Is Zimbabwe's education system disaster-ready? Evaluating risk reduction strategies in Binga district schools

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Building on the 2006 Disaster Risk Reduction Begins at School campaign by the International Strategy for Disaster Reduction (ISDR), this study examines the role of formal education in enhancing hazard awareness and disaster preparedness among learners in Binga district, Zimbabwe a region that is highly exposed to recurring climate-induced hazards. Despite the implementation of various school-based DRR awareness and training initiatives, their efficacy remains largely unverified through empirical research. This study adopts a qualitative research design, utilizing a structured questionnaire administered to learners aged 8−18 across 20 primary and secondary schools. Key indicators assessed include disaster knowledge, hazard education participation, preparedness levels, risk perception, and community engagement. A two-tier cluster sampling strategy stratifying Binga into northern and southern zones was employed to ensure geographical representation. Findings reveal that current DRR education initiatives are inadequate in cultivating comprehensive disaster resilience among learners. The study calls for targeted programmatic improvements, including curriculum integration, teacher capacity development, and stronger school-community DRR linkages.

KEYWORDS

disaster risk, disaster knowledge, Disaster Risk Reduction, Zimbabwe, hazard awareness, school-based preparedness, Binga district

1 Introduction

The imperative of cultivating disaster-resilient communities has gained renewed urgency in light of increasing climate variability and the rising frequency of extreme weather events. Central to this objective is integrating Disaster Risk Reduction (DRR) and Climate Change Education (CCE) within educational systems. As Kagawa and Selby (2012) articulated, these educational interventions represent vital strategies to inform and empower populations, especially vulnerable groups such as children, about current and future climate-related hazards. The Sendai Framework for Disaster Risk Reduction (2015–2030) underscores education as a core component for strengthening disaster preparedness at all levels [UNDRR (United Nations Office for Disaster Risk Reduction), 2015]. Notably, DRR and CCE are envisioned as both reactive and anticipatory educational responses to the compounding risks posed by anthropogenic climate change and natural

hazards (UNESCO, 2020a; Anderson, 2021). Historical frameworks such as the International Strategy for Disaster Reduction [ISDR (International Strategy for Disaster Reduction), 2005] and the Hyogo Framework for Action (UNISDR, 2006) laid the foundation by advocating for the mainstreaming of DRR into formal education systems, emphasizing the dual importance of formal and informal education as mechanisms to disseminate DRR knowledge into homes and communities. The campaign "Disaster Risk Reduction Begins at School" (UNISDR, 2006) championed these ideals, pushing for the integration of DRR into school curricula while also highlighting the need for safe school infrastructure. More recent global initiatives have expanded upon this by promoting the notion of risk-sensitive education planning, which includes infrastructural resilience, teacher training, and inclusive curriculum development (UNESCO and UNICEF, 2014). Governments, NGOs, and academic institutions continue to operationalize these frameworks at both grassroots and policy levels (Schipper and Pelling, 2013; Gaillard and Mercer, 2013). In sub-Saharan Africa, including Zimbabwe, integration efforts remain fragmented but are gaining momentum as Ministries of Education increasingly acknowledge the strategic role of schools in building long-term resilience.

1.1 Binga district: geographic and demographic context

Binga district is situated in the Zambezi Valley basin in north western Zimbabwe, characterized by its proximity to Lake Kariba and its semi-arid climate. According to the Zimbabwe National Statistics Agency [ZIMSTAT (Zimbabwe National Statistics Agency), 2022], the district has an estimated population of 121,118, with approximately 60% comprising children and young adults, reflecting a high dependency ratio [ZIMSTAT (Zimbabwe National Statistics Agency), 2022]. The dominant ethnic group, the Tonga people, have historically relied on riverine agriculture, fishing, and hunting, but their livelihoods were severely disrupted following the construction of the Kariba Dam in the 1950s, which led to forced displacement (Scudder, 2012; Mavhura, 2020; Mashingaidze, 2013).

Binga's 21 rural wards exhibit acute susceptibility to climate-induced disasters, including droughts, floods, and food insecurity (Mudavanhu et al., 2016). Table 1 illustrates its high disaster risk index compared to other districts in Zimbabwe, making it an ideal case study for examining gaps in disaster education and preparedness (Mudavanhu et al., 2015).

2 Problem statement

Climate change has intensified the frequency and severity of social and natural hazards induced disasters in Zimbabwe, with Binga district emerging as a high-risk area. The district has experienced recurrent climate-induced hazards such as floods and droughts, including the 2008 Zambezi River floods and the 2019 Cyclone Idai-related events, which caused significant disruptions to infrastructure, livelihoods, and community wellbeing. Despite the escalating risks, disaster

risk reduction (DRR) education remains marginal within the national curriculum. The lack of structured DRR content, awareness campaigns, and capacity-building initiatives in schools limits the preparedness and adaptive capacity of learners and surrounding communities. This study seeks to generate evidence to inform policy and practice, with the goal of enhancing educational resilience and community-level disaster preparedness in Binga district.

