

Designing for All: The Role of Universal Design in School Architecture

Prashant Tomar¹, Ar. Thoudam Sudha Devi²

¹Undergraduate Student, Amity University Chhattisgarh

²Assistant professor, Amity University Chhattisgarh

Abstract— Universal Design (UD) in educational buildings is centered on the creation of learning spaces that are accessible, operable, and inclusive for all students, irrespective of physical, sensory, or cognitive impairments. The aim of this study is to investigate the means that the theory and practice of UD can be brought into harmony with school design being the means of equity, independence, and participation. Instead of segregating accessibility as an extra character, UD immerses inclusivity in the very beginning of the planning phase, which is providing different students' needs through careful space strategies. The document presents various design standards and theoretical frameworks for the introduction of architectural solutions that not only comply but also to work for the creation of flexible, power-giving school environments that back up all learners equally.

Key Words— Universal Design, Sensory Design, Design Standards, Cognitive Accessibility, Disabilities.

I. INTRODUCTION

Universal Design (UD) in education is a new dynamic way to create an inclusive environment in school which ensures that school spaces are accessible and usable by all students, despite their disability, without discrimination on physical, sensory, or cognitive abilities. Unlike accommodation as accessory or secondary, UD is the very heart and interpreter of space planning and architectural design. This is very important for the educational system, because a building setting is a direct influencer on how a child can succeed in learning, how the child can interact and be the part of the society and school, and the degree to which he will develop both socially and academically. UD-designed inclusive schools are characterized by the absence of barriers, and the provision of tactual and auditory cues, and are flexibly designed to match diverse needs. These various settings serve ubiquitously from physically challenged, blind and deaf, and neurodiverse children by allowing each of

them to participate on equal ground. The major objective is not just to meet the legal universal access standards but also to establish such a milieu that would make it possible for all students to function with dignity and without assistance, regardless of their abilities.

This study aims to analyse how the Universal Design guidelines can be implemented in the architectural design of schools. The main goal is to show the right choice of the local, technological, and functional material to build learning environments in which human rights are fully observed, the participation of all, and the sense of belonging of each learner is supported.



Figure 1 Universal design. Source- https://www.kimbodesign.ca/assets/media/shutterstock_348308231.jpg (Retrieved on- 22/04/2025)

II. LITERATURE STUDY

A. UNIVERSAL DESIGN FOR LEARNING IN SCHOOLS

Universal Design for Learning (UDL) is a framework that provides instructional practice with the aim of creating flexible and adaptable educational environments for all student needs. UDL encourages

the use of many methods of content delivery, student engagement, and assessment instead of the one-size-fits-all approach. Why use a wheelchair where there is a ramp available? – In the same way, UDL refers to designing spaces, which do not require any additional adjustments, and which are perfectly suited for participation. Thus, classrooms should be fully equipped with adjustable furniture, flexible layouts, and clear navigation that would allow children with mobility, vision, or hearing difficulties to participate freely. By incorporating these design features in the outset, UDL guarantees that all students will have the same opportunities to learn and be involved (Priyadharsini & Mary, 2024).

B. INCLUSIVE SCHOOL DESIGN FOR VISUALLY IMPAIRED STUDENTS

Visually impaired children feel a building through their memory, sounds, and the sense of touch. They need to be able to use their other senses to the fullest like the sense of touch. The design of the hallway must be straightforward enough. That should help in wandering around the premises without a helper or peers' assistance. Not only do these things aid them in feeling familiar with their surroundings, but they also help them to be not overly reliant on others. They are thus able to perform other activities on their own without being dependent on anyone (Oteifa, Dewidar, & Mansour, 2023).



Figure 2 Visually impaired students smart learning through ANNIE device. Source- Author

C. UNIVERSAL DESIGN IMPLEMENTATION CHALLENGES

Despite having accessibility standards in place, many schools struggle to fully implement universal design principles. Common design flaws include steep ramps, absence of handrails, slippery floors, and the lack of visual or tactile indicators. These limitations create partial accessibility and restrict the movement of

children with disabilities. For true inclusion, the entire school must be designed as a barrier-free space—from entrances and classrooms to toilets and play areas. Periodic assessment of school infrastructure is necessary to identify such gaps and ensure that inclusivity is not just on paper, but present in the actual built environment (Denizou, 2022).



Figure 3 Standard ramp for handicapped people. Source- Author

D. DESIGN BARRIERS FOR HEARING-IMPAIRED STUDENTS

People with auditory impairment are generally more dependent on lip-reading, visual cues, and facial expressions. If the acoustics are bad, or their visibility is restrained, and the visual alarms do not function properly, the learning process may not be smooth. The use of certain architectural techniques such as open spaces, circular seating, acoustic paneling, and light-based alarms increases communication clarity, and hence, the communication barrier is removed. As the working classroom design ensures that the room is visible and allows for effective communication, the teacher and classmates are the key factors contributing to a classroom's successful design. Furthermore, these characteristics not only cater to people with hearing problems but are also quite beneficial to the general students as they promote clarity and communication in the classroom (Hashimoto, Nomura, Yatogi, & Saitoh, 2006).



