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Understanding of extreme weather events and disaster risk reduction among students, teachers and school inspectors in Ouagadougou, Burkina Faso

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Abstract

Extreme weather events (EWEs) are becoming increasingly frequent and severe due to climate change, posing significant challenges to education systems, particularly in vulnerable countries such as Burkina Faso. Understanding how educational stakeholders perceive and understand these events is essential for developing effective climate change education and disaster risk reduction (DRR) strategies. This study assessed the knowledge and understanding of EWEs and DRR among primary school students, teachers, and educational inspectors in Ouagadougou. A cross-sectional survey involving pupils, teachers, and inspectors was conducted using structured questionnaires and interviews. The findings revealed that most students were familiar with floods and droughts and could identify their principal causes and impacts. Teachers and inspectors demonstrated a generally good understanding of climate-related hazards but reported limited access to teaching resources and specialized training on climate change and disaster risk reduction. Despite high awareness levels, important gaps remain regarding adaptation measures, preparedness strategies, and climate resilience. The study recommends strengthening climate education programmes, enhancing teacher training, and developing educational materials adapted to local climatic realities.

Keywords: Climate change education; Extreme weather events; Disaster risk reduction; Awareness; Primary schools; Burkina Faso.

1. Introduction

Climate change is increasingly recognized as one of the most pressing global challenges of the 21st century. According to the Intergovernmental Panel on Climate Change (IPCC), human-induced warming has led to a significant rise in the frequency, intensity, and duration of extreme weather events (IPCC, 2021). These include floods, droughts, heatwaves, and storms, all of which have profound impacts on ecosystems, human settlements, and socio-economic systems worldwide. The IPCC Sixth Assessment Report further emphasizes that vulnerable populations, particularly in developing countries, are disproportionately affected due to limited adaptive capacity and weak institutional resilience IPCC Reports AR6 (IPCC, 2023) .

Among the various sectors affected by climate change, education is particularly sensitive. Schools are not only physical infrastructures that can be damaged by disasters, but also social institutions where disruption has long-term consequences on human capital development. UNESCO (UNESCO, 2016) highlights that climate-related hazards increasingly threaten school continuity, especially in low-income countries where infrastructure is often inadequate and emergency preparedness is limited UNESCO Climate Change Education (UNESCO, 2024a). When schools are

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damaged or closed due to floods or storms, learning losses accumulate, widening educational inequalities and affecting children's future opportunities. Children represent one of the most vulnerable groups to climate-related hazards. Their vulnerability is not only physical but also cognitive and social, as they depend on adults and institutions for protection and guidance (UNDRR, 2016). The United Nations Office for Disaster Risk Reduction (UNDRR) stresses that integrating disaster risk reduction (DRR) into education systems is essential for building a culture of safety and resilience from an early age UNDRR Disaster Risk Reduction Education. Educating children about extreme weather events (EWEs) enhances their ability to respond appropriately during disasters and contributes to long-term community resilience (UNISDR, 2015). In Sub-Saharan Africa, the impacts of climate variability are particularly severe due to high exposure and limited adaptive capacity. Studies show that West Africa has experienced increasing rainfall variability, leading to recurrent flooding in urban areas and prolonged droughts in rural zones (Morioka et al., 2015), (Jury, 2002). These changes have direct implications for livelihoods, infrastructure, and essential services such as education. In urban centers, rapid and unplanned urbanization further increases flood risk by reducing natural drainage capacity and increasing surface runoff. Burkina Faso, located in the Sahelian region, is highly vulnerable to climate extremes. Over the past decades, the country has experienced recurrent floods, especially in urban areas such as Ouagadougou, where rapid population growth and inadequate urban planning exacerbate flood risks (Miller et al., 2022) (Fowé et al., 2026). For example, major flood events have repeatedly damaged housing, roads, and school infrastructure, disrupting academic calendars and displacing thousands of households. The National Adaptation Plan of Burkina Faso recognizes floods and droughts as priority climate risks requiring urgent attention in both urban and rural planning frameworks. In the municipality of Ouagadougou, primary schools are increasingly exposed to flooding hazards due to their location in low-lying and poorly drained areas. These events often result in school closures, destruction of educational materials, and interruption of teaching activities. Despite these recurring impacts, there remains limited integration of climate risk education into the primary school curriculum. As a result, both pupils and teachers may have insufficient knowledge regarding the causes, impacts, and appropriate responses to extreme weather events (Coulibaly et al., 2020) (Dos Santos et al., 2019) (Fowé et al., 2026).