2.1 Research questions

The following research questions were used to guide the study:

- What is the level of learner awareness and understanding of disaster risk reduction concepts in Binga district schools?
- What DRR education and awareness initiatives currently exist within the school system in Binga?
- What strategies can be implemented to strengthen DRR education and improve learner preparedness in Binga district?

3 Literature review

3.1 Children's knowledge of hazards and disasters

Children's vulnerability to disasters has sparked global recognition of their dual role as both victims and potential agents of change. Their inclusion in DRR frameworks is advocated not only on humanitarian grounds but also as a strategic component of resilience-building (UNICEF, 2017; Wisner et al., 2022). The Hyogo Framework emphasized child-focused DRR education as a means to foster early understanding of hazards, vulnerabilities, and response mechanisms (UNISDR, 2005). Empirical studies confirm that child-centered DRR education enhances knowledge retention, risk perception, and self-protective behavior (Ronan et al., 2015; Johnson et al., 2014).

School-based disaster risk reduction (DRR) education especially when aligned with local hazard contexts markedly improves children's awareness and preparedness across disaster phases (before, during, after) (Ronan and Johnston, 2003; Finnis et al., 2010a,b; Tarrant and Johnston, 2011a,b). It equips them to serve as effective communicators of risk within households and communities (Petal, 2008; Mitchell et al., 2008). Recent comparative studies reinforce this: in Nepal's Pokhara, secondary learners showed significant gains in DRR knowledge and risk perception after community-linked training (Ghale et al., 2025), and a 2023/24 Indonesian pilot using ethnoscience-based digital modules improved elementary students' preparedness by integrating local volcanic histories with safety protocols (Haryati et al., 2025). Beyond cognitive gains, DRR education also strengthens psychosocial resilience. Peek (2008) and Gibbs et al. (2019) emphasize children's susceptibility to trauma and post-disaster educational disruption. However, participatory models—such as those in Chennai slums demonstrate that actively engaging children in DRR development supports their mental wellbeing and fosters agency Krishna et al. (2022). Such

TABLE 1 Hazard, vulnerabilities, and capacities in Zimbabwe.

Hazard	Vulnerability	Capacity
Lightning	- Gutu, Lupane, and Binga report ~10 fatalities annually. - Guruve and Hwedza record 3–4 deaths per year. - Other districts experience 1–2 casualties annually.	Limited forecasting precision (only prone areas identified). - Public awareness on lightning conductors (ZESA, CPO). - Risk assessments by the Zimbabwe Republic Police (ZRP).
Storms and hailstorms	- Annual destruction of homes, tobacco, maize, and other crops.	- Early warning systems (EMA). - Damage assessments (EMA, AGRITEX). - Mitigation support (NGOs, UN agencies).
Earthquakes	- Lake Kariba: Natural and reservoir-induced tremors (frequently felt in Binga). - Zambezi Valley and Eastern Border: Linked to East African Rift. - Penhalonga: Mine-induced rock bursts. - Nyamandlovu Aquifer: 4 recorded events since 1999 (max magnitude 4.0 in 2004).	- Seismic monitoring (Goetz Observatory). - Infrastructure resilience planning (CPO). - Regional/international collaboration (data sharing, scientist training).
Environmental degradation	- Severe in communal areas with sandy/alluvial soils (Binga, Lupane, Tsholotsho, Guruve, Hwedza, Gokwe, Muzarabani). - Gold mining zones face exacerbated degradation.	- Early warnings (EMA). - Land rehabilitation programs (AGRITEX, NGOs). - Policy enforcement (EMA, Social Welfare).
Fires	- High risk in Eastern Highlands forests, roadsides, national parks, and newly resettled areas. - Domestic/industrial fires prevalent in Lupane and Guruve.	- Early alerts (MET, public reporting). - Fire management (EMA, CPO). - Community firefighting training.
Biological hazards (Malaria, Cholera, Typhoid, HIV/AIDS, Animal/Crop Epidemics)	Historically linked to poor WASH (Binga, Chipinge, Lupane, Mangwe). - Nationwide risk due to economic collapse (water/sanitation shortages).	- Cholera Control: WHO-aligned guidelines (MOHCW). - Disease Surveillance: Integrated Disease Surveillance and Response (IDSR). - Training: National-to-local health structures

Sources: SADC training workshop notes 2021; Department for Civil Protection (DCP), ZIMSTAT reports, EMA bulletins.

findings reinforce Mitchell et al. (2008) and Wisner (2011), who contest the notion of children as passive victims; instead, properly supported, children are capable co-creators of preparedness and response strategies. Despite growing scholarship, contexts like Zimbabwe remain underexplored, particularly regarding children's perceptions of their preparedness roles (Sillah, 2015; Fazeli et al., 2024). This gap undermines effective policy and program design, risking the exclusion of children's valuable experiential and culturally-rooted insights.

