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Classroom Design for Diverse Learners: A Synthesis, Focus on Outcomes and Pedagogy

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Abstract

This literature review brings together research on classroom layout on how physical environments can best accommodate diverse learners. Considering Universal Design principles, the review assesses studies regarding flexible furniture, spatial zoning, assistive technology integration, accessibility, and sensory-aware environmental features. Collectively, the evidence demonstrates that classroom layout plays an essential role in reducing barriers for learners with disabilities, neurodiverse learners, and culturally and linguistically diverse students by enabling adaptable instructional arrangements and multiple pathways for participation.

Results of this research state that effective layouts should include flexible spaces, quiet and active areas, clear circulation patterns, adequate lighting and acoustics, and a variety of seating options. The inclusion of these phenomena is meant to accommodate the academic, social, and sensory needs of diverse learners. However, resource limitations, inflexible arrangements, and insufficient teacher training place barriers to the implementation of inclusivity in classrooms. Overall, the review sums up that classroom layout is an important aspect of inclusive education that can be designed to increase accessibility, engagement, and learning outcomes for all students.

Keywords: Classroom Layout, Diverse Learners, Inclusive Design.

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1. Introduction

Today's classrooms are heterogeneous or diverse in terms of learners. This diversity means classrooms comprise learners from virtually all walks of life. A diverse learner is an individual whose level of knowledge, ability, competence, emotions, or behavior differs from others. They are individuals who need extra support, require different programs of learning, or utilize different teaching strategies in order to reach their full educational potential.[1], [2]

Inclusive education is a process that ensures all learners can actively participate and succeed in educational programs without discrimination. In Tanzania, this involves minimizing barriers and maximizing resources to support learners across race, economic status, social class, ethnicity, language, religion, gender, sexual orientation, and ability. The goal is to eliminate exclusion and promote equitable learning opportunities.[2]

There are many types of diversity, as stated in the figure 1:

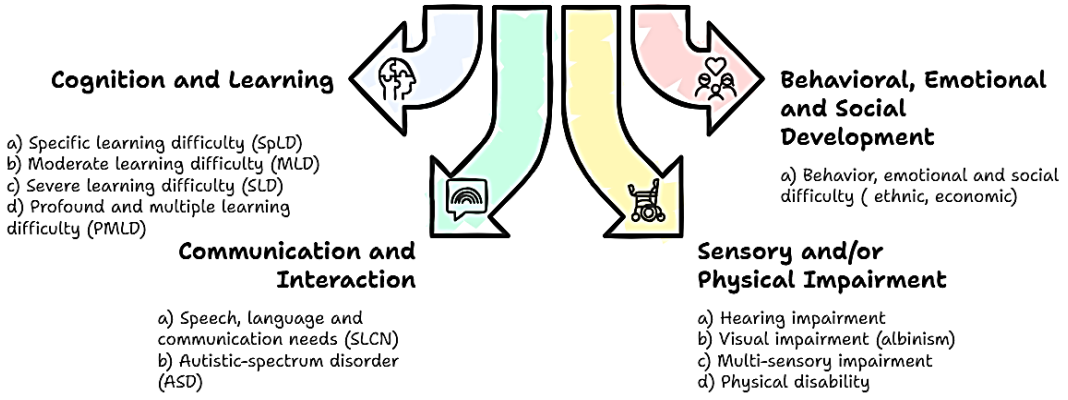


Fig. 1. Types of diverse learners [3].

2. Needs of diverse learners

Diverse learners require specific supports such as: trained teachers in special needs education, adopted School facilities and resources for learners with disabilities, Language differences among students should be recognized and accommodated, sign language teachers should be trained and employed, and current teachers should learn sign language. Appropriate teaching and learning equipment should be provided for learners with disabilities.[2] Their needs, based on each category, are stated as follows:

1) Cognitive and Learning: students with specific learning difficulties or behavioral difficulties. These students need programs and strategies that support their learning and understanding process

2) Behavioral, Emotional, and Social: these students may be isolated, disturbed, or hyperactive. They may confront a lack of concentration or immature social and behavioral skills. structured learning spaces with clear outlines for each activity, additional personal space, and quiet areas for therapeutic support are the needs of these students.

3) Communication and Interaction: Children with speech and language impairment or autistic spectrum falls in this category. Their needs are regarding understanding and using language that can be provided by a peer or teacher. Alternative means of communication

and quiet spaces for different types of support are important for this group. For an autistic student, it's hard for them to interact, so a low level of distraction and reduced sensory stimuli in an environment are essential that help them to decrease anxiety.