Figure 4 Learning system for hearing impaired peoples.

Source- Author

E. EVALUATION OF INCLUSIVE SCHOOL ENVIRONMENTS

Designing of the schools with inclusive character should consider not only the exterior features but also receive a live response from users so that the material could be checked to remain fitting and open. Disabled youth can frequently be faced with problems that come up as a surprise to designers, such as a lack of zones to rest, unclear corridors, or non-readable label signs. Acquiring knowledge from them in person can help in creating more insightful spatial plans in the coming times. For instance, users' comments received during a walk-through or an interview can help to display such issues that exist in the design subtly and make learning that is inclusive more practical for the students (Alterator, Cleveland, & Boys, 2022).



Figure 5 Walking junction for visually impaired students.

Source- Author

III. CASE STUDY

1. AL-OROUBA SCHOOLS COMPLEX (Gerges, Ahmed, & Mirghani, 2021).



Figure 6 AL-OROUBA INTERNATIONAL COMPANY
Source- https://alorubaschools.com/_nuxt/img/00b0fb7.jpg
(Retrieved on - 22/04/2025)

1.1 Introduction

The Al-Orouba Schools Complex in Aswan City, Egypt is the key example of an institutional endeavor to apply the principles of the Universal Design in the renovation of school infrastructure. The reason for choosing this case is the implementation of Egypt's national campaign, initiated by the announcement of 2018 as the "Year of Disabled Persons," which, in turn,

led to the revision of the policy that now suggests the implementation of inclusive public spaces, especially educational ones. The school, besides conventional students, also has children with physical, sensory, and psychological disorders. This study sets the cornerstone of the current performance of an official school regarding the parameters of Universal Design.

1.2 Findings

- Limited vertical access in the building made the classrooms situated in the upper floors of the building impassable for students with mobility disabilities, especially those without walking capability or difficulty in walking.
- Narrow hallways and entrances as well as small doors provided a physical barrier to the independent movement of wheelchair users, thus the circulation of the building was not sufficient for people with disabilities of this type.
- Tactile and visual aids were not available; thus, visually impaired students could not locate places without a guide dog. In the same way, the building was not equipped with tactile flooring and wayfinding in Braille or contrast memories, which visually challenged students did not find walking easy.
- The restrooms had no grab bars for people in wheelchairs or turning space, the floor was wet, and the rooms were very hazardous.
- The classrooms had an easy way that did not provide any acoustic treatment and there were no visible alarms or silent zones. Therefore, students with hearing problems and neurodiverse children had no other option than to stand the noise.

2. SAKSHAM RESIDENTIAL SCHOOLS.



Figure 7 Saksham Residential School Boys. Source- Author

2.1 Introduction

The Saksham Residential Schools, Saksham-1 and Saksham-2 are the primary educational institutions in Jawanga, Geedam block of Dantewada district, Chhattisgarh. The schools were opened as a Corporate Social Responsibility (CSR) initiative of the National Mineral Development Corporation (NMDC) and Chhattisgarh state government and are meant for those, children, who are not being educated due to their physical or mental disabilities. The schools cater to the deprived area that is confronted by socio-political issues, and hence the schools desire to be the source of establishing a culture that caters to the needs of the disabled, emphasizes the education, and integrates the community.



Figure 8 Ramp and Garden area With UDL Guideline flooring. Source- Author

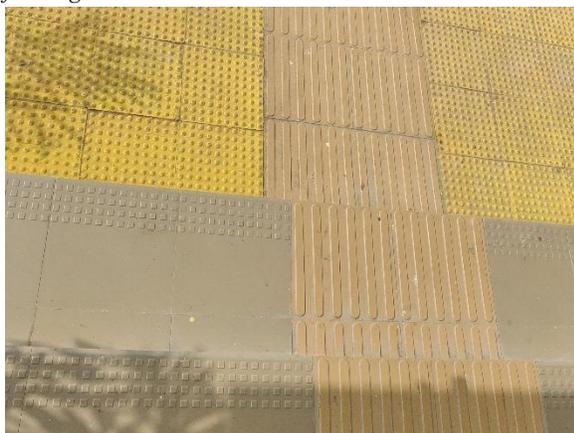


Figure 9 Flooring which is accessible for all. Source- Author

2.2 Findings

- **Inclusive Infrastructure:** The schools are constructed in such a manner that a disabled person can easily move around. They have ramps, wide corridors, accessible restrooms, and tactile flooring so that students with any disability can fully use the facilities.

- **Educational Practices:** Learners are given books that have Braille, and the room itself has facilities that mean sign language communication is very possible. Supplementing academics, the students are also given life lessons that will help in their independence.
- **Community Integration:** Pupils confidently participate in cultural programs and other daily activities without any outside support; thus, they do not feel afraid and are full of energy.
- The previous sentence is the main idea. That is, students have gained the confidence to oversee their own lives.
- **Operational Support:** NMDC is giving a large amount of money each year for construction and the daily operation of the schools is to be used in the future for continued development and growth.



