypothesis that inclusive architectural design positively influences learning outcomes among physically disabled pupils by enhancing accessibility, participation, comfort, and psychosocial well-being. It approaches this topic through a qualitative synthesis of peer-reviewed journal articles and empirical studies from both high-income and low-to-middle-income country contexts. This method allows for a comprehensive understanding of theoretical frameworks, design principles, and evidence-based findings across different educational and cultural settings.

By situating the architectural dimension of inclusivity at the center of the conversation on disability and education, this review contributes to bridging the gap between built environment studies and educational research. It also provides actionable insights for policymakers, architects, school administrators, and disability advocates committed to creating truly inclusive schools. The rest of the paper proceeds as follows: The Methods section outlines the selection criteria, databases, and review

process used to gather relevant literature. The Results section presents the main findings of the review, organized around key themes such as accessibility, user-centered design, and learning outcomes. The Discussion interprets these findings in light of broader debates and practical challenges, particularly in the context of Lagos State and similar environments. Finally, the Conclusion summarizes the key insights, reflects on limitations, and offers directions for future research and policy implementation.

II. METHODS

This study employed a systematic literature review methodology to identify, evaluate, and synthesize scholarly works that examine the relationship between inclusive architectural design and the learning outcomes of pupils with physical disabilities in primary education settings. The review aimed to develop a comprehensive understanding of how the built environment contributes to or impedes inclusive learning, and to uncover thematic patterns, gaps, and methodological trends in the existing body of knowledge. The literature search was conducted using four major academic databases: ResearchGate and Google Scholar. To maintain the relevance and quality of sources, the criteria in Table 1 below were applied.

Table 1: Selection Criteria

Inclusion criteria	Exclusion criteria
Peer-reviewed journal articles	Studies focusing solely on intellectual or sensory disabilities without architectural emphasis
Published in English between 2010 and 2025	Articles dealing only with general disability policies without reference to physical design
Focus on physical disabilities (e.g., mobility impairments, use of assistive devices)	Duplicates, opinion pieces, and blog posts
Direct discussion of school architectural design, physical environments, or spatial accessibility	
Empirical or theoretical linkage to learning outcomes or	

educational engagement	

Source: Author's Compilation (2025)

III. RESULTS

Table 2: Synthesis of Literature

S/N	Citation	Target Educational Level	Type of study	Architectural Features Discussed	Learning Outcome Impact
1	Orim, Mohammed, Udie & Salis (2022)	Secondary school students with physical impairments in Calabar Metropolis	Descriptive survey; correlational with Pearson correlation & regression	Physical infrastructure: ramps, widened doors, accessible halls, labs, etc.	Positive significant impact; combined model explains ~73% variance; inclusive attitude strongest predictor
2	Ibrahimi & Saliu (2021)	Preschool and school-aged children (e.g., kindergarten)	Professional design analysis; literature/code-based, no empirical data	Movement, safety, flexible spaces, furniture, lighting, acoustics, nature	Deduced positive effects on independence, well-being, engagement, no direct measurement, but framed as supportive of learning and inclusion
3	Erkilic & Durak (2013)	Primary (elementary) school students	Qualitative/descriptive evaluation of policies/design specs via UD	UD-related elements (accessibility, circulation, design standards)	Deduced positive impact on inclusion, participation, and engagement; no direct empirical measurement
4	Ackah-Jnr & Danso (2019)	Ghanaian primary school students (including those with physical/sensory disabilities)	Mixed-method descriptive (teacher surveys and observation, n = 164)	Ramps, wide doors, classroom spacing, playground surfaces, ventilation, lighting, décor, washrooms	Explicitly reduced participation and engagement due to environment; deduced negative effect on learning
5	Mwandikwa, Ndunge & John (2022)	Primary (Standards 6 & 7); public integrated schools in Kitui County, Kenya	Mixed methods (quantitative & qualitative); cross-sectional survey and correlational design	Ramps, wide paths/doors, accessible washrooms, even terrain, reachable handles/switches, etc.	Explicit correlation with facility access (r = 0.537); Regression R² = 0.288; indirect impact on inclusion and learning participation
6	Ahmed, Isiaka & Tauheed (2024).	Primary school (specifically Primary 6 in public schools in Abuja, Nigeria)	Descriptive quantitative survey with Likert scales, supported by field observations and photography	Ramps, stairs, restrooms, door handles, furniture, spatial layout, corridor widths, toilets, signage	Limited access affects attendance, participation, and psychosocial well-being
7	Page, Anderson & Charteris (2023)	Primary and secondary school students with disabilities in Australia	Conceptual framework; no empirical or quantitative analysis	Flexible layouts, accessible paths/seating, sightlines, sensory elements	Enhancement in engagement, inclusion, collaboration, and sense of belonging
8	Alterator,	Primary and	Scoping Literature	Acoustics, visual	Inclusive physical