3.2 Disaster risk reduction education as complementary response

Zimbabwe introduced Heritage-Based Education in 2024, and DRR is one of the aspects that has been integrated into various Syllabi. DRR is one of the eight cross-cutting themes, which also include climate change, environmental issues, safety and health issues, disaster risk management, enterprise, sexuality, HIV and AIDS, heritage, and financial literacy. These are not dealt with in one subject area but are infused in all subjects. The same eight themes are also integrated at all levels of the school system, that is, right across from primary school level, junior secondary through to senior school levels. Incidentally, all eight themes do have embedded risks that can result in disasters of different forms and character.

The expectation is that in Binga, students are conversant with the most common risks associated with environmental issues, health, and climate change. Binga is a unique area with its own unique hazards and associated risks. A hazard is anything that has the potential to cause harm to people, property, and or the

environment (Back et al., 2009; Roos et al., 2010). It is the weather and climate hazards, such as floods, droughts, and lightning, which school children in Binga regard as common. As pointed out by Lunga et al. (2019), each hazard is characterized by its location, intensity, frequency, and probability. Thus, when the likelihood or probability of a hazard to cause harm is high, then it becomes a risk. On the extreme end of the continuum are disasters, which are serious disruptions to the functioning of a community that exceed the community's capacity to cope using its own resources (United Nations Office for Disaster Risk Reduction (UNDRR), 2017). DRR education is a comprehensive approach that encompasses both structural and non-structural elements. Structural elements refer to the physical resilience of school infrastructure, while non-structural components include policy reforms, teacher training, curriculum integration, and community engagement (UNESCO, 2011; Shaw et al., 2019). Effective DRR education seeks to create a "culture of prevention" through formal school curricula as well as non-formal and informal learning activities [UNDRR (United Nations Office for Disaster Risk Reduction), 2019a,b].

The Sendai Framework recognizes that DRR knowledge must be embedded in curricula at all education levels, and such inclusion is used as an indicator of national commitment to resilience-building [UNDRR (United Nations Office for Disaster Risk Reduction), 2015]. Nonetheless, implementation remains uneven, especially in low-income contexts. As of the last global progress reports, fewer than 80 countries had fully integrated DRR into their national curricula (UNESCO, 2020b). In Zimbabwe, the Ministry of Primary and Secondary Education, in collaboration with development partners, has made strides in developing DRR teaching materials and curriculum content [Government of Zimbabwe (GoZ) and United Nations Development Programme (UNDP), 2009a]. Historically, disaster education in Zimbabwe and

much of Africa tended to be abstract, focusing on distant events using foreign-authored textbooks (Lidstone, 1999). However, there has been a paradigm shift toward contextualized learning, emphasizing local hazards such as floods, lightning, and cholera outbreaks (Petal, 2008; Pan African International, 2007a,b). This shift is complemented by the involvement of agencies like the Department of Civil Protection and international partners in co-developing localized reading materials and training teachers (Wardhani et al., 2024).

Despite these efforts, institutional DRR implementation remains *ad hoc*, poorly resourced, and often reactive. Structural weaknesses identified by Munro and Calder (2005) continue to hamper systemic resilience-building. DRR strategies in Zimbabwe are still largely seasonal and episodic, with limited attention to addressing structural vulnerabilities and poverty cycles (Mashingaidze, 2013; Chanza and Musiyiwa, 2022). Moreover, the social dynamics of disaster vulnerability are inadequately addressed. Research by Makamanzi (2025), and Chineka et al. (2019), and Munro and Calder (2005) overlooked the potential contributions of marginalized groups such as children and women in DRR, although emerging research emphasizes the transformative potential of inclusive resilience strategies (Gaillard et al., 2019a,b; Wisner et al., 2022). Integrating gender and age-disaggregated approaches in DRR education is therefore not only equitable but strategically necessary.

3.3 Institutional frameworks and DRR governance in Zimbabwe

Zimbabwe has developed institutional mechanisms for disaster governance, including the Department of Civil Protection (DCP) under the Ministry of Local Government, Public Works and National Housing, which oversees meteorological and sudden-onset disaster responses, and the Department of Social Welfare (DSW), responsible for managing slow-onset crises such as droughts and food insecurity. These structures extend to the community level, involving traditional leadership, councilors, and government field officers [Government of Zimbabwe (GoZ) and United Nations Development Programme (UNDP), 2009a].

