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Periodic Accessibility Audits for Emergency Mock Drills at Special School: A Case Study Approach

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Abstract:

This research study explored the interconnectedness of accessibility auditing, emergency preparedness, and children with disabilities' experiences in Indian special schools to establish an inclusive and equitable learning ecosystem. While previous research has examined these aspects individually, this study offers a comprehensive analysis of their intersection. Through a case study of a special school, the study highlighted the importance of regular accessibility audits, emergency mock drills, and accessible public transportation options. By conducting accessibility audits, schools can identify and address barriers, ensuring compliance with regulations and improving the learning experience for all students. Emergency mock drills serve as a valuable tool for enhancing school preparedness and safeguarding the safety of students and staff. The research employed a comprehensive approach, collecting data through physical accessibility audits, interviews, surveys, and emergency mock drills. By analyzing this data, accessibility barriers, gaps in emergency preparedness, and areas for improvement were identified. Recommendations were then developed to enhance accessibility, improve emergency preparedness, and establish an inclusive learning

ecosystem for students with disabilities. Additionally, the study established standard operating procedures for future mock drills and identified key individuals responsible for implementing recommendations and ensuring ongoing accessibility and emergency preparedness. This study improves upon the current knowledge on accessibility in special schools by offering valuable insights into its various dimensions. The overall findings of this research study provide practical recommendations for improving accessibility in educational settings and public transportation systems, ultimately fostering a more inclusive and equitable society for all.

Keywords: ***Inclusive education, Accessibility audit, Emergency preparedness, Children with disabilities.***

1.0 Introduction

Regular school audits are crucial for ensuring that educational institutions comply with the Sustainable Development Goals (SDGs) related to inclusivity and safety for children with disabilities. These audits should evaluate various aspects of accessibility, including physical access to buildings and facilities, communication systems that accommodate diverse needs, emergency preparedness plans tailored to accommodate the specific needs of individuals with disabilities, and requisite staff training to support these students during emergencies. By conducting thorough audits and implementing necessary improvements, schools can create inclusive learning environments that foster the well-being and equal opportunities of all children. This study seeks to examine the relationship between accessibility, emergency preparedness, and public transportation experiences in Indian schools for students with disabilities. By exploring how these factors can be integrated

effectively, the study aims to identify strategies for improving the overall learning environment for students with disabilities. Specifically, the research will delve into the challenges faced by these students when using public transportation, such as physical barriers, lack of information, and safety concerns. The study will also examine how these challenges can be addressed to ensure inclusive mobility and enhance the educational experience for students with disabilities. Through thorough research and analysis, this study seeks to offer crucial inferences and recommendations for policymakers, educators, and transportation authorities to create more inclusive and accessible educational environments in India. The Asia Pacific Report of 2019 revealed that disasters disproportionately impact social sectors, especially education and health, exacerbating existing inequalities (United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP], 2019). These essential infrastructures play a crucial role in shelter, rebuilding, and capacity development. Schools, in particular, house a large, vulnerable child population and serve as vital facilities during emergencies. Asian countries, including India, face significant hazard risk patterns due to their geographical location and human activities. This is especially concerning considering the region's vast student population and historical instances of student casualties during disasters. The Sendai Framework for Disaster Risk Reduction highlights the significance of developing educational infrastructures that are resilient to multiple hazards, recognizing them as a crucial component of disaster risk management (United Nations Office for Disaster Risk Reduction [UNDRR], 2015). It acts as a major source of encouragement to identify, strengthen, and invest in these infrastructures as a means to augment efforts invested in reducing risk.

2.0 Background

2.1 Statistics on Persons with Disabilities Global and National

According to the World Health Organization (WHO, 2011), approximately 15% of the world's population lives with some form of disability. This translates to over a billion people worldwide. In India, the 2011 Census reported that 2.68% of the total population, or approximately 26.8 million people, have disabilities (Government of India, 2011). People with disabilities face significant challenges in accessing healthcare, education, and employment opportunities, further marginalizing them (World Health Organization [WHO], 2011).

2.2 Statistics on Loss of Life During Disasters Global and National

Disasters, both natural and man-made, have devastating consequences worldwide. According to the United Nations Office for Disaster Risk Reduction (UNDRR, 2020), disasters can lead to loss of life, property damage, and displacement of communities. While precise statistics on the number of lives lost due to disasters are difficult to obtain, it is evident that these events disproportionately affect vulnerable populations, including those with disabilities (UNDRR, 2020). Disasters can exacerbate the vulnerabilities of people with disabilities, making them more susceptible to injury, illness, and death (UNDRR, 2020).

2.3 Vulnerable Populations Devoid of Accessibility and at the Time of Disasters

Persons with disabilities are often among the most vulnerable populations during disasters. They may face challenges in accessing information, evacuating, and receiving assistance due to physical,

sensory, or cognitive impairments. Additionally, many public spaces and buildings are not accessible to people with disabilities, hindering their ability to navigate and respond to emergencies. The lack of accessibility in public spaces and buildings can significantly impede the ability of people with disabilities to prepare for, respond to, and recover from disasters (UNDRR, 2020).

3.0 Aim and Objectives

The aim of this research is to comprehensively validate the standards of emergency preparedness and accessibility in Indian special schools, with a particular focus on the needs of students with disabilities. By assessing the current standard of physical accessibility in school premises and the effectiveness of existing emergency plans, the study seeks to identify areas for improvement. Additionally, the research will delve into the difficulties faced by children with disabilities, who are more vulnerable during emergencies. Through in-depth analysis, the study will develop recommendations to enhance emergency preparedness measures, improve accessibility, and strengthen support services for students with disabilities, ensuring their safety and well-being in educational environments.

This objective aims to delve into the psychological and behavioral responses of students with disabilities during emergencies. By examining their coping strategies, we can gain insights into how they navigate stressful situations, such as seeking help, following instructions, and managing anxiety. The study will also explore the impact of familiarity with the environment on coping abilities. It is hypothesized that students may feel more comfortable and confident in familiar settings like their school, which could enhance their ability to cope with emergencies. Additionally, the research will investigate

the role of social support from peers and staff in helping students with disabilities navigate challenging situations, highlighting the importance of a supportive and inclusive environment.

4.0 Methodology

This research study employed a qualitative methodology to investigate the state of emergency preparedness in Indian special schools, focusing on accessibility for students with disabilities. A review of literature was carried out to ascertain existing research gaps and to formulate the scope of this study. Data collection involved a multi-faceted approach. Firstly, national and international guidelines and frameworks related to auditing methods for assessing physical accessibility in schools were reviewed. Secondly, emergency preparedness guidelines for conducting mock drills were examined. Finally, one-on-one interviews were conducted with stakeholders, including school administrators, teachers, and students with disabilities. Field surveys were conducted to observe and analyze the organization of fire mock drills in the selected schools. The surveys followed a step-by-step procedure, starting with awareness creation, sharing responsibilities, providing standard operating procedures (SOPs), and concluding with an analysis of drawbacks and areas for improvement. The study focused on identifying children with disabilities, who are the most vulnerable section of the population, and understanding their coping mechanisms during emergencies faced in familiar environments and in unfamiliar settings like public transportation.

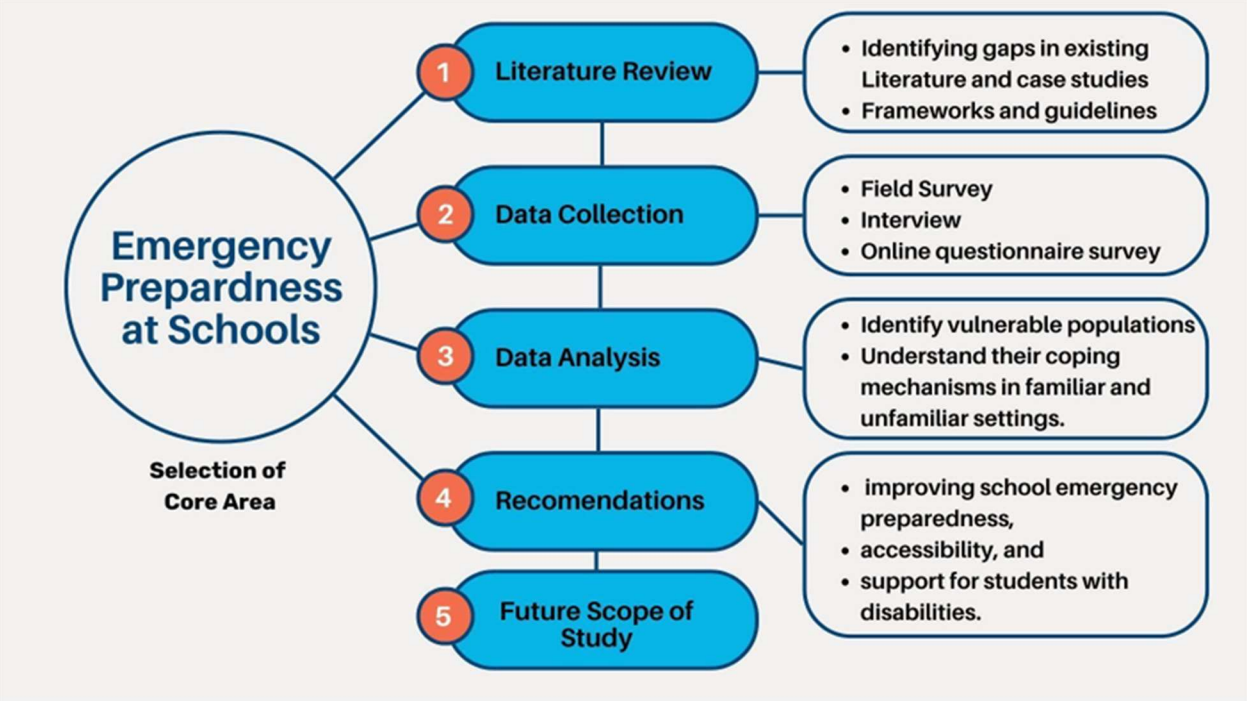


Fig 01 :Flow chart of Methodology

5.0 Scope and Limitation

This research study focused on evaluating the state of emergency preparedness and accessibility in Indian special schools, with a particular emphasis on the requirements of students with disabilities. Although the study offers important insights into the challenges, it also elucidates potential areas for improvement to overcome certain crucial voids. The findings may not be fully generalizable to other countries or regions, and the sample size may have limitations on the representativeness of the results. Additionally, the reliance on interviews and observations may introduce potential biases in data collection. It is also worth noting that the findings may not be applicable to all types of special schools or students with disabilities. Furthermore, the study primarily focused on special schools serving students with disabilities, and the findings may not be directly

applicable to mainstream schools or schools serving students without disabilities. Despite these limitations, the study offers valuable recommendations for enhancing emergency preparedness and accessibility in Indian special schools.

6.0 Hypothesis

Children with disabilities who participate in regular emergency mock drills in familiar school environments will demonstrate improved coping mechanisms and preparedness to respond to emergencies in unfamiliar public spaces.

7.0 Literature Review

The National Education Policy (NEP) 2020 is recognized as a significant step forward towards our country's educational reform. However, substantial policy gaps still persist in addressing the educational needs of children with disabilities. Despite considerable efforts towards inclusive education, many disabled children remain neglected. A majority of students do not advance beyond primary school, with only 9% completing secondary education. Approximately 45% of disabled individuals are illiterate, and only 62.9% between the ages of 3 and 35 have attended mainstream schools. Specific disability groups and genders face even greater challenges. Around 60% of the schools do not have ramps, and only 17% of school toilets are accessible (National Sample Survey, 2018).

Safety and well-being of students with disabilities in Indian special schools are paramount. Ensuring that these schools are equipped with adequate emergency preparedness measures and are accessible to all students is essential. The literature review presents a detailed summary of current research on emergency preparedness and accessibility in Indian schools, with emphasis on the unique needs of

students with disabilities. By examining the current state of research, identifying key findings, and highlighting gaps in knowledge, this review will lay the groundwork for further investigation and inform the development of effective strategies to enhance the safety and inclusivity of these schools.

Child Centered Education and Continuous and Comprehensive Evaluation

Key concepts of including a diverse range of students with varying abilities involve a child-centric approach. It should have a well-defined curriculum that supports the child's overall physical and mental growth. The system should commit itself to providing all resources that facilitate teaching and learning.

Table 1: Literature Review Process

Method	Collection of Data and Analysis	Result Expected	Recommendations
Integrative literature assessment	Scholarly articles: Total of 60 + 10 Guidelines. Software-based search options were used to weed out insignificant literature. Evaluations focused on abstract and actual content, with special emphasis on indicator-based studies. After thorough analysis of contents, 15 literature studies were selected and reviewed to understand the importance of emergency preparedness, identify the most vulnerable population, comprehend	Identifying the most vulnerable category of disabilities among children in 7 to 9 major disability categories.	Conceptual Frameworks for Auditing in School Premises

	the guidelines, and know the procedure to conduct mock drills in school premises.		

7.1 Accessibility Audits

Creating structures and ecosystems that cater to the diverse needs and preferences of various individuals based on Inclusive Design (ID) principles has emerged as an important priority (Smith, 2020). This design initiative focused on disability, originating from the need to address the difficulties faced by disabled soldiers in the US Army returning from WWII (Gordon, 2015). In the latter half of the 20th century, the increasing demand for assistive products and accessible buildings for individuals with physical disabilities led to the establishment of numerous standards and regulations worldwide (Jones & Smith, 2019).

