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RESEARCH PAPER

Equitable Urban Climate Action:

Integrating Disability-Inclusive Plans Into School Disaster Preparedness

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2025

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Acronyms

KMO	Kaiser–Meyer–Olkin Measure – Statistic used to assess sampling adequacy for factor analysis.
DRR	Disaster Risk Reduction – Framework for minimizing disaster risks through preparedness and prevention.
UNDRR	United Nations Office for Disaster Risk Reduction – UN agency coordinating DRR efforts globally.
UNICEF	United Nations Children's Fund – Supports education and child protection in disaster preparedness contexts.
DPO	Disabled Persons' Organization – Representative body advocating for rights and inclusion of persons with disabilities.
ZAPD	Zambia Agency for Persons with Disabilities – National institution supporting and representing persons with disabilities.
CDF	Constituency Development Fund – Local government fund supporting community projects, including school preparedness.
CSSF	Comprehensive School Safety Framework – Sendai-aligned global framework for school disaster preparedness and safety.
DMMU	Disaster Management and Mitigation Unit – Zambian government body overseeing disaster management.
MoE	Ministry of Education – Government ministry responsible for education policy and administration.
PPS	Probability-Proportional-to-Size Sampling – Sampling method used to allocate survey respondents proportionally by school size.
KII	Key Informant Interview – Qualitative data collection method used with teachers, planners, and DPOs.
SDG	Sustainable Development Goal – Global UN development targets (e.g., SDG 4: Quality Education).
CwD	Children with Disabilities – Primary study population group.
USAID	United States Agency for International Development – Referenced in relation to data on school disruptions.

Abstract

Climate-induced disasters increasingly threaten Zambia's education system, disrupting learning and exposing inequities in school preparedness. Students with disabilities face heightened risks due to inaccessible infrastructure, limited teacher capacity, and exclusion from preparedness initiatives. This study examined how schools in Western Province, particularly in Mongu and Kaoma, build disability-inclusive disaster resilience, guided by Resilience Theory's three capacities: absorptive, adaptive, and transformative.

A mixed-methods design was used, combining a survey of 160 students with disabilities across nine schools with twenty key informant interviews involving teachers, head teachers, socio-economic planners, and representatives of Disabled Persons' Organizations (DPOs). Quantitative analyses (factor analysis, t-tests, chi-square, regression, and content analysis) assessed relationships among preparedness, absorptive, adaptive, and transformative capacities, while qualitative data were thematically analyzed to contextualize institutional practices and barriers.

Findings revealed significant disparities between mainstream and special schools, with mainstream settings reporting higher preparedness levels. Prior disaster exposure did not significantly predict preparedness, underscoring that experience alone does not ensure readiness without structured education. Absorptive and adaptive capacities, alongside district context, were strong positive predictors of disaster preparedness. The finding that absorptive capacity, rooted in trust and teacher support, significantly predicts preparedness introduces the new concept of relational resilience, shifting focus from material readiness to social-emotional connectedness as a foundation for inclusion.

Transformative capacity emerged through calls for systemic change, focusing on inclusive infrastructure development, teacher training on disaster and disability inclusion, curriculum integration, intersectoral coordination, and sustained funding. Strengthening absorptive, adaptive and transformative capacities can ensure equitable, disability-inclusive resilience across Zambia's education system.

Keywords: Disaster Preparedness, Students with Disabilities, Climate-Induced Disasters, Resilience Theory

This work was part of a multi-country research initiative led by the Global Disaster Preparedness Center of the American Red Cross.

1. Introduction

Zambia, a lower middle-income country in Southern Africa, is increasingly facing the impacts of climate-induced disasters, including floods, droughts, and extreme heat events. These hazards continue to intensify in frequency and severity, exacerbating structural inequalities and deepening poverty (Libanda & Ngonga, 2018; Ngoma, Finn & Kabisa, 2021). Among those most affected by climate-induced disaster are persons with disabilities, who face heightened risks of injury, mortality, and prolonged recovery due to barriers related to accessibility, mobility, and exclusion from mainstream preparedness initiatives (Nkhuwa, 2024). Despite growing global and regional emphasis on inclusive climate adaptation and disaster risk reduction, the needs of persons with disabilities remain inadequately addressed in policy design, practice, and implementation (WHO, 2022).

In Zambia, progress toward disability-inclusive disaster preparedness is constrained by limited and inconsistent data. The 2015 National Disability Survey estimated that 10.9% of adults and 4.4% of children (aged 2–17) live with a disability (Zambia Statistics Agency, Ministry of Health, & ICF, 2019). However, subsequent national datasets, such as the 2018 Demographic and Health Survey and the 2022 Population and Housing Census, did not disaggregate or publish disability prevalence data. The absence of reliable data has hampered targeted interventions, making it difficult for authorities and schools to design preparedness strategies that adequately address the safety and support needs of students with disabilities.

The education sector has been particularly vulnerable to climate-related disruptions. School closures caused by floods, strong winds, and heatwaves have significantly interrupted learning and compromised students' access to social and protective services (Shah et al., 2022). In 2022 alone, over 523 schools with more than 74,000 learners were affected by climate events, and in 2023, 127 schools were closed for up to 90 days, mainly in the Southern and Western Provinces of Zambia (UNICEF, 2025). These disruptions reveal the urgent need for robust and inclusive school disaster preparedness systems, particularly those that safeguard children with disabilities, who often face compounded risks during emergencies.

While Zambia's education policy framework, including the 1996 Education Policy and subsequent inclusive education reforms, commits to equity and accessibility, implementation gaps persist. Schools have limited capacity and resources to mainstream disability inclusion within disaster preparedness, and there are few tailored programs that address the needs of students with disabilities before, during, and after climate-induced

events (Muzata et al., 2021). Additionally, schools remain underrepresented within local disaster management structures, such as Satellite Disaster Management Committees (SDMCs), resulting in limited coordination and weak inclusion in decision-making.

Against this backdrop, this study focuses on Western Province, one of Zambia's regions most affected by climate-related disruptions and home to a significant population of children with special education needs (Ministry of Education, 2024). Guided by Resilience Theory, the study examines how urban schools develop and sustain resilience through three interrelated capacities that include absorptive, adaptive, and transformative. These capacities collectively reflect schools' ability to anticipate, respond to, learn from, and reform practices to enhance preparedness and inclusion for students with disabilities.

The study specifically sought to:

1. Determine the extent to which school type (mainstream versus special) and prior exposure to disasters influence students' knowledge of disaster preparedness procedures.
2. To assess the predictive influence of absorptive (coping and basic response mechanisms) and adaptive (learning, adjustment, and innovation) capacities on students' preparedness levels.
3. Identify and categorize the most frequently suggested improvements for disability-inclusive disaster preparedness among students with disabilities.
4. Explore how teachers, school administrators (or head teachers), policymakers (socio-economic planners) and representatives of Disabled Persons' Organization (DPO) describe the challenges, practices, and institutional dynamics that shape disability-inclusive disaster preparedness and resilience-building in schools.

Through a mixed-methods approach, this study integrated quantitative analysis with qualitative insights from educators (teachers and head teachers), socio-economic planners, and representatives of Disabled Persons' Organizations (DPOs). Ultimately, this study contributes to advancing equitable urban climate action by providing empirical evidence on how schools in Zambia can strengthen resilience among students with disabilities. By uncovering both the institutional gaps and opportunities for reform, the research offers actionable recommendations to integrate disability inclusion within school disaster preparedness frameworks and national resilience strategies.

2. Review

2.1. Empirical Discussion

School Type, Prior Disaster Exposure and Disaster Knowledge

Disaster preparedness in schools has gained increased scholarly attention as climate-induced hazards continue to threaten children's safety, particularly in urban environments. Educational institutions play a critical role in shaping students' disaster risk awareness, mitigation knowledge, and emergency responsiveness (White-Lewis et al., 2021; Seddighi et al., 2020). However, disparities in preparedness levels often mirror broader institutional inequalities, including differences in school types, resourcing, and exposure to prior disasters.

Across multiple studies, school type emerges as a significant determinant of students' disaster preparedness knowledge. Urban and public schools tend to demonstrate higher preparedness levels than private, under-resourced, or rural schools (Rizky et al., 2025; Widowati, 2025; Salsabila et al., 2023). Rizky et al. (2025), compared five senior high schools in Indonesia and found that the public school scored significantly higher (M = 28.17) on a knowledge–attitude–practice index than the private school (M = 21.28). Similarly, Widowati (2025) reported that public primary school students exhibited stronger disaster risk reduction knowledge than their private school counterparts (p = .014). These differences have been attributed to varying levels of teacher training, resource access, and exposure to government-led disaster programs.

In a related study, Salsabila et al. (2023) compared urban and rural junior high schools in Indonesia, finding that urban students demonstrated significantly higher earthquake preparedness (p = .000). This urban advantage aligns with the broader argument that access to facilities, information, and disaster education initiatives is concentrated in urban, government-supported institutions (Cvetković & Šišović, 2024; Garibay Rubio et al., 2024). By contrast, under-resourced and special schools, though often located in hazard-prone areas, receive minimal institutional support for safety education, leaving them with limited preparedness (White-Lewis et al., 2021).

Collectively, these studies converge on a key insight with institutional and resource inequalities among school types shape disaster knowledge acquisition. While curricula may include disaster topics, schools with inadequate infrastructure or trained personnel struggle to translate knowledge into practical preparedness behaviors (Rofiah et al., 2024).

This aligns with resilience and equity theories, which posit that system-level disparities reinforce vulnerability, especially among marginalized student groups.

While school type shows a consistent relationship with preparedness, the influence of prior disaster exposure remains less clear. Among the reviewed studies, only one, Shah et al. (2022), directly measured individual disaster exposure. In this Pakistani study, 68% of students had previously experienced floods between 2010 and 2014. Surprisingly, prior exposure did not correspond with higher preparedness of knowledge or improved emergency behavior. Only 12% of students reported having a family disaster plan, and a mere 5% practiced it regularly. This finding suggests that experience alone does not foster preparedness without structured educational reinforcement.

Other studies referred to community-level disaster histories rather than personal experience. For instance, Rizky et al. (2025) examined schools in a post-tsunami context and found that, despite extensive community exposure to disasters, preparedness knowledge remained uneven. Similarly, Cvetković & Šišović (2024) documented that in Serbia, Belgrade students' earthquake and flood awareness was shaped more by information sources and education exposure than by personal or community experience. These findings indicate that formal education and institutional preparedness programs play a more decisive role than lived disaster experience in shaping students' readiness.

The evidence above underscores that prior exposure is an insufficient predictor of preparedness. While it may heighten awareness, it does not guarantee knowledge retention or behavioral readiness unless reinforced through systematic school-based training (Shah et al., 2022).

Beyond school type and exposure, several contextual factors interact to influence disaster preparedness knowledge. Studies reveal that gender, socioeconomic background, parental education, and district context can affect how preparedness knowledge is acquired and applied (Cvetković & Šišović, 2024; White-Lewis et al., 2021). For instance, in under-resourced urban districts of the United States, White-Lewis et al. (2021) found that targeted interventions significantly improved secondary students' preparedness knowledge ($p < .05$), yet baseline awareness remained low due to systemic neglect.

Similarly, district-level governance and infrastructure have been shown to mediate preparedness outcomes. Shah et al. (2022) observed substantial differences in flood preparedness across districts in Pakistan, underscoring that local resource distribution and institutional coordination matter as much as individual school attributes. Studies in Indonesia (Widowati, 2025; Rizky et al., 2025) and Mexico (Garibay Rubio et al., 2024) corroborate this, showing that sustained engagement from local authorities, community

stakeholders, and educators enhances the overall learning ecosystem of disaster resilience.

Institutional and Pedagogical Determinants of Disability-Inclusive Disaster Preparedness

Across diverse contexts, teacher training consistently emerges as the most influential determinant of school preparedness (Kawasaki et al., 2023; Olympia et al., 2005). Teachers are often the first responders and on-the-spot decision-makers during emergencies, yet many remain ill-equipped to support students with disabilities or to manage crisis situations effectively (Sharp et al., 2025). Building teacher capacity is therefore central to strengthening institutional resilience.

In Japan, training programs for special school-teachers emphasize individualized evacuation assistance, effective communication with non-verbal students, and emotional regulation during crises (Kato et al., 2014). Likewise, New Zealand's inclusive preparedness workshops highlight scenario-based learning and peer collaboration, encouraging teachers to learn through reflection and shared problem-solving (Ronoh et al., 2015). Collectively, these initiatives demonstrate that developing teachers' adaptive capacity, their ability to learn, adjust, and innovate, fosters a culture of shared responsibility and continuous institutional learning. In this way, teacher training acts as both a preventive and transformative mechanism for inclusive disaster preparedness.

However, under-resourced schools, particularly in low- and middle-income countries, lack access to such specialized programmes. Chowdhury et al. (2025) observed that Bangladeshi teachers rarely receive formal disaster management training, relying instead on "common sense" or improvised responses during emergencies. This finding reflects what Bahadur et al. (2013) describe as a gap in institutional absorptive capacity, where schools lack structured systems and professional knowledge to absorb shocks or manage crises effectively. Without ongoing professional development and institutional support, teachers' preparedness remains fragmented, undermining both inclusion and resilience.

Beyond training, infrastructure readiness is another decisive factor shaping inclusive disaster preparedness outcomes. Several studies identify architectural inaccessibility as a major barrier to the safety of students with disabilities (Kawasaki et al., 2023; Chowdhury et al., 2025). Narrow corridors, steep staircases, and the absence of ramps or accessible exits can create life-threatening barriers during evacuation.

Kato et al. (2014) reported that during Japan's 2011 earthquake, children with physical disabilities faced disproportionate risks because evacuation routes were not wheelchair accessible. Similarly, Rofiah et al. (2024) found that special schools in Indonesia's seismic zones lacked safe assembly points and structurally reinforced buildings, further increasing

vulnerability. These findings underscore a widespread design inequity in educational infrastructure; schools are often built for the "able-bodied" majority, neglecting inclusive safety design.