Existing literature on climate change awareness has largely focused on adult populations, including policymakers, farmers, and urban residents. For instance, research conducted in various African contexts indicates moderate to high awareness of climate change among adults, but limited understanding of specific risk reduction strategies (Ayanlade & Jegede, 2016). However, fewer studies have examined the perceptions and knowledge of school-based actors, particularly primary school pupils and teachers. This gap is critical because schools represent strategic entry points for disseminating climate risk knowledge and fostering adaptive behaviors from an early age. Furthermore, educational inspectors, who play a key role in curriculum implementation and teacher supervision, are often overlooked in climate change education studies. Their perceptions and level of awareness are crucial for the effective integration of disaster risk reduction into teaching practices(Jones, 2023) (Rector, 2021). Without adequate training and institutional support, efforts to mainstream climate education in schools may remain limited in scope and impact (UNESCO, 2006). Given this context, there is a clear need to assess the level of awareness and understanding of extreme weather events among educational stakeholders in Ouagadougou. This study aims to contribute to this gap by evaluating the knowledge of primary school pupils, teachers, and educational inspectors regarding floods, droughts, and other climate-related hazards, as well as their understanding of disaster risk reduction strategies. By doing so, the study seeks to provide evidence that can support the integration of climate change education into primary school curricula in Burkina Faso. Strengthening awareness at the school level is essential not only for reducing vulnerability to current climate risks but also for building long-term resilience in future generations.

1.1. Objectives

The study aims to:

- Assess students' understanding of extreme weather events.
- Evaluate teachers' knowledge of climate-related hazards and disaster risk reduction.
- Examine inspectors' perceptions of climate education and DRR.
- Identify knowledge gaps and educational needs.

2. Material and methods

2.1. Study Area

The study was conducted in the municipality of Ouagadougou (Figure 1), the capital city of Burkina Faso, located in the central part of the country within the Sudan-Sahelian climatic zone. The city is characterized by a semi-arid climate with a highly variable rainfall regime and increasing exposure to climate extremes. In recent decades, Ouagadougou has

experienced recurrent flooding events, particularly during the peak rainy season, largely driven by intense precipitation episodes combined with rapid and often unplanned urban expansion. These dynamics have resulted in increased surface runoff, inadequate drainage capacity, and heightened vulnerability of urban infrastructure, including educational facilities. Consequently, climate variability and flood risk represent major environmental and socio-spatial challenges for the municipality, directly affecting human settlements and public services such as education.