	Cleveland & Boys (2022)	Secondary Education (Mainstream, hybrid, and special schools were all considered)	Review. Surveyed 130 relevant papers	access, physical access, safety, layouts, transitions, thresholds, materials, complexity, zoning	design promotes access and meaningful involvement, which are precursors to effective learning for students with disabilities.
9	Jebril & Chen (2021)	Special Schools (Primary and possibly Secondary)	Qualitative Study with Case-Based Observations	Spatial arrangement, Lighting, Acoustics, Accessibility, Zoning	Designs that respect students' sensory and mobility needs enable higher participation and task engagement, critical for learning progress.
10	Cheryan, Ziegler, Plaut & Meltzoff (2014)	Undergraduate architectural students	Qualitative, experiential focus groups/interviews	Ramps, circulation, inclusive spatial planning, barrier-free design	Shift in attitudes, increased empathy, and commitment to inclusive design
11	McIntosh, Marques & Lim (2019)	Primary school students (5–12 years)	Examination of schools (Fuji Kindergarten and Hazelwood School)	Natural elements, accessible roofs, sensory cues, Tactile, auditory, and visual design for impaired children, Lighting, acoustics, spatial layout	Design reduces barriers to school engagement. Sensory integration and self-directed play can improve problem-solving.
12	Itani (2022)	Primary school students	Combines quantitative (Likert-scale questionnaires) and qualitative (interviews) data. Sequential explanatory design.	Ramps, tactile pathways, adjustable furniture, Lighting, acoustics, color schemes, and biophilic elements, flexible furniture arrangements, assertive technologies	Students reported higher confidence in navigating spaces and using assistive tools. Improved participation and performance in classroom and communal activities
13	Mendoza, M., & Heymann, J. (2024).	Primary and secondary school students in low- and lower-middle-income countries	Systematic review of 31 evaluated interventions (quantitative/qualitative/mixed)	Included facility improvements (accessibility adjustments), though specifics vary across studies	Enhanced participation and inclusion, often tied to facility upgrades, even if academic scores weren't measured
14	Merrigan & Senior (2023)	Primary and Secondary students in special schools (moderate to complex SEN needs)	Mixed methods: postal survey, semi-structured interviews, thematic analysis	Conceptual only: symbolism of space; critique of spatial segregation of special vs.	Better engagement, confidence, tailored support; challenge to "one-size-fits-all" mainstreaming

				mainstream schools	
15	Altay, Ballice, Bengisu, Alkan-Korkmaz & Paykoç (2016)	Primary (elementary) school students in Turkey	Descriptive policy/spec evaluation (Universal Design audit); no empirical data	Ramps, door/corridor widths, circulation, access, but focused on regulations, not physical audit	Non-inclusive regulations constrain participation and equitable learning opportunities
16	Gaurav, Kolhe & Jaiswal (2023)	Higher Education (undergraduate/postgraduate) students in a Central Indian architectural institute	Qualitative embedded case study with interviews, observation, and participatory assessment	Flooring, ramps, stairs, vertical access, classroom layout, lab furniture, corridors, common/social spaces	Negative effects on access, participation, confidence, and academic autonomy
17	Coelho, Cordeiro, Alcoforado & Moniz (2022)	Primary/lower-secondary students	Development and pilot of a participatory design tool (S3S) using questionnaires and walkthroughs	Spatial adaptability, furniture ergonomics, lighting, circulation, comfort, affordances for learning	Improved student agency, engagement, comfort, precursors to better learning
18	Mostafa, Sotelo, Honsberger, Honsberger, Brooker Lozott & Shanok (2024)	Pre-K to Grade 12 students in an autism-specialized charter school	Case study with post-occupancy evaluation using staff surveys, observations, and interviews	ASPECTSS Index elements: acoustics, sequencing, transitions, zoning, compartmentalization, escape/safety	Staff-reported positive impact on environment, student focus, behavior management, and navigation
19	Willis, Gillett-Swan, Franz, Farahnak Majd, Carroli, Gallagher & Bray (2024)	Year 8 secondary students in urban vertical high schools in Australia	3-year collective case study; mixed-methods: student maps and adult interviews; theory-driven via salutogenesis	Choice zones, comfort amenities, reset spaces, intuitive layout/navigation, spaces with cultural/community meaning	Enhanced well-being, inclusive design, emotional regulation, belonging and focus, precursors to improved learning