While these structures have proven effective in averting major humanitarian crises during events such as Cyclone Eline in 2000 and Cyclone Idai in 2019, weaknesses persist. Munro and Calder (2005) noted that DRR strategies are often reactive, poorly resourced, and inadequately integrated into long-term development planning, particularly in the education sector. This results in a cyclical pattern of vulnerability, especially among women and children, whose roles in building resilience are often undervalued or ignored (Chineka et al., 2019; Lunga et al., 2023). A comprehensive approach that includes child-focused DRR planning, community education, gender-sensitive interventions, and capacity building at all levels is required. Research by Makamanzi (2025) and subsequent critiques call for a more systemic inclusion of marginalized groups, particularly in policy design, risk communication, disaster education, and post-disaster evaluations.

3.4 Disaster vulnerability and humanitarian challenges

Binga is classified as a chronic disaster hotspot due to recurrent droughts, erratic rainfall (averaging below 450 mm annually), and frequent food insecurity (Mavhura, 2020; Mashingaidze, 2013). The district's vulnerability is exacerbated by its reliance on rain-fed agriculture and limited access to alternative livelihoods (Mudavanhu et al., 2015). Studies indicate that over 70% of households require annual humanitarian assistance, primarily due to crop failures and livestock losses. Furthermore, ineffective disaster risk reduction (DRR) interventions by government agencies and NGOs have perpetuated cycles of vulnerability (Chagutah, 2020; Mavhura, 2020; Mashingaidze, 2013).

3.5 The role of schools in disaster preparedness

In Zimbabwe, schools serve as critical hubs for disaster education and community resilience (Mutasa, 2013). Approximately 40% of Binga's population engages directly with schools daily, including students, teachers, and support staff [ZIMSTAT (Zimbabwe National Statistics Agency), 2022]. Schools also function as multi-purpose centers for community gatherings, disaster planning, and public awareness campaigns [Government of Zimbabwe (GoZ) and United Nations Development Programme (UNDP), 2009a]. Parent-Teacher Associations (PTAs) play a pivotal role in mobilizing local participation in disaster preparedness (Shaw et al., n.d.). Recent research underscores the need for institutionalizing disaster risk education in schools, particularly in high-risk areas like Binga (Amri et al., 2021a,b,c). The proposed Emergency Preparedness and Disaster Management Manual for Schools aligns with global frameworks such as the Sendai Framework for Disaster Risk Reduction (2015–2030), which emphasizes child-centered disaster risk reduction (CC-DRR) (UNISDR Annual Report, 2015).

3.6 Disaster risk and institutional challenges in Binga district

The table above underscores the multi-hazard vulnerability of Binga District, where communities face recurrent disasters, including lightning strikes, storms, droughts, and human-wildlife conflict. While experiential knowledge may have equipped locals with adaptive strategies (Mudavanhu et al., 2015), systemic gaps in disaster risk reduction (DRR) governance exacerbate their exposure.

3.7 Multi-hazard exposure and local coping mechanisms

Binga's disaster profile reflects both climatic and anthropogenic risks. Lightning fatalities in Zimbabwe are attributed to challenges in forecasting and inadequate protective infrastructure

(Mudavanhu et al., 2016). Meanwhile, droughts and erratic rainfall, worsened by climate change (Eboreime et al., 2025), disrupt subsistence agriculture, forcing reliance on humanitarian aid. Local knowledge, such as drought-resistant crop varieties and indigenous early warning signs (e.g., animal behavior), offers some resilience (Mavhura, 2020; Mashingaidze, 2013). However, such measures are insufficient against large-scale shocks like Kariba Dam-induced earthquakes (Scudder, 2012) or disease outbreaks linked to water scarcity (Bangure et al., 2015).

3.8 Institutional failures and coordination gaps

As noted by Manyena (2006), post-disaster responses in Binga are often fragmented, with overlapping interventions from NGOs, government agencies, and international actors. The lack of a centralized DRR framework leads to duplicated efforts, as seen in the 2000s when uncoordinated food aid programs failed to address chronic malnutrition [Government of Zimbabwe (GoZ) and United Nations Development Programme (UNDP), 2009b]. Local institutions (e.g., EMA, CPO) struggle with resource constraints, leaving early warning systems unevenly distributed (Nobambela and Yekani, 2025). For instance, seismic monitoring exists near Kariba but not in rural wards, leaving communities unprepared for tremors (Mudavanhu et al., 2016).

3.9 Geographic and structural inequalities

Binga's remoteness amplifies its marginalization. Poor road infrastructure delays emergency responses, while limited healthcare access heightens cholera/malaria mortality [ZIMSTAT (Zimbabwe National Statistics Agency), 2022]. Nobambela and Yekani (2025) highlights disparities in post-disaster recovery in urban centers like Harare that receive faster reconstruction aid than Binga, where resettlement programs are underfunded. This inequality mirrors Wisner's (1995) critique of "top-down" DRR models that neglect local participation.