4) Sensory and physical impairment: Permanent visual or hearing impairment, to lesser levels of sensory loss and physical impairment, fall in this category. These students may need special equipment, programs, specific lighting conditions or acoustics, Special-designed furniture and accessible facilities, and extra space to move around, such as for wheelchair users.[3]

Therefore, among all environments of school, the place where a student spends most of his /her time is the classroom. since class room layout is essential for supporting diverse learners and classrooms are inherently heterogeneous, this heterogeneity must be considered so that every student regardless of their ability or background, be able to learn and foster both academically and socially.

The Objective of this research is to Analyze researches on classroom layouts for diverse learners and to state and summarize how classroom layouts should be designed to meet the needs of diverse learners.

3. Methodology

This literature review used a clear approach to assess research on classroom layouts that support diverse learners. The objective of this research was to bring up empirical and theoretical findings to identify best practices and design principles in creating an inclusive learning classroom layout.

A Deep search was conducted across academic databases, like Google Scholar, Scopus, and Web of Science, using keywords such as "classroom layout," "diverse learners," and "inclusive classroom design." Boolean operators (AND, OR) were used to refine search results.

Studies addressing classroom layouts, spatial layout, or learning environments specifically designed for diverse learners, including students with disabilities, neurodiverse learners, language diversity, and culturally diverse students, were studied.

Key information was drawn from each study, and a thematic analysis was conducted to identify patterns, principles, and challenges related to classroom layout for diverse learners.

4. Literature review

A diverse classroom includes diverse students who come together, and everyone will have their distinct variations from one another. Therefore, in a diverse classroom, it's necessary to consider the needs of all learners under Universal Design for Learning (UDL) principles in physical environments. [4]

4.1. Flexibility and Adaptability in Layout

In a flexible learning environment, students can access and interact with content in ways that work best for them.[5] Flexible layouts allow interchangeable spaces that shift between classrooms, therapy rooms, and play areas by utilizing movable partitions and adaptable furniture. For example, Adaptable Furniture that can be easily rearranged

(modular desks and movable partitions) can accommodate group work, one-on-one instruction, or sensory breaks. [6]
If replacing desks is not possible, current layouts can be adapted by creating a semi-circular arrangement of desks for discussion, or by placing desks face-to-face to create makeshift tables for small group work.
Flexible layout designs allow for group work and many different activities at the same time, and allow teachers to utilize a number of pedagogies and modalities of learning. Traditional classroom arrangement, particularly a row of desks facing the front, should be avoided because they restrict peer interaction, limits teachers' movement, and reduces opportunity for active learning(See figure 2). [7] [8]

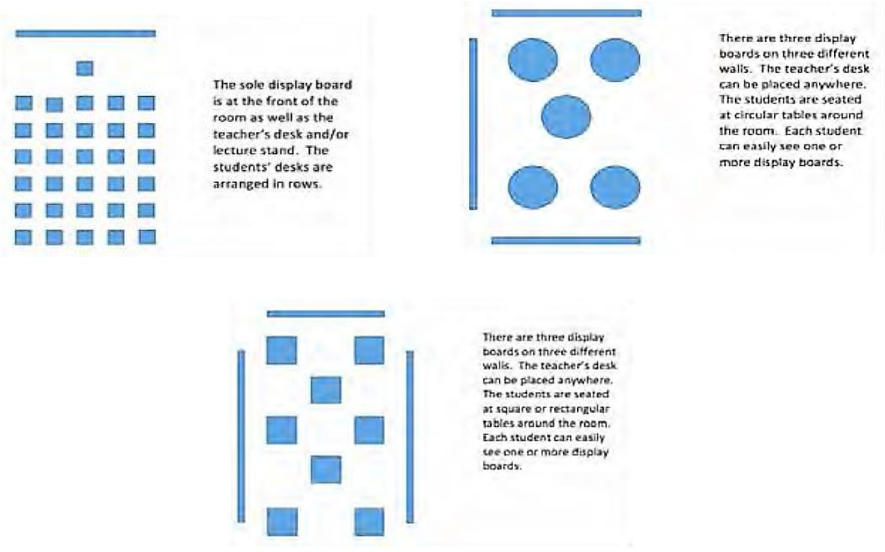


Fig. 2. Types of classroom layout: traditional classroom layout and ALC [7]