The consensus across these studies is that universal design principles and inclusive physical environments are prerequisites for equitable preparedness. Disaster resilience, therefore, must extend beyond pedagogical reform to include spatial and infrastructural transformation, reimagining schools as accessible, flexible, and safe spaces for all learners. In this context, the physical environment becomes both a site of exclusion and a potential catalyst for inclusion.

On the contrary, embedding disaster education into the school curriculum is widely recognized as a cornerstone of preparedness (Nagata & Kimura, 2020). Rather than treating disaster response as a stand-alone activity, researchers advocate integrating it into existing subjects such as science, social studies, and civic education through experiential and participatory methods, including storytelling, simulation, and drama. This approach deepens students' understanding while normalizing preparedness as part of everyday learning.

Nagata and Kimura (2020) developed a disaster management curriculum for Japanese students with intellectual disabilities, focusing on enhancing self-protection skills and cultivating a "zest for life." Similarly, Rofiah et al. (2024) promoted multimodal instructional strategies, such as tactile maps and sign language, to accommodate learners with different sensory and cognitive needs. These inclusive teaching methods operationalize disaster education as a form of empowerment, helping students with disabilities build confidence and agency during emergencies.

At the policy level, the reviewed literature reveals persistent tensions between policy intent and implementation reality. While many countries have developed Disaster Risk Reduction and Management (DRRM) frameworks, these policies often lack operational clarity or mechanisms for school-level integration (Alarte, 2024). Diquito and Sangil (2025) further observed that Special Education (SPED) teachers seldom receive policy guidance explicitly addressing learners with disabilities, forcing them to interpret and adapt national directives on their own.

This persistent policy–practice gap points to weak institutional coordination among ministries, local governments, and schools. Policymakers tend to prioritize compliance and documentation over contextual adaptation, resulting in top-down mandates that rarely align with classroom realities. Consequently, teachers and principals frequently become de facto implementers, translating policy aspirations into improvised, context-sensitive actions (Diquito & Sangil, 2025). While grassroots adaptability demonstrates institutional

resilience, it also highlights the absence of coherent governance that could otherwise support systematic inclusion and preparedness.

Further, empirical evidence increasingly confirms that preparedness and adaptive capacity are mutually reinforcing. Safriani et al. (2022) demonstrated a significant statistical relationship ($p < .05$) between preparedness and adaptive capacity among Indonesian junior high school students, showing that structured preparedness initiatives can cultivate adaptability and resilience in crisis situations. Extending this logic to educators and administrators, schools that institutionalize preparedness, through regular drills, curriculum integration, and community partnerships, simultaneously enhance their organizational learning and reflective practice.

Thus, policymakers play a pivotal enabling role in this process. When education ministries embed disaster risk reduction within national curricula or teacher professional standards, they strengthen the system's transformative capacity, its ability to evolve from reactive preparedness toward proactive resilience. However, most current policies remain focused on short-term compliance targets rather than iterative learning cycles, limiting schools' ability to contextualize inclusion and sustain long-term adaptive change (Safriani et al., 2022).

Disability-Inclusive Disaster Preparedness in African Schools

Regional Evidence from Africa

Across Africa, research increasingly reveals the systematic exclusion of persons with disabilities from disaster preparedness planning and implementation. The United Nations Office for Disaster Risk Reduction (UNDRR) Regional Office for Africa (2024) reports persistent challenges in Cameroon, Ethiopia, Kenya, and Togo, including the absence of formal participation mechanisms for persons with disabilities, limited disability-disaggregated data, and insufficient funding for inclusive disaster risk reduction (DRR) measures. Although most countries have signed onto inclusive DRR frameworks, disability considerations often remain peripheral within governance and communication systems.

In Southern Africa, country-level studies provide detailed insights. Following Cyclone Idai, school-based research in Zimbabwe's Chimanimani and Chipinge districts found that most school disaster preparedness plans failed to address the needs of learners with disabilities (Makamanzi, 2024). Where inclusive practices, such as disability-sensitive evacuation drills, role assignments, and teacher training, were implemented, both preparedness and confidence among students and staff improved significantly. Post-disaster analyses also emphasize the need for "build-back-better" strategies that integrate

inclusive design and capacity-building within education systems to enhance resilience (Dube, Wedawatta, & Ginige, 2021).

In East Africa, school DRR programmes frequently overlook learners with disabilities, with teacher preparation gaps and inaccessible infrastructure noted in Kenya and Tanzania (Ressa, 2022; UNPRPD, 2022; Ressa, 2021). In Ethiopia's urban schools, studies report limited adaptive learning materials and institutional capacity constraints, which hinder participation by students with visual or hearing impairments (Burningham et al., 2024; Belay & Yihun, 2020). These patterns echo Africa-wide findings on policy–practice gaps in inclusive DRR (UNDRR Regional Office for Africa, 2024).

Comparable trends persist in West and Central Africa, where DRR communication and governance remain largely non-inclusive. A multi-country study by Gvetadze, & Pertiwi (2022), found that DRR information in many African contexts is rarely available in accessible formats. In Cameroon and Niger, the limited participation of persons with disabilities in designing early warning systems, combined with poor data accessibility, significantly hampers inclusive disaster management.

Collectively, these studies indicate that across the African continent, disability inclusion in DRR remains more aspirational than operational. Without targeted policy implementation, accessible communication, and investment in teacher and institutional capacity, schools will continue to face critical barriers to achieving disability-inclusive disaster preparedness.

Local Evidence from Zambia

According to Muzata et al. (2021), Zambia's education system operates under a dual-track model for educating learners with disabilities, comprising mainstream schools with inclusive education components and special schools or units designed specifically for children with disabilities.

Studies show that learners with disabilities are disproportionately affected due to limited accessibility, communication barriers, and inadequate support mechanisms (Ngoma et al., 2021). Although national education policies in Zambia endorse inclusive education, it has been noted that implementation remains inconsistent, and disability-inclusive disaster preparedness practices are yet to be fully integrated across school systems (WHO, 2022).

The broader challenge of inclusion in Zambia's education system predates the current climate pressures. Muzata et al. (2021) describe Zambia's model as one of "partial inclusion," in which learners with mild or moderate disabilities are placed in mainstream classrooms, while those with severe disabilities are frequently excluded. This exclusion extends into disaster preparedness planning, those outside mainstream settings are less

likely to participate in school-based drills or receive appropriate support during emergencies.

Recent climate-related and public health crises underscore Zambia's multi-hazard vulnerability. Severe flooding in 2023 damaged schools and displaced families, while the 2024 El Niño–induced drought prompted a national disaster and emergency declaration, disrupting agriculture, energy supply, and school operations (IFRC, 2023; ACAPS, 2025). Concurrently, the 2023–2024 cholera outbreak led to nationwide school closures and delayed reopening (MoE, 2024). These overlapping shocks magnify educational risks for already marginalized learners, particularly those with disabilities, emphasizing the urgent need for comprehensive, disability-inclusive disaster preparedness and school resilience frameworks.

2.2. Theoretical Discussion

Resilience Theory and the Capacities of Disability-Inclusive School Preparedness

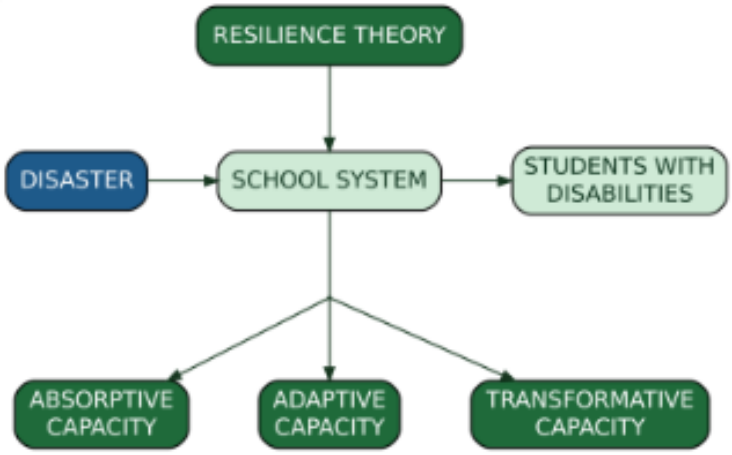
Resilience Theory offers a useful framework for understanding how schools anticipate, absorb, and recover from disasters while safeguarding learning, especially for students with disabilities. In education, resilience is conceptualized through three interconnected capacities: absorptive, adaptive, and transformative (Folke, 2006).

Absorptive capacity is a school's ability to maintain safety and learning continuity during crises through accessible infrastructure, inclusive emergency procedures, and effective communication systems (Rofiah et al., 2024; Doll et al., 2025). Adaptive capacity refers to how schools learn and adjust between disaster events by evaluating drills, revising plans, and enhancing teacher training to address evolving risks (Béné et al., 2012). Transformative capacity represents systemic change that embeds disability inclusion into education policies, teacher preparation, and governance structures, ensuring long-term resilience and equity in disaster preparedness (Béné et al., 2012; Folke, 2006; GADRRRES, 2022; UNDRR, 2015).

Application of Resilience Theory

Figure 1 below depicts a framework illustrating how disasters affect school systems and, in turn, students with disabilities, with outcomes mediated through three interrelated resilience capacities: absorptive, adaptive, and transformative.

Figure 1. Conceptual framework applying Resilience Theory to disability-inclusive school disaster preparedness.



Adapted from Folke (2006); Béné et al. (2012); GADRRRES (2022); UNDRR (2015).

The resilience framework depicted in Figure 1 guides this study by enabling a multi-layered assessment of how schools address disability-inclusive disaster preparedness. The absorptive capacity perspective helps evaluate existing preparedness plans through tangible indicators such as accessible alarms, evacuation routes, individualized support, and inclusive evacuation drills (Rofiah et al., 2024). This assessment reveals how effectively schools' current systems ensure immediate safety and educational continuity for students with disabilities.

The adaptive capacity lens examines whether schools engage in continuous improvement, through post-drill evaluations, targeted teacher training, and the integration of both local and scientific knowledge into preparedness plans (UNDRR, 2015; GADRRRES, 2022). This helps identify how schools evolve over time to enhance inclusivity and responsiveness, consistent with the Sendai Framework and the Comprehensive School Safety Framework's emphasis on learning and risk-informed planning.

Finally, the transformative capacity perspective explores how broader institutional and policy reforms support systemic inclusion. It considers school participation in municipal DRR committees, enforcement of accessibility standards, and the integration of disability-disaggregated data into education management systems (Béné, 2015; UNDRR, 2015). This lens highlights the shift from reactive, short-term preparedness to long-term, equity-driven resilience building.

2.3. Research Gap

Despite growing global attention to school disaster preparedness, limited research exists in Zambia on how different school types influence students' preparedness, particularly for students with disabilities. Most existing studies come from high-income contexts with

stronger institutional and infrastructural capacities (White-Lewis et al., 2021; Seddighi et al., 2020). In Zambia, where education for students with disabilities follows a dual-track model of mainstream and special schools (Muzata et al., 2021), no study has examined how these two settings, both serving students with disabilities, differ in promoting disaster preparedness. Understanding this relationship is essential for developing equitable, disability-inclusive strategies suited to Zambia's education system.

The study's focus on Zambia's Western Province, a disaster-prone region affected by floods, droughts, heat waves and epidemics, adds contextual significance. While repeated exposure to hazards might influence preparedness, there is insufficient evidence on whether such experience enhances disaster knowledge or readiness among students. Investigating this in a high-risk region offers insights into how prior disaster experience interacts with school capacity and inclusivity to shape preparedness outcomes.

Although adaptive and absorptive capacities have been explored globally (Béné et al., 2012), few studies have quantified their relationship with students' preparedness. This study introduces a novel methodological contribution by computing composite indices of disaster preparedness, adaptive capacity, and absorptive capacity using Exploratory Factor Analysis (EFA). This approach provides empirical clarity on how these resilience dimensions operate within disability-inclusive education. Additionally, no Zambian study has compared the transformative aspects of preparedness, or more specifically, the improvements needed to enhance inclusion, across mainstream and special schools. By identifying and contrasting suggested improvements from both, this research highlights systemic and pedagogical reforms essential for sustainable inclusion in disaster planning.

Finally, while prior studies often use a single methodological approach, this research adopts a mixed-methods design, integrating survey data with insights from teachers, school administrators, policymakers (socio-economic planners of the districts), and representatives of Disabled Persons' Organizations. This enables a comprehensive understanding of disability-inclusive disaster preparedness from both top-down and bottom-up perspectives, thus addressing the persistent gap between policy intentions and practical realities in Zambian schools.

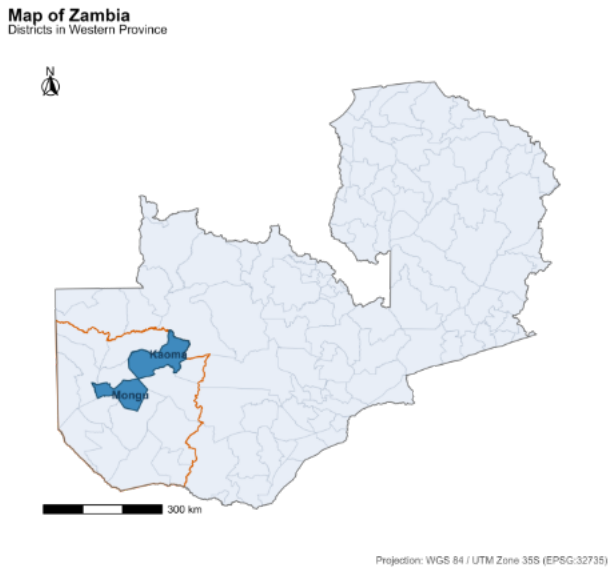
3. Methodology

This study adopts a convergent (concurrent) mixed-methods design, in which quantitative and qualitative strands are planned and implemented in parallel, carry comparable priority, and are integrated during analysis and interpretation. The rationale is twofold. First, concurrent collection enables a more complete picture of disability-inclusive school

disaster preparedness by capturing patterns (pertaining to what is happening, to whom, and how often) alongside rich explanations (why and how practices succeed or fail) within the same temporal window. Second, convergence allows corroboration and elaboration; areas of agreement strengthen confidence in findings, while areas of divergence surface implementation gaps or contextual contingencies that merit targeted recommendations (Creswell & Plano Clark, 2018; Fetters, Curry, & Creswell, 2013).