7.1.1 Technical Standards

Building regulations and technical standards have evolved significantly to address the needs of individuals with physical and sensory disabilities. Notably, the American National Standards Institute's ANSI 117.1–1961 was the first standard focused on accessible design, and the Americans with Disabilities Act produced documentation that addressed various requirements for building occupants (ADA, 1990). Recent guidelines and standards reflecting these new priorities include "Building for Everyone: A Universal Design Approach," BS 8300:2018 (Design of an Accessible and Inclusive Built Environment), EN 17210:2021 (Accessibility and Usability of the Built Environment), and BSI PAS 6463 (Design for the Mind - Neurodiversity and the Built Environment) (Bennett, 2020; Clarkson & Coleman, 2021). However, despite the increased

regulations and guidance available to building professionals, many structures still do not meet the standards for creating inclusive experiences for their users (White, 2018; Johnson, 2019).

7.1.2 Types of Auditing Systems

Inclusive design strives to create environments that are accessible and usable for everyone, regardless of their abilities. To ensure these environments meet diverse needs, various audit systems can be employed. This paper, drawing on the work of Zallio and Clarkson (n.d.), explores the different types of audit systems used in inclusive design. By understanding these systems, we can create a more comprehensive approach to evaluating and improving the accessibility and usability of buildings and environments (Zallio & Clarkson, n.d.).

In the existing literature, there is a comprehensive overview of various occupant survey tools used in the field of building design and evaluation. These tools focus on different aspects of building performance, including indoor environmental quality (IEQ), sustainability, comfort, health, design quality, and usability and inclusion. By utilizing these survey tools, researchers and practitioners can gather valuable insights into occupant experiences and identify areas for improvement in building design and operation. Out of all the survey tools, "The Universal Design-Based Framework to Assess Usability and Inclusion of Buildings," categorized under Design Quality and Usability Surveys, was selected for implementation in a pilot case study at Asha Special School. The survey tool was shortlisted for three major reasons: (a) It aligns with universal design principles, ensuring that the school's buildings and facilities are accessible to everyone, regardless of their abilities. (b)

It has a well-established methodology and has been used in previous studies, providing confidence in its reliability and validity. (c) It can provide actionable recommendations to guide the school in implementing specific improvements to enhance accessibility and inclusion.

7.1.3 Selection of Method for Accessibility Audit in Primary Case Study

Universal Design (UD) provides a set of principles for designing buildings that fulfill the requirements of every individual. The Universal Design (UD) strategy was officially launched by Ron Mace in 1995. It is 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 (Mace, 1995). In architectural practice, this strategy aims to ensure that different users have the same experience of the built environment and that they are not excluded (Mace, 1995).

7.1.4 Checklist from Documents Identified for Auditing Physical Accessibility in Selected Primary Case Study

- **Collaboration of International and Accessible India campaign along with NGO "Samarthyam" Guidelines titled "Making Schools Accessible to Children with Disabilities," year 2013 (Samarthyam, 2013).**
- **National Level Checklist used for Accessibility Audits prepared by CBSE Board India, titled "Accessibility Code for Educational Institutions," supported by Accessible India Campaign, year 2021 (CBSE, 2021).**

7.1.5 SDG Goals Related to Children with Disabilities

Several Sustainable Development Goals (SDGs) directly address the needs of children with disabilities and the importance of accessible and disaster-resilient schools. Here are some key SDGs that are relevant (United Nations, 2015):

Table 2: List of SDG Goals Connected with Children with Disabilities

SDG Goal	Relevance to Children with Disabilities and School Audits
SDG 1: No Poverty	Ensuring inclusive education. Accessible schools are essential for providing quality education to all children, including those with disabilities, reducing poverty and inequality.
SDG 2: Zero Hunger	Addressing nutritional needs. Accessible schools can help ensure that children with different disabilities have access to necessary nutrition programs and support services.
SDG 3: Good Health and Well-being	Promoting physical and mental health. Inclusive education environments contribute to the overall health and well-being of children with disabilities. Accessible facilities and support services can prevent discrimination and stigma.
SDG 4: Quality Education	Inclusive education. This goal explicitly calls for inclusive education for all. Accessible schools are essential for ensuring that children with various disabilities have equal opportunities to learn.

SDG 5: Gender Equality	**Addressing gender-based discrimination. Inclusive education can help address gender-based discrimination faced by children with disabilities, especially girls.**
SDG 10: Reduced Inequalities	**Reducing inequalities. Accessible schools can help reduce inequalities faced by children with various disabilities, ensuring they have the same opportunities as their peers.**
SDG 11: Sustainable Cities and Communities	**Inclusive and safe cities. Accessible schools contribute to the creation of inclusive and safe cities for all residents, including children with disabilities.**
SDG 13: Climate Action	**Disaster preparedness. Accessible schools should be equipped to handle various disasters, including those related to climate change. Emergency preparedness plans should consider the specific needs of children with different disabilities.**

7.2 Emergency Mock Drills at Schools

Emergency mock drills are essential preparedness measures for special schools, ensuring that students, staff, and caregivers are equipped to respond effectively to various disaster scenarios. These drills replicate actual emergencies, enabling participants to rehearse evacuation methodologies, communication strategies, and first aid skills. By regularly conducting mock drills, special schools can identify potential vulnerabilities, refine their emergency plans, and build a culture of safety and resilience.

Table 3: List of Documents

List of Documents Referred
Overview of Existing Guidelines Identified for School Mock Drills
Fire and Evacuation Drills in Schools - Delhi State Guidelines
Overview of School Disaster Management Plan
Overview of National Disaster Management Guidelines
Glimpse of Topics Implemented in the Primary Case Study

7.2.1 School Disaster Management Plan

Schools should establish comprehensive disaster management plans, incorporating guidance from the Delhi Disaster Management Authority (DDMA), to effectively handle emergencies and crises. Beyond their immediate role, schools can significantly contribute to fostering a "culture of safety" within the surrounding community through the efforts of students and teachers. Disaster education is crucial for schools. This involves integrating disaster risk management (DRM) into the curriculum, providing educational materials, and conducting regular training programs (DDMA, 2021). By enhancing the knowledge and awareness of teachers and students about DRM, schools can build capacity and promote a culture of preparedness. The involvement of the Parents Teachers Association (PTA) further strengthens these efforts.

7.2.2 Capacity Building for Safe Schools

Capacity building for school safety involves a comprehensive approach, encompassing awareness campaigns, sensitization programs, and targeted training for various stakeholders. This process is ongoing, requiring continuous reinforcement of acquired knowledge and skills to ensure their practical application in the daily operations of schools, teachers, students, and staff.

7.2.3 General Training for Students and School Staff

Fire prevention and safety measures should be integrated into the initial design of schools and maintained consistently. This includes limiting, isolating, or eliminating flammable materials, ensuring clear exit routes, maintaining detection and alarm systems, regularly inspecting fire extinguishers and equipment, and ensuring electrical systems are safe and operational. These practices align with the recommendations from the International Finance Corporation's (IFC) Environmental, Health, and Safety Guidelines (EHS, 2020).

7.2.4 International and National Level Guidelines

By following these guidelines, organizations can ensure that their fire drills are comprehensive and help to prepare employees and visitors for potential emergencies. This table below provides an overview of the key international and national guidelines for fire mock drills. It outlines the primary standards and authorities to consult for guidance on conducting effective fire drills. The table also highlights essential considerations, such as frequency, participation, evacuation routes, emergency response, and documentation.

Table 4: Various Methods Available to Audit

Guideline	International	National (India)
Overall Standards	International Fire Safety Standards (IFSS)	National Disaster Management Authority (NDMA)
Building Codes	ISO 14001, ISO 45001	National Building Code of India (NBC)
Specific Fire Safety Standards	NFPA	State Disaster Management Authorities (SDMA)
National Standards		Indian Standards Institution (ISI)

Key Considerations for Fire Mock Drills are as follows:

- **Frequency: Mock drills should be conducted regularly to ensure that everyone is familiar with emergency procedures.**
- **Participation: All occupants of the building should participate in fire drills, including employees, visitors, and tenants.**
- **Evacuation Routes: Drills should focus on practicing evacuation routes and procedures.**
- **Emergency Response: Participants should be trained on how to respond to emergencies, such as using fire extinguishers or reporting fires.**

- **Documentation: Documentation of fire drills should be maintained, including attendance records and any issues identified during the drills.**

7.2.5 Secondary Case Studies

Based on the existing literature related to the theme "Mock Drills Conducted in Schools and Universities in Other Countries," the following research gaps were identified:

Table 5: List of Countries Considered to Assess the Mock Drills

Ref No	Country	Research Category	Authors
[31]	USA	Methods of Emergency Preparedness	Gail Insko Wise
[32]	Sri Lanka	Methods of Emergency Preparedness	Jonas Cels et al. (7 citations)
[33]	Bangladesh	Methods of Emergency Preparedness	Md Mostafizur Rahman et al. (4 citations)

The paper "Preparing for Disaster: A Way of Developing Community Relationships" (Wise, 2015) focuses on emergency preparedness in the USA from a theoretical perspective. While the paper does not directly address mock drills, the concept of emergency preparedness it explores aligns well with their purpose. The learning outcome is expressed through the table below:

Table 6: Learning outcome form RP1

R31	**Community Relationships: Mock drills can be a valuable tool for building and strengthening relationships within a community. By working together to prepare and participate in drills, residents become more familiar with each other's needs and capabilities. This fosters trust and cooperation, crucial during an actual disaster.**
	Emergency Preparedness: Mock drills simulate real-world emergencies, allowing participants to practice emergency response procedures. This helps identify weaknesses in plans, communication breakdowns, and areas requiring improvement. It also familiarizes people with evacuation routes, safety protocols, and resource allocation during a crisis.
	Effectiveness: The paper emphasizes the importance of effective emergency preparedness. Mock drills provide a controlled environment to assess the effectiveness of disaster plans and identify areas for improvement. This iterative process leads to better preparedness and potentially saves lives during real disasters.

Table 7: Learning outcome from RP2

R32	**conduct drills annually or biannually, and many teachers are unprepared to guide students to evacuation points. Teachers often lack awareness, training, and resources for emergency evacuation.**
	Evacuation protocols also need to be adapted: to accommodate students and staff with special needs. While teachers receive regular training on curriculum development, integrating tsunami preparedness into the curriculum is recommended.
	Parent involvement is crucial for successful evacuations and reunification. Schools in New Zealand's practice of "family reunification" drills could be a valuable model for Sri Lanka.

Table 8: Learning outcome from RP3

R 33	**Given the prevalence of fires in Dhaka City, Bangladesh, this study aimed to evaluate the overall fire preparedness of the community using the Holistic Individual Preparedness Model (HIPM). Based on Jensen's six dimensions of HIPM, it was hypothesized that the community might have certain shortcomings in fire preparedness. [34].**
	This study focuses on assessing the community's preparedness for fire incidents using the Holistic Individual Preparedness Model (HIPM). We applied this framework to the urban population of Bangladesh, but it could also be applicable in other areas with high fire risks. Despite the frequent occurrence of fires in Bangladesh, particularly in Dhaka, our findings suggest that the community may be inadequately prepared.

7.3 Children with disabilities

Number of children affected by disabilities in India is significant and varies depending on the specific disability and data source. While the 2011 Census of India provides some information, it's important to consider limitations and potential underreporting.

7.3.1 2011 Census of India:

The 2011 census revealed that approximately 7.62% of the disabled population in India consisted of children, translating to about 2.04 million out of 26.8 million individuals with disabilities. The age group with the largest representation of disabled individuals was between 10 and 19 years, accounting for 17% of the total disabled population. Additionally, those aged 60 and older comprised 21% of all individuals with disabilities. The census classified disabilities into eight main categories, including visual, hearing, mental, speech, and locomotor impairments [35].

7.3.2 WHO Report:

As per latest statistics released by WHO, at the most 15% of the world's population is suffering from some form of disability. It is no surprise that children are the biggest sufferers amongst all disabled people. Although specific figures for India are not provided in the report.

7.3.3 UNCRPD:

The Convention on the Rights of Persons with Disabilities (CRPD) defines children with disabilities as those who experience long-term physical, mental, intellectual, or sensory impairments. These impairments, when combined with various barriers, can impede their

ability to fully and effectively participate in society on equal terms. Currently, around 240 million children globally are estimated to have some type of disability. This figure is an increase from earlier estimates, reflecting a more comprehensive and inclusive perspective on disability that takes into account multiple domains of functioning, including aspects related to psychosocial well-being [36].

7.3.4 Disaster Risk Reduction:

- **Vulnerability: Children having various kinds disabilities are often more vulnerable to disasters due to physical, sensory, or cognitive impairments. They may face challenges in accessing information, evacuating, and receiving assistance during emergencies.**
- **Impact: Disasters can exacerbate the difficulties faced by children with disabilities, leading to increased risk of injury, displacement, and loss of education.**

Secondary Case Study

Introduction

Periodical school audits ensure safety, quality, and effectiveness of educational institutions. They provide a systematic evaluation of various aspects of a school's operations, including infrastructure, academic programs, financial management, and student well-being.

Key Benefits of Conducting Regular School Audits

- **Identifying and Addressing Safety Hazards: Audits can help identify potential safety hazards such as structural defects, fire risks, or inadequate emergency procedures. By addressing these**

issues proactively, schools can prevent accidents and ensure the well-being of students and staff.