Consideration related to Individual Differences / Personalization and Learner Grouping [9], where the Layouts should reflect a mix of pedagogical practices, including provision for targeted small group or individual learning activities in addition to shared whole-class activities. Layouts should support varied sizes and profiles of learner groups.
The layout must allow for quick and easy reconfiguration of the space. Furniture should be movable to facilitate a smooth transition between instructional formats.[10] In a flexible class room Identified configurations include Linear (Lecture, Presentation, Video), Horizontal (Class Discussion), Cluster (Small Group Discussion and Activities), and Network (Decentralized Instruction). [11]
Using flexible grouping strategies can support Differentiate Instruction and promote peer collaboration and peer tutoring, and Foster a Collaborative Classroom Environment. These strategies encourage peer interactions and collaborative learning experiences and promote discussions and group projects that allow students to share their diverse perspectives and learn from one another[5] [12] [13].

4.2. Zoning and Spatial Organization

Classroom layouts should incorporate multi-functional and pedagogically responsive spaces that can serve multiple purposes (e.g., quiet retreat area during certain times, collaborative space during others)(see figure 3). These zones may include sensory rooms designed to offer calming activities or stimuli (such as soft lighting, sensory toys, calming sounds) for students to retreat when overwhelmed, as well as small group breakout rooms or spaces during class or for study and project work after class. [6] [7]

This can be achieved by the use of partitions, different flooring, or color changes to clearly delineate various zones. [6]



Fig. 3. An Inclusive classroom allowing group work [24]

All of these zones should be achieved by the flexibility of the classroom configuration that allow the same space to operate as a collaborative area at one time and a quiet or retreat zone at another. Caution is necessary with open-plan or large classrooms, as these environments can increase distractions, especially for students with disabilities.[14]

Articulation of Space is Necessary because classrooms are not homogeneous, and students need spatial stimulation that triggers mental stimulation. Layouts should move away from traditional unarticulated rooms (rows facing the blackboard) to articulated, versatile classrooms. This includes providing nooks and niches to work in, areas for individual concentration, and shared collaborative areas. [15] [16]

The teacher Support Space is likewise important, as it provides an area for managing instructional materials, resources, and feedback [17]. This space may hold not only traditional tools such as boards, but also technologies and other instructional supports.

4.3. Seating Arrangements

Seating arrangement influences students' participation, as Teachers should use instructional strategies and seating layouts to ensure equal opportunities for participation during teaching and learning. [2]

As demonstrated in ALC, the layout should allow the teacher to move easily around the room and among the students, visiting different tables to support one-on-one or small group work.

While arranging the seating, the number of students per classroom should be kept as low as possible to allow for movement and increase success. Expanding classroom space can increase flexibility and allow teachers to diversify their teaching methods. [7]
In cooperative learning, the class setting, combined with non-teacher-centered approaches, promotes co-operation among pupils, often by placing pupils with special educational needs (SEN) in heterogeneous groups with peers who can offer support. [18]
The setting should be arranged the way to maximize visibility. Desks should be arranged in a semicircle or clustered groups, as this configuration encourages cooperative learning, builds a sense of class community, and promotes active engagement. [19][20]
Students' specific disabilities determine seating arrangements.

- Visual impairment: Front-row seating for learners with albinism or partial sight.
- Hearing impairment: Hearing-impaired students should sit where they can see teachers to facilitate lip-reading and sign language.
- Mobility impairment: Classrooms should have sufficient space between desks to accommodate wheelchairs. [2]

Seating should be arranged to facilitate necessary support, such as having a student sit next to a peer who serves as a translator. The setting arrangement should allow a student to move freely and have appropriate physical access to all areas or zones of the class. [21] [22] [19] It should provide adequate space regardless of body size, posture, or mobility, accommodating children with physical disabilities who use assistive devices or require personal assistance. (see figure 4) [23]