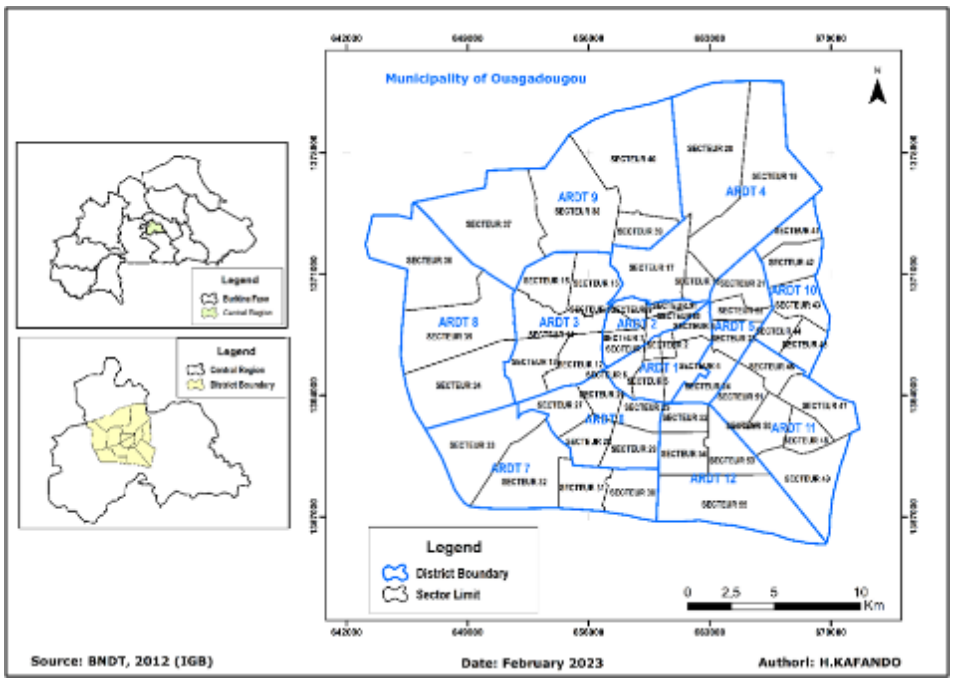

Figure 1 Study Area

2.2. Research Design

This study adopted a descriptive cross-sectional survey design. This approach was considered appropriate for assessing the level of awareness, knowledge, and perceptions of extreme weather events and disaster risk reduction among different categories of educational stakeholders at a specific point in time. The design allowed for the collection of quantitative and qualitative information without manipulating study variables, making it suitable for exploratory assessment in the field of climate change education and risk awareness.

2.3. Study Population

The study targeted key actors within the primary education system in Ouagadougou. These included :

- Primary school pupils, representing the main beneficiaries of climate risk education;
- Primary school teachers, responsible for delivering classroom instruction and shaping pupils' understanding of environmental issues;
- Educational inspectors, who supervise pedagogical practices and ensure curriculum implementation at the institutional level.

This multi-level selection enabled a comprehensive assessment of knowledge and awareness across different institutional actors involved in primary education.

2.4. Data Collection

Data were collected using a combination of quantitative and qualitative methods to ensure a comprehensive understanding of the research problem. Structured questionnaires were administered to primary school pupils to assess their basic knowledge and perceptions of floods and other extreme weather events. Similar questionnaires were distributed to teachers to evaluate their understanding, teaching practices, and exposure to climate-related content in the curriculum. In addition, semi-structured interviews were conducted with educational inspectors to obtain in-depth insights into institutional policies, curriculum implementation, and challenges related to integrating disaster risk reduction and climate education in primary schools.

2.5. Data Analysis

Collected data were systematically coded and analyzed using descriptive statistical techniques. Frequencies and percentages were computed to quantify the levels of awareness, understanding, and preparedness related to extreme weather events among the different categories of respondents. The analysis enabled the identification of knowledge gaps and disparities between pupils, teachers, and inspectors. Qualitative data from interviews were used to complement and contextualize the quantitative findings, providing a more comprehensive interpretation of the results.

3. Results

3.1. Students' Understanding of Extreme Weather Events

The distribution of pupils across grades and age groups is presented in **Table 1**. The findings indicate a relatively balanced sample across the three upper primary levels, ensuring comparability in terms of cognitive development and exposure to environmental knowledge.

Table 1 Students' class and age distribution

Class	Age Range	Number	Percentage (%)
Grade 4	8-10	127	32.82
Grade 5	9-13	125	32.30
Grade 6	10-15	135	34.88
Total		387	100.00

The results showed (figure 2) that 94.5% of pupils correctly defined flooding, 76.4% correctly identified its causes, and 98.0% recognized its impacts on communities and schools. These findings indicate a high level of awareness among pupils regarding extreme weather events.