- **Ensuring Compliance with Regulations: Schools must adhere to a variety of regulations, including building codes, health and safety standards, and educational requirements. Audits can help verify compliance with these regulations, preventing legal issues and ensuring a safe learning environment.**
- **Improving Educational Quality: Audits can assess the quality of a school's academic programs, teaching methods, and curriculum. By identifying areas for improvement, schools can enhance student learning outcomes and better prepare students for success.**
- **Optimizing Resource Allocation: Audits can help schools evaluate the efficiency of their resource allocation, ensuring that funds are being used effectively to support educational programs and services.**
- **Enhancing Accountability: Regular audits can increase accountability by providing transparency into a school's operations and performance. This can help build trust with parents, the community, and other stakeholders.**

Identified International Case Studies and Their Outcomes

Table 1: International Case Studies and Their Outcomes with Respect to Research Theme

Theme	Reference No.	Aim of the Study	Considered Case Study	Purpose of the Study
Evaluation of Accessibility	**[37]**	**Understanding the implementation and effectiveness of the National Strategy for PWD in creating an inclusive learning environment for students with disabilities in Jordan**	**Jordan's School of Engineering accessibility evaluation**	**Examining accessibility, assessing student experiences, identifying barriers, and evaluating support services**
Action Research to assess the behaviour of university students at the time of earthquake mock drill.	**[38]**	**To identify the strengths and weaknesses of university students during a potential earthquake**	**Turkey, now called Turkiye, is a large peninsula that bridges the continents of Europe and Asia**	**Student behaviour during earthquake drills, compliance with emergency plan, challenges and improvements**

Mapping experiences of Children's views on evacuation drills and school preparedness	**[39]**	**Understanding Children's Perceptions of Evacuation Drills and School Preparedness**	**Colegio Ingles, located in Iquique, the capital of Chile's northern Tarapaca Region, is the city's largest and most long-standing school.**	**Qualitative methods (focus groups and individual mapping) to understand students' evaluations of the school's emergency evacuation plan. Participants were 11–18-year-old children (n=31). The data was analysed using NVivo 11.**

Identified Research Gaps from Secondary Case Studies

Firstly, one of the primary goals of the National Strategy for Persons with Disabilities (PWD), which was established for implementation between 2010 and 2015, was to ensure that PWD have the right to access higher education institutions by fostering an inclusive learning environment (HCAPD, n.d.). Students with disabilities are entitled to enroll in any field of study they choose at higher education institutions (HCAPD, 2016b) [40].

Secondly, drills are essential for ensuring readiness for earthquakes, which can strike at any hour [41]. In this regard, regular orientation and emergency drills should be conducted for university students to enhance their resilience during potential crises and to help them

manage the psychological impacts of disasters more effectively [42]. Such drills are widely recognized as effective methods for equipping the school community to respond safely to natural disasters and to manage aftermath situations. Research indicates that preparedness and evacuation drills can significantly decrease evacuation times and promote appropriate and safe practices, minimizing panic ([43], [44], [45]).

Thirdly, to enhance students' preparedness for emergencies, it is essential to involve them more actively in formulating an appropriate evacuation plan and integrating the same with their family's emergency plans.

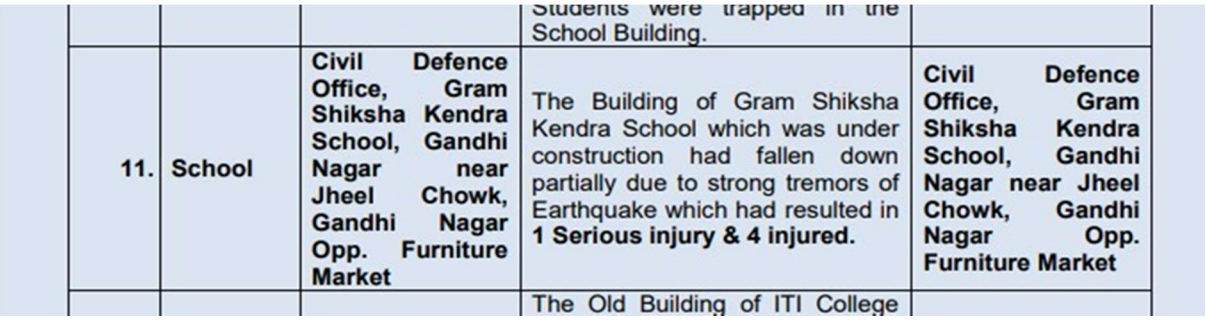
Identified State-Level Case Studies and Their Outcomes

Data referred to the Delhi Disaster Management Authority, Mega mock drill report conducted across Delhi in the year 2012, but here they covered the city-level connectivity and management. In our research, campus-level mock drills specific to fire accidents were considered and executed effectively.

Example Scenario: For example, one scenario related to school buildings was explained as follows

			Official Staff were trapped in the campus.	
9.	School	RSKV, Kondli	New Building of RSKV School which was under construction had been fallen down due to strong tremors. **2 casualties, 1 Serious injury & 6 slightly injured** while 1500 Students were still trapped in the School.	RSKV, Kondli
10.	School	GBSSS, Vivek	The School had developed huge	GBSSS, Vivek

Figure 2: Data presented in Report "Mega Mock Drill Report and Template PART-II" in Delhi Disaster Management Authority website

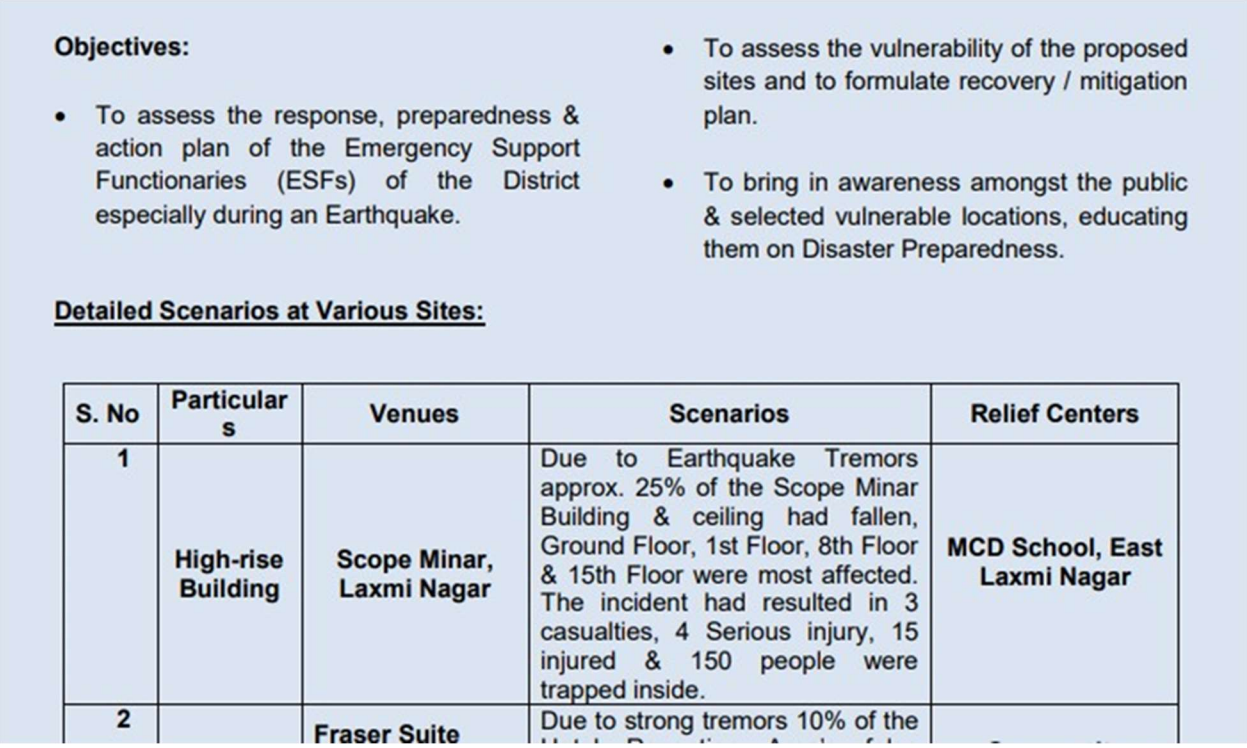


			Students were trapped in the School Building.	
11.	School	Civil Defence Office, Gram Shiksha Kendra School, Gandhi Nagar near Jheel Chowk, Gandhi Nagar Opp. Furniture Market	The Building of Gram Shiksha Kendra School which was under construction had fallen down partially due to strong tremors of Earthquake which had resulted in **1 Serious injury & 4 injured.**	Civil Defence Office, Gram Shiksha Kendra School, Gandhi Nagar near Jheel Chowk, Gandhi Nagar Opp. Furniture Market
			The Old Building of ITI College	

Figure 3 : Data presented in Report "Mega Mock Drill Report and Template PART-II" in Delhi disaster management authority website

Analysis

All the emergency support functionaries (ESFs) participated in the exercise. 100 numbers didn't respond. MCD response was late Response from the residents was very encouraging [46].



Objectives:

- To assess the response, preparedness & action plan of the Emergency Support Functionaries (ESFs) of the District especially during an Earthquake.
- To assess the vulnerability of the proposed sites and to formulate recovery / mitigation plan.
- To bring in awareness amongst the public & selected vulnerable locations, educating them on Disaster Preparedness.

Detailed Scenarios at Various Sites:

S. No	Particulars	Venues	Scenarios	Relief Centers
1	High-rise Building	Scope Minar, Laxmi Nagar	Due to Earthquake Tremors approx. 25% of the Scope Minar Building & ceiling had fallen, Ground Floor, 1st Floor, 8th Floor & 15th Floor were most affected. The incident had resulted in 3 casualties, 4 Serious injury, 15 injured & 150 people were trapped inside.	MCD School, East Laxmi Nagar
2		Fraser Suite	Due to strong tremors 10% of the	

Figure 4 : Data presented in Report "Mega Mock Drill Report and Template PART-II" in Delhi Disaster Management Authority website

Primary Case Study

Introduction

Special schools in India are an important facet of an inclusive society as they provide specialized education and support for children with disabilities. These schools offer a tailored curriculum, individualized attention, and accessible facilities to cater to the unique needs of these students. They facilitate students with disabilities in achieving their maximum potential and engaging more actively in society by offering early intervention, specialized tools, and a nurturing environment. While mainstream schools are also working towards inclusivity, special schools continue to be essential for many students with disabilities in India.

Need for the Study

However, it is pertinent to mention that accessibility features may vary from building to building. It is based on their vintage and renovation history. Thus, periodic accessibility audits and quarterly mock drills need to be conducted. To initiate this, the following practical approach was selected to experiment in the primary case study campus.

Brief About Asha School

Over a period, 37 ASHA Schools for 'Special Children' have started functioning in as many stations. The AWWA Asha School in Delhi Cantonment is a premier educational institution established by the Army Wives Welfare Association (AWWA). It offers high-quality education and holistic development to children of Indian Army personnel. The school is known for its excellent academic standards,

experienced faculty, and a nurturing environment. It provides a range of facilities, including modern classrooms, well-equipped laboratories, a library, sports grounds, and extracurricular activities. AWWA Asha School aims to produce well-rounded individuals who are academically proficient, socially responsible, and morally sound. The school identified for the primary case study is located in Delhi Cantonment, India. Some of the disabilities handled by Asha schools are intellectual disabilities, including autism, cerebral palsy, hearing/speech impairment, visual impairment, and multiple disabilities. The one considered for the primary case study caters to all children with disabilities except visual impairment.

Vision & Mission of Asha Schools

The school stated that their goal is to empower children with special needs by fostering their life skills, social skills, and vocational abilities. They aim to create inclusive and supportive learning environments that provide equal educational opportunities for all students. They strive to meet the unique needs of children with disabilities by offering specialized facilities, qualified faculty, and adequate resources. The school also mentioned that their environment is designed to support learning through personalized instruction, rehabilitation, therapy, and active parental involvement. They emphasized that they prioritize universal design principles to ensure that their facilities, programs, and services are accessible to all students. Overall, the school highlighted that the AWWA Asha School in Delhi Cantonment exemplifies their commitment to inclusivity. They said that the school features accessible ramps, handrails, and toilets, creating a welcoming and supportive environment for children with disabilities.

Existing Scenario with Respect to Physical Accessibility

To accommodate individuals with mobility impairments, the school has provided ramps and accessible entrances. For those needing to reach the first floor, a standard ramp is available to ensure access to all areas. The restrooms are equipped with appropriate features for individuals with disabilities, including grab bars, wheelchair-accessible stalls, and accessible sinks.

- **Sensory Accessibility: To create a sensory-friendly environment, the school has established a sensory park both outdoors and indoors.**
- **Curricular Accessibility: The school's curriculum is designed to accommodate students with disabilities, ensuring that all students enrolled for admission have opportunities to learn and participate. Additionally, the school is equipped with smart boards to enhance the learning experience.**
- **Assistive Devices:**
  - **Wheelchairs, crutches, canes, and walkers**
  - **Other assistive devices such as hearing aids**
  - **Cognitive aids, such as screen readers and screen enlargement applications**
- **Accessibility Policies and Staff Training: The school has established straightforward policies and procedures to ensure that all students can access education and facilities equally. Furthermore, school staff are trained on accessibility issues and how to effectively support students with disabilities.**

Data Collection Strategy Applied in the Research Study

The data collection strategies applied in the research study are as follows:

- **Surveys: Collecting data through questionnaires or interviews.**
- **Observations: Here the events are observed, and their behaviors are recorded.**
- **Experiments: Certain hypotheses are tested.**
- **Case Studies: Detailed analysis of information about specific individuals/groups.**
- **Document Analysis: The existing documents are thoroughly examined.**

Interview Conducted

Three different questionnaires were prepared for students, special educators, and therapists, keeping a child-centric approach in mind regarding ethnic background and education level.