4 Methodology

4.1 Study purpose and design

This qualitative study sought to explore the levels of disaster risk reduction (DRR) knowledge among children aged 8–19 years in Binga District, Zimbabwe. Specifically, it investigated how DRR programs implemented by international and national non-governmental organizations (INGOs and NGOs) have influenced children's and communities' understanding of disaster risks, their perceptions, awareness of early warning systems, household preparedness, and adaptive strategies. The study also aimed to capture children's subjective perspectives on disaster experiences and DRR interventions. A qualitative research design was deemed most suitable due to its emphasis on eliciting in-depth, context-specific understandings of human experiences, perceptions, and

meaning-making processes (Creswell and Poth, 2018; Braun and Clarke, 2022).

4.2 Qualitative approach and data collection tools

This study employed a qualitative design using Focus Group Discussions (FGDs), Key Informant Interviews (KIIs), and chChild-led narrative methods to explore children's perceptions, experiences, and local knowledge of disasters and disaster risk reduction (DRR) in Binga District. These methods are widely validated in child-focused DRR research for accessing situated, socially constructed perspectives (Mwalwimba et al., 2024; Peek et al., 2018).

4.3 Focus group discussions with children

FGDs were conducted with school-going children aged 8–19, a group shown to possess sufficient cognitive and verbal capacity to engage in structured dialogues (Morgan et al., 2002). Groups of 7–12 participants met during regular class periods in school settings. Ethical protocols were emphasized at the outset, including informed assent, voluntary participation, and confidentiality.

4.4 The sessions were guided by a semi-structured tool exploring

Children's understanding of disasters (e.g., "What comes to your mind when you hear the word 'disaster'?"), Common hazards in their communities ("Can you give examples of disasters you've seen or heard about?"), Perceived causes and impacts ("What do you think causes disasters?" and "Who or what gets affected?"), Preparedness knowledge and practices ("What do you or your family do during lightning or heavy rains?"), Gendered and cultural dimensions ("Do boys and girls experience disasters differently?" and "Are there any traditional practices to protect from disasters?"), Children's recommendations for DRR ("What would help you feel safer?").

Participatory techniques such as storytelling, drawing, and scenario-based discussions enhanced engagement and expression. Children also created visual illustrations and some kept diaries, adding depth and temporal richness to the data. Child facilitators were trained to lead discussions, fostering peer-driven dialogue and reinforcing emerging evidence that youth-led spaces can yield more candid and authentic insights (Back et al., 2022). Visual aids and child-appropriate language were used throughout to maintain accessibility.

4.5 Key informant participant's interviews

KIIs targeted school heads, teachers, NGO workers, Red Cross officers, and community leaders to triangulate

institutional perspectives. Using a structured interview guide, key themes included:

Hazard awareness ("What disasters are most common in Binga?"), Learners' understanding of risk causation and classification ("Can learners distinguish between natural and human-induced hazards?"), Integration of DRR into the school curriculum ("Is DRR taught in schools? How?"), Institutional challenges and training gaps. The role of NGOs and community knowledge systems in disaster education, Sustainability of DRR programmes ("What happens when external support ends?"), Gender-specific vulnerabilities and psychosocial impacts among learners, and actionable recommendations ("What structural or policy support is most urgently needed?").

The combined tools supported rich, multi-layered insights into how children conceptualize, experience, and respond to disasters, while highlighting systemic enablers and barriers to effective DRR education.

5 Triangulation procedures

To contextualize and validate the findings from the FGDs, semi-structured interviews were conducted with key informants, including school educators, village leaders, and local disaster risk reduction (DRR) practitioners. These interviews served to triangulate children's perspectives with broader institutional and community narratives. The interview protocol was informed by extant literature on child-centered disaster resilience (UNICEF, 2020; Tierney, 2019) and tailored to address local socio-cultural and environmental conditions influencing DRR practices. This multi-source approach facilitated a comprehensive understanding of the intergenerational and institutional dimensions of disaster preparedness and resilience in the study communities.

6 Sampling procedure

Cluster sampling was used to select 20 schools (9 primary and 11 secondary) from the 91 schools in Binga District. The sampling framework accounted for geographic distribution, community vulnerability rankings, and disaster history, ensuring representativeness of diverse socio-ecological zones. Schools with active DRR programs by the government and NGOs were prioritized. From each selected class, seven students were randomly sampled, and informed consent was obtained from their parents/guardians. Child assent was also secured on the day of participation.

In total, 140 children (87 girls and 53 boys) aged 8–19 years participated in FGDs. Participants' knowledge was assessed through open-ended discussion questions exploring their understanding of disaster types, historical events in their communities, DRR practices, risk perception, preparedness levels, and emotional responses to disasters. The responses were thematically grouped during analysis into five core domains: (1) Disaster Knowledge, (2) Risk Awareness, (3) Preparedness Practices, (4) Risk Perception, and (5) Adaptive Strategies.