3.1 Study Sites

Figure 2. Location of Mongu and Kaoma districts of Western Province with the study districts, where we conducted the field work highlighted.



3.2. Data and methods

3.2.1. Quantitative Data Collection

Quantitative data were gathered via a structured, school-based survey administered using KoboCollect, a mobile data-collection application, and aligned with the absorptive, adaptive, and transformative capacities derived from Resilience Theory, as depicted in Table 1 below. Items are organized into theoretically informed scales and indices to allow school- and district-level comparisons. Analysis proceeds with data screening and missing data handling, reliability checks (e.g., Cronbach's α), and, where scales are adapted, factor analyses to examine dimensionality (Kline, 2016).

Table 1. Mapping Survey Sections to the Resilience Capacities

Survey Section	*Resilience Capacity*	*Interpretation*
Awareness of Disaster Preparedness (knowledge of what to do, emergency exits, safe zones, teacher explanations)	Absorptive Capacity	Reflects immediate preparedness and awareness of procedures, how well students (including those with disabilities) can respond during an emergency to minimize harm.
Accessibility of Disaster Preparedness (accessible exits, safe zones, information clarity, need for help)	Absorptive Capacity	Measures infrastructure and procedural readiness, e.g., accessible routes, assistive supports, and inclusive drills.
Participation and Inclusion (involvement in drills, inclusion, being listened to, equal treatment)	Adaptive Capacity	Captures learning and participatory adaptation. If students with disabilities are involved and their feedback used, schools are learning and adjusting preparedness practices.
Communication (clarity of instructions, accessible formats, reminders)	Absorptive → Adaptive	Initially absorptive (effective information delivery), but also adaptive when feedback and accessible channels improve communication over time.
Safety and Confidence (feeling safe, trusting teachers, confidence to follow procedures)	Absorptive Capacity	Demonstrates immediate psychosocial and procedural preparedness.
Past Experiences (experience with disasters, how often learning was disrupted, getting help)	Adaptive Capacity	Evidence of learning from previous disasters. Schools that have improved plans post-event show adaptation.
Resources and Plans (availability of accessible facilities, presence of disaster plans with disability provisions)	Transformative Capacity	Reflects institutionalization, how disability inclusion is codified in school policy, plans, and budgeting.
Suggestions and Improvements (open-ended)	Transformative Capacity	Reveals potential for structural change, policy reform, or inclusive governance. Students' and teachers' suggestions highlight perceived system-level gaps.

Table 1 links each survey module to a resilience dimension and clarifies what it measures. Absorptive capacity (awareness, accessibility, safety/confidence, basic communication) captures a school's immediate readiness to protect all learners, including those with disabilities. Adaptive capacity (participation/inclusion, past experiences, feedback-driven communication) shows whether schools learn from drills/events and improve practice. Transformative capacity (resources/plans, suggestions) gauges institutionalization, policies, budgets, and governance for disability inclusion. Together, these modules turn resilience

theory into practical indicators of how schools protect now, learn over time, and embed inclusion structurally.

The survey instrument measured most constructs with 5-point Likert items (Strongly Disagree–Strongly Agree). This format is used for Awareness (e.g., knowing what to do, where exits and safe zones are, and whether teachers explain clearly), Participation & Inclusion (feeling included in drills, equal treatment, being listened to), Communication (clarity of instructions, knowing whom to ask for help, provision of information in usable formats, receiving reminders), and Safety & Confidence (feeling safe, confidence to follow procedures, trust in staff, overall preparedness). These Likert items directly populate the absorptive and adaptive indices by reflecting immediate readiness and feedback-driven improvement in practice.

Complementary dichotomous questions (Yes/No/"I don't know") document enabling conditions, such as existence of exits and safe zones, accessible safe places, knowledge of where to go, need for help to evacuate, and whether the school has a disaster plan that includes disability provisions; a 5-point frequency scale (Never–Always) captures how often disasters interrupt learning; multi-select checklists record communication channels (announcements, posters, teachers, sign language, Braille); and open-ended items elicit challenges and suggested improvements.

Furthermore, to enhance instrument quality, the survey was theoretically anchored in resilience theory, specifically the absorptive, adaptive, and transformative capacities. Several Likert-scale items were adapted from validated school-safety and climate instruments, notably the Delaware School Climate Survey (Bear et al., 2011; UNESCO, 2017) and from child disaster-preparedness questionnaires used in recent cross-national research (Yildiz et al., 2023). The instrument was pilot tested with seven participants to assess clarity and reliability and then underwent expert review by two professors in educational measurement; their feedback informed iterative refinements, consistent with best-practice guidance for questionnaire testing (Presser et al., 2004).

3.2.2. Sample Size and Sample Selection for the Quantitative Strand

Table 2. Western Province (2025): Children with Disabilities by District

District	*Children with disabilities (count)*	*Share of provincial total (%)*
Kalabo	28	2.9
Kaoma	110	11.5
Lukulu	8	0.8
Mongu	255	26.7
Mulobezi	7	0.7

Mwandi	6	0.6
Nalolo	18	1.9
Nkeyema	30	3.1
Senanga	322	33.7
Sesheke	116	12.1
Shangombo	36	3.8
Sikongo	7	0.7
Sioma	12	1.3
Total	955	100.0

Source: Zambia Agency for Persons with Disabilities (ZAPD), 2025 education statistics for Western Province

Determining the exact number of children with disabilities by province in Zambia is challenging, as official figures were last published in the 2020 Education Statistics Bulletin. To address this gap, we obtained 2025 administrative data for Western Province from the Zambia Agency for Persons with Disabilities (ZAPD). The dataset included total enrollments, the number of children with disabilities, the number of teachers in special units, and the number of teachers trained in special education. Province-wide, a total of 955 children with disabilities were enrolled in Special Schools, which constituted the key population for this study. Because the project focuses on 'urban equitable climate action', we restricted the sampling frame to districts with schools located in urban areas. Rural districts were therefore excluded, and four urban districts, Mongu, Kaoma, Senanga, and Sesheke, were retained, yielding 803 children with disabilities in total (Mongu = 255; Kaoma = 110; Senanga = 322; Sesheke = 116).

For in-depth fieldwork, we intentionally selected Mongu and Kaoma (see Table 2, highlighted in blue). Mongu, the provincial capital, hosts seven readily accessible special/special-unit and mainstream schools in urban areas, while Kaoma, the district administrative headquarters and a major urban centre, hosts two special schools. Beyond site availability and accessibility, three considerations guided this choice. First, hazard relevance and variation: both districts experience recurrent flooding and heat stress linked to the Barotse and Kafue River–floodplain systems, major hydrological systems in Zambia that drive seasonal inundation and local climate extremes, aligning with the study's climate-risk focus and enabling meaningful cross-case comparison. Second, logistical feasibility: schools in both districts were easily reached via established transport corridors, supporting safe fieldwork and reliable engagement with participants and services. Third, scalability and policy relevance: as administrative hubs, Mongu and Kaoma offered strong prospects for institutional uptake, allowing tested tools and practices to be embedded in routine school preparedness planning and scaled across Western Province.

In line with sample selection or sampling strategy, we implemented probability-proportional-to-size (PPS) sampling across urban schools in both Mongu and Kaoma, using the number of enrolled children with disabilities (CwD) per school as the measure of size. The fixed total sample was 160 (n = 160). Expected school-level sample sizes were computed as: $n_i = n \times \frac{N_i}{N_{total}}$

Where *ni represents the number of respondents selected from district* ***i, n*** *is the total sample size of the study,* ***Ni*** *population size per stratum(district), and Ntotal represents the total population size.*

With N_{total} = 365 (Mongu = 255; Kaoma = 110). To obtain integer targets that sum to 160 while preserving proportionality, we applied Hamilton's (largest remainder) rounding. This PPS approach minimizes selection bias toward larger or smaller schools and supports efficient precision for school-level comparisons.

Table 3. PPS Sampling by School in Mongu and Kaoma

District	*School*	*CwD (* Ni N_i *)*	*PPS expected* ni n_i	*Allocated* ni n_i
Kaoma	Kaoma Hospital Teaching Unit	85	37.26	37
Kaoma	Mulamatila Special Unit	25	10.96	11
Mongu	Kanyonyo Primary Special Unit	28	12.27	12
Mongu	Lewanika Hospital Teaching Unit	37	16.22	16
Mongu	Mongu Cheshire Homes	72	31.56	32
Mongu	Mongu College of Education Unit	10	4.38	4
Mongu	Mongu Primary Special Unit	40	17.53	18
Mongu	Sefula School for the Blind	40	17.53	18
Mongu	Sefula Secondary School	28	12.27	12

Method: Probability-proportional-to-size (PPS) using Hamilton's largest remainder rounding, with total N = 365 children with disabilities (Mongu = 255; Kaoma = 110). Allocations sum to 160 and preserve district proportions.

Table 3 shows how the fixed sample of 160 children with disabilities (CwD) was allocated across schools in Kaoma and Mongu using probability-proportional-to-size (PPS). The column CwD (N_i) lists the number of CwD enrolled at each school; PPS expected (n_i) is the fractional sample each school would receive under PPS and Allocated n_i is the final whole-number target after rounding (Hamilton/largest-remainder), which sums exactly to 160. Larger schools therefore receive larger targets. For example, Mongu Cheshire Homes (N_i=72) receives 32, while Mongu College of Education Unit (N_i=10) receives 4. The allocation yields 48 surveys in Kaoma (37 at Kaoma Hospital Teaching Unit; 11 at Mulamatila Special Unit) and 112 surveys in Mongu (distributed 12, 16, 32, 4, 18, 18, and 12 across the seven schools), preserving each district's share of the underlying CwD population.

3.2.3. Codebook: Variables Used in the Study

This codebook presents the variables used in the quantitative analysis of disaster preparedness and resilience among students with disabilities in mainstream and special schools. Besides the school characteristics and the background variables, the aggregated variables align with Resilience Theory, encompassing three key capacities: Absorptive Capacity (ABSO_C), Adaptive Capacity (ADAPT_C), and Transformative Capacity (TRANS_C), which together shape the Preparedness Index (PREP_IND).

Table 4. Background Variables and Aggregated Indices

1. School Characteristics and Background Variables

Variable Name	*Description*	*Variable Codes*	*Measurement Type*
school_type	Type of school attended by the respondent	1 = Mainstream school; 2 = Special school	Nominal
disability_type	Reported category of disability	1 = Cognitive/Learning; 2 = Visual; 3 = Mobility; 4 = Speech/Language; 5 = Multiple; 6 = Hearing; 7 = Albinism; 8 = Down Syndrome	Nominal
gender	Gender of respondent	1 = Male; 2 = Female	Nominal
district	Location of respondent	1 = Mongu; 2 = Kaoma	Nominal
age_group	Age category of respondent	1 = 10–12 years; 2 = 13–15 years; 3 = 16–18 years	Ordinal

2. Aggregated Indices

Variable Name	Definition	Computation / Derivation	Measurement Type

PREP_IND	Overall preparedness index	Mean or sum of all preparedness items (PREP1–PREP12)	Scale
ADAPT_C	Adaptive capacity index	Mean or sum of adaptive capacity items (ADAPT1–ADAPT6)	Scale
ABSO_C	Absorptive capacity index	Mean or sum of absorptive capacity items (ABSO_C1–ABSO_C5)	Scale
TRANS_C	Transformative capacity indicator	Textual responses on suggested improvements are categorized and codes assigned	Nominal

According to Table 4, the study utilized both background and aggregated variables to analyze disaster preparedness and resilience among children with disabilities in mainstream and special schools. The background variables included school type, disability type, gender, district, and age group. These variables provided essential demographic and contextual information, allowing for comparisons across different educational settings, disability categories, and geographical locations. Each variable was measured at either nominal or ordinal level, ensuring appropriate categorization for statistical analysis.

In addition to background characteristics, the study developed four aggregated indices, Preparedness Index (PREP_IND), Adaptive Capacity Index (ADAPT_C), Absorptive Capacity Index (ABSO_C), and Transformative Capacity Index (TRANS_C), to measure various dimensions of resilience based on Resilience Theory. These indices were computed as composite measures derived from several preparedness and capacity-related items. Collectively, they represent learners' individual and systemic ability to prepare for, adapt to, and transform educational environments in response to disaster-related challenges

3.3. Qualitative Data Collection

The qualitative strand ran concurrently with the survey to generate contextual explanations for observed patterns in disability-inclusive school disaster preparedness. We conducted semi-structured interviews with three stakeholder groups, teachers and head teachers, district-level authorities (socio-economic planners), and representatives of Disabled Persons' Organizations (DPOs), to surface practice experiences, governance linkages, and implementation barriers and facilitators. Interviews lasted 45–60 minutes and covered roles and experiences with learners with disabilities, written plans and drills, accessibility of routes and safe zones, communication modalities, staff training and

support, policy alignment, and improvement needs. A common interview guide ensured comparability while allowing flexible probing tailored to each participant's expertise. Semi-structured interviewing was selected to balance cross-case consistency with depth appropriate to policy-and-practice inquiry.