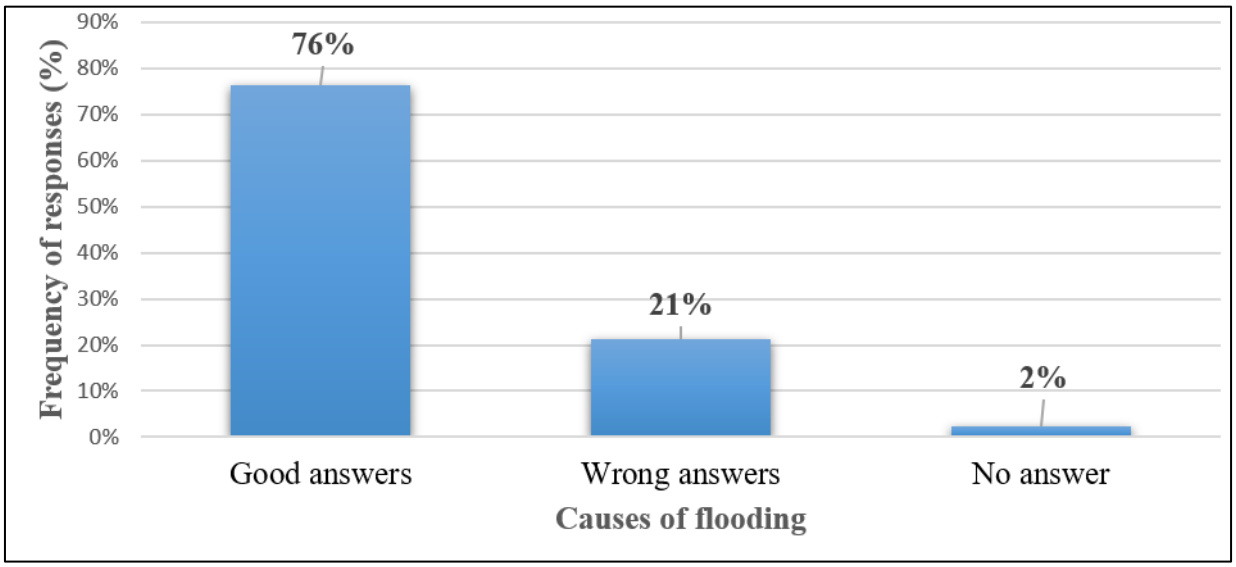

Figure 2 Students' knowledge of flooding causes

Students mainly associated flooding with heavy rainfall, blocked drainage systems, and overflowing watercourses. This suggests that pupils rely largely on observable environmental and infrastructural conditions to explain flooding phenomena.

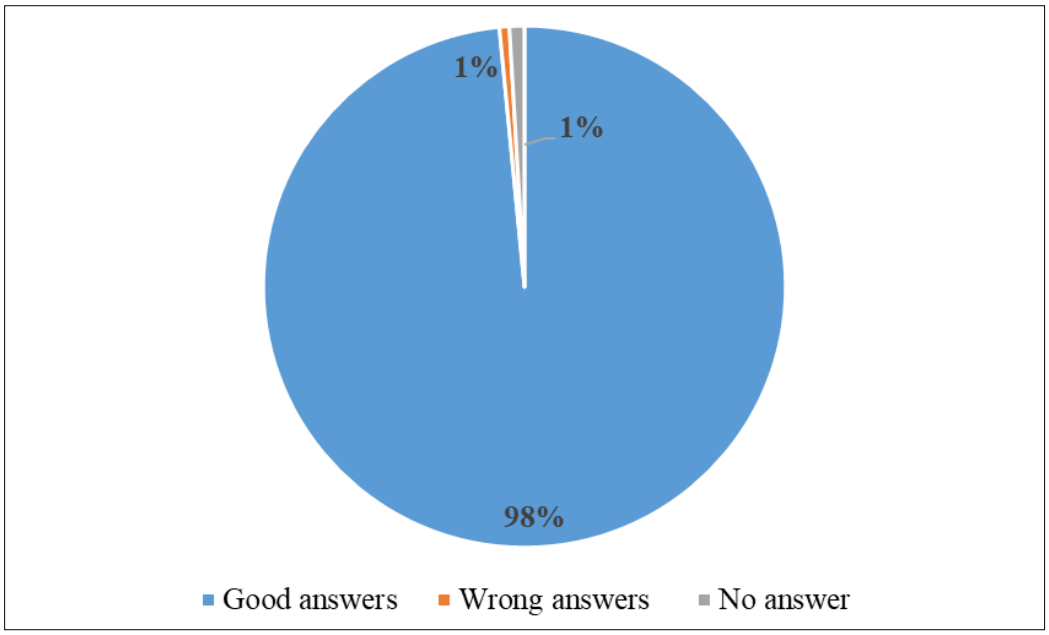

Figure 3 Students' knowledge of flooding impacts

The most frequently cited impacts included destruction of houses, school disruptions and damage to roads and infrastructure (figure 3). These responses highlight that pupils are particularly aware of the direct consequences of flooding on their immediate living and learning environments.

3.2. Teachers' Understanding of EWEs and DRR

The results indicate that teachers in the study area have an overall awareness of key climate-related hazards affecting schools, particularly floods, droughts, strong winds, and extreme rainfall events.

As shown in Table 2, access to climate-related educational resources remains limited among teachers. A majority of respondents reported not having access to climate change documents (59.02% No), climate education materials (65.57% No), and environmental education resources (65.57% No). Similarly, more than half of the teachers indicated that they had not received any training in disaster risk reduction (52.46% No), while only a minority reported having been trained (16.39% Yes).