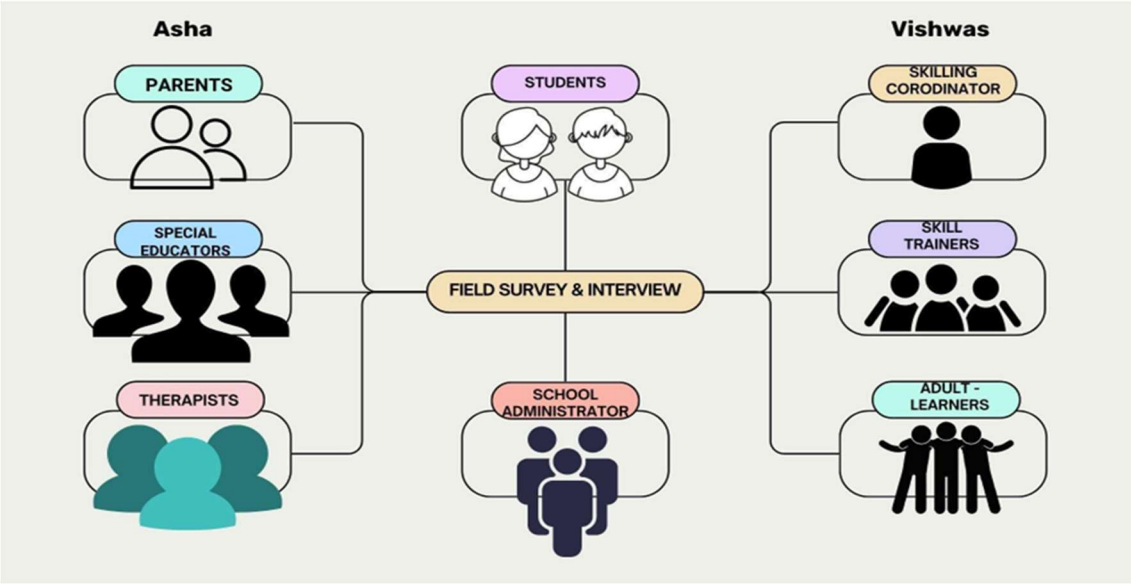


Figure 5: Interview approach

Participants

Participants in the Study

- **Special Educators**
- **Therapists**
- **Categorization of Disabilities in Groups**
- **Children with Disabilities and Their Categorization of Disabilities in Groups**

Table 1: Categorization of Disabilities in Groups

Asha School, New Delhi				
Categories	**Boys**	**Girls**	**Total**	**Percentage**
Intellectual Disability	**34**	**15**	**49**	**49%**
Cerebral Palsy	**5**	**7**	**12**	**12%**
Autism	**9**	**4**	**13**	**13%**
Hearing Impairment	**4**	**3**	**7**	**7%**
Total (Asha)	**52**	**29**	**81**	

Vishwas (A Skill Development Centre), New Delhi

Categories	**Total**

Students with Multiple Disabilities	**20**

Total Strength in Asha cum Vishwas School

Total Strength	**10 1**

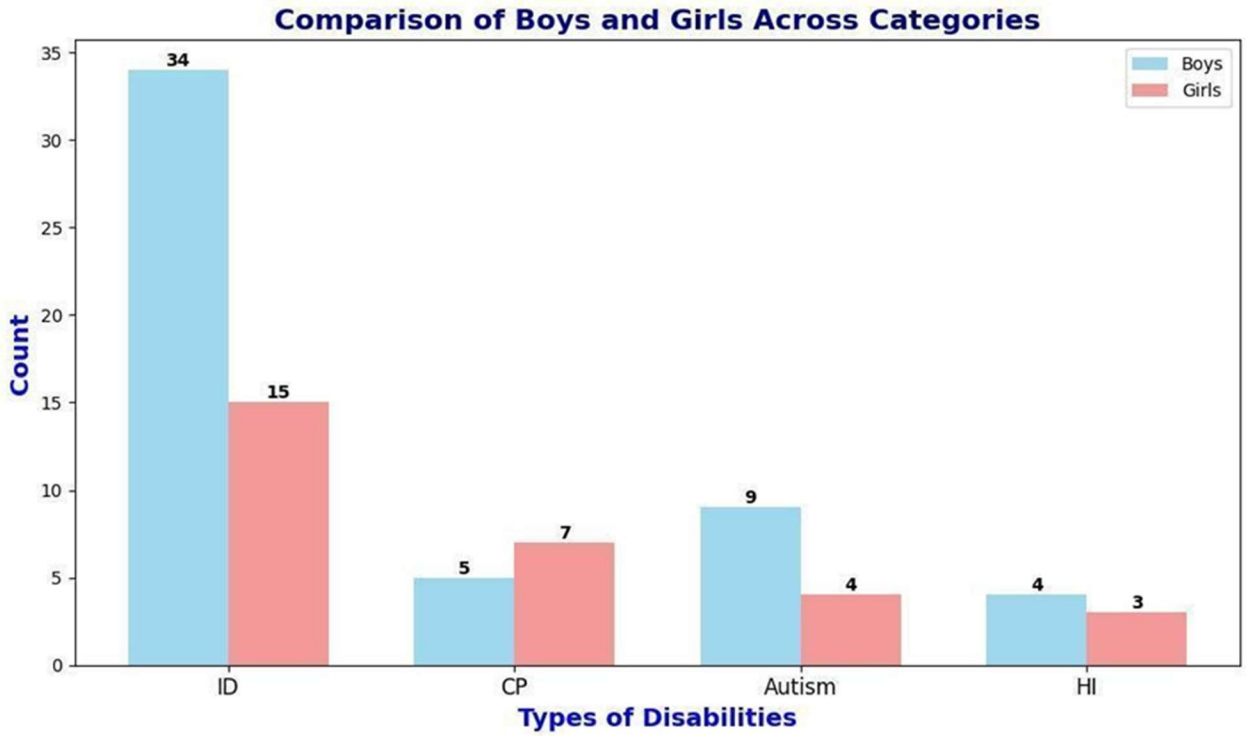


Figure 5: Comparison of Boys and Girls across categories

Key: ID - Intellectual Disabilities, CP - Cerebral Palsy, HI - Hearing Impairment

9.3.3 Glimpse of questionnaire:

To conduct pilot case study, three manual questionnaire surveys prepared specific to children with disabilities, special educators and therapists. The objective of this questionnaire is to understand the psychosocial aspects of students of understanding spaces and requirements of accessibility in the context of familiar places like their school and unfamiliar surroundings like the public transportation space.

Figure 6 : Questionnaire sample prepared for children with disabilities

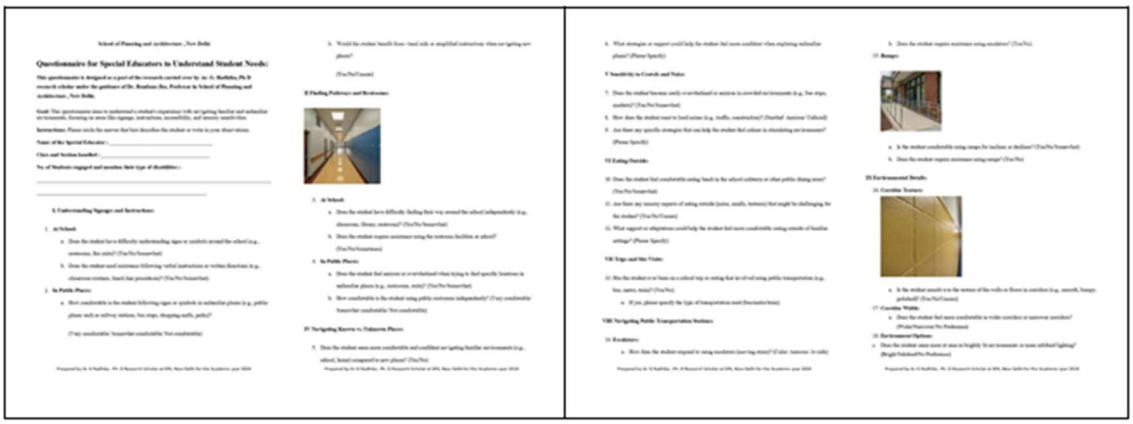


Figure 7: Questionnaire sample prepared for special educators

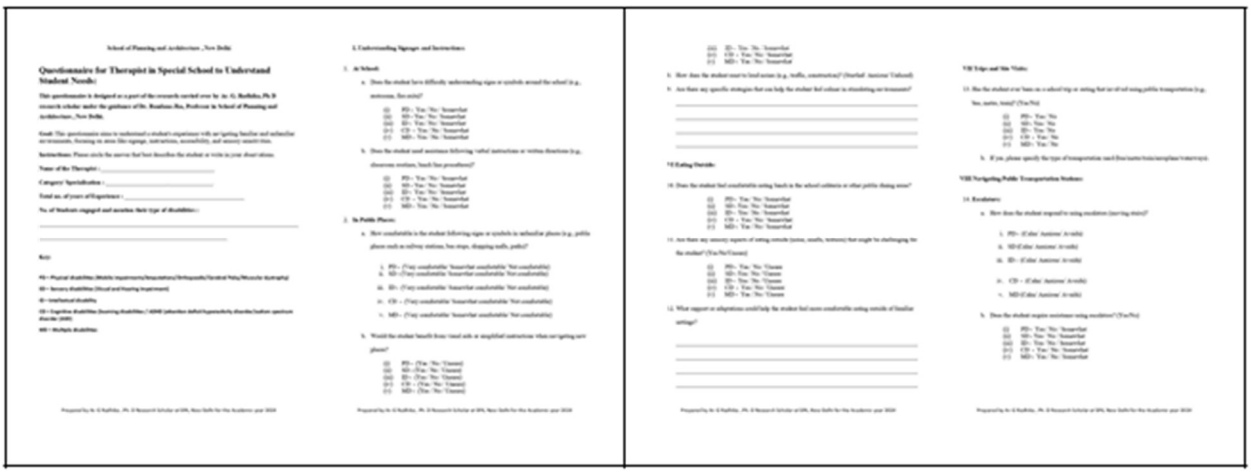


Figure 8: Questionnaire sample prepared for Therapists

10. Experimental Approach

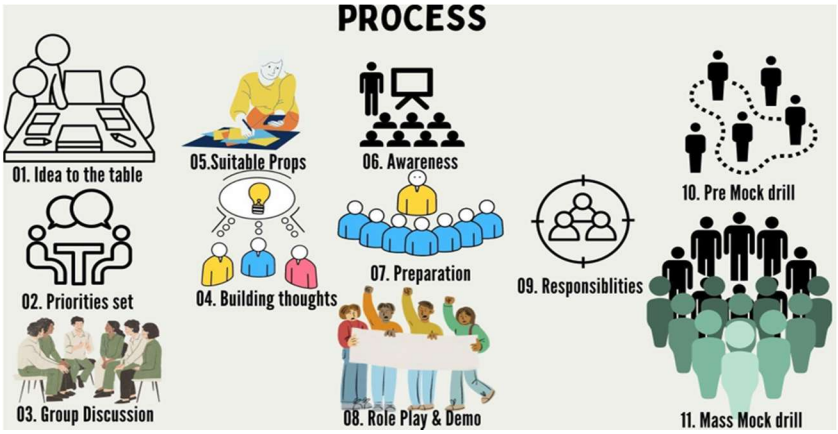


Figure 9 : Interview and Group discussion Process for conducting Fire Mock drill

Procedures Followed to Conduct Mock Drill at School

10.1 Focus Group Discussion

A discussion was held with management and special educators to understand that fire mock drills, terrorist attack preparedness, and earthquake preparedness are common areas of focus. Among these, fire mock drills were considered the highest priority due to the prevalence of fires as a hazard worldwide. Fires can occur in any region or climate and can result from natural events or human activities. Human-caused fires typically stem from accidents, negligence, or intentional acts such as arson. Cities globally have become primary hotspots for various disasters, including those related to fires (Smith, 2021; Jones, 2022).

10.2 Standard Operating Procedure Followed in the Case Study Approach to Conduct Fire Mock Drill

(i) Planning and Preparation

- **Planning Meeting: A meeting was held to discuss the drill scenario, evacuation routes, assembly points, and roles and responsibilities for staff and students.**
- **Script Development: A clear script was created outlining the fire drill sequence, including simulated fire alarm activation, evacuation procedures, and communication protocols.**
- **Staff Training: All staff members were provided with training on their designated roles during the drill, covering evacuation leaders, safe evacuation procedures, and assisting students with disabilities.**
- **Props and Signage: Necessary props and clear signage for evacuation routes and assembly points were prepared.**

(ii) Awareness Programs

- **Video Resources: Age-appropriate videos on fire safety and emergency preparedness were developed and shown to students with disabilities.**
- **Demonstrations: Interactive demonstrations on fire safety procedures, such as using fire extinguishers and crawling low to the ground, were conducted.**
- **Integration: Fire safety awareness programs were integrated into classroom activities and school assemblies.**

(iii) Fire Mock Drill Execution

- **Simulated Fire Alarm: A simulated fire alarm was activated to initiate the drill.**
- **Evacuation: Staff and students followed practiced evacuation procedures and proceeded to designated assembly points.**

- **Emergency Response: Fire marshals, evacuation coordinators, and first responders played their assigned roles in guiding and assisting individuals during the evacuation.**
- **Roll Call: A roll call was conducted at the assembly points to ensure that all individuals were accounted for.**

(iv) Debriefing and Evaluation

- **Discussion: A debriefing was carried out to evaluate the effectiveness of the drill, recognize areas for improvement, and provide feedback to participants.**
- **Evaluation: The drill was evaluated based on the speed and efficiency of evacuation, the effectiveness of communication, and the overall preparedness of staff and students.**

(v) Follow-up Actions

- **Corrections: Any identified issues or deficiencies were addressed to improve future drills.**
- **Documentation: The drill was documented, including attendance records, observations, and evaluation results.**

By following this process, Asha School ensured that its fire mock drills were conducted effectively, providing valuable training and practice for staff and students in case of a real fire emergency.