Sampling followed purposeful variation to capture breadth across roles and school contexts. We aimed for meaning saturation rather than a fixed numeric target, monitoring redundancy as data collection progressed. Interviews took place in quiet, accessible locations or near schools or council offices. Ethical procedures included informed consent/assent, permission for audio-recording, and confidentiality safeguards. Audio-recordings were transcribed verbatim (and translated where applicable), with field notes documenting analytic impressions and context. Transcripts were stored securely, pseudonymized, and imported into NVivo for analysis. We used reflexive thematic analysis anchored in Resilience Theory's absorptive, adaptive, and transformative capacities: initial, theory-informed codes (e.g., accessible drills/evacuation and communication; post-event learning/training and participation; policy/budget/information systems and representation in DRR bodies) were expanded inductively to capture locally salient themes.

The final qualitative sample comprised 20 key informant interviews (KIIs) as depicted in Table 5 below, selected across Mongu and Kaoma to reflect role- and system-level variation: head teachers (n=5) from special and mainstream schools; teachers (n=9), emphasizing those responsible for or knowledgeable about preparedness and special education; district socio-economic planners (n=2), one per district to clarify school–district linkages; and DPO representatives (n=4), three from the Zambia Agency for Persons with Disabilities (ZAPD) and one from Cheshire Homes. This composition triangulates practice (teachers, head teachers), governance and resource flows (district planners), and external support and advocacy (DPO representatives), illuminating how disability-inclusive preparedness is interpreted, operationalized, and sustained from district offices into school routines across the urban provincial context.

Table 5. Key Informants Characteristics for the Qualitative Strand

Key Informant Interview (KII)	*Position*	*District*
KII 1	Head Teacher	Mongu
KII 2	Head Teacher	Mongu
KII 3	Head Teacher	Mongu
KII 4	Head Teacher	Mongu
KII 5	Head Teacher	Kaoma
KII 6	Socio-Economic Planner	Kaoma
KII 7	Socio-Economic Planner	Mongu
KII 8	DPO Representative	Kaoma

KII 9	DPO Representative	Mongu
KII 10	DPO Representative.	Mongu
KII 11	DPO Representative	Mongu
KII 12	Teacher (Special Education)	Mongu
KII 13	Teacher (Special Education)	Mongu
KII 14	Teacher (Special Education)	Mongu
KII 15	Teacher (Special Education)	Mongu
KII 16	Teacher (Special Education)	Mongu
KII 17	Teacher (Special Education)	Kaoma
KII 18	Teacher (Special Education)	Kaoma
KII 19	Teacher (Special Education)	Kaoma
KII 20	Teacher (Special Education) Kaoma	Kaoma

4. Key Results

4.1. Presentation of Quantitative Results

Demographics

We surveyed 160 learners with disabilities from urban schools in Mongu (n=127; 79.4%) and Kaoma (n=33; 20.6%), selected via probability-proportional-to-size (PPS) to mirror the underlying enrollment distribution. Participants were drawn from special schools (56.3%) and mainstream schools (43.8%) and were 59.4% female (n=95) and 40.6% male (n=65). The median age was 14 years (IQR 13–16), with most in upper primary/lower secondary. Over half had spent more than 3 years at their current school (52.5%), suggesting familiarity with routines relevant to disaster preparedness.

Table 6. Participant Characteristics

Domain	*Category*	*N*	*%*
District	Mongu	127	79.4
District	Kaoma	33	20.6
Gender	Female	95	59.4
Gender	Male	65	40.6
Age (years)	12–14	87	54.3
Age (years)	15–17	51	31.9
Age (years)	18–20	22	13.8

Education level	Primary	126	78.8
Education level	Secondary	34	21.2
School type	Special	90	56.3
School type	Mainstream	70	43.8
Duration at current school	<1 year	33	20.6
Duration at current school	1–3 years	43	26.9
Duration at current school	>3 years	84	52.5

Figure 3. Distribution of Reported Disabilities Among Respondents (n = 160)

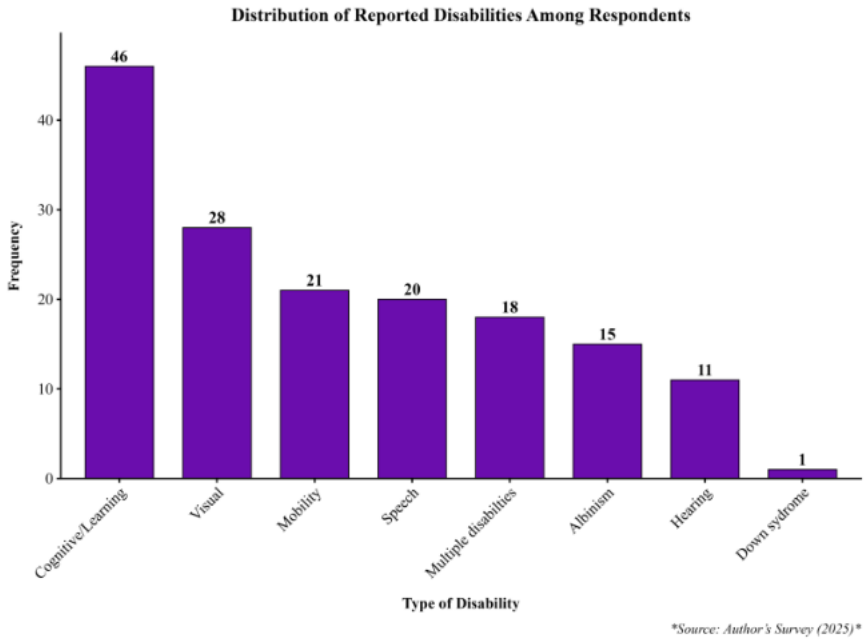


Figure 3 presents the distribution of reported disabilities among 160 student respondents. The results indicate that cognitive or learning disabilities were the most frequently reported (28.8%), reflecting a high prevalence of learning-related challenges within the inclusive education settings studied. This finding underscores the need for differentiated instructional strategies and adaptive learning support as integral components of school disaster preparedness planning.

Visual impairments (17.5%) and mobility impairments (13.1%) followed, highlighting the importance of ensuring physical accessibility, safe infrastructure, and the use of visual aids during emergency drills and disaster response activities. A smaller yet meaningful proportion of students reported speech and language impairments (12.5%) and multiple

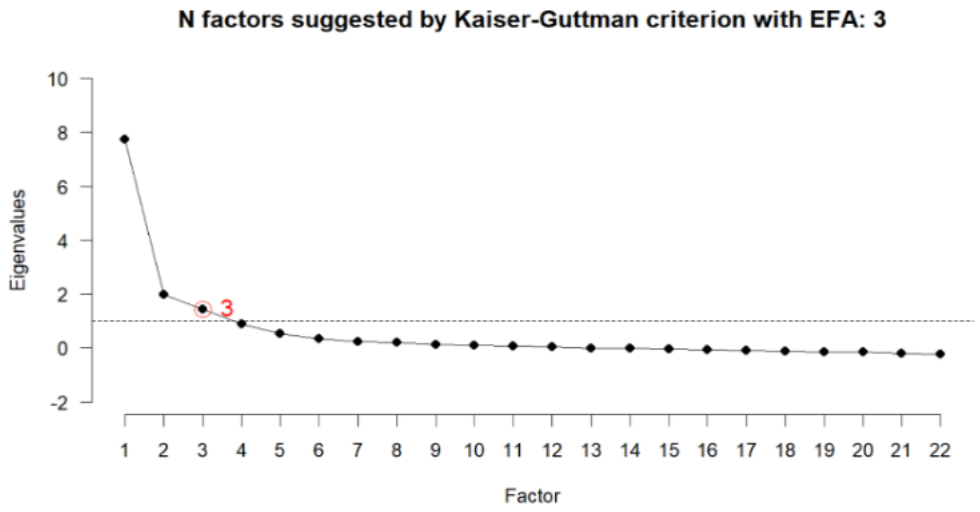
disabilities (11.3%), both of which emphasize the complexity of communication and coordination needs in inclusive disaster planning.

Additionally, 9.4% of students had albinism, 6.9% reported hearing impairments, and 0.6% had Down Syndrome. Collectively, these patterns demonstrate that disability inclusion in disaster preparedness must address both sensory and cognitive diversities, ensuring that all learners are supported through accessible communication, inclusive drills, and equitable safety measures that align with the principles of resilience and inclusion in education.

EFA-Guided Derivation of Three Composite Indices

We first conducted Exploratory Factor Analysis (EFA) on our data to understand the underlying structure, before conducting statistical tests on the research questions. The study involved 160 observations. The data was accessed for factorability and normality checks. Both the Multivariate Normality Test Based on Skewness and the Henze-Zirkler test showed that the normality assumption was violated, hence we used the paf extraction method. The Kaiser-Meyer-Olkin criterion (KMO) score was 0.89, indicating that the data were suitable for factor analysis. We computed the parallel test and the Kaiser-Guttman criterion, which suggested a 3-factor structure.

Figure 4. Three (3) factor structure as suggested by Kaiser-Guttman Criterion



We identified three principal factors through the exploratory factor analysis. For the Preparedness Index (PREP_IND), which comprised 11 variables, the most influential indicator was “materials are accessible,” explaining 74% of the variance. Within Adaptive Capacity (ADAPT_C), the variable “availability of exit zones” emerged as the most significant contributor, accounting for 82% of the variance. For Absorptive Capacity

(ABSO_C), “trust in teachers’ help” was the dominant factor, explaining 86% of the variance.

The reliability analysis indicated that the Preparedness Index demonstrated good internal consistency (α = 0.89), and Adaptive Capacity also showed good reliability (α = 0.83). In contrast, Absorptive Capacity yielded a moderate reliability (α = 0.63). Although the Cronbach’s alpha coefficient for Absorptive Capacity fell slightly below the conventional 0.70 threshold typically recommended for established instruments (Nunnally & Bernstein, 1994), it remains acceptable for exploratory research, particularly in studies employing contextually adapted instruments with a limited number of items (Hair et al., 2019; Taber, 2018). Considering that the present study involved field-based data collection in Zambian schools and utilized scales adapted to a local educational context, the obtained reliability coefficient (α = 0.63) was deemed satisfactory for preliminary analysis and interpretation.

Table 7. Variables per Composite Index Construct

Preparedness index (PREP_IND)	Adaptive Capacity Index (ADAPT_C)	Absorptive capacity index (ABSO_C)
1. Materials accessible	1. Exits zones accessible	1. Trust teachers help
2. Instructions clear	3. Know exits	2. Can get help to understand
4. Feel prepared	2. Know exits	3. Know who to ask
5. Opinions are listened	4. Know safe zones	4. School cares for children with disabilities
6. Information modalities provided	5. Enough exits for children with disabilities	
7. Get reminders	6. Teachers explain	
8. Teachers check understanding	7. Know what do	
9. Confidently follow procedures	8. Drill considers the needs of CWD	
10. Information easy to understand		
11. Got help on past disasters		
12. Feel safe at school		

Figure 5. Preparedness Index

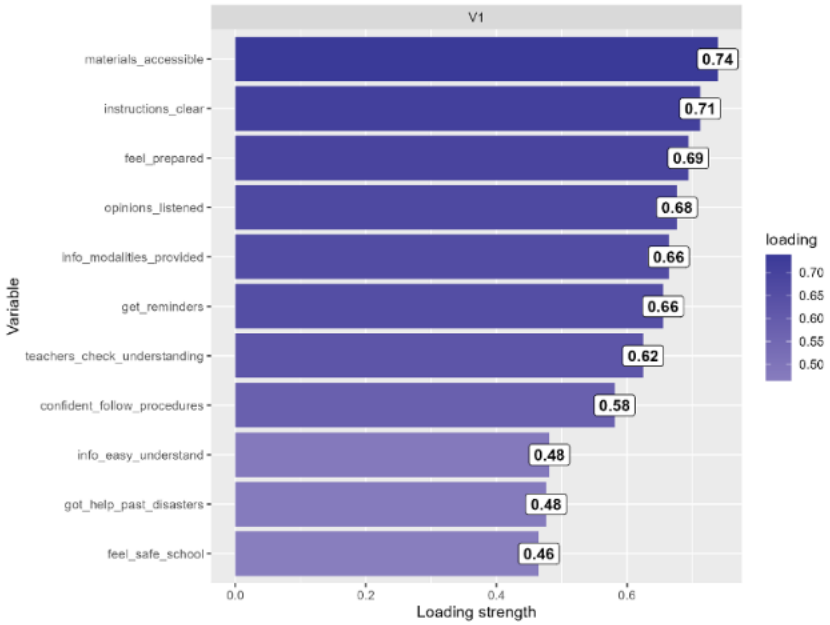


Figure 5 displays factor loadings for 11 items that align on a single preparedness factor. The strongest contributors are materials_accessible (λ = .74), instructions_clear (.71), feel_prepared (.69), and opinions_listened (.68), followed by info_modalities_provided (.66), get_reminders (.66), teachers_check_understanding (.62), and confident_follow_procedures (.58). Smaller, but still substantive loadings are observed for info_easy_understand (.48), got_help_past_disasters (.48), and feel_safe_school (.46). Collectively, these loadings indicate a dominant latent construct that integrates accessibility of preparedness resources, clarity of communication, and students perceived readiness for disaster. Accordingly, we constructed a dependent composite Preparedness Index (PREP_IND) that aggregates these items into a standardized score for subsequent analyses.