Table 2 Teachers' access to climate education resources

Indicator	No (%)	Yes (%)
Access to climate change documents	59.02	9.84
Access to climate education documents	65.57	3.28
Access to environmental education documents	65.57	3.28
Training in DRR	52.46	16.39

Despite this limited access to formal resources and training, teachers identified floods, droughts, strong winds, and extreme rainfall events as the principal climate-related hazards affecting schools in Ouagadougou. This indicates that their understanding of EWEs is largely based on observation and experience within the school environment rather than formal instructional materials.

3.3. Inspectors' Understanding of EWEs and DRR

The results show that educational inspectors recognize the growing relevance of climate change and disaster risk issues within the primary education system. Their responses indicate an awareness of the importance of integrating environmental and climate-related considerations into school supervision and educational planning.

As presented in Table 3, access to climate-related educational resources among inspectors is very limited. A large majority reported not having access to climate change documents (91.67% No), climate education materials (91.67% No), and environmental education resources (91.67% No). These results suggest a significant lack of institutional documentation available to inspectors in relation to climate and environmental education.

Table 3 Inspectors' access to climate and DRR resources

Indicator	No (%)	Yes (%)
Access to climate change documents	91.67	8.33
Access to climate education documents	91.67	8.33
Access to environmental education documents	91.67	8.33
Training in DRR	33.33	66.67

In contrast, a majority of inspectors reported having received training in disaster risk reduction (66.67 % Yes), while a smaller proportion indicated no training (33.33% No). This indicates a relatively higher exposure to DRR capacity-building compared to teachers. Despite limited access to formal climate education resources, inspectors acknowledged the increasing importance of environmental education and the integration of disaster risk reduction principles within the primary education system. Their responses reflect an institutional-level awareness of climate-related challenges affecting schools.

3.4. Access to Climate Education Resources

3.4.1. At the student level

When asked whether pupils had any documents on climate change, climate change education, environmental education or disaster risk reduction, the results showed that many pupils did not have any documents on climate change: 84.24% said no, compared with 13.96% who did. As for documents on climate change education, 85.53% said they did not have any, compared with 13.18%. For the documents on environmental education 82.95% said no against 16.02% yes. Only 5.94% of pupils said they had been made aware of or trained in disaster risk reduction, compared with 92.51% (figure 4).

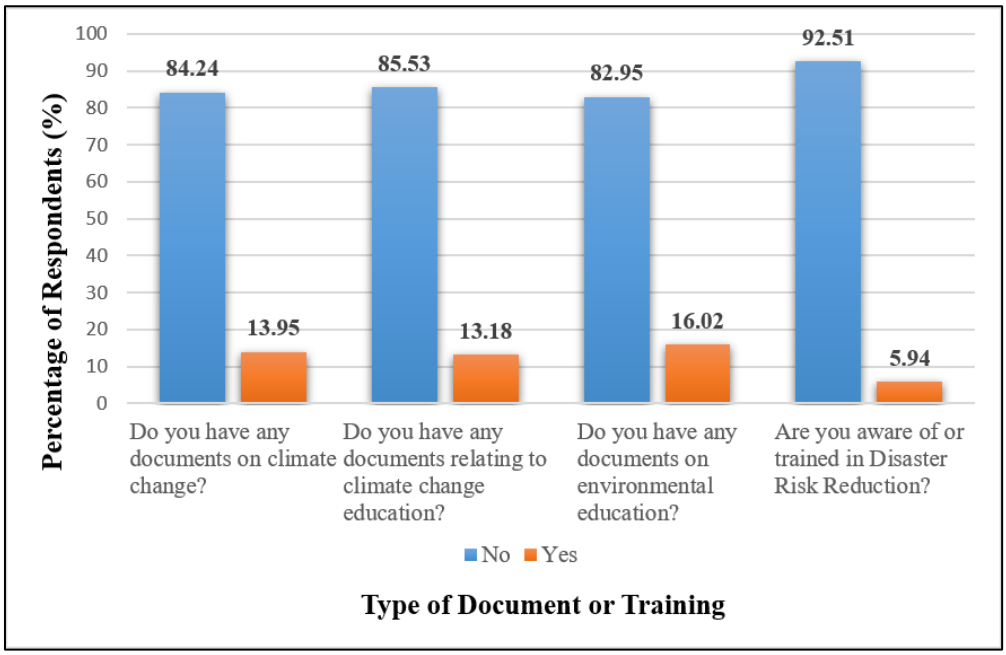

Figure 4 Proportion of student respondents

3.4.2. At teacher level

We asked teachers if they had any documents on climate change, climate change education, environmental education and disaster risk reduction. The results showed that many teachers did not have any documents on climate change, 59.02% replied that they did not. Regarding climate change education materials, 65.57% responded that they did not have any, compared with 3.28%. With regard to environmental education documents, 65.57% answered 'no' and 3.28% answered 'yes'. Only 16.39% of students said they knew about or had already received training in disaster risk reduction, compared with 52.46% (figure 5).