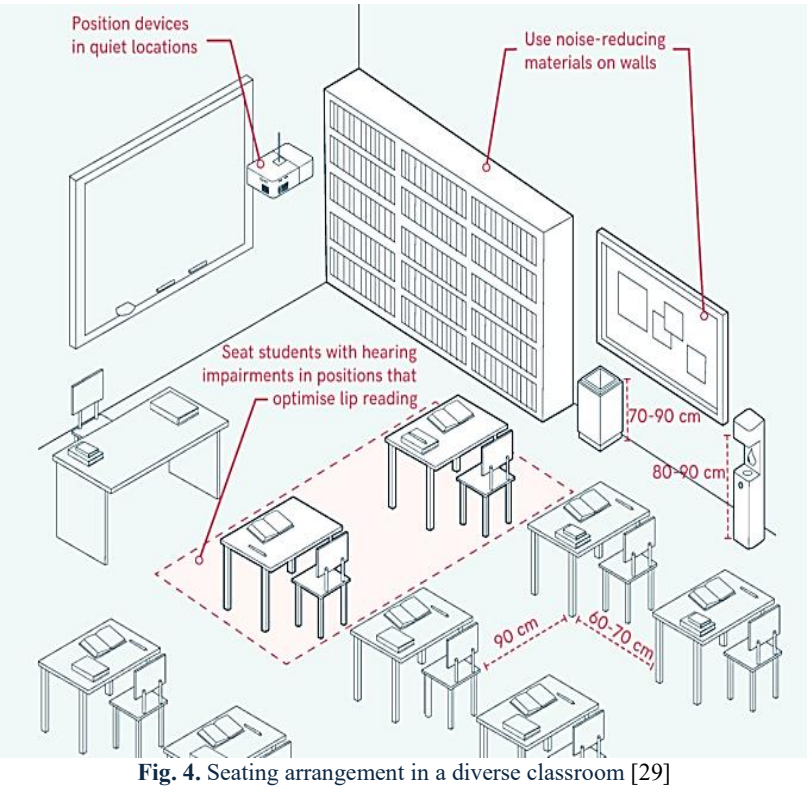


Fig. 4. Seating arrangement in a diverse classroom [29]

Traditional seating arrangement should be avoided as it puts a barrier and limits active student participation and turns the class to teacher centric. (See figures 5&6) [24]



Fig. 5. A class for diverse learners; seating arrangement allowing some students to be near the instructor, Opposite to Traditional Class rooms[21]



Fig. 6. A classroom layout considering diversity; Accessible chairs, Enhanced Flexibility for collaborative work [16]

4.4. Sensory and Environmental Layout Considerations

Classroom layouts must account for sensory sensitivities, particularly among neurodiverse learners. Students with albinism are sensitive to lighting; proper lighting and window coverings are necessary for effective learning. [2] Adequate lighting is necessary for learners with visual impairments and should be glare-free.

A classroom layout should avoid direct sunlight, and the natural light should enter from the sides [17]. As ventilation is important, classrooms should be arranged linearly alongside windows to allow the majority of students access to fresh air, or otherwise spaces should be considered for breakout sessions.

A noisy environment hinders, particularly for students with hearing challenges or autism spectrum disorder (ASD) [22] .therefore class room Layouts must address poor acoustic quality. (Figure 4)

Visual clutter should be minimized, as it can overwhelm students' ability to actively maintain task goals and ignore distractions. Colorful and richly decorated environments may be perceived as "a cacophony of visual noise" by students with learning disabilities or neurodevelopmental conditions. [16]

Furniture and fixtures should have soft, rounded edges to prevent injury, and they should be made of safe, non-toxic, easy-to-clean, and durable materials [6]. Calming colors, such as blue and green, are recommended for decoration, whereas red and orange should be avoided. [19]

4.5. Displays

Layouts should facilitate the use of visible Visuals to support social communication, such as charts and posters containing illustrations in multiple languages and reflecting diverse cultural content. [21] [25] These visuals can be displayed **on walls or suspended from the ceiling** if wall space is limited. [20] ALCs often feature multiple display boards on different walls. [7] There must be enough displays to showcase all students' works, promoting cultural and linguistic diversity.

4.6. Technology Integration in Layout

Technology should be integrated into the classroom layout by ensuring adequate space for assistive tools such as screen readers, speech-to-text devices, and adaptive technologies. The arrangement should allow easy access to these tools and support their use during instruction. [26]

Display boards used in ALCs should be connected to computers, enabling students to utilize them for group work, such as in Project-Based Learning (PBL). [7]

4.7. Layout for Accessibility and Movement

The classroom must allow unobstructed movement and provide a barrier-free environment [23]. Classrooms should have sufficient spaces for functional participation and enable students with disabilities to move freely between desks or tables. This can be facilitated by applying universal design principles throughout the entire school. (See figure 7) [27] [28]