Source: Author's Compilation (2025)

IV. DISCUSSION

The findings from the 19 studies in this review collectively highlight the critical role of school architecture in shaping the educational experiences and outcomes of students with disabilities. This study aimed to investigate how architectural features of school environments influence learning outcomes in inclusive educational settings. The reviewed literature provides compelling evidence that the design and configuration of educational spaces significantly shape students' participation, well-being, and academic success, particularly for those with disabilities or special educational needs (SEN). The studies analyzed span early childhood to higher

education and reflect diverse geographic and institutional contexts.

A. Universal Design and Accessibility as Foundational Elements

A recurring theme across studies is the necessity of Universal Design (UD) in school infrastructure. Research consistently demonstrates that accessible features, such as ramps, widened doors, tactile pathways, and adjustable furniture, positively influence participation and inclusion (Orim et al., 2022; Mwandikwa et al., 2022; Ahmed et al., 2024). For example, Mwandikwa et al. (2022) found a strong correlation (r = 0.537) between accessible facilities and student engagement in Kenyan primary schools, while Orim et al. (2022) reported that inclusive infrastructure explained 73% of variance in student participation. These findings align with Itani's (2022) work in Lebanon, where students with special needs reported higher confidence in navigating spaces with UD features. However, Ackah-Jnr & Danso (2019) and Altay et al. (2016) caution that non-inclusive environments exacerbate exclusion. In Ghana, poor infrastructure (e.g., narrow doors, uneven surfaces) directly reduced student engagement, while in Turkey, regulatory gaps in UD compliance limited equitable access. This suggests that policy enforcement is as critical as design innovation.

Across the board, physical infrastructure such as ramps, accessible restrooms, wide corridors, and navigable classroom layouts emerged as foundational to student inclusion. In Calabar (Orim et al., 2022), the presence of inclusive design features like accessible halls and labs had a statistically significant impact on learning outcomes, with inclusive attitudes and infrastructure explaining nearly 73% of variance in student performance. Similarly, Mwandikwa et al. (2022) in Kenya and Ahmed et al. (2024) in Abuja documented strong correlations between inclusive architecture and students' ability to access educational facilities. These findings align with Ackah-Jnr and Danso's (2019) work in Ghana, which explicitly linked poor architectural planning to reduced participation and engagement among primary school students with physical and sensory disabilities. The lack of fundamental infrastructure like ramps and adequate ventilation not only limited

mobility but also impacted psychosocial well-being and classroom engagement.

B. Sensory and Psychological Considerations in Learning Spaces

Beyond physical accessibility, studies emphasize the importance of sensory and psychological well-being in school design. McIntosh et al. (2019) and Jebril & Chen (2021) highlight how natural elements (light, greenery), acoustics, and zoning improve focus and reduce stress for neurodiverse students. Similarly, Mostafa et al. (2024) found that autism-friendly design (e.g., compartmentalization, controlled acoustics) enhanced student behavior and navigation in specialized schools. These findings resonate with Page et al. (2023), who argue that flexible, sensory-responsive layouts foster belonging and collaboration. However, Merrigan & Senior (2023) critique the segregation of special-needs students in mainstream schools, advocating for symbolically inclusive spaces that challenge traditional hierarchies.