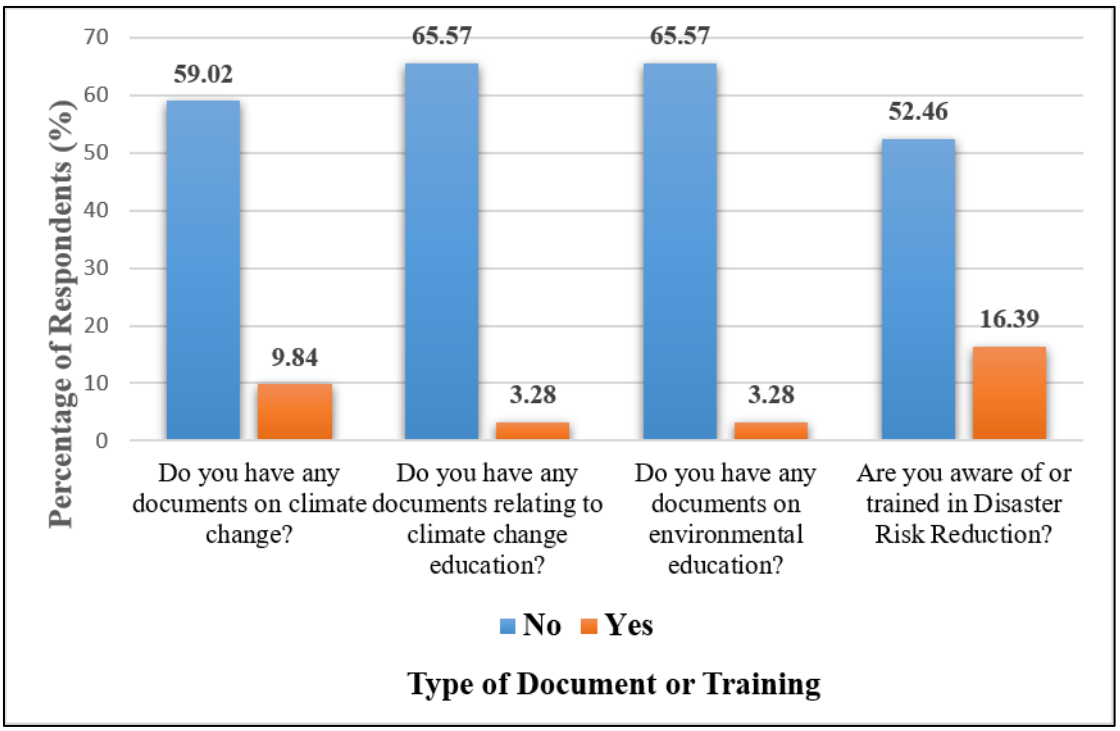

Figure 5 Proportion of teacher respondents

3.4.3. At the pedagogical inspector's level

We asked education inspectors if they had any documents on climate change, climate change education, environmental education and disaster risk reduction. The results showed that many education inspectors did not have any documents on climate change, with 91.67% answering no and 8.33% answering yes. Regarding climate change education materials, 91.67% said no, while only 8.33% said yes. Concerning environmental education documents, 91.67% of people disagreed and 8.33% agreed. 66.67% of respondents said they knew or had already received training on disaster risk reduction, compared with 33.33% (figure 6).