Figure 10 Railing and pattern tiles with standard ramp. Source- Author

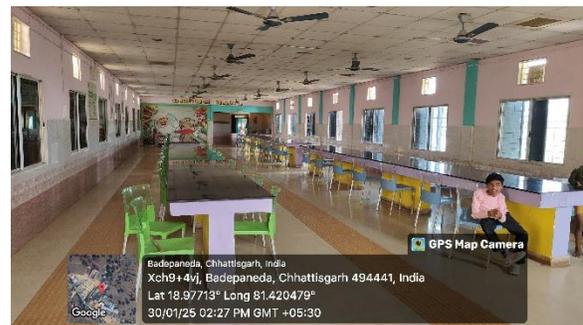


Figure 11 Dining Area with flooring which is accessible for all. Source- Author

IV. CONCLUSION

This study underscores that the concept of Universal Design is not only a useful addition but is also a basic requirement to eliminate barriers and provide proper learning conditions for all children in the school environment. Designing for all students, right from the start, is the guarantee of accessibility, independence,

and dignity for those with physical, visual, or hearing disabilities.

The research brings out the fact that architecture significantly impacts how children live in the educational process. According to this publication, inclusive design is not a mere conformance to the principles but also an advancement of equity through intelligent spatial decisions. It is to the architects' credit to create spaces that are not complex, without obstacles, and that are also helpful in providing the diverse and inclusive needs of society.

Ultimately, the school building must accommodate Universal Design as a standard feature to reflect not only inclusiveness but also a declaration of commitment and dignity as the fundamental basis of human rights

V. ACKNOWLEDGEMENT

I would like to extend my sincere gratitude to everyone who has supported me during this research. The first and the major credit belongs to my research guide, Ar. Thoudam Sudha Devi, whose eternal guidance, positive criticism and encouragement during the whole research period were the main factors that enabled me to carry out my research. I am thankful for the support of the entire Amity University Chhattisgarh (AUC) for their offering of the resources and the supportive physical surroundings of my research. I am most indebted to my family and close friends for their benevolent trust and support besides their persistent push. Moreover, the authors of various research papers, books, and online resources, whose valuable insights and data contributed to the development of this paper are also among the people I would like to convey my thanks to for their efforts in the cause of my success. Furthermore, I would like to express my thanks to my peers and companions for helping with their ideas and corrections that supported me to refine my work.

REFERNCE

[1] Priyadharsini, V., & Mary, R. S. (2024). Universal Design for Learning (UDL) in Inclusive Education: Accelerating Learning for all. *Shanlax International Journal of Arts Science and Humanities*, 11(4), 145–150. <https://doi.org/10.34293/sijash.v11i4.7489>

[2] Oteifa, S., Dewidar, K., & Mansour, Y. (2023). Inclusive Schools Design: A Phenomenological Investigation into Visually Impaired Lived Experiences. *Civil Engineering and Architecture*, 11(3), 1616–1631. <https://doi.org/10.13189/cea.2023.110340>

[3] Denizou, K. (2022). Universal design in primary schools. *Studies in Health Technology and Informatics*. <https://doi.org/10.3233/shti220883>

[4] Hashimoto, H., Nomura, K., Yatogo, T., & Saitoh, M. (2006). RESEARCH ON BARRIERS IN ARCHITECTURE FOR HEARING IMPAIRED PERSON (Architectural Planning and Design). *AIJ Journal of Technology and Design*, 12(24), 339–344. <https://doi.org/10.3130/aijt.12.339>

[5] Alterator, S., Cleveland, B., & Boys, J. (2022). The evaluation of inclusive school environments: a scoping review of the literature. *IUL Research*, 3(6). <https://doi.org/10.57568/iulres.v3i6.313>

[6] Girgs, I., Ahmed, M., & Merghany, E. (2021). Towards a Universal Design approach for Public Schools design. “The case study of Al-Orouba Schools Complex in Aswan City., 11(2), 277–290. <https://doi.org/10.21608/idj.2021.152371>

[7] NMDC’s Groundbreaking Education Initiatives Offer Hope to Children in the heart of Chhattisgarh https://www.apnnews.com/nmdcs-groundbreaking-education-initiatives-offer-hope-to-children-in-the-heart-of-chhattisgarh/?utm_

[8] McIntosh, J., Marques, B., & Lim, J. (2019). Designing Schools for Children with Impairments: The Powers of Architecture. *The International Journal of Design in Society*, 13(3), 17–29. <https://doi.org/10.18848/2325-1328/cgp/v13i03/17-29>

[9] Ergenoglu, A. S. (2015). Universal Design teaching in Architectural education. *Procedia - Social and Behavioral Sciences*, 174, 1397–1403. <https://doi.org/10.1016/j.sbspro.2015.01.766>