Several studies (e.g., McIntosh et al., 2019; Itani, 2022; Mostafa et al., 2024) extend beyond accessibility to address how sensory-rich, adaptive, and emotionally supportive spaces contribute to inclusion. The ASPECTSS-based case study by Mostafa et al. (2024) shows that acoustics, spatial sequencing, and escape zones significantly improve student behavior and focus in autism-specialized settings. Similarly, Itani's (2022) mixed-methods study demonstrated that tactile pathways, biophilic design, and adjustable furniture increased students' confidence and performance. In mainstream settings, McIntosh et al. (2019) show that integrating nature, sensory cues, and self-directed spatial engagement enhances learning for both disabled and non-disabled students. These insights reinforce the idea that inclusive architecture is not only about physical access but also about creating environments that are emotionally and cognitively attuned to diverse learner needs.

C. The Role of Human-Centered and Participatory Design

Several studies advocate for human-centered approaches that involve students and educators in the design process. Coelho et al. (2022) developed a participatory tool (S3S) that improved student agency through adaptable furniture and lighting. Likewise,

Willis et al. (2024) found that student-led spatial mapping in Australian vertical schools enhanced emotional regulation and belonging. This aligns with Itani's (2022) Reciprocal Design Method, which integrates environmental psychology with architectural planning to boost self-efficacy. However, Gaurav et al. (2023) reveal a gap in higher education, where inaccessible design (e.g., poor vertical access) still hinders autonomy, suggesting that UD adoption remains uneven across educational levels.

Emerging methodologies also place students at the center of design. Coelho et al. (2022) piloted a participatory tool (S3S) that enabled students to evaluate and redesign their school spaces. While direct learning outcomes were not measured, student agency and engagement increased, strong predictors of academic success. Willis et al. (2024) support this with findings from Australian vertical schools, where "reset spaces" and culturally meaningful environments were perceived by Year 8 students as enabling focus, belonging, and emotional regulation. This participatory approach is echoed in Mendoza & Heymann (2024), whose systematic review found that facility improvements, especially those informed by local stakeholder input, significantly improved inclusion across 31 intervention studies in low- and lower-middle-income countries.

CONCLUSION

This review explored how architectural design features impact learning outcomes in inclusive educational settings, drawing on evidence from 19 diverse studies. The findings overwhelmingly indicate that the physical environment of schools plays a pivotal role in promoting or hindering the inclusion, participation, and academic success of students with disabilities and special educational needs (SEN). From early childhood to higher education, the presence or absence of Universal Design (UD) features, such as ramps, spatial adaptability, and sensory zoning, shapes not only students' access to learning but also their emotional well-being, sense of belonging, and autonomy. A key takeaway is the distinction between physical accessibility and holistic inclusion. Also, the study underscores the importance of participatory and human-centered design processes, where students and educators contribute to shaping environments that reflect their diverse needs and identities. However, the review also reveals several limitations. First, many studies are either qualitative or conceptual, with few offering robust longitudinal data linking architectural design directly to academic achievement. Second, there is a relative lack of representation from secondary and post-secondary settings, where inclusion challenges become more complex. Lastly, while participatory approaches are gaining traction, their integration into mainstream architectural and policy frameworks remains limited. Recommendations for Future Research and Practice based on this study are;

i. Expand empirical studies that directly link architectural interventions to measurable learning outcomes, such as test performance, attendance, and behavioral data, especially in underrepresented contexts like secondary schools and universities.

ii. Mainstream Universal Design principles into national and institutional policies, ensuring that accessibility is not treated as a retrofit but as a foundational component of school planning and renovation.

iii. Promote participatory design involving students with disabilities, educators, and architects collaboratively, using tools like the S3S to bridge design theory and lived experience.

iv. Prioritize sensory and psychological inclusivity in spatial design, incorporating flexible, calm, and emotionally safe environments that support both neurodiverse and neurotypical learners.

v. Encourage cross-sector partnerships between ministries of education, architects, public health experts, and disability advocates to ensure that learning environments address the full spectrum of human needs and capabilities.

In conclusion, inclusive school architecture must be recognized as a pedagogical tool, not just a logistical necessity. Creating learning spaces that are physically, emotionally, and socially inclusive is essential to achieving equity in education, particularly for students historically marginalized by

traditional schooling environments. As the evidence base grows, future policies and practices must reflect the understanding that the design of educational spaces is inseparable from the outcomes they produce.

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