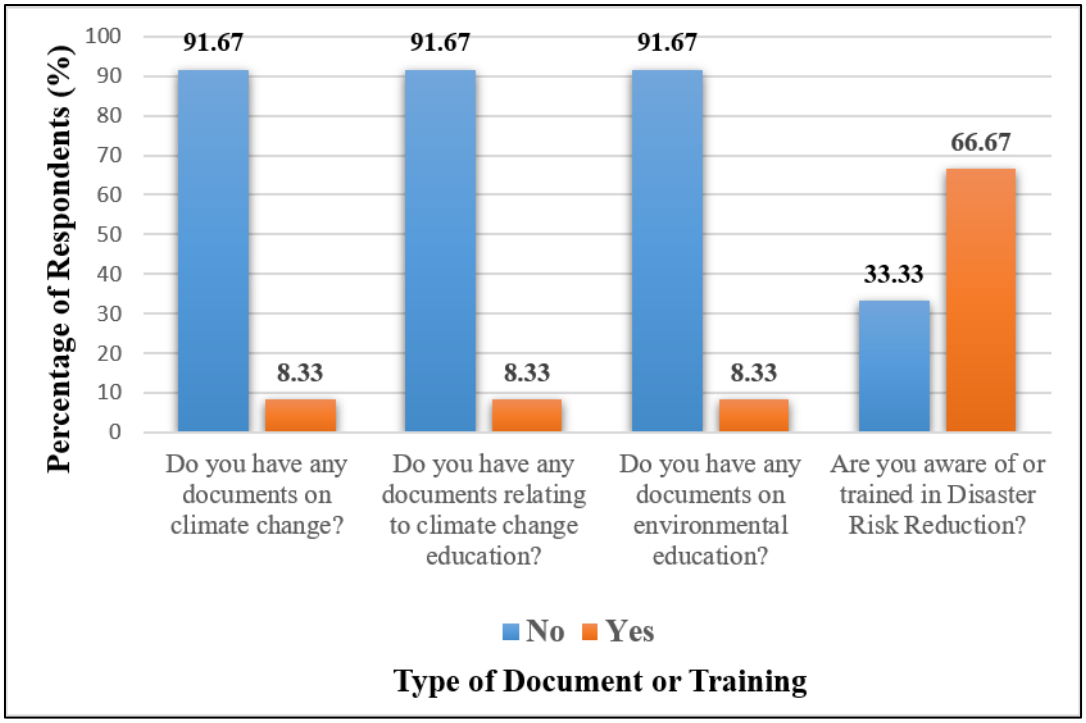

Figure 6 Proportion of the pedagogical inspector's respondents

The study revealed significant resource constraints. More than 80% of pupils lacked access to climate-related educational materials. Similarly, more than 60% of teachers and more than 90% of inspectors reported inadequate access to educational resources on climate change and disaster risk reduction.

4. Discussion

This study reveals a complex but coherent pattern of awareness and knowledge regarding extreme weather events (EWEs) and disaster risk reduction (DRR) among pupils, teachers, and educational inspectors in Ouagadougou. Overall, the results highlight a clear imbalance between high experiential awareness of climate hazards and weak institutionalization of climate education, confirming a persistent gap between knowledge, pedagogy, and operational capacity in the school system. Pupils demonstrate a high level of awareness of floods, with strong recognition of their definition (94.5%) and impacts (98%). This finding reflects the role of lived experience in shaping environmental understanding in hazard-prone contexts. As argued by (Nissan et al., 2019), risk perception is strongly influenced by direct exposure to hazards and everyday environmental interactions. However, this awareness remains largely descriptive and fragmented, lacking deeper understanding of underlying structural and systemic drivers such as urban planning deficits, drainage infrastructure limitations, and climate variability. In this sense, pupils' knowledge aligns with (Alruqi & Aksoy, 2023), who emphasize that vulnerable populations often interpret disasters through immediate environmental cues rather than through broader socio-environmental processes. Consequently, while awareness is high, its transformation into adaptive capacity remains limited, consistent with (Ramiaramanana et al., 2026) who stresses that resilience requires more than risk recognition; it demands anticipatory and informed action-oriented knowledge.

Teachers, for their part, demonstrate moderate awareness of EWEs, identifying floods, droughts, strong winds, and extreme rainfall as key hazards. This aligns with (Ayanlade & Jegede, 2016), who report relatively high climate awareness among educators in African contexts due to direct environmental exposure. However, their pedagogical effectiveness is constrained by limited access to climate education materials and insufficient training in DRR. More than half of teachers report not having received structured DRR training, indicating a significant capacity gap. According to (Rambau et al., 2012) (Barroca-Paccard, 2023), teachers are central to climate change education, but their effectiveness depends on institutional support, curriculum integration, and continuous professional development. In the absence of these conditions, climate education remains informal, inconsistent, and heavily dependent on individual initiative rather than structured educational frameworks. Educational inspectors exhibit relatively higher exposure to DRR training, suggesting some level of institutional recognition of disaster risk issues within the education system, consistent with (Mutanda & Ngcamu, 2026) However, this capacity is undermined by an extreme lack of access to climate-related

documentation, with over 90% reporting no available resources. This reveals a critical implementation gap between institutional awareness and operational tools. As highlighted by (Pal et al., 2023) and (Ihinegbu, 2021) effective disaster risk governance requires not only policy commitment but also adequate resource provision and institutional coherence. In this case, inspectors' awareness is not matched by the material and informational infrastructure needed to effectively guide schools in integrating DRR.