10.3 Scenario Considered for Mock Drill in the Primary Case Study

Table 1: About School Considered for Primary Case Study

S No	Particulars and Venue	Type of Building	Scenario	Assembling Area
1	School Building	Ground plus first floor building	Fire accident in the kitchen area	Asha Building - Ground level - Playground and Sensory Park, Vishwas Building - adjacent to basketball area

(i) Based on this Decision

Awareness of fire accidents, dos and don'ts, were explained, and then procedures for the fire mock drill were communicated among faculty, staff, and students. A disaster response team at the school level was identified, and roles and responsibilities were distributed. Initially, a pre-mock drill was conducted only for faculty, and later, within two days, the actual fire mock drill was conducted involving students to clarify the evacuation plan and assembly area.

As an outcome of accessibility auditing and analyzing the existing different exit routes in the premises, with the involvement of the principal and selected special educators and therapists, evacuation plans were generated to provide clarity to faculty and staff. Finally, analysis reports were prepared to update the outcome of the fire mock drill with recommendations for improvement. Feedback forms were circulated only to faculty to assess the effectiveness of mock drills and expectations from management in the future.

(ii) Actual Exercise: Based on Minute-to-Minute Report

Points discussed during the debriefing meeting were updated during pre-mock as Standard Operating Procedures (SOP) and after the mock drill in report form, including recommended improvements. The procedures to be followed for emergency mock drills were understood through a literature study that included:

a. General guidelines for schools (national and international level)
b. Guidelines specific to Delhi state level
c. Comparisons with other state school guidelines such as those from Kerala

(iii) Outcome of Fire Mock Drill or Accident Analysed

There were no casualties, and all occupants were evacuated within 5 to 10 minutes; however, arrangements for ambulances were missed. On the safer side, this campus is located close to a hospital, which indirectly reduces the risk.

10. Results:

(i) Faculty Background

Female faculty are mostly 80 percent and male are 20 percent and with respect to their age group minimum faculty prevails under range 25 to 34 holding 13.3%, whereas other faculty equally distributed in 3 ranges of age group namely 35 to 44, 45 to 54 and 55 to 64 holding 26.7 percent each.

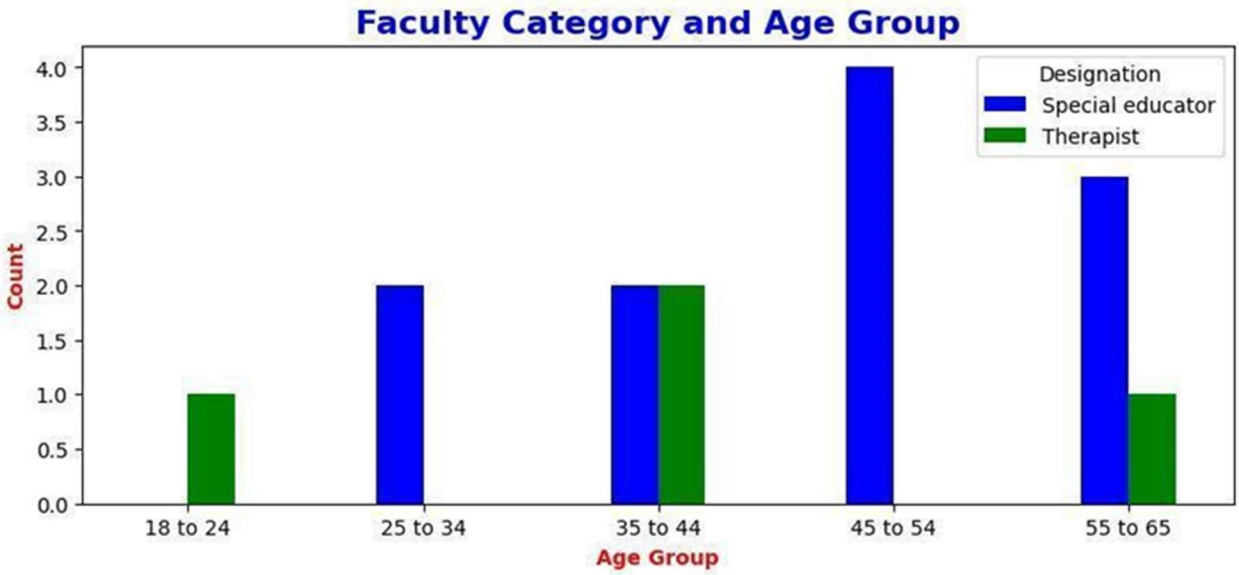


Figure 10: Faculty category and their age group

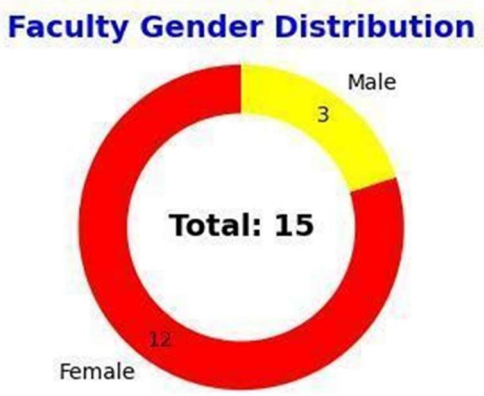


Figure 11: Faculty gender distribution

A Fire Mock drill was conducted for the whole school, but the feedback form was filled by only faculty members consisting of Special educators and therapists after the mock drill. As we can see in the graph, the data has been obtained on line forms from a small sample of 15 participants.

(ii) Students Background

With respect to the category of students with disabilities handled by faculty are children with intellectual disabilities, children with

mobility issues, children with multiple disabilities and speech and hearing impairment. In Asha school, children with multiple disabilities hold the maximum strength among all other categories. Faculty handling students falls under different age groups ranging from 6 to 18 years in Asha School. Second highest group would be children with cognitive or intellectual disabilities. Less percentage of students fall under mobility issues and speech, hearing impairment.

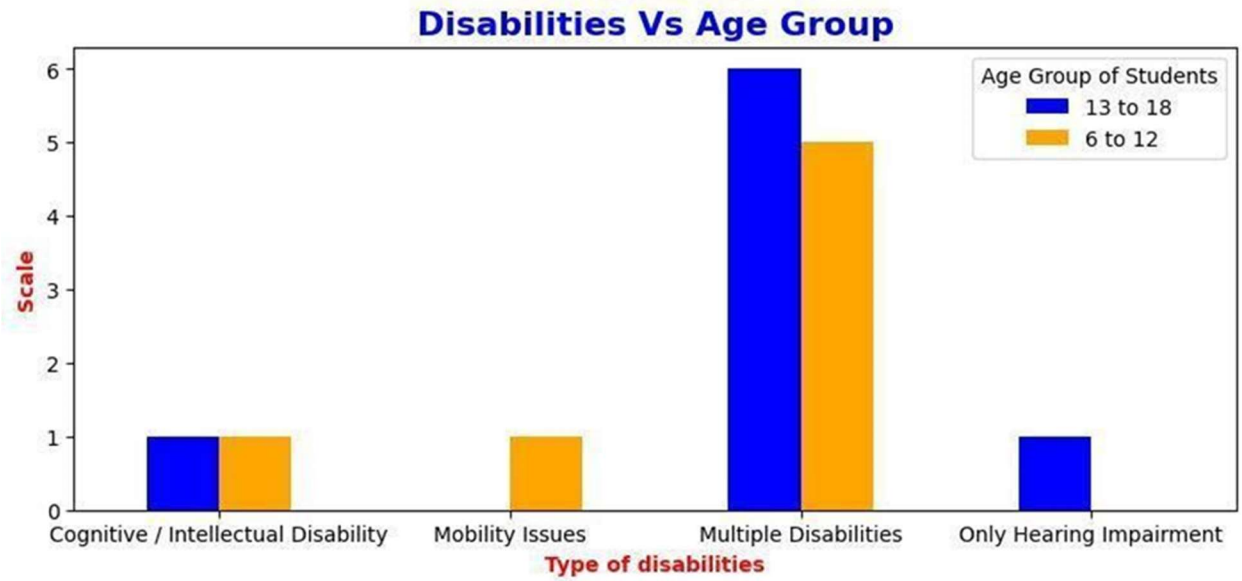


Figure 12: Students age group and their disability category

Fig: Percentage of students with various disabilities handled by faculty

(iii) Understanding the awareness on Emergency preparedness:

Overall Rating on Fire Mock drill conducted on 25th July 2024 in Asha School, feedback form submitted by 15 participants, Faculty provided their perspectives in the lens of faculty and for the students too.

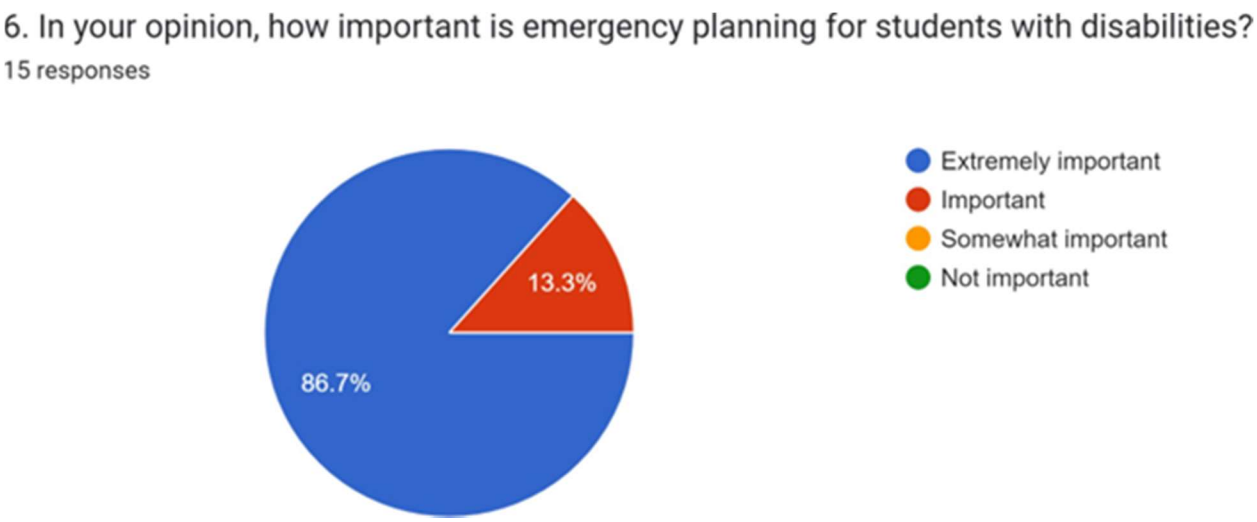


Figure 13: Faculty perception about importance of emergency preparedness for children with disabilities

The vast majority of faculty (86.7%) deemed emergency preparedness as extremely important, while the remaining 13.3% considered it important. When asked about the school's preparedness to handle emergencies, a significant portion (93.3%) expressed confidence, while 13.3% were less certain, opting for a more moderate response.

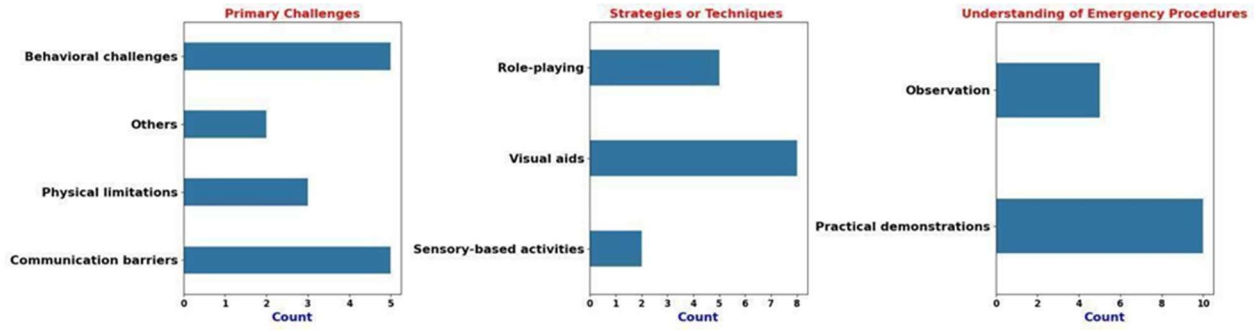


Figure 14: Assessment of primary challenges, strategies or techniques for improvement and essential approaches to understand emergency preparedness better.