Figure 6. Adaptive Capacity Index

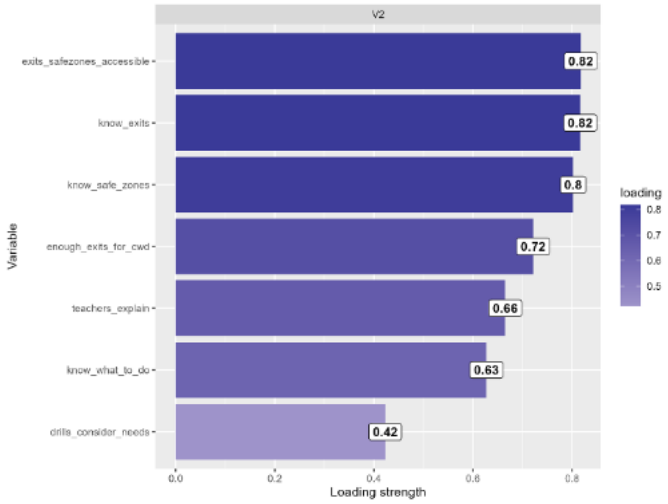


Figure 6 displays EFA loadings for seven items that align on a single adaptive-capacity factor consistent with resilience theory. The factor is driven most strongly by exits_safezones_accessible (λ = .82), know_exits (.82), and know_safe_zones (.80), with additional contributions from enough_exits_for_cwd (.72), teachers_explain (.66), and know_what_to_do (.63); drills_consider_needs (.42) loads more modestly but in the expected direction. Together, these items capture adaptive capacity as the extent to which schools translate knowledge and accessible infrastructure into practice through instruction and drills. On this basis, we constructed a composite Adaptive Capacity Index (labelled ADAPT_C), where higher scores indicate stronger adaptive capacity.

Figure 7. Absorptive Capacity

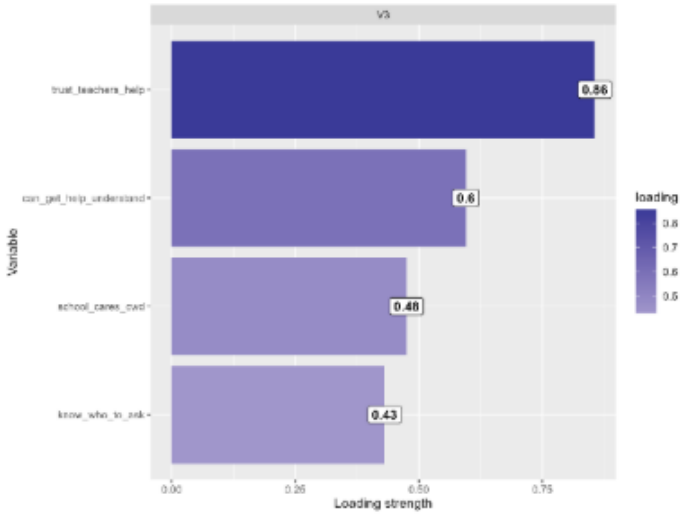


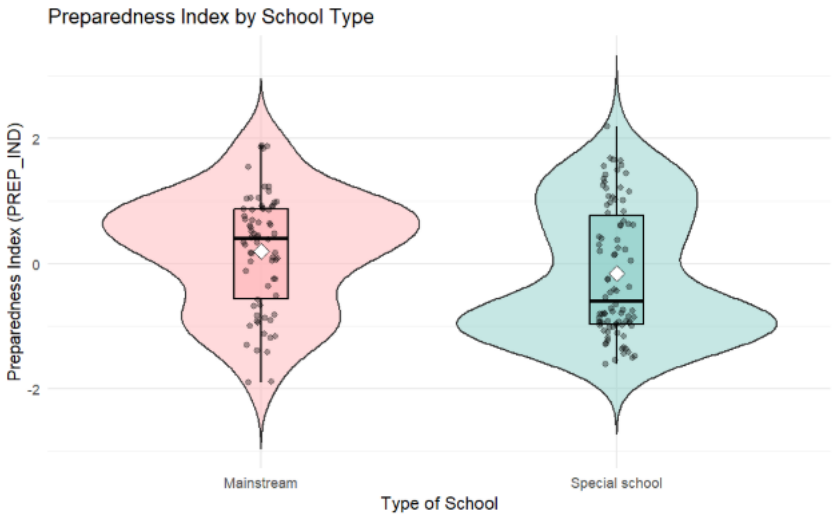
Figure 7 presents EFA loadings for four items that form a single absorptive-capacity factor (ABSO_C), consistent with resilience theory. The factor is dominated by trust_teachers_help (λ = .86) and can_get_help_understand (.60), with smaller but directionally consistent contributions from school_cares_cwd (.48) and know_who_to_ask (.43). Together, these items index students' access to teacher support in schools and clear help-seeking pathways, which are key features of absorptive capacity. A composite ABSO_C score was computed for subsequent analyses; higher values indicate stronger absorptive capacity.

4.2. Research Questions and Hypotheses Test

H1: Students with disabilities in special schools have higher knowledge of climate-induced disaster procedures than those in mainstream schools.

In response to the first research question, we conducted an independent samples t-test to compare disaster preparedness scores between mainstream and special schools. The results indicated a statistically significant difference in preparedness levels between the two school types, t(154.82) = 2.31, p = .022. Students from mainstream schools (M = 0.20) reported significantly higher preparedness scores than those from special schools (M = –0.16). The mean difference between the two groups was approximately 0.37, with a 95% confidence interval ranging from 0.05 to 0.67. These findings do not support the hypothesis (H1) that students in special schools have higher knowledge of climate-induced disaster procedures; instead, the results indicate that students in mainstream schools demonstrate greater preparedness knowledge.

Figure 8. Preparedness Index by School Type



The violin plot in Figure 8 above illustrates the distribution of the preparedness Index (PREP_IND) across two types of schools, mainstream and special schools. Students in mainstream schools generally demonstrate higher preparedness levels than those in special schools, as reflected by the slightly higher median and distribution centered above zero. Conversely, the preparedness index for special schools is lower and less variable, suggesting that students in these settings may have limited exposure to disaster preparedness training. Overall, the plot highlights a disparity in disaster preparedness knowledge between mainstream and special schools, indicating potential inequalities in access to preparedness education.

H2: Prior exposure to disasters positively influences children's knowledge of disaster preparedness in schools.

We also explored whether there was a significant difference in preparedness scores between those who had prior disaster experience and those who did not. The results show that the distribution of preparedness scores is broadly similar between students who had and had not experienced a prior disaster. Median scores are nearly identical, and the Wilcoxon test indicates that the difference is not statistically significant (*p = 0.20*). However, there was a significant interaction between school type and prior disaster experience, F (1,156) = 6.24, p = .014. These findings do not support the hypothesis (H2) that prior disaster exposure positively influences children's knowledge of disaster preparedness; rather, they suggest that experience alone does not significantly enhance preparedness without structured education or formal training. This indicates that the relationship between school type and preparedness varies depending on whether students had prior disaster experience.

Figure 9. Distribution of Preparedness Index by Prior Disaster Experience

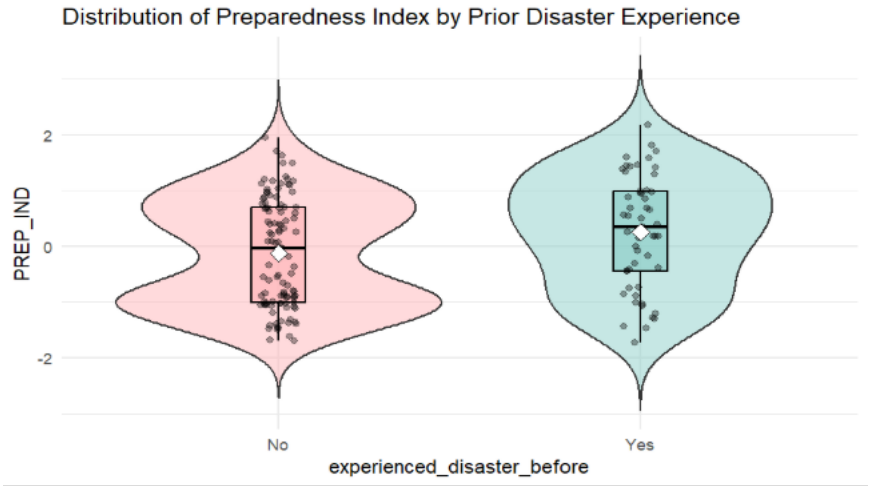


Figure 9 compares preparedness levels of children who have previously experienced a disaster (Yes) with those who have not (No). Although children with prior disaster experience tend to show slightly higher preparedness scores on average (as indicated by the higher central tendency of the right violin), the substantial overlap between the two distributions suggests that this difference is not statistically significant. In other words, prior exposure to disasters does not necessarily translate into markedly higher preparedness knowledge or skills. This finding implies that direct experience alone may be insufficient to enhance preparedness. Instead, structured education or formal disaster-response training within schools may play a more critical role in building students' preparedness capacities.

H3: Adaptive and absorptive capacities have a significant positive influence on students' disaster preparedness in schools.

To examine the effects of our key predictors (adaptive and absorptive capacities) on students' disaster preparedness scores (PRED_IND), we estimated three regression models. The first two models assessed the independent effect of each predictor while controlling for demographic and school-related variables, whereas the final model examined the combined influence of both capacities on preparedness. Table 8 presents the regression results.

Table 8. Multiple Regression Analysis

	Dependent variable:		
	Preparedness Index		
	Model (1)	Model (2)	Model (3)
age	0.042	0.002	0.001
	(0.026)	(0.032)	(0.025)
genderMale	0.080	−0.040	0.060
	(0.121)	(0.140)	(0.111)
school_typeSpecial school	−0.066	−0.316**	−0.048
	(0.125)	(0.141)	(0.115)
ABSO_C	0.570***		0.543***
	(0.061)		(0.057)
ADAPT_C		0.375***	0.324***
		(0.075)	(0.060)
districtMongu	0.989***	1.191***	1.279***
	(0.148)	(0.184)	(0.146)
Constant	−1.390***	−0.778*	−1.030***
	(0.399)	(0.469)	(0.373)
Observations	160	160	160
R^2	0.473	0.291	0.557
Adjusted R^2	0.456	0.268	0.540
F Statistic	27.645*** (df = 5; 154)	12.671*** (df = 5; 154)	32.058*** (df = 6; 153)
Note:			*p<0.1; **p<0.05; ***p<0.01

In Model 1, which included demographic characteristics (age, gender, and school type), absorptive capacity (ABSO_C), and district, the overall model was statistically

significant, $F(5, 154) = 27.64$, $p < .001$, explaining approximately 45.6 % of the variance in preparedness ($R^2 = .473$, adjusted $R^2 = .456$). Both absorptive capacity ($\beta = 0.57$, $p < .001$) and district (Mongu) ($\beta = 0.99$, $p < .001$) were significant positive predictors, indicating that participants from Mongu district demonstrated higher preparedness levels and that greater absorptive capacity was associated with increased preparedness. Age, gender, and school type were not statistically significant predictors in this model.

In Model 2, adaptive capacity (ADAPT_C) was introduced alongside demographic characteristics. The model was statistically significant, $F(5, 154) = 12.64$, $p < .001$, explaining 26.8 % of the variance ($R^2 = .291$, adjusted $R^2 = .268$). Significant predictors included school type ($\beta = -0.32$, $p = .026$), district (Mongu) ($\beta = 1.19$, $p < .001$), and adaptive capacity ($\beta = 0.38$, $p < .001$). Participants from Mongu and those with higher adaptive capacity exhibited higher preparedness, whereas respondents from special schools reported lower preparedness levels.

The final model (Model 3), which simultaneously included both absorptive (ABSO_C) and adaptive (ADAPT_C) capacities, was also statistically significant, $F(5, 154) = 32.06$ accounted for the largest proportion of variance (54.0 %, $R^2 = .557$, adjusted $R^2 = .540$). In this model, absorptive capacity ($\beta = 0.54$, $p < .001$), adaptative capacity ($\beta = 0.32$, $p < .001$), and district (Mongu) ($\beta = 1.28$, $p < .001$) remained significant and positive predictors of preparedness, while demographic variables were non-significant.

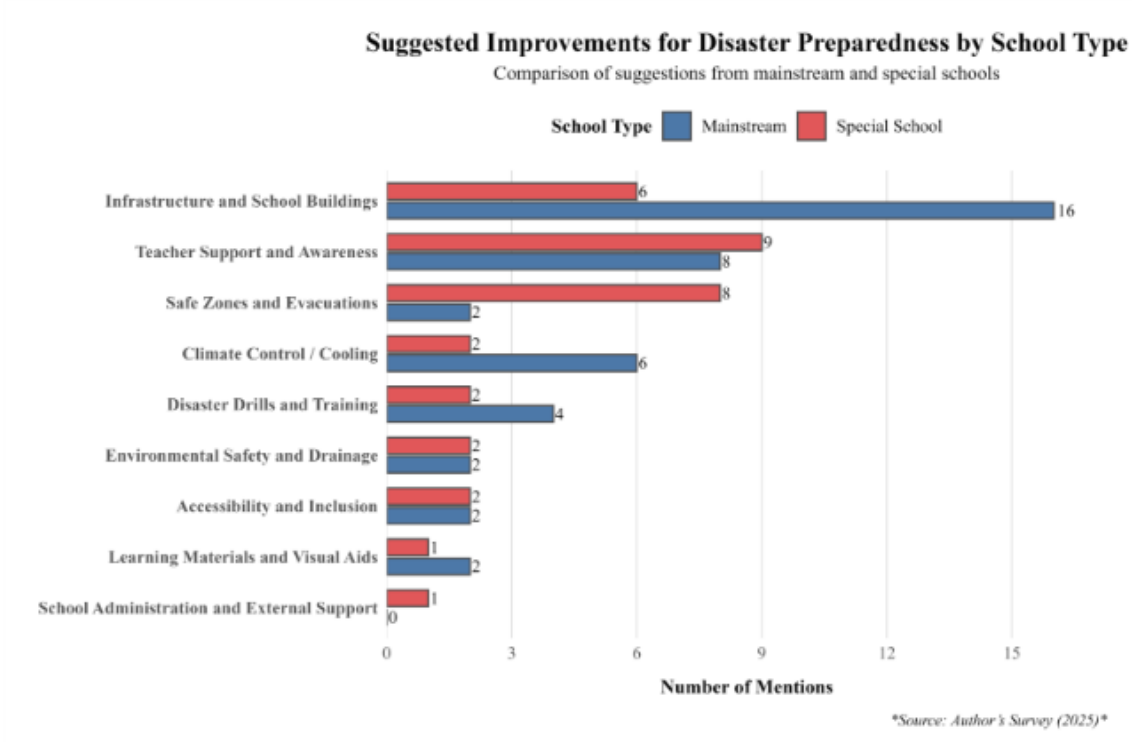
These findings support the hypothesis (H3) that adaptive and absorptive capacities have a significant positive influence on students' disaster preparedness, demonstrating that institutional resilience factors are stronger predictors of preparedness than individual demographics. Taken together, the three regression models reveal that the most powerful predictors of preparedness are absorptive capacity, adaptive capacity, and district context, understood here as differences in governance arrangements, access to services and infrastructure, exposure to floodplain hazards, and the presence of local institutions and support systems, particularly for participants in Mongu.