7 Data analysis

Data from FGDs and interviews were transcribed verbatim and triangulated with audio recordings to enhance reliability. Thematic analysis, as outlined by Braun and Clarke (2006, 2022), was used to identify, analyze, and report patterns (themes) within the data. This involved six key phases: familiarization with data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Additional coding steps from Tesch (1990) were used to support iterative categorization and the development of a thematic framework grounded in the participants' narratives.

Thematic triangulation was performed across data sources (FGDs, KIIs, narratives) to validate findings. Key themes were organized under three broad categories: (1) Knowledge and Awareness of common hazards, (2) Risk Perception and Preparedness, and (3) Emotional and Social Responses to Disasters. Coding was conducted manually and with the aid of qualitative analysis software (e.g., NVivo) to enhance analytic rigor.

8 Findings

The children in all the schools described some of the disaster features, which include dread factors like dangerous, frightening, destructive, and failure to predict their occurrence. The students identified examples of disasters they felt were common in their community, as illustrated in Table 2 below.

With regards to conceptual understanding and hazard classification, the study found that children especially those in primary school struggled to distinguish between natural hazards (e.g., floods, droughts) and human-induced threats (e.g., child abuse, unsafe roads). Hazards such as potholes, crocodile attacks, or sexual abuse were often discussed alongside floods and droughts, demonstrating a blurred classification of risk.

This lack of differentiation indicates an absence of structured DRR education, particularly in early schooling. It aligns with findings from (Ronan et al., 2016a,b), who argue that children's disaster literacy is often shaped by fragmented exposure to information, with formal education failing to establish clear hazard typologies.

Younger children exhibited limited causal reasoning, often attributing disasters to simple, observable phenomena ("floods come from too much rain"), while older learners identified environmental drivers like deforestation or poor farming practices. This progression supports Piagetian developmental theory and findings from Gibbs et al. (2013) and Back et al. (2022) on the relationship between cognitive maturity and disaster reasoning.

Children's awareness was heavily influenced by experience and culture. While school programs emphasized formal DRR knowledge (fire drills, safety clubs), informal learning at home focused on local hazards like crocodile attacks and gender-based violence. This dualism echoes Mutch (2015), who argue for integrating everyday knowledge into formal education to enhance relevance.

On the theme of Risk Perception and Preparedness the findings showed differential preparedness and protectives strategies. While most children could explain basic safety procedures (e.g., using

TABLE 2 Knowledge and awareness of common hazards in Binga.

Disaster risk/hazard	Who/what is affected	Effects
Drought (*bhalangwe*)	Community, pastures, domestic animals, crops, forest resources	- Inadequate pastures/water leads to wildlife encroachment (disease risks to livestock, human danger). - Poor crop yields due to rainfall shortages.
Hailstorms (*izambangulwe*), Lightning (*Lulabe/indaba*)	Crops Infrastructure community	- Crop destruction. - Damage to roads, dams, and mud-brick homes. - Lightning fatalities/injuries
Child trafficking	Children Women Community	- Loss of life. - Emotional, physical, and psychological trauma.
Potholes	Community Road vehicles	- Accidents causing fatalities/injuries.
Excessive rainfall resulting in floods	Community and the environment	- Soil nutrient leaching → poor harvests. - Soil erosion/crop loss. - Infrastructure damage (roads, dams, homes). - Waterborne diseases (cholera, typhoid).
Dangerous wildlife (lions, elephants, snakes, etc.)	Community Livestock	- Lions: Livestock/human fatalities. - Elephants: Crop destruction, road accidents. - Snakes: Poisonous bites. - Poisonous fruits: Harm to humans/livestock.
HIV/AIDS	Affects people of all age groups	- High morbidity/mortality (especially youth/children).
Veld fires	Communities, pastures, homes	- Infrastructure loss. - Pasture/human fatalities.
Heavy winds	Infrastructure, school buildings and homes	-Structural collapse.
Narrow roads and damaged bridges	Community transport	-Fatal accidents
Child Abuse (Sexual/physical) (*kujatwa bunjaka muzyamungubo*)	Children	- Physical/psychological trauma.
Drowing (*kunikila*)	Affects people of all age groups	- Fatalities (especially children).
Dilapidated school buildings	Children, teachers	- Collapse risks (life, furniture, learning materials).

Source: primary data.

fire extinguishers or reporting abuse), broader disaster causation remained poorly understood among younger learners. This supports evidence from showing that technical disaster concepts must be age-appropriate and linked to learners' realities.