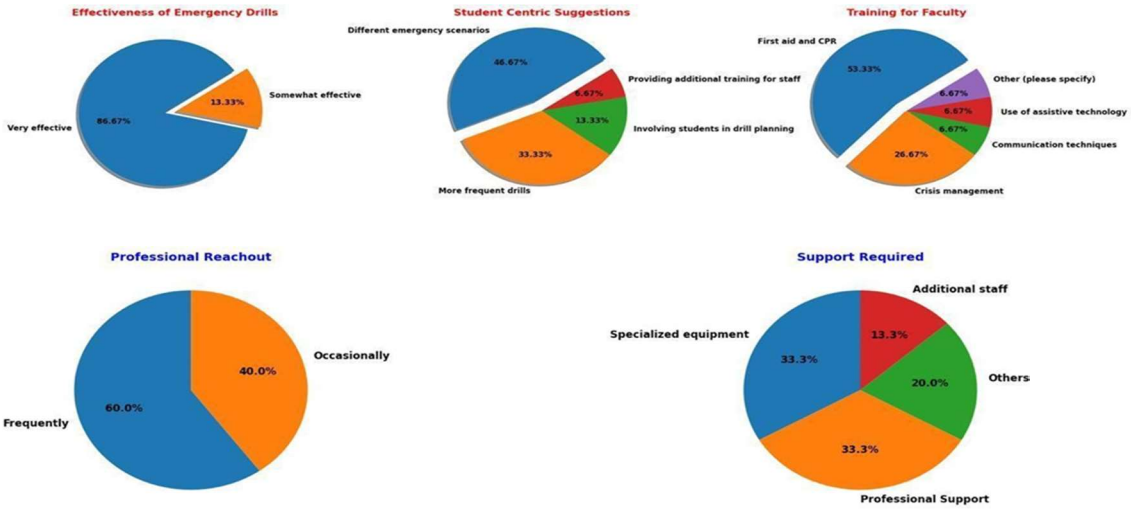


Figure 15: Faculty Rating on Professional reach out and proposed support for future from school administration

(iv) Challenges and improvements required for 3 major categories of students suffering from disabilities at the time of emergency

A. Category 1: Students with Mobility Issues

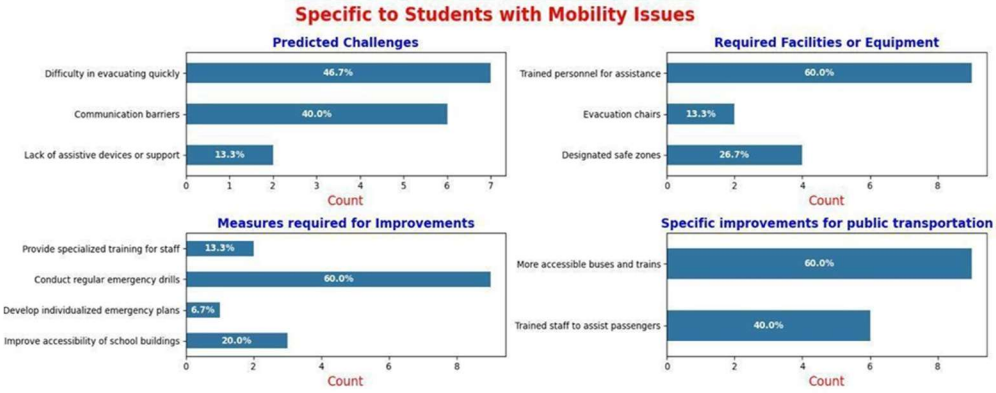


Figure 16: predicted challenges , measures required for improvement in familiar place i.e school and required facilities , improvement in unfamiliar place such as public places

Faculty with their experience and analysing from the recent fire mock drill shared their views with respect to special challenges seen among students would be maximum of communication barriers and behavior

challenges, the next predominant issue would be physical limitation. To provide awareness on emergency preparedness to students, faculty recommended visual aids with more weightage of 53.3 percentage, whereas role playing with 33.3% and the least opted was for sensory based activities. To learn the procedure , faculty believes only practical demonstration is essential with 66.7% and other opted "Observation" methods with 33.3%. They agreed that the capacity building program by conducting mock drills to students and faculty would be very effective with 86.7%, and others opted for somewhat effective. Also when questions are asked , what are the essentials to be prepared for different emergency scenarios.

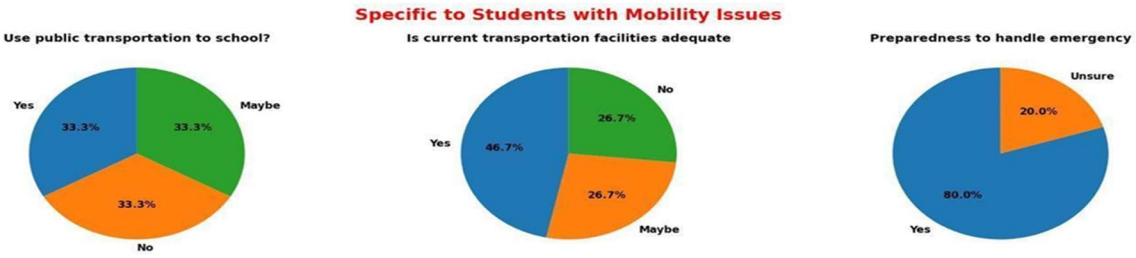


Figure 17: Relevance of Public transportation, current facilities and Students preparedness for emergency in unfamiliar places

B. Category 2: Students with Intellectual Disabilities

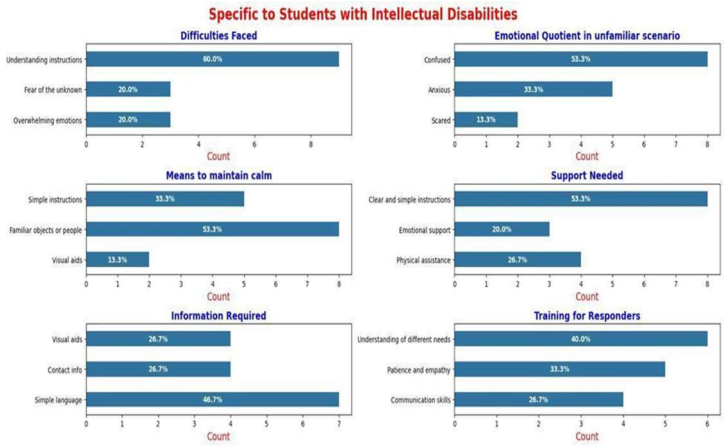


Figure 18: (left-top to bottom order): Assessment on difficulties faced, what emotional quotient required in familiar place ie. in school at the time of Fire mock drill

(right-top to bottom order): Predictions of emotional quotient in unfamiliar places and what support and training required to students and responders at the time of emergency

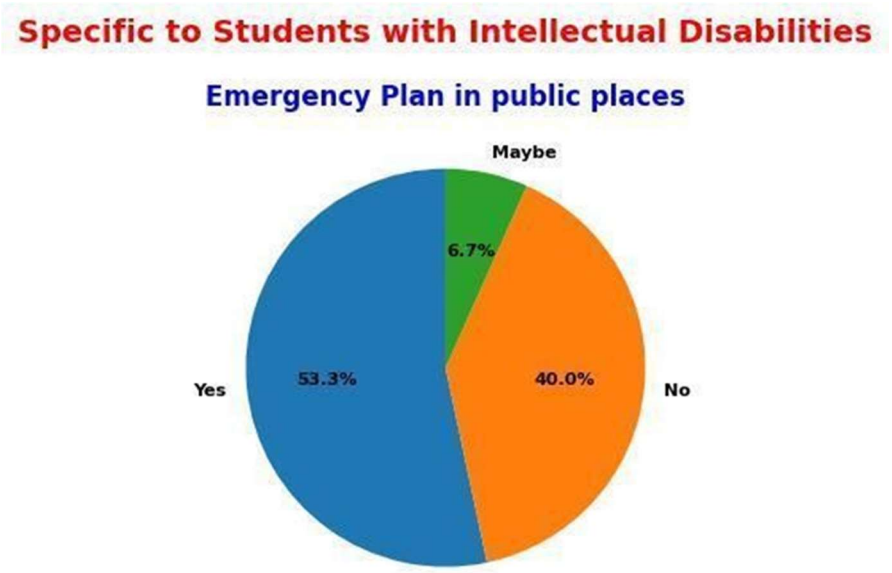


Figure 19 : Ranking of emergency planning in public places

Faculty members believe that students with disabilities may face significant challenges in understanding emergency instructions. A significant percentage reported that students might experience fear or overwhelming emotions during emergencies. Regarding psychosocial aspects, faculty identified confusion as a primary concern for students with intellectual disabilities. Additionally, a substantial number of faculty believed that students might experience anxiety or fear. When comparing familiar and unfamiliar environments, faculty noted that students with disabilities often feel more comfortable in familiar surroundings with familiar people. They suggested that simple instructions are crucial for effective communication during emergencies. Visual aids were considered a secondary priority for conveying emergency information. Furthermore, faculty emphasized the importance of physical

assistance and emotional support from responders to help students with disabilities during emergencies.

C. Category 3: Students with Hearing Impairment

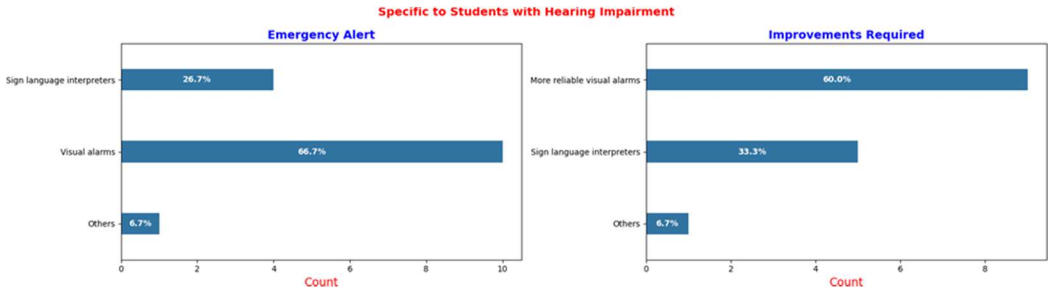


Figure 20: Emergency alert and improvement required feedback specific to Hearing Impairment

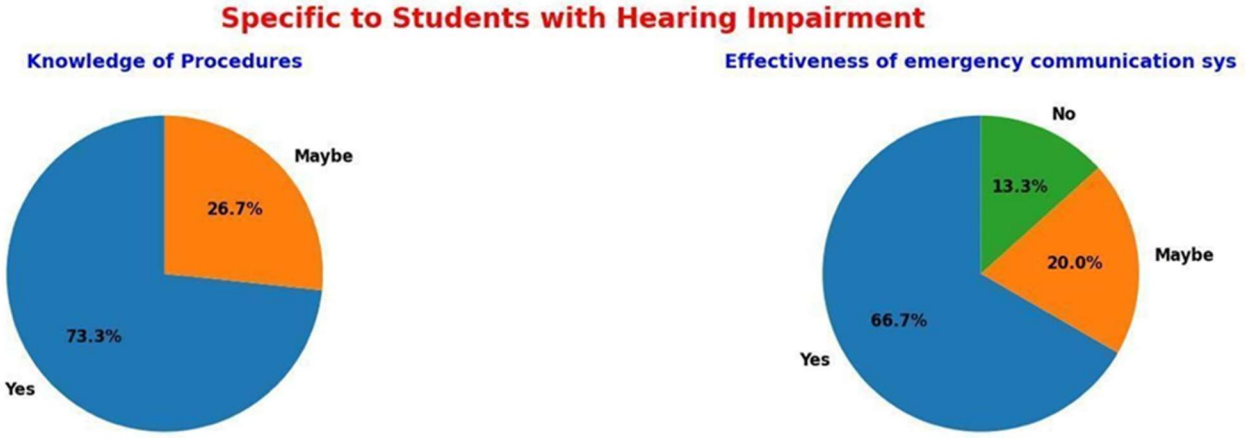


Figure 21: Knowledge procedures and effectiveness of emergency communication(yes or no) questions specific to students with Hearing impairment

Questions specific to students with hearing impairment, majority faculty agreed visual alarms are essential to alert students at the time of emergency and some opted for sign language. Based on the recent fire mock drill conducted in the premises, faculty felt students knew the procedure to evacuate the premises, whereas in unfamiliar places.

12. Discussions

This research seeks to enhance the field of disaster management through an extensive literature review focused on school disaster resilience. According to the UNDRR, resilience refers to a system's capability to withstand, absorb, adapt to, and recover from disasters. This study tackles essential issues related to school safety and identifies the stakeholders necessary for engaging students and faculty in capacity-building initiatives as part of emergency preparedness. The author has recognized various dimensions and indicators of school resilience from the current literature; however, there is a lack of tools and instruments for evaluating each of these dimensions[48].

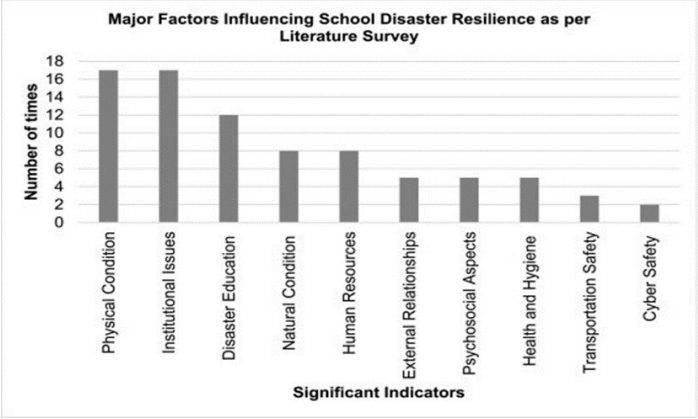


Figure 22 : Resilience Index

Source:
https://www.sciencedirect.com/science/article/pii/S2590061722000242

The researchers who compiled the major factors of school disaster resilience indicated there is scope of study to develop tools and instruments to assess disaster resilience for a school. Also, there are research gaps in the capacity building program of special schools in India and abroad. Thus, this research study focused on this area and

conducted an experimental research study. As an outcome of the study, it is understood the following parameters such as Physical conditions excluding structural dimensions, disaster education and Human resources were widely used in this research study and developed tools and instruments are considered to conduct a fire mock drill as a part of emergency preparedness for children with disabilities and faculty in a special school. Based on the outcome of feedback form after participation of emergency drill, main priorities to be considered specific to the category of children with disability such as children with Mobility issues, Hearing impairment and intellectual disabilities is recognised. However, the sample size is low, for further study the sample size could be increased and assessed to get better results. However, this study did not recognise children with visual impairment, since there are no students with such disabilities present in the school where primary study was conducted.With respect to accessibility, suggestions and recommendations were made based on the checklist followed and assessment made prior to the mock drill to the school administration for improvements based on priority.