These variables consistently and positively influenced preparedness scores, even when demographic characteristics were controlled. The adjusted R^2 values (ranging from .27 to .54) indicate that nearly half of the variation in preparedness can be explained by these predictors. The findings emphasize that preparedness depends less on individual demographics and more on institutional and structural capacities that foster adaptive and inclusive educational environments.

What are the most frequently suggested improvements for disaster preparedness among children with disabilities across mainstream and special schools?

Suggested improvements by students with disabilities were conceptualized as the Transformative Capacity (TRANS_C) derived from Resilience Theory, reflecting the students' ability to identify strategies that strengthen school systems in the face of disasters. A quantitative content analysis was conducted to examine the most frequently suggested improvements for disaster preparedness among children with disabilities in mainstream and special schools, as depicted in Figure 10, below. The analysis revealed that the most common improvement theme was infrastructure and school buildings (n = 22), followed by teacher support and awareness (n = 17) and safe zones and evacuations (n = 10). Other less frequent suggestions included climate control and cooling in classrooms (n = 7), disaster drills and training (n = 6), accessibility and inclusion (n = 4), environmental safety and drainage (n = 4), learning materials and visual aids (n = 3), and school administration and external support (n = 1). The findings above highlight the capacity of learners with disabilities to envision adaptive and transformative improvements that enhance both safety and inclusivity within school disaster preparedness systems, which are key dimensions of transformative capacity within the resilience framework.

Figure 10. Suggested Improvements for Disaster Preparedness



To examine whether the distribution of suggested improvements differed significantly between mainstream and special schools, a Chi-square test of independence was conducted. The results showed no statistically significant association between school type

and the type of suggested improvement, $\chi^2(9, N = 75) = 11.58$, $p = .238$. This indicates that children from both mainstream and special schools emphasized similar categories of improvements for disaster preparedness.

The absence of statistically significant differences suggests that students with disabilities, regardless of school type, share comparable perceptions of what constitutes effective disaster preparedness. This finding reinforces the notion of transformative capacity within the Resilience Theory framework, demonstrating that learners across diverse educational settings possess shared adaptive insights and priorities for improving safety and inclusion. Their collective emphasis on structural safety, teacher preparedness, and accessible environments illustrates a unified understanding of resilience-building measures within education systems.

4.3. Presentation of Qualitative Findings

This section presents the qualitative findings addressing the research question:

How do teachers, school administrators (head teachers), policymakers (socio-economic planners) and representatives of Disabled Persons Organizations describe the challenges, practices, and institutional dynamics that shape disability-inclusive disaster preparedness and resilience-building in schools?

The perspectives obtained from key informants illuminate school-level, district, and institutional processes shaping inclusive disaster preparedness and resilience-building.

Absorptive Capacity: Institutional Readiness and Basic Response Mechanisms

The absorptive capacity, schools' ability to anticipate, absorb, and cope with shocks, remains underdeveloped across both mainstream and special schools. This interview finding aligns closely with the statistical findings which revealed that students from special schools reported significantly lower preparedness scores than those in mainstream schools ($t(154.82) = 2.31$, $p = .022$). Together, these results collectively suggest that structural and institutional limitations, rather than individual factors, constrain schools' ability to plan for and respond to disasters.

Across interviews, head teachers and teachers consistently emphasized that disaster preparedness in schools is largely *improvised*, with minimal planning, formal guidelines, or structured procedures in place. Schools often respond to disasters reactively rather than proactively, a situation attributed to the absence of systematic preparedness frameworks.

"It is quite challenging for the school to prepare for disasters, because we are not adequately equipped. We do not have any structured plans for disaster preparedness. For

example, when we experienced a drought the other year, it was a major challenge since our learners depend on daily school meals. The drought meant that food became scarce, and we struggled to provide for them." (Head teacher, Special School)

This reactive approach corresponds with the statistical finding showing that prior disaster experience did not significantly enhance preparedness (p = .20). Despite previous exposure to droughts and floods, schools demonstrated no measurable improvement in readiness, indicating that experiential learning alone is insufficient without structured institutional mechanisms.

At the district level, socio-economic planners confirmed that while general disaster preparedness plans exist, inadequate and fragmented funding mechanisms remain the greatest barrier to effective school preparedness. They explained that approximately 1,000,000 ZMK per constituency is allocated for disaster-related activities; however, these funds must cater to *all forms of disasters* across sectors, sometimes leaving education severely underfunded.

"The number one challenge is funding. As local government, we do not have a specific allocation dedicated to supporting schools that host students with disabilities. It's as if everyone is competing within the same funding basket, and when that happens, it becomes very difficult to implement certain interventions." (Socio-Economic Planner)

This institutional funding gap directly undermines the absorptive capacity of schools, reinforcing the statistical conclusion that preparedness depends more on *institutional and structural capacity* than on individual demographic variables. Schools lack the financial and logistical means to establish and sustain preparedness measures, leaving them ill-equipped when disasters occur.

Consistent with both qualitative and quantitative evidence, the lack of physical safety infrastructure further limits schools' readiness. Many schools lack written disaster management plans, safe zones, emergency exits, or evacuation routes. One head teacher described the unsafe school infrastructure, emphasizing the absence of proper emergency exits and training:

"There's nothing in place in this school. As you can see, the environment itself poses a problem. In the event of a fire, the exits are so narrow that if everyone rushed to the door, we could all be trapped and die right there at the doorway. There are no proper exits; the windows are sealed, and the doors are reinforced. How would anyone get out? We have a fire extinguisher over there, but I don't even know how to use it." (Head teacher, Special School)

Teachers in mainstream schools also highlighted a persistent exclusion of learners with disabilities from communication channels, drills, and awareness programs. Despite the label of "inclusive education," disaster preparedness initiatives often prioritize non-disabled students 'normals', reinforcing systemic inequities within the school environment.

"This school is said to be inclusive, but you find that most of the information goes to the so-called 'normals.' For those of us handling children with special education needs, there is very little information shared with them. All the attention is directed toward the so-called 'normals.'" (Teacher, Mainstream School)

The findings above affirm that absorptive capacity is weakened by institutional fragmentation, inadequate funding, and poor coordination, leaving schools reliant on improvised and inequitable responses to disasters.

Adaptive Capacity: Learning, Adjustment, and Innovation in Response to Disasters

Statistical findings revealed that adaptive capacity was a strong positive predictor of preparedness (β = 0.32–0.38, p < .001). Schools demonstrating higher adaptive capacity, those that integrated disaster awareness into teaching, practiced inclusive drills, and maintained accessible safe zones, reported greater overall preparedness. District context also emerged as a significant predictor, indicating that schools within supportive governance structures exhibited stronger adaptive performance.

Interview findings corroborate this relationship, illustrating how learning and adjustment occur through curriculum integration and creative instruction. Teachers and head teachers described incorporating disaster awareness into cross-cutting subjects such as Environmental Science, Civic Education, and Social Studies.

"In the new syllabus, there's a component called 16+, where we teach students with disabilities life skills, including climate-smart agriculture. This prepares learners to understand what to do in times of drought or other hazards. These are some of the ways disaster education is integrated within the syllabus." (Head teacher, Mainstream School).

Some teachers also leveraged co-curricular activities to teach disaster preparedness in more interactive ways.

"We teach about disasters through different activities such as clubs, poetry, and drama. Learners participate in role plays where they act out what to do during a fire or flood, and this

helps them remember the steps better. We also involve them in preventive maintenance activities, like checking that the surroundings are clean and that drainage systems are not blocked." (Teacher, Mainstream School).

These examples confirm the positive correlation between adaptive capacity and preparedness, demonstrating that institutional learning occurs through both formal and informal pathways. However, integration remains uneven and dependent on individual teacher initiative.

 *"We have never had a specific time set aside to prepare for a disaster. The only time we talk about it is when the topic appears in the syllabus, usually under environmental science or social studies. Once that lesson is over, we move on to other topics. It would be better if disaster preparedness was treated as an ongoing activity, not just a once-off classroom topic." (Teacher, Mainstream School).*

This indicates that while adaptive capacity statistically predicts preparedness, qualitative evidence reveals its fragmented and unsystematic nature.

Furthermore, school type influenced adaptation, with mainstream schools outperforming special schools ($t(154.82) = 2.31$, $p = .022$). Teachers in special schools attributed this disparity to inaccessible learning materials, limited training, and physical barriers.

 *"For visually impaired learners, most information is not recorded or transcribed in Braille. They are left behind when it comes to acquiring disaster information." (Teacher, Special Education).*

Some teachers also described improvised adaptive strategies, such as using visual aids or tactile objects to communicate safety procedures.

 *"Every learner has a different provision; I adapt my lessons for each of them. I talk to them verbally, sometimes draw pictures, or use objects they can touch." (Teacher, Special Education).*

However, despite these local innovations, teachers expressed frustration at the disconnect between national policy and school-level practice.

 *"On paper, the policies exist, but on the ground, we don't see them being implemented. The Ministry of Education has not provided clear guidance on what exactly we should do in the*

event of a disaster. We have never received any specific instructions or training, so each school is left to manage on its own." (Teacher, Special School).

 *"Usually, we follow the existing policies, but implementation is weak because there's no adequate monitoring or funding." (Head teacher, Mainstream School).*

These accounts show that adaptive capacity operates under structural constraints that limit its full potential. While the statistical finding identifies adaptation as a key determinant of preparedness, the interview findings reveal how policy fragmentation, resource shortages, and lack of institutional guidance hinder the translation of adaptive knowledge into sustained practice.

Transformative Capacity: Structural Change and Inclusive Resilience

The statistical findings revealed that there was *no significant association* between school type and the types of suggested improvements for disaster preparedness ($\chi^2(9, N = 75) = 11.58$, $p = .238$). This implies that students with disabilities across both mainstream and special schools share comparable perceptions of what constitutes effective disaster preparedness. These insights are reinforced by the interview findings, which show that students with disabilities, teachers, socio-economic planners, and representatives of Disabled Persons' Organizations (DPOs) converge around similar priorities for inclusive structural reform, infrastructure improvement, and participatory governance in disaster preparedness.

Head teachers and teachers expressed concern that many school facilities remain unsafe and poorly equipped to accommodate students with disabilities during disasters. They emphasized the need for barrier-free infrastructure, accessible evacuation routes, and greater investment in disability-friendly school designs.

 *"Buildings should be user-friendly. We receive wheelchair-bound learners, but there are no ramps or wide exits. Even classrooms are congested, which makes it difficult for those with mobility challenges to move quickly during an emergency." (Head teacher, Special School)*

Similarly, DPO representatives emphasized that infrastructure for learners with disabilities often lacks quality and safety standards. They argued that true inclusion requires schools to be designed, constructed, and maintained in ways that uphold the dignity, accessibility, and security of all learners. Strengthening monitoring and evaluation mechanisms during school construction was highlighted as essential to ensuring accountability and resilience.

 *"I have seen a lot of massive schools being built under the Constituency Development Fund (CDF) program, but we also have to question the quality of this infrastructure. We've seen schools built today, and three days later the entire roof is blown off and learners are soaked. These are the things we must consider going forward. Every school should have a risk manager responsible for monitoring and evaluating infrastructure, looking at accessibility, stability, and quality, so that disasters do not arise from poor construction." (DPO Representative)*

The perspectives above underscore a shared recognition of the urgent need for transformative investment in school infrastructure. Such investment should not only focus on expansion but also ensure that all educational spaces are safe, accessible, and resilient, thereby advancing inclusive disaster preparedness.

Head teachers and teachers identified professional capacity and awareness as key areas requiring transformation to strengthen disaster preparedness in schools. Many participants observed that disaster management is not systematically integrated into teacher training programs, leaving educators without the necessary knowledge or confidence to manage emergencies effectively. This observation aligns with the statistical findings, which identified teacher support and awareness as the second most frequently suggested area for improvement (n = 17).

Several head teachers and teachers emphasized that, despite their willingness to create awareness among learners with disabilities, they receive little to no internal or external support in disaster preparedness training. Consequently, most educators rely on personal initiative, past experience, or improvisation when responding to disasters.

 *"As teachers, we have not received any training or orientation on disaster preparedness. I think my experience has shown me that we really need to do something about disaster preparation in schools. We need to have materials and equipment in place so that we can also become prepared for such matters. Learners with special needs should also know what to do when a disaster occurs." (Head teacher, Mainstream School).*

 *"Apart from my general training in guidance and counselling, I have not received any specific training on how to support learners with disabilities during disasters. Most of what I do comes from experience and general knowledge. Still, I think more formal training and sensitization would really help us support these students better during emergencies." (Teacher, Special Education)*

The narratives above underscore that transformative capacity in schools begins with empowering educators as agents of change. Professional development and institutionalized disaster training were viewed as crucial to ensuring that teachers can effectively guide and protect students, particularly those with disabilities. While statistical evidence shows that students with disabilities value teacher awareness and preparedness, interview findings reveal that teachers themselves lack formal training, thus constraining their ability to foster resilience at the school level.