8.1 Role of schools, NGOs, and local knowledge

Both FGDs and KIIs revealed that DRR strategies in Binga are delivered through a mosaic of school curriculum, NGO support (e.g., Zimbabwe Red Cross Society), and traditional knowledge systems. Intergenerational knowledge such as reading bird behavior or praying for protection plays a key role in risk detection and mitigation. However, implementation is inconsistent. As one teacher noted, "We have no materials or training; we just improvise." When NGOs withdraw, sustainability falters. These findings echo the critique by Gaillard and Mercer (2013) that many DRR programs lack long-term institutional support or integration with Indigenous knowledge.

8.2 Knowledge gaps in anthropogenic risk

A notable gap was children's inability to link human actions to disasters. While students recognized floods and droughts,

few discussed anthropogenic causes such as land degradation or deforestation. This suggests a need for critical environmental education that connects ecological and social drivers of risk.

8.3 Emotional and social responses to disasters

Children vividly recalled disasters tied to emotional impact floods that displaced families, or lightning strikes that killed livestock. These memories were more enduring than abstract concepts, aligning with schema theory, which suggests emotionally charged events are more likely to be encoded and recalled (Tanner et al., 2009).

8.4 Gendered risk perception

Distinct gendered fears emerged as girls emphasized sexual violence during displacement, while boys feared drowning or being attacked. These differentiated anxieties reflect societal vulnerabilities and were confirmed by key informants. Yet, few psychosocial interventions exist to address them. Plan International (2016) and Ager et al. (2018) have emphasized the need for gender-sensitive DRR that includes trauma-informed support.

8.5 Spiritual and cultural coping mechanisms

Cultural and spiritual beliefs offered emotional reassurance. Learners often mentioned prayer as protection from lightning or floods. These findings mirror those of Mercer et al. (2010), who highlight the role of faith-based coping in African risk cultures.

The study revealed significant gaps in children's understanding of disasters, especially among younger learners who often conflated natural and human-induced hazards. Older students showed better causal reasoning, influenced by age and school exposure. Disaster knowledge was shaped by both formal education and informal sources like family and local culture, highlighting the need to integrate localized experiences into structured DRR education.

Emotional and social responses were strongly shaped by gender and cultural beliefs. Girls expressed fear of sexual violence during displacement, while boys feared physical harm. Prayer and traditional practices were commonly cited as protective measures. While schools and NGOs support DRR efforts, sustainability remains a challenge. The findings call for context-sensitive, gender-responsive, and participatory DRR education that combines scientific knowledge with local practices.

9 Discussion

The state of disaster risk education (DRE) in Binga District, Zimbabwe, reveals persistent systemic gaps between policy intentions and implementation. Despite robust national policy frameworks—Zimbabwe Revised Nationally Determined Contribution (2021) and Education Sector Strategic Plan (2021–2025) the implementation gap in Binga District remains stark. These policies advocate for comprehensive, experiential DRR education, yet on-the-ground practice reveals fragmented delivery and superficial DRR content. This discrepancy aligns with the first research question examining whether national intent translates to grassroots action and confirms that policy, in isolation, is insufficient. Malawi, for instance, school-based disaster risk reduction (DRR) programs effectively combine indigenous early warning systems with formal scientific monitoring, resulting in community-anchored preparedness strategies (Dewa et al., 2022). Scholars like Dube and Nhamo (2023) document similar divergences in other Southern African settings, reinforcing that coherent DRR education demands sustained investment in teacher training, curriculum resources, and institutional oversight.

The second research question investigated how children's lived disaster experiences integrate into formal education. In Binga, students vividly describe local hazards floods, droughts, crocodile attacks yet their formal learning largely omits these contexts. By contrast, Mozambique employs participatory cyclone simulations that blend meteorological science with local coping practices, yielding practical application and resonance among students (Artur and Hilhorst, 2022). In Binga, only 12% of students understand watershed management (Dube and Nhamo, 2023), indicating formal education remains abstract and disconnected from local realities. This gap echoes patterns in Zambia, where DRR persists in academic silos without integrating community knowledge.

The third research question relates to the institutional conditions that support DRR. Zimbabwe's rural schools are highly vulnerable: just 8% meet disaster-resilient building standards, in stark contrast to South Africa's 62% retrofitted high-risk schools. Cyclone Idai exposed this disparity 36 Zimbabwean schools collapsed compared to only two in Mozambique with improved codes (World Bank, 2021). Teacher preparedness is equally deficient: only 9% of Matabeleland North educators have DRR training Mutseekwa and Razuwika (2023), contrasted with 53% in Eswatini's Lubombo (Government of Eswatini, 2021) and Namibia's universal annual training (Namibia, 2013). These findings underscore that policy intentions must be matched with infrastructure and capacity to be effective at the community level.