With respect to Emergency mock drills, the results from the feedback form clearly indicates that emergency preparedness is essential and based on demonstration and practical approach, children with disabilities would be prepared to face any kind of emergency. At the same time, fulfilment of accessibility standards in the infrastructure, necessary assistive equipment and trained human assistance will enhance the safety along with disaster management awareness education.

With respect to children with disabilities, as we understood from the study that there are multiple disabilities to be catered and individual

adaptive approach is also essential. "The 2015-adopted Sustainable Development Goals, a 15-year plan, pledge to leave no one behind. "so that "no one is left out" needs to be taken care. The survey and the outcome of this research study with the specific questions addressed three major disability categories such as Children with Mobility issues, Children with Intellectual disabilities and Children with hearing impairment. The requirements and challenges to be met in the familiar places like school and unfamiliar places like public transportation is also understood from the results and it is explained in the bar chart below.

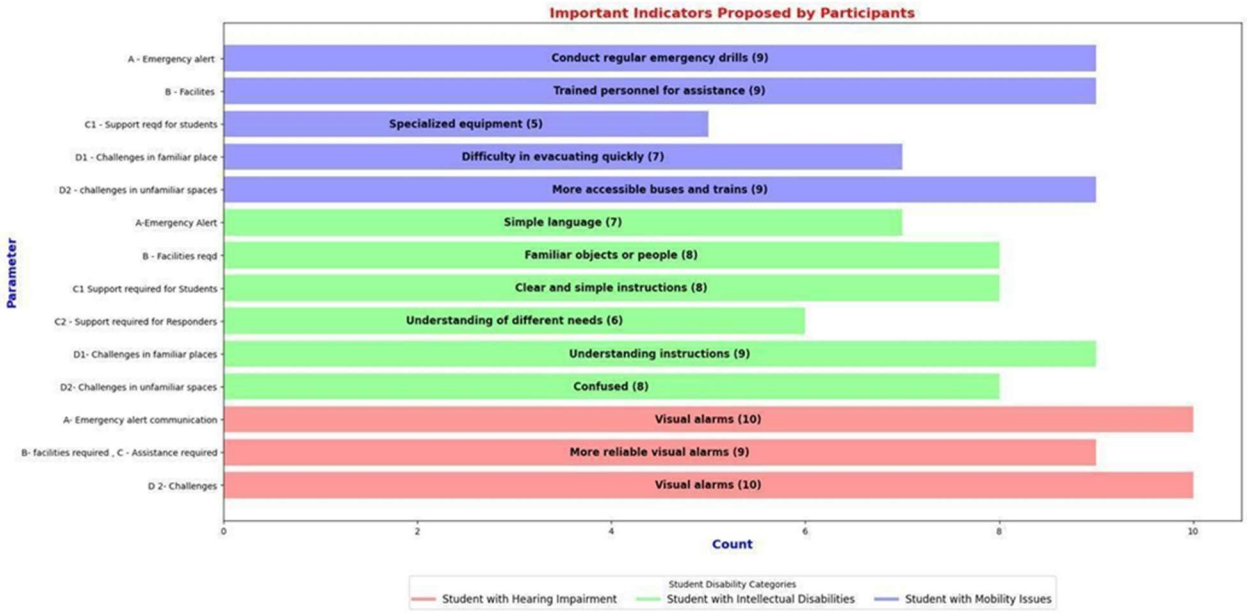


Figure 23 : Explains the Major impact parameter to be address to fulfill the requirement of specific category at the time of emergency .

Important indicators proposed by participants in the fire mock drill feedback form suggested are as follows:

12.1 Specific to Students with Mobility issues:

Regular emergency drills are essential for familiarizing students with emergency procedures, especially those with mobility issues. Schools

should have trained professionals on staff to assist students, particularly those with disabilities, during emergencies. Specialized equipment like evacuation chairs or ramps should be available to support students with mobility impairments. Students with disabilities may face challenges evacuating quickly in familiar places like the school. In unfamiliar places like public transportation, accessible buses and trains are crucial for ensuring the safety of students with disabilities during emergencies.

Most essential parameter identified with respect to following aspects:

- ***Emergency Alerts: Regular emergency drills are crucial for familiarizing students with emergency procedures, especially those with mobility issues.***
- ***Trained Professionals: Schools should have trained professionals on staff to assist students, particularly those with disabilities, during emergencies.***
- ***Specialized Equipment: To support students with mobility impairments, schools should be equipped with specialized equipment like evacuation chairs or ramps.***
- ***Evacuation Challenges: Students with mobility issues may face difficulties evacuating quickly in familiar places like the school.***
- ***Public Transportation Challenges: In unfamiliar places like public transportation, accessible buses and trains are essential for students with disabilities during emergencies.***

12.2 Specific to Students with Intellectual Disabilities:

Emergency alerts should be announced in simple language that is easy to understand. Schools should use familiar objects and persons as

reference points in emergency instructions. Students need clear and simple instructions that guide them to escape routes during emergencies. Responders should be trained to understand the diverse needs of students, including those with disabilities. In familiar places, understanding emergency instructions is crucial for a timely and effective evacuation.

Students may experience confusion in unfamiliar places during emergencies, making clear guidance even more important.

Most essential parameter identified with respect to following aspects:

- ***Emergency Alerts: Emergency alerts should be announced in simple language that is easy to understand.***
- ***Familiar Objects and Persons: Schools should use familiar objects and persons as reference points in emergency instructions.***
- ***Clear and Simple Instructions: Students need clear and simple instructions that guide them to escape routes during emergencies.***
- ***Trained Responders: Responders should be trained to understand the diverse needs of students, including those with disabilities.***
- ***Understanding Instructions: In familiar places, understanding emergency instructions is crucial for a timely and effective evacuation.***
- ***Confusion in Unfamiliar Places: Students may experience confusion in unfamiliar places during emergencies, making clear guidance even more important.***

12.3 Specific to Students with Hearing Impairment:

Emergency alerts should include visual alarms to accommodate students with hearing impairments. Schools should invest in more reliable visual alarms, visual aids, and sign interpreters to support these students. The absence of visual alarms can pose significant challenges for students with hearing impairments in preparing for emergencies and finding their way to evacuation routes, especially in unfamiliar places.

Most essential parameter identified with respect to following aspects:

- ***Visual Alarms for Hearing-Impaired Students: Emergency alerts should include visual alarms to accommodate students with hearing impairments.***

- ***Reliable Visual Alarms, Visual Aids, and Sign Interpreters: Schools should invest in more reliable visual alarms, visual aids, and sign interpreters to support students with hearing impairments.***

- ***Challenges Without Visual Alarms: The absence of visual alarms can*** **pose significant challenges for students with hearing impairments in preparing for emergencies and finding their way to evacuation routes, especially in unfamiliar places.**

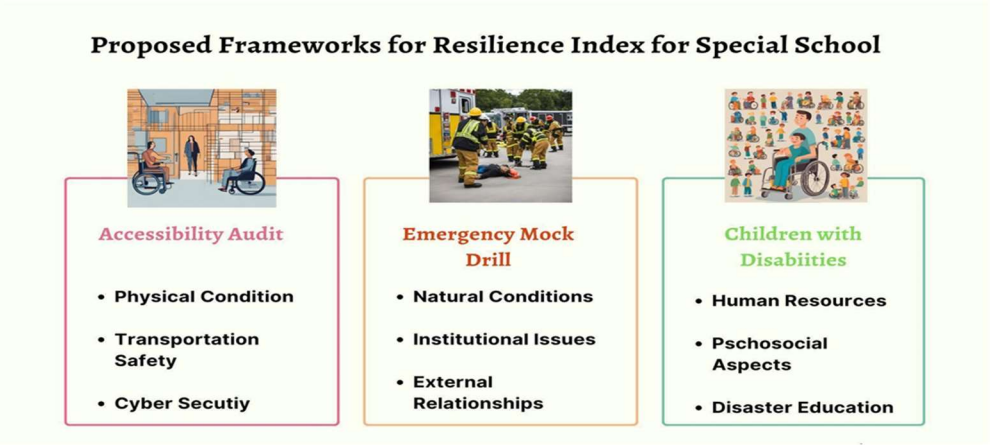


Figure 24: Conceptual framework for Resilience Index for Special School

Overall Evaluation of Accessibility, Emergency Preparedness, and Disability

Based on the outcome of the study, which was centered on three themes—Accessibility Audit, Emergency Mock Drills, and Children with Disabilities—we evaluated the findings using the dimensions and indicators outlined in the Resilience Index gathered from the literature review. The conceptual frameworks developed from this analysis, bridging the Resilience Index with key parameters associated with the three themes, are expressed in Figure 24 above. The indicators connected with nine dimensions from the existing literature are as follows:

Table 12: Indicator and Respective Key Components

Indicator	Key Components
Physical Condition	Structural elements (building quality, codes, exits, etc.), non-structural elements (electrical, gas installations, safety measures)
Institutional Issues	SDMP, HVCA, disaster management organization, evacuation plans, emergency equipment, mock drills, CCTV, funds
Natural Conditions	Hazard exposure, surrounding environment, distance from industrial areas
Disaster Education	DRM integration in curriculum, training, capacity building

Human Resources	**Teacher and student knowledge, training, PTA involvement**
External Relationships	**Collaboration, community linkages, funding, government liaison**
Psychosocial Aspects	**Harassment, violence, delinquency, drug abuse, child labor, gender sensitization, reporting environment**
Home-to-School-to-Home Approach	**Health and hygiene, transportation safety, cyber safety**

Source: Enlisted the identified dimensions and indicators collated from the study: https://www.sciencedirect.com/science/article/pii/S2590061722000242

Conclusions

This research study explored the psychological and behavioral responses of students with disabilities to emergencies. We found that children with disabilities employ various coping strategies, including seeking help, following instructions, and managing anxiety. Familiarity with the school environment and social support from peers and staff also play crucial roles in their resilience. However, our research raises concerns about the lack of inclusive education, public spaces, educational institutions, and office spaces in India. These spaces often fail to meet the requirements necessary to support individuals with disabilities. This isolation can lead to a reliance on special schools and limited exposure to inclusive environments.

To address these issues, we propose a replicable procedure for other schools, both within the Asha School network and beyond. This

procedure involves conducting periodic accessibility audits and quarterly emergency mock drills. By simulating different scenarios and assigning roles and responsibilities to teachers, students, and management, we can identify and address gaps in accessibility and emergency preparedness. In conclusion, creating inclusive environments requires a multifaceted approach. It involves not only physical accessibility and assistive devices but also human support, effective communication, and ongoing evaluation. By implementing these strategies, we can ensure that all students, including those with disabilities, are well-prepared for emergencies and have the opportunity to thrive in inclusive learning environments.

Ethics Approval and Consent to Participate

This study was approved by the ethical review board of Army Public School, which participated in the research survey, and the School of Planning and Architecture for conducting this research and survey in this area. Written informed consent was obtained at the beginning of the study.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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SPATIAL CHARACTERISTICS OF HOME ENVIRONMENTS AND COMFORT OF THE ELDERLY PERSONS

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Abstract

Architectural design of residential environments plays a significant role in ensuring the physical and psychological comfort of elderly individuals, facilitating healthy aging. Identifying spatial characteristics that enhance comfort for the elderly is essential. This study, conducted in Pune, India, aimed to identify such spatial characteristics. A sample of 52 elderly individuals from various parts of Pune were interviewed in their homes. Participants highlighted aspects of their home environments that they liked or disliked concerning comfort. Additionally, closed-ended questions were used to rate various aspects of their homes. Correlation analysis was applied to explore associations between spatial factors and comfort. Findings suggest that location, neighborhood characteristics, spatial organization, and interior architecture influence the comfort of elderly residents.

Keywords: ***homes, spatial characteristics, comfort, elderly persons, aging in place.***

Introduction

The aging process affects both physical and psychological well-being. With age, individuals face challenges in daily tasks due to age-related

ailments and disabilities. As Lindel (1991) posited, 'the form of the environment can determine the extent to which a disability can create a handicap,' thereby emphasizing the responsibility of architects to create inclusive environments. Internationally, the Research Agenda on Aging for the 21st Century (UNPA & IAGG, 2007) identified 'age-friendly architectural design' as a priority research area. Additionally, Ramamurti (2003) highlighted the need for strategies to enhance the quality of life for elderly individuals.

Liebig (2003) noted that only 1% of elderly Indians reside in old age homes, with the majority preferring to stay with family in their homes. The National Policy for Senior Citizens (2011) emphasizes 'aging in place,' which reflects the desire of elderly individuals to remain in familiar surroundings rather than move to institutional settings. Consequently, examining home environments from the elderly perspective becomes essential. This study aims to contribute to environmental gerontology by examining spatial characteristics of home environments in India and their influence on the elderly's comfort.