Beyond these teacher-level insights, the interviews revealed suggestions that extend beyond the statistical findings, highlighting the systemic dimensions of transformation. Socio-economic planners underscored that for disaster preparedness in schools to become genuinely transformative, reforms must occur at the governance, planning, and coordination levels. They argued that resilience cannot be achieved through isolated school-based efforts alone but must be embedded within district and national development strategies.

Planners noted that while the district maintains a general disaster preparedness framework, its implementation remains fragmented, with limited alignment between the education sector, local government, and key departments such as health, infrastructure, and social welfare.

"We have the Disaster Management Committee at the district, but coordination is still a challenge. Education is not always fully represented, and this affects how resources are allocated and how special schools are supported when disasters occur." (Socio-Economic Planner, Local Government)

To address these challenges, socio-economic planners proposed comprehensive capacity-building initiatives targeting not only teachers and head teachers in special schools but also local government staff and community stakeholders. Such initiatives, they explained, would promote collaborative disaster governance and enhance the integration of education into local disaster management structures.

"Disaster management should be treated as a shared function. If the education, health, and infrastructure departments plan together, we can address issues like school safety, water supply, and sanitation in an integrated way." (Socio-Economic Planner, Local Authority)

Taken together, these findings reveal that transformation in disaster preparedness requires both bottom-up capacity building among educators and top-down structural reform across governance levels. Teachers must be equipped with the skills to act

confidently in emergencies, while institutional coordination and multi-sectoral engagement ensure that preparedness becomes a sustained and system-wide priority.

5. Discussion

This study examined disability-inclusive disaster preparedness in urban schools in Zambia's Western Province through a mixed-methods design guided by Resilience Theory. It explored differences in preparedness between mainstream and special schools, the role of prior disaster exposure, and the predictive influence of absorptive and adaptive capacities on preparedness. It also integrated student perspectives on transformative improvements and insights from teachers, head teachers, socio-economic planners, and representatives from Disabled Persons' Organizations (DPOs).

A major finding of this study was that students in mainstream schools demonstrated significantly higher preparedness levels than those in special schools ($t(154.82) = 2.31$, $p = .022$). This contrasts with the initial hypothesis (H1) and reveals an institutional disparity in disaster education access. The finding aligns with global evidence that public, urban, and well-resourced schools tend to show stronger disaster awareness and response readiness (Rizky et al., 2025; Widowati, 2025; Salsabila et al., 2023). However, it diverges from studies in Japan and New Zealand that report higher preparedness in special schools due to systematic inclusion and tailored teacher training (Kato et al., 2014 Ronoh et al., 2015). The lower preparedness among special schools in Zambia reflects structural inequities rather than cognitive limitations of learners with disabilities. Interview findings confirmed that special schools lack accessible infrastructure, structured drills, and formal disaster management plans. Teachers reported relying on improvisation due to limited training and absence of institutional guidance. These findings reinforce Bahadur et al. (2013) who noted that resource constraints and fragmented institutional planning weaken schools' absorptive capacity.

Contrary to expectations, prior disaster exposure did not significantly influence preparedness ($p = 0.20$). This finding mirrors Shah et al. (2022) and Cvetković & Šišović (2024), who found that disaster experience alone does not enhance preparedness unless supported by structured education. In the Zambian context, the lack of correlation underscores the absence of reflective learning mechanisms within schools. Despite repeated exposure to floods and droughts, schools rarely institutionalize lessons learned, an indicator of weak adaptive capacity.

The multiple linear regression analysis provides one of the most novel empirical contributions of this study. Both adaptive ($\beta = 0.32$, $p < .001$) and absorptive ($\beta = 0.54$, $p < .001$) capacities emerged as significant positive predictors of preparedness, jointly

explaining 54% of the variance (adjusted R^2 = .540) in students' disaster readiness. These results empirically validate the resilience framework's central proposition that preparedness is a function of systemic, institutional capacities rather than individual or demographic attributes (Béné et al., 2012; Folke, 2006). The dominance of absorptive capacity, operationalized through trust in teachers, availability of help-seeking mechanisms, and perceptions of care, reveals that emotional and social safety play critical roles in preparedness. This finding adds depth to previous literature, which has primarily emphasized structural and instructional preparedness (Rofiah et al., 2024). By quantifying the effect of absorptive capacity, this study introduces a novel dimension of *relational resilience*, highlighting how teacher–student trust and perceived institutional support predict practical readiness during crises.

Adaptive capacity, defined through accessibility of exits, safe zones, and inclusive drills, also demonstrated a strong predictive influence. This supports Safriani et al. (2022) and GADRRRES (2022), who found that iterative learning and reflective practices enhance schools' resilience. Interview findings reinforced this link, showing that teachers who integrated disaster awareness into civic education, environmental science, or co-curricular activities achieved better learner engagement and recall. However, adaptation remains inconsistent and often dependent on individual initiative rather than systematic institutional policy, echoing Diquito and Sangil's (2025) observation of fragmented policy enactment in low-resource contexts.

Interestingly, district context was a significant positive predictor ($\beta = 1.28$, $p < .001$), reflecting stronger local governance structures and perhaps better coordination among schools and disaster committees. This finding suggests that location-specific institutional networks influence preparedness, a dimension rarely quantified in the recent previous studies conducted in Africa (Makamanzi, 2024).

Students' suggested improvements and key informant interviews converge around three transformative priorities: inclusive and safe infrastructure, teacher training and awareness, and multi-sectoral governance coordination. The absence of significant differences in improvement priorities between school types ($\chi^2 = 11.58$, $p = .238$) indicates shared perceptions of what constitutes effective preparedness. This consensus resonates with African regional evidence (UNDRR, 2024; Dube et al., 2021), which highlights accessibility, teacher capacity, and interdepartmental coordination as prerequisites for inclusive resilience. However, the study extends this understanding by empirically linking transformative capacity to learner agency. Students with disabilities demonstrated the ability to articulate structural reforms, such as accessible school buildings, functional ramps, and evacuation routes, showing that they are not passive recipients but active co-designers of preparedness strategies. This finding contributes to inclusive resilience

scholarship by integrating student voice into the conceptualization of transformative capacity, an area underexplored in resilience and DRR literature.

Head teacher and teacher-level interviews further revealed that professional capacity gaps severely limit transformation. Despite policy commitments to inclusive education (MoE, 2024; WHO, 2022), teachers rarely receive formal disaster preparedness training. As a result, they rely on improvisation, aligning with Chowdhury et al. (2025) who reported similar findings in Bangladesh. This underscores a policy–practice disconnect, where national DRR policies lack operational clarity at the school level (Alarte, 2024). The socio-economic planners' perspectives add another layer to this argument: weak inter-sectoral coordination and limited dedicated funding for inclusive preparedness hinder system-wide resilience. Without integrating education into district-level disaster management frameworks, schools remain isolated actors. This finding reinforces Béné (2015) and UNDRR (2015), emphasizing that transformative capacity requires multi-level governance reform, linking school-level inclusion with national DRR frameworks.

Moreover, this study makes several novel empirical and theoretical contributions that further advance understanding of disability-inclusive disaster preparedness in the Global South. First, through the empirical quantification of resilience capacities, it derived composite indices for preparedness, adaptive, and absorptive capacities using Exploratory Factor Analysis (EFA). This represents a methodological innovation in resilience measurement and provides a replicable tool for assessing school-level disaster preparedness. Second, the finding that absorptive capacity, rooted in trust and teacher support, significantly predicts preparedness introduces the new conceptual dimension of *relational resilience*. This perspective shifts the discourse from material readiness to social-emotional connectedness as a foundation for safety and inclusion. Third, by integrating mixed perspectives from learners, teachers, policymakers, and representatives of DPOs, the study bridges top-down policy insights with bottom-up lived experiences, offering a more holistic understanding of systemic barriers and opportunities for reform. Lastly, the study provides context-specific insight from Zambia, filling a national research gap by comparing mainstream and special schools, quantifying institutional predictors of preparedness, and producing actionable evidence to inform inclusive DRR policy and educational reform.

6. Recommendations

1. Enhancing Immediate Preparedness and Safety

- The Disaster Management and Mitigation Unit (DMMU), in collaboration with the Ministry of Education (MoE), should develop national school preparedness

guidelines that include clear disability accessibility standards, Braille and Sign Language resources, and protocols for inclusive drills and evacuations.

- Every school should develop a School Disaster Risk Reduction (DRR) Plan outlining accessible alarms, designated evacuation zones, and individualized emergency support for students with disabilities.
- A School Safety and Resilience Checklist should be introduced and used annually to assess infrastructure, emergency procedures, and accessibility.
- Schools should ensure universal design standards in all new construction and renovation projects, including ramps, wide exits, tactile signage, and accessible sanitation facilities. Accessibility audits should be mandatory before handover of new buildings.
- The government should appoint School Risk and Safety Officers or District-level Risk Managers to oversee compliance with safety and accessibility standards, particularly in schools hosting learners with disabilities.

2. Building Learning and Institutional Flexibility

- Teacher training colleges and in-service programs should integrate Disability-Inclusive Disaster Education (DIDE) modules, focusing on inclusive evacuation strategies, communication during crises, and psychosocial support for all learners.
- The MoE should collaborate with Disabled Persons' Organizations (DPOs) to co-facilitate practical workshops, simulation drills, and community sensitization sessions, ensuring teachers gain hands-on experience in inclusive preparedness.
- Schools should conduct regular, inclusive disaster drills that actively involve learners with disabilities and use feedback to update emergency protocols and learning materials.
- The curriculum should enhance and embed disaster awareness and inclusive safety education into subjects such as civic education, science, and social studies, fostering a culture of preparedness from early grades.

3. Fostering Collaboration, Trust, and Participation

- Policy coordination should be institutionalized among the MoE, Ministry of Community Development, and Ministry of Local Government through joint implementation and monitoring frameworks aligned with the Sendai-aligned Comprehensive School Safety Framework (CSSF).

- District Education Disaster Management Committees (DEDMCs) should be established to link schools, local councils, DMMU, health, and infrastructure departments for coordinated planning and rapid response.
- Schools should partner with DPOs, community leaders, and parents to strengthen social trust and shared responsibility for preparedness.
- Student Disaster Safety Clubs or Disaster Ambassadors programs should be institutionalized to enable learners with and without disabilities to co-lead awareness activities, drills, and advocacy.
- The "nothing about us without us" principle should guide all planning processes, ensuring that students with disabilities have meaningful input into school and district DRR plans.

4. Embedding Inclusion and Resilience Systemically

- The MoE and DMMU should establish a ring-fenced budget line for school disaster preparedness within the Constituency Development Fund (CDF) and district DRR budgets, with specific allocations for schools serving students with disabilities.
- The government should institutionalize policy reforms that embed inclusion and preparedness into school governance, infrastructure planning, and teacher education frameworks.
- Universal design principles should be codified in national education infrastructure standards to ensure accessibility and sustainability in all future developments.
- A national data-sharing system should be developed to capture disability-disaggregated information on school safety, infrastructure, and preparedness, supporting evidence-based decision-making and continuous improvement.
- Long-term, cross-sectoral partnerships should be fostered between education, DRR, health, and social welfare institutions to embed inclusive resilience into Zambia's broader national development agenda.

7. Limitation And Open Questions

This study has several limitations that merit acknowledgment and point to important directions for future research. First, the focus on urban schools in Western Province limits the generalizability of findings to other contexts in Zambia. Disaster experiences, institutional capacities, and access to inclusive education resources vary significantly

between urban, rural, and peri-urban schools. Future comparative studies across multiple provinces would help validate and contextualize these findings more broadly.

Second, while the mixed-methods design provided a comprehensive view of institutional and experiential dynamics, the quantitative strand (n = 160) included only students with disabilities. Although this focus generated valuable insights into a marginalized population, incorporating the perspectives of non-disabled peers could offer a fuller understanding of inclusivity dynamics and peer-based preparedness behaviors in school environments.

Third, the absorptive capacity index exhibited relatively low internal reliability ($\alpha = 0.63$). It was nonetheless retained due to strong theoretical justification under Resilience Theory, emphasizing its conceptual importance despite statistical limitations. Future research should refine this construct by including more items and larger, more diverse samples to improve psychometric robustness.

Finally, time constraints limited the opportunity for direct observation of disaster drills, infrastructure assessments, and classroom practices. Such observational evidence could have enhanced data triangulation and offered deeper insight into how inclusive preparedness operates in practice.

Building on the above limitations, several open questions remain. How do rural and peri-urban schools compare in terms of disability-inclusive preparedness and resilience capacity? What are the long-term effects of repeated disaster exposure on students' adaptive and transformative capacities? To what extent can targeted interventions, such as teacher training, infrastructure improvements, or community-based preparedness programs, strengthen inclusive resilience in resource-constrained settings? Future studies employing longitudinal, experimental, or participatory designs could address these questions and test the effectiveness of inclusive disaster education strategies at scale. Expanding future samples to include non-disabled students, parents, and community actors will also deepen understanding of the broader social ecosystem that shapes school-based disaster resilience.

8. Conclusion

This study explored disability-inclusive disaster preparedness in urban schools in Zambia's Western Province using a mixed-methods design guided by Resilience Theory. It examined how school type, prior disaster exposure, and institutional capacities (absorptive, adaptive, and transformative) influence preparedness among students with disabilities. The results showed that preparedness depends less on individual or experiential factors and more on institutional systems, teacher competence, and inclusive school practices.

Students in mainstream schools were found to be better prepared for disasters than those in special schools, highlighting disparities in infrastructure, teacher training, and access to safety education. Prior disaster experience did not significantly influence preparedness, confirming that exposure without structured learning does not lead to resilience. Regression analysis revealed that absorptive and adaptive capacities were the strongest predictors of preparedness, jointly explaining over half of the variation (adjusted R^2 = .540). These findings affirm that institutional resilience, rather than demographics or experience, forms the foundation of disaster readiness in schools.