These findings must also be interpreted within the broader context of increasing flood risk in Ouagadougou, driven by rapid urbanization, inadequate drainage systems, and high rainfall variability. Studies by (Fraser et al., 2017) and (Mudavanhu et al., 2015) demonstrate that urban expansion has significantly increased surface runoff and exposure of built environments, including schools. In parallel, West African climatic variability characterized by alternating drought and flood cycles (Mukendi & Choi, 2023) further amplifies vulnerability. In this context, schools represent both highly exposed infrastructures and strategic entry points for resilience-building, as also noted by (Dimasaka et al., 2024) yet they remain insufficiently supported by structured risk education systems. Across all categories of respondents, a central finding emerges: awareness of EWEs does not translate into effective disaster preparedness or resilience-building capacity. This disconnect reflects what (Wagner et al., 2021) and (Musiyam et al., 2024) describe as the gap between perception and adaptive capacity, where knowledge alone is insufficient without institutional, pedagogical, and material support. The absence of integrated curricula, limited teacher training, and inadequate educational resources collectively hinder the operationalization of DRR within schools.

In conclusion, while awareness of extreme weather events is relatively high among pupils, teachers, and inspectors in Ouagadougou, the study reveals significant structural and institutional constraints that limit the effectiveness of climate change education. Strengthening resilience will therefore require not only increasing awareness but also institutionalizing DRR through curriculum reform, teacher capacity building, and the provision of context-specific educational materials, in line with the recommendations of (UNESCO, 2024b) and (UNDRR, 2016).

5. Conclusion

This study assessed the understanding of extreme weather events (EWEs) and disaster risk reduction (DRR) among primary school pupils, teachers, and educational inspectors in Ouagadougou, Burkina Faso. The findings reveal a generally high level of awareness of key climate hazards particularly floods and droughts across all categories of respondents. However, this awareness is predominantly experiential and does not consistently translate into structured knowledge, pedagogical competence, or institutionalized risk reduction practices. At the pupil level, the results highlight strong recognition of flood events and their impacts, reflecting direct exposure to recurrent climatic hazards. Nevertheless, their understanding remains largely descriptive, with limited grasp of underlying environmental and socio-technical drivers. For teachers, while basic knowledge of EWEs is evident, the absence of adequate training and limited access to climate education resources significantly constrain their ability to effectively integrate DRR into teaching practices. Similarly, educational inspectors demonstrate relatively higher exposure to DRR training yet face critical shortages in operational tools and educational documentation necessary for effective supervision and curriculum implementation. Overall, the study underscores a persistent gap between climate risk awareness and the institutional capacity required to operationalize disaster risk reduction in primary education. This disconnect limits the potential of schools to function as effective spaces for resilience building in the face of increasing climate variability in Burkina Faso. In light of these findings strengthening climate change education requires a multidimensional response, including curriculum reform, systematic teacher training, improved access to educational resources and enhanced institutional coordination. Aligning these efforts with global frameworks such as UNESCO's climate change education agenda and the UNDRR Sendai Framework is essential to ensure coherent integration of DRR into the education system. Ultimately, transforming awareness into action is critical for building long-term resilience among future generations. Schools in Ouagadougou have the potential to serve as strategic entry points for disaster risk reduction but this will only be achieved through sustained investment in human, pedagogical, and institutional capacities.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

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

Statement of ethical approval

The study was conducted in accordance with internationally recognized ethical principles for research involving human participants. Approval to conduct the study was obtained from the relevant educational authorities in Ouagadougou, Burkina Faso "The Ministry of National Education, Literacy and Promotion of National Languages (MENAPLN), Burkina Faso, under authorization number 2023-002506/MENAPLN/SG/DG_AEF/DEPrim dated 13 November 2023". All procedures were designed to ensure the anonymity, confidentiality, and protection of participants throughout the research process.

Statement of informed consent

Informed consent was obtained from all participants involved in the study