Review of Literature

Comfort is typically associated with a sense of physical or psychological ease (Wikipedia, 2013). Kolcaba (2003) contextualized this ease in four domains: physical, psycho-spiritual, socio-cultural, and environmental. Moos and Lemke (1984) noted that elderly individuals prefer environments that make them feel secure and address their physical limitations. Kroemer (2006) emphasized that reducing the demands on elderly individuals by adapting the environment can enhance comfort. Further, Vinodkumar (2003)

highlighted the importance of financial, occupational, family, and housing conditions for healthy aging.

The Ecological Theory of Aging by Lawton and Nahemow (1973) introduced the concepts of 'Personal Competence' and 'Environmental Press.' This theory posits that individuals' abilities influence their responses to environmental demands. However, Gitlin (2003) argued that this model can be overly deterministic, as it overlooks modifications that elderly individuals may make to adapt their environments.

The World Health Organization (WHO, 2007) proposed a checklist for age-friendly cities, including housing and built environment as essential elements. 'Aging in place' is increasingly recognized as a vital area of study (Smith, 2009; WHO, 2007; NPSC, 2011). Lawton (1990) argued that familiarity is essential for elderly comfort, underscoring the importance of designing environments that facilitate aging in place.

Methodology

The research was conducted in Pune, Maharashtra, an important city in the western part of India, ranking eighth in terms of population. Blessed with a moderate climate, the city has attracted people from surrounding states. It is popularly known as the "Oxford of the East" due to its educational institutes. In the past, it was also known as the "pensioner's paradise" as it was a preferred retirement destination. Presently, Pune is an important industrial and IT city of the country. The city has evolved in a radial pattern, with the old city core in the center, which has high density. The old city, once characterized by traditional house forms, is gradually transforming into new apartment

buildings. The morphological transformations of the city were particularly rapid in the past 50 years. There were also social changes, such as the emergence of the nuclear family structure. This necessitated the elderly to stay independently, supporting themselves.

Fifty-two elderly persons above the age of sixty were randomly selected from different parts of the city and interviewed at their homes using an interview schedule. The heterogeneity of the sample in terms of socio-cultural and architectural variables was achieved by selecting respondents from different parts of the city. The objective was to understand their perceptions about the quality of their homes and identify the relationship between the physical environment of their homes and their comfort. The critical aspects of the homes of the respondents were documented in the form of sketches and photographs. Questions seeking demographic profile, health profile, and leisure activities were also included in the schedule. Care was taken to select the sample from various parts of the city. The sample comprised thirty men and twenty-two women. Age-wise composition of the sample was 60-69 years (20 persons), 70-79 years (20 persons), 80-89 years (11 persons), and 90 years and above (1 person).

Marathi being the dominant spoken language in Pune, it was decided to prepare the schedules in Marathi along with the ones in English. The interview schedule was discussed with three judges (experts in the field of architecture and research). Pilot testing of the schedule was carried out by interviewing seven elderly persons. The schedule was finalized based on the recommendations of the judges and the responses in the pilot study. The respondents were asked to rate the quality of various physical aspects of their homes and their perception

of comfort and satisfaction with their homes on a 4-point scale. A 4-point scale ensured that the respondents voiced an opinion. However, a "cannot answer" option was available. There were twenty-nine items in all. The items are categorized into five broad heads and presented in Table 1. Open-ended questions sought the aspects of their homes which they disliked and liked. Since the data was collected through face-to-face interviews with the users, the problem of incorrectly filled information was minimal. The responses to open-ended questions in Marathi Schedules were translated into English while retaining their meaning.

Statistical Package for the Social Sciences (SPSS) was used to analyze the data. A comprehensive list of responses to all the open-ended questions was prepared and then coded. It was noticed that users had more than one response for the open-ended questions. These responses were analyzed as multiple response variables. Ordinal data was analyzed using Spearman correlation analysis.

Table 1 – Aspects of Homes Included in the Interview Schedule

Perception of Satisfaction with respect to Rooms	Perception of Comfort with respect to Elements	Perception of Satisfaction with respect to Environmental Factors	Perception of Satisfaction with respect to Facilities	Perception of Satisfaction with respect to Neighborhood
Living room	Stairway	Natural Light	Nearness to parks	Socio-Cultural Environment

Kitchen	**Main door**	**Airiness**	**Nearness to recreational facilities**	**House and surroundings visual quality**
Bedroom	**Flooring**	**Views**	**Nearness to shopping**	**Opportunity to meet friends**
Bathroom	**Cupboards**	**External noise**	**Nearness to Medical facilities**	**Safety**
W.C.	**Doors**	**Overall quality of neighborhood**	**Room available for self**	**Neighbors**
Windows	**Surroundings and Open space**	**Overall quality of the house**	**Overall satisfaction with the house**	

Findings

The findings of the interviews are summarized broadly into two groups:

A. **Correlation analysis of closed-ended questions related to the quality of the house and respondents' perception of comfort and satisfaction about their homes.**
B. **Analysis of open-ended questions asking the respondents to spell out what they "liked" or "disliked" about their homes.**

Perception of Quality of Home

Various aspects of the homes rated on a 1 to 4 ordinal measure were analyzed using the Spearman rank correlation (Leach, 1979) matrix. The Spearman correlation coefficient is indicated as "ρ". Following are the important findings from the correlation matrix:

- **Perception of safety (of homes) was found to have strong positive correlations with the perception of the quality of entry door (ρ = 0.501), friendliness and relationship with neighbours (ρ = 0.550), perception of quality of w.c. (ρ= 0.495) and bath (ρ = 0.521), and moderately with visual quality of the surroundings of the house (ρ = 0.330).**
- **Opportunities to meet friends had strong positive correlations with the perception of the socio-cultural environment of the neighbourhood (ρ = 0.552), nearness to parks (ρ = 0.439), quality of neighbourhood (ρ = 0.439), visual quality of the surroundings (ρ = 0.395).**
- **Satisfaction with the "room for self" correlated positively with the airiness of the house (ρ = 0.541), away from external noise (ρ = 0.353), and safety (ρ = 0.355).**
- **Overall satisfaction with house was found to very strongly correlate with the quality of neighbourhood (ρ = 0.695), visual quality of the house and surrounds (ρ = 0.675), and strongly correlate with perception of safety (ρ = 0.495), quality of doors**

(ρ = 0.488), windows (ρ = 0.520), staircase (ρ = 0.446), and WC (ρ = 0.511).

These findings bring forth the association of perception of comfort with the quality of the spaces and elements of the home and its surroundings. Designs of staircases, water closets, and bathrooms are important for the elderly as these are areas where they encounter physical challenges. Steep risers and lack of railings on staircases are commonly mentioned aspects, while the absence of commodes and grab bars are noted in relation to bathrooms and water closets. Greenery and less clutter in surrounding built environments contributed to the visual quality of the surrounds as mentioned by the respondents.

Likes and Dislikes of the Elderly about Their House

Multiple response analysis was used to analyze the responses to the open-ended questions asking elderly persons' likes and dislikes about their homes. This analysis was undertaken because a person could have more than one answer, leading to the number of responses exceeding the sample size. The data was inductively coded and analyzed. This section presents the findings of this analysis, with the tabulations showing the percentage of respondents mentioning a particular aspect or response. Since the questions were open-ended, the elderly could freely express and elaborate on their living environments.

Aspects of Homes Liked By the Elderly Persons

The responses given by the elderly were broadly categorized as "location aspects," "architectural aspects of the house," "social aspects," "liked everything," and "liked nothing" (see Table 1).

Sr. No.	Aspect	% of Respondents
A	Location Aspects Total (1 to 8) = 71.50%	
1	Lower floor / Ease of access	21.15
2	Amenities close to house	11.54
3	Central location	7.69
4	Open spaces around	7.69
5	Greenery around the house	5.77
6	Peaceful location	9.62
7	Less polluted	5.77
8	Clean surrounds	1.92

B	**Architectural Aspects Total (9 to 18) = 46.15%**	
9	**Compact house**	**5.77**
10	**Airiness**	**17.31**
11	**Good Light**	**5.77**
12	**Elevator / Lift**	**3.85**
13	**Own garden for gardening**	**1.92**
14	**Balcony**	**1.92**
15	**Own room**	**1.92**
16	**Attached toilet**	**1.92**
17	**Solar water supply**	**1.92**
18	**Spacious house**	**3.85**
C	**Social Aspects Total (19 to 21) = 13.46%**	
19	**Good Neighbors**	**1.92**

20	**Safe**	**5.77**
21	**Good socio-cultural environment**	**5.77**
D	**Like Everything**	**9.62**
E	**Like Nothing**	**1.92**

Additional Findings

The following were important findings from the multiple response analysis of the data:

1. **Liking the location of the house was mentioned by 71% of the respondents. Out of these, "lower floor/ease of access" was noted by 21%, which is crucial for physical comfort when accessing the house. Similarly, closeness to amenities and central location were also mentioned. Liking the greenery, low pollution, and open spaces around the house indicates the importance of landscape quality in daily living environments. Peacefulness is also mentioned as an important aspect.**
2. **Among the architectural aspects, the people mentioned they liked "airiness" (17%), noted by the highest number in this category. Physical comfort aspects like an attached toilet and lift were mentioned. A compact house was liked for ease of**

use and maintenance. Having one's own room, garden, or balcony signifies the importance of place-making aspects in a home, contributing to personal space, visual quality, and psychological comfort.

3. **Social aspects were mentioned by 13.4% of the respondents. A majority of these individuals were living in their own homes with their spouses or families in familiar environments. This highlights the significance of aging in place.**

Aspects of Homes Disliked by the Elderly Persons

The responses given by the elderly were broadly categorized as "location aspects," "architectural aspects of the house," "social aspects," and "disliked nothing." The following were important findings from the multiple response analysis of the data.

Sr. No.	Aspect	% of Respondents
A	Location Aspects Total (1 to 8) = 92.31%	
1	No lift (upper floor house)	17.31
2	Noisiness / sound disturbance	38.46
3	Slums nearby causing nuisance	3.85

4	**Amenities far away**	**13.46**
5	**No good views**	**5.77**
6	**Congested locality**	**9.62**
7	**Garbage bin close to house**	**1.92**
8	**Traffic**	**1.92**
B	**Architectural Aspects of the House Total (9 to 29) = 76.92%**	
9	**Steep steps**	**9.62**
10	**Slippery floor**	**13.46**
11	**Indian toilet (squatting type WC)**	**3.85**
12	**Top floor heats up**	**1.92**
13	**Less light**	**9.62**
14	**Dirty look of mosaic tiles**	**1.92**

15	**MS windows get jammed**	**1.92**
16	**No breeze**	**1.92**
17	**Small kitchen**	**3.85**
18	**Small house**	**3.85**
19	**Old house**	**1.92**
20	**No parking facility**	**1.92**
21	**Tile drop creates problem**	**1.92**
22	**Circular staircase**	**1.92**
23	**Toilet away from house**	**1.92**
24	**No visual contact with exteriors**	**1.92**
25	**New latch doors difficult to open**	**1.92**
26	**Nuisance of rats due to garden**	**1.92**

27	**House not as per Vaastu**	**1.92**
28	**No security**	**1.92**
29	**No maintenance**	**5.77**
C	**Social Aspects Total (30 to 32) = 11.54%**	
30	**Not so good social environment**	**1.92**
31	**Not safe**	**5.77**
32	**No neighbors**	**3.85**
D	**Nothing**	**1.92%**

Key Findings

1. **Of the "location aspects" disliked by the respondents, "noisiness" was mentioned by almost 38% of the total sample. This highlights the need for peacefulness in the surroundings. A congested locality, traffic, and slums nearby were also possible reasons for noisiness mentioned by respondents. Similarly, congested localities, adjoining slums (perceived as reasons for poor visual surroundings and unhygienic conditions), and traffic were indicators of poor environmental and landscape quality in the respondents' neighborhoods. Lack of a lift in houses on**

upper floors was also an important concern for elderly individuals, affecting accessibility.

2. **Architectural aspects were mentioned by 76% of the respondents. Steep steps, slippery floors (homes with newer flooring materials such as polished tiles), Indian-type WCs (which were difficult to use due to physical inability to squat), circular staircases, and jammed windows contributed to physical discomfort. Insufficient lighting within the house also affected visibility and movement.**
3. **Regarding the "dislikes," only 11.54% of respondents expressed dissatisfaction with the social environment around them. This aligns with the findings in the "likes" section, likely due to the fact that the majority of individuals lived in familiar environments with their spouses or families, developing social ties over time. This highlights the importance of aging in place.**
4. **Some responses, such as "rats in the garden," were received but are case-specific and not particularly significant from the perspective of elderly comfort.**

Conclusions and Recommendations

Physical comforts necessary in old age—such as ease in carrying out personal tasks, unimpeded movement, accessibility without the fear of falling, and easy access to one's home—are affected by the design and construction of homes. Non-slip floors, provision of lifts, grab bars, handrails in toilets, commodes, and proper illumination are essential features. Spatial characteristics of a home, which may not have been a concern during younger years, become sources of anxiety in later life. Upper floors present problems for mobility and

accessibility among elderly persons, underscoring the need for adaptable and universally designed environments.

Psychological comforts in old age, such as crime safety, social interaction opportunities, recreational activities, a sense of independence, aesthetic satisfaction, and opportunities for self-expression, are also impacted by aspects of the built environment. Factors such as window locations and floor plans can affect feelings of security and visibility. Physical elements like house location, access to community spaces and parks, and landscape development in the vicinity can influence psychological comfort. Despite the physical challenges within their environments, elderly persons tend to feel content with their homes, which aligns with the theory of aging in place. This study emphasized spatial factors over social ones and utilized a qualitative approach to identify numerous factors contributing to elderly comfort.

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