Qualitative insights further revealed that most schools operate under constrained conditions with limited training, poor coordination, and inadequate facilities. Despite this, teachers and learners demonstrated creativity by incorporating disaster education into lessons and extracurricular activities, showing a capacity for adaptive learning that could be strengthened through clear policies and institutional support.

A major theoretical contribution of the study is the concept of *relational resilience*, which underscores the importance of teacher–student trust, care, and emotional support in fostering preparedness. By quantifying the interplay between absorptive and adaptive capacities through Exploratory Factor Analysis (EFA), the study also provides a methodological innovation for measuring school resilience in inclusive, low-resource settings.

Importantly, the study showed that students with disabilities are active participants in disaster planning. Their suggestions, focused on accessible infrastructure, teacher training, and evacuation systems, align with those of educators and policymakers, reflecting a shared vision for inclusive preparedness. This demonstrates the potential of participatory approaches to strengthen school-level transformation.

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Appendices

Appendix 1: Ethical Clearance Letter

THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND DEVELOPMENT

Great East Road Campus | P.O. Box 32379 | Lusaka10101 | Tel: +260-211-290 258/291 777
E-mail: director.drgs@unza.zm | Website: www.unza.zm

APPROVAL OF STUDY

IORG No. 0005376
HSSREC IRB No. 00006464
REF NO. HSSREC-2025-APR-026

11th June, 2025

Mr Jacob Malama
Plot 144, Minsestone, Chainama
LUSAKA

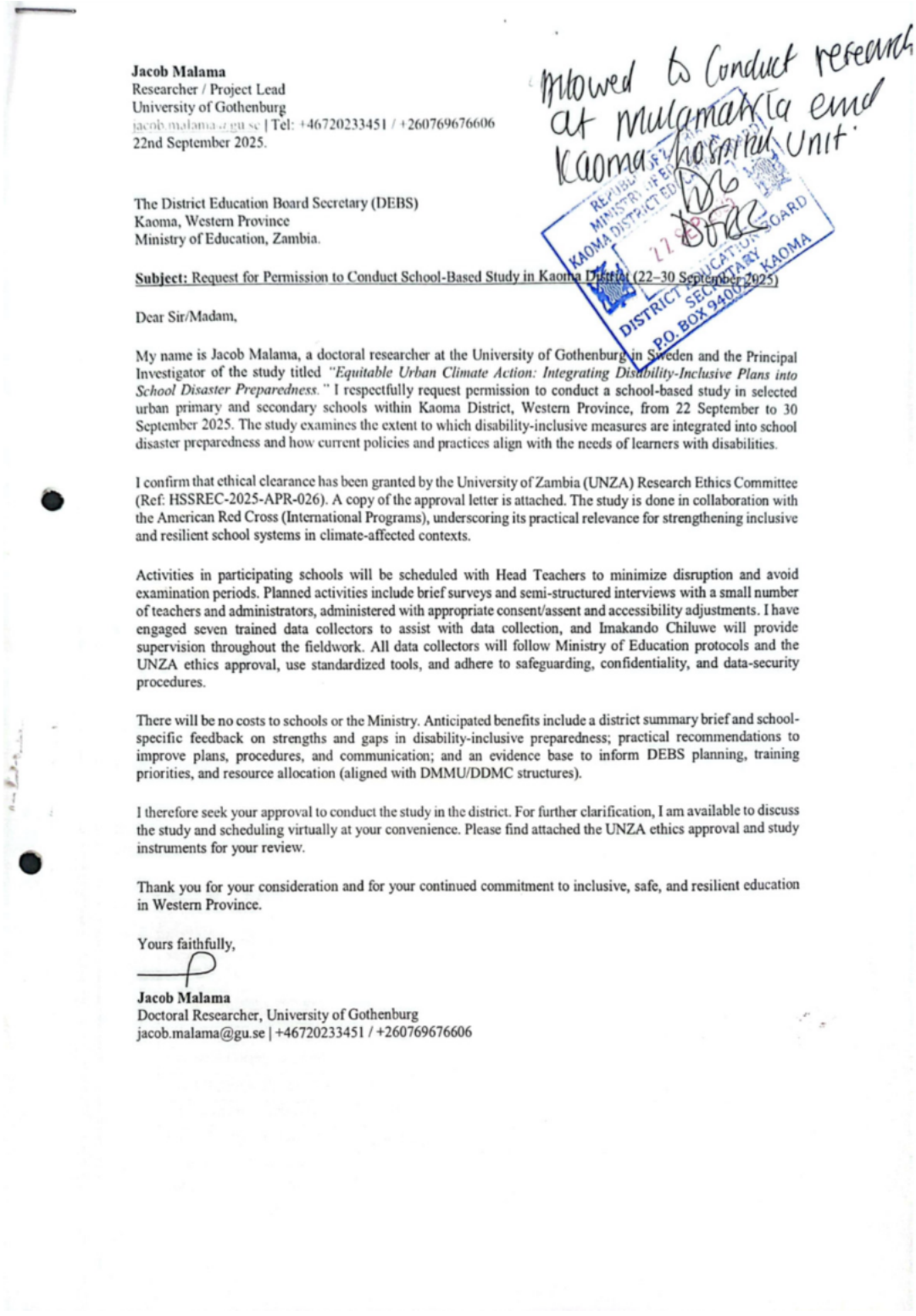
Dear Mr Malama,

RE: "EQUITABLE URBAN CLIMATE ACTION: INTEGRATING DISABILITY-INCLUSIVE PLANS INTO SCHOOL DISASTER PREPAREDNESS"

Reference is made to your submission of the protocol captioned above. The HSSREC resolved to approve this study and your participation as Principal Investigator for a period of one year.

REVIEW TYPE	ORDINARY REVIEW	APPROVAL NO. HSSREC:-2025-APR-026
Approval and Expiry Date	Approval Date: 11th June, 2025	Expiry Date: 10th June, 2026
Protocol Version and Date	Version - Nil.	10th June, 2026
Information Sheet, Consent Forms and Dates	□ English.	To be provided
Consent form ID and Date	Version - Nil	To be provided
Recruitment Materials	Nil	Nil
Other Study Documents	Questionnaire.	
Number of Participants Approved for Study		

Appendix 2: Permission Letter to Collect Data from Kaoma: District Education Board Secretary



Jacob Malama
Researcher / Project Lead
University of Gothenburg
jacob.malama@gu.se | Tel: +46720233451 / +260769676606
22nd September 2025.

Allowed to Conduct research at Mulamatta and Kaoma Hospital Unit.

REPUBLIC OF ZAMBIA MINISTRY OF EDUCATION KAOMA DISTRICT EDUCATION BOARD DISTRICT EDUCATION BOARD SECRETARY KAOMA P.O. BOX 940002

The District Education Board Secretary (DEBS)
Kaoma, Western Province
Ministry of Education, Zambia.

Subject: Request for Permission to Conduct School-Based Study in Kaoma District (22–30 September 2025)

Dear Sir/Madam,

My name is Jacob Malama, a doctoral researcher at the University of Gothenburg in Sweden and the Principal Investigator of the study titled *"Equitable Urban Climate Action: Integrating Disability-Inclusive Plans into School Disaster Preparedness."* I respectfully request permission to conduct a school-based study in selected urban primary and secondary schools within Kaoma District, Western Province, from 22 September to 30 September 2025. The study examines the extent to which disability-inclusive measures are integrated into school disaster preparedness and how current policies and practices align with the needs of learners with disabilities.

I confirm that ethical clearance has been granted by the University of Zambia (UNZA) Research Ethics Committee (Ref: HSSREC-2025-APR-026). A copy of the approval letter is attached. The study is done in collaboration with the American Red Cross (International Programs), underscoring its practical relevance for strengthening inclusive and resilient school systems in climate-affected contexts.

Activities in participating schools will be scheduled with Head Teachers to minimize disruption and avoid examination periods. Planned activities include brief surveys and semi-structured interviews with a small number of teachers and administrators, administered with appropriate consent/assent and accessibility adjustments. I have engaged seven trained data collectors to assist with data collection, and Imakando Chiluwe will provide supervision throughout the fieldwork. All data collectors will follow Ministry of Education protocols and the UNZA ethics approval, use standardized tools, and adhere to safeguarding, confidentiality, and data-security procedures.

There will be no costs to schools or the Ministry. Anticipated benefits include a district summary brief and school-specific feedback on strengths and gaps in disability-inclusive preparedness; practical recommendations to improve plans, procedures, and communication; and an evidence base to inform DEBS planning, training priorities, and resource allocation (aligned with DMMU/DDMC structures).

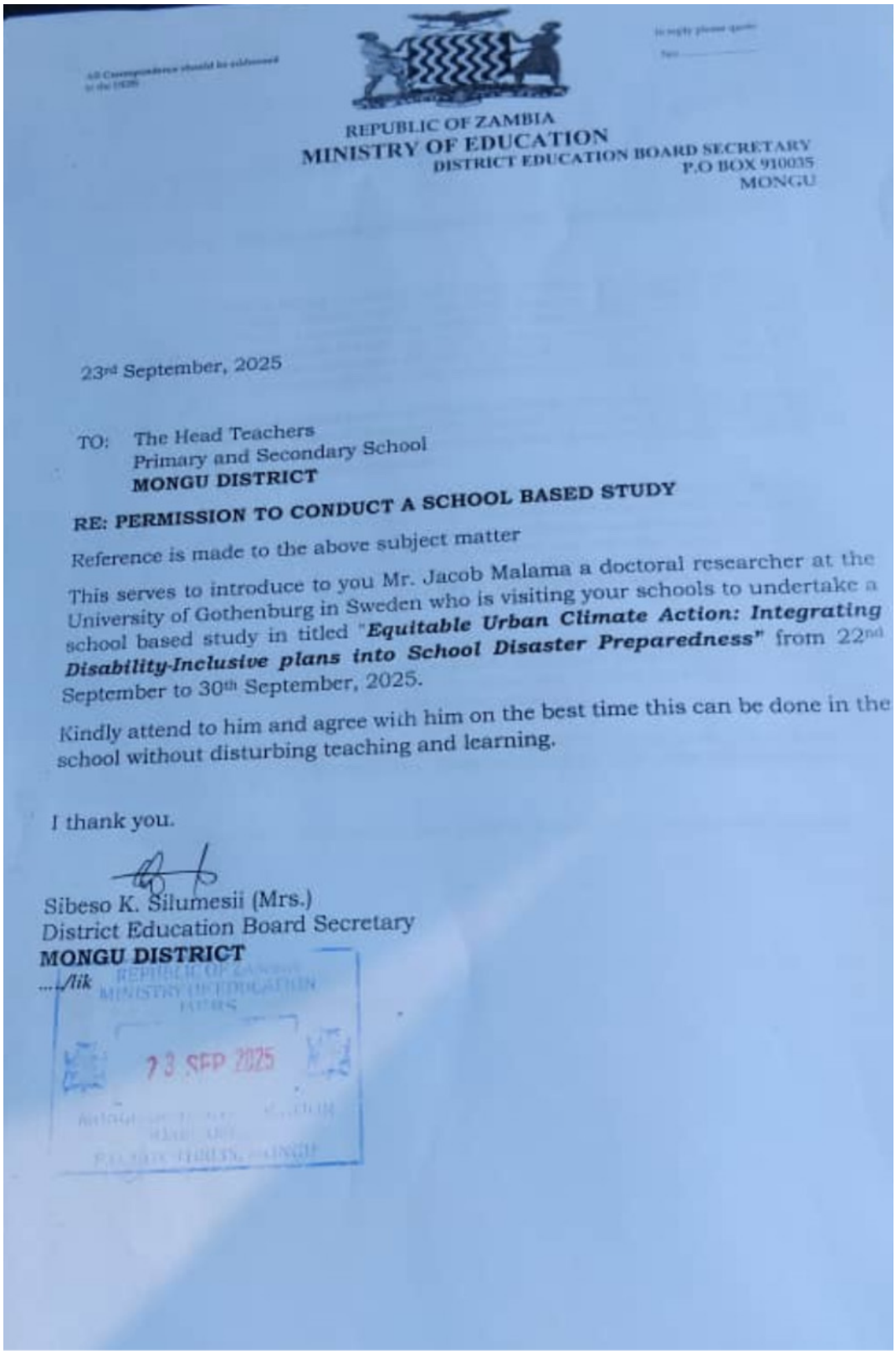
I therefore seek your approval to conduct the study in the district. For further clarification, I am available to discuss the study and scheduling virtually at your convenience. Please find attached the UNZA ethics approval and study instruments for your review.

Thank you for your consideration and for your continued commitment to inclusive, safe, and resilient education in Western Province.

Yours faithfully,

Jacob Malama
Doctoral Researcher, University of Gothenburg
jacob.malama@gu.se | +46720233451 / +260769676606

Appendix 3: Permission Letter to Collect Data from Mongu: District Education Board



REPUBLIC OF ZAMBIA
MINISTRY OF EDUCATION
DISTRICT EDUCATION BOARD SECRETARY
P.O BOX 910035
MONGU

23rd September, 2025

TO: The Head Teachers
Primary and Secondary School
MONGU DISTRICT

RE: PERMISSION TO CONDUCT A SCHOOL BASED STUDY

Reference is made to the above subject matter

This serves to introduce to you Mr. Jacob Malama a doctoral researcher at the University of Gothenburg in Sweden who is visiting your schools to undertake a school based study in titled "***Equitable Urban Climate Action: Integrating Disability-Inclusive plans into School Disaster Preparedness***" from 22nd September to 30th September, 2025.

Kindly attend to him and agree with him on the best time this can be done in the school without disturbing teaching and learning.

I thank you.

Sibeso K. Silumesii (Mrs.)
District Education Board Secretary
MONGU DISTRICT
.../lik

23 SEP 2025