4.7.1. Layout Models and Examples: Several models are developed that can be adapted to diverse learners based on the characteristics studied:



Fig. 7. Illustrating different aspects of inclusion in school [30]

4.7.2. Flexible Learning Spaces (FLS): The design of classroom layouts should prioritize creating Flexible Learning Spaces (FLS) that integrate pedagogy, physical design, and instructional technology to support a variety of pedagogical approaches and learning experiences. This approach enhances student engagement, collaboration, flexibility, and learning. It is particularly necessary because the traditional classroom with fixed seating constrains teaching and learning to one-way flows and restricts the effectiveness of student-centered approaches.[11]

4.7.3. ALC model: This model utilizes clustered seating, multiple display areas, and reconfigurable furniture to promote engagement and movement [7].

4.7.4. Cork castle system: This system employs Modular and Open-Ended Tools (see figure 8) that are essential for maximizing children's creativity, allowing them to assign meaning to simple forms based on their experiences and knowledge. The system's building pieces are intentionally large (big) so that children need to collaborate to construct their environments. The blocks allow users to design their own spaces, facilitating infinite possibilities such as reading nests, room dividers to split areas, a stage for theatre plays, or forts. [15]

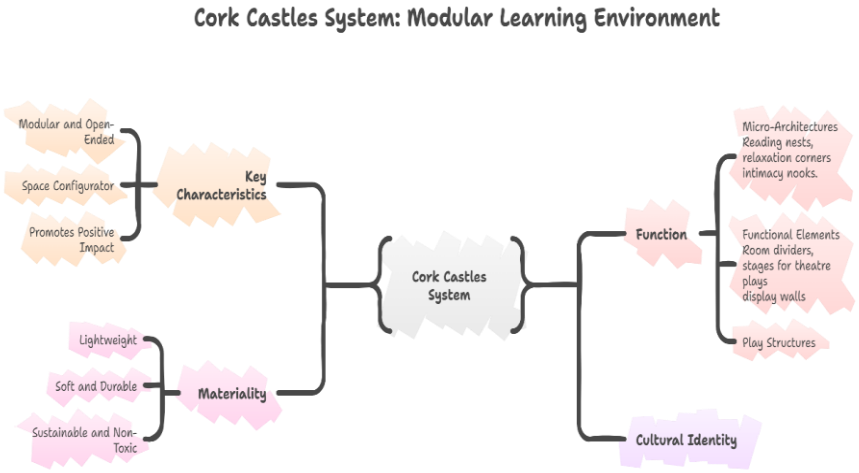


Fig. 8. Elements of Cork Castle system [15]

5. Challenges in Layout Implementation

Despite guidelines, several challenges face the layout design of a classroom for diverse learners. As stated in the literature review Inflexible class room such as fixed furniture or inadequate space, limits adaptability. While open plan or large classrooms can increase distractions, especially for students with attention or sensory problems.

Economic constraints and access to modular furniture or acoustic treatments also reveal barriers to classroom layouts to accommodate diverse learners. Additionally, the insufficiency of teachers' training in spatial pedagogy impacts how the layout can be better used or rearranged.

6. Synthesis and Layout Recommendations

Based on the reviewed literature, effective classroom layouts for diverse learners should have the following characteristics (see Table 1):

Table 1. Characteristics of an effective classroom layout

Design Aspect	Detail
Flexible and reconfigurable	Movable furniture and Modular partitions to achieve individual work, small groups, whole-class activities, or quiet zones.
Clear zoning	Collaboration, peer tutoring, quiet work, and sensory regulation zones Clear Marking with colors or signage
Displays	Visible and accessible displays
Seating arrangement	Should let Teachers free movement Provide different seating positions
Varied seating options	To accommodate physical and sensory preferences
Minimized sensory overload	Controlled lighting, acoustics, and visual simplicity
Physical accessibility	Clear pathways for students to navigate the class and accessible storages
Integrated technology	Accessible and decentralized Through boards or Hearing / visual aids
UDL principles	Multiple means of engagement and expression

7. Conclusion

Classroom layout is an important part of an inclusive learning environment. By introducing flexibility, clear zoning, sensory-aware design, and accessible technology, educators can reduce barriers and promote equitable participation for students. Future efforts should address implementation challenges through teachers' training, resource allocation, how flexibility can be achieved easily and cost-effectively, and continued research into the impact of spatial design on learning outcomes.

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