Investigating the fourth research question how gender, emotion, and culture shape DRR our study found that girls feared sexual violence during displacement, and boys feared physical hazards like drowning. Yet school programs remain gender-neutral. This contrast is pronounced when compared to Lesotho, which incorporates gender-based violence prevention into DRR education (Morojele, 2013). Additionally, children's reliance on prayer an emotional and spiritual coping mechanism is under-acknowledged by formal curricula, despite evidence linking spiritual resilience to disaster preparedness (e.g., Lalani et al., 2021). This disconnect indicates a need for gender-informed, emotionally supportive DRR that reflects local cultural frameworks.

Finally, aligning with the fifth question how Zimbabwe's DRE compares regionally evidence from Malawi, Botswana, Mozambique, and Kenya indicates that hybrid, community-anchored DRR is highly effective. Malawi's indigenous early-warning systems have demonstrable impacts (Mwalwimba et al., 2024); Botswana's cultural forecasting improved preparedness in 76% of schools (Moeti et al., 2023); and Kenya's 'Paper Volcanoes' project successfully decolonized hazard frameworks (Bertoli et al., 2024). These models share three success factors: (1) integration of scientific and local knowledge, (2) investment in teacher training and infrastructure, (3) gender-sensitive and culturally relevant content. Zimbabwe's current, siloed approach risks low engagement and limited efficacy. A compelling pathway emerges: a context-sensitive, capacity-driven reform that embeds DRR within both policy and practice, truly bridging national vision with local action.

10 Limitations and research opportunities

The findings of this study are shaped by certain methodological constraints and contextual limitations. Notably, the rural focus on Binga District may not capture the complexities of urban Zimbabwe, where the nature of hazards and institutional responses may differ. Furthermore, the reliance on free-listing exercises without visual prompts may have underestimated the depth of younger children's disaster-related knowledge. Future research should consider longitudinal designs that track the evolution of disaster literacy across educational levels and age groups. Such an approach could illuminate how cognitive, environmental, and institutional factors influence the assimilation of disaster risk knowledge over time.

11 Conclusion and recommendations

This study reveals a persistent and troubling gap between Zimbabwe's national disaster risk education (DRE) policies and their local implementation in Binga District. While children demonstrate vivid experiential knowledge of disasters, formal education fails to integrate this lived reality with scientific understanding, infrastructure remains substandard, and teacher preparedness is critically low. Moreover, Indigenous Knowledge Systems (IKS), emotional coping, and gender-specific vulnerabilities are overlooked in current curricula. Comparative insights from Malawi, Mozambique, Botswana, Lesotho, and Kenya underscore the effectiveness of hybrid, locally anchored DRE approaches that fuse scientific and traditional knowledge, reinforce infrastructure, and build educator capacity. To align Zimbabwe's DRE system with these emerging regional best practices, a shift is needed from rhetorical policy to community-embedded, evidence-based action. This paper, therefore, is recommending the following.

Firstly, there is a need for localized curriculum integration. This involves the revision of the school curricula to reflect local hazards and lived experiences, blending scientific content with Indigenous Knowledge Systems (IKS) and cultural practices. But this is only possible if curricula revision is complimented by the integration of DRR into teacher education. Teachers need to be capacitated and trained in local risk typologies, gender sensitivity, and participatory methods. However, since Zimbabwe's curriculum is exam driven, there is need to ensure that DRR becomes part and parcel of both the formative and summative assessment processes. Thus, the Zimbabwe School Examinations Council (ZIMSEC), need to be involved so that the whole process becomes wholesome. Secondly, local authorities need to strengthen school infrastructure. This can take the form of retrofitting and disaster-proofing schools to meet regional safety standards. This implies that even gender-specific risks and psychosocial coping strategies need to be integrated into DRR education so as to address both physical and emotional vulnerabilities. Thirdly, change can only succeed if the community owns it, otherwise the initiative can be perceived as an imposition. In short, there must be implementation which is community—driven. Such a move can only be successful if a school–community DRR committee is set up to co-create content, monitor delivery, and ensure cultural relevance.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/supplementary material.

Ethics statement

The studies involving humans were approved by Ethics Clearance of HSRC Research Ethics Committee Protocol No REC 2/22/06/22: 8. "Is Zimbabwe's Education System Disaster-Ready? Evaluating Risk Reduction Strategies in Schools". The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

WL: Writing – review & editing, Conceptualization, Writing – original draft, Investigation, Methodology, Project administration, Formal analysis, Validation, Visualization, Data curation, Supervision. MZ: Writing – review & editing, Writing – original draft. JK: Writing – original draft, Writing – review & editing. CM: Formal analysis, Writing – original draft, Methodology, Writing – review & editing. MM: Writing – original draft, Writing – review & editing. CB: Writing – review & editing, Validation, Writing – original draft. AM: Data curation, Methodology, Conceptualization, Formal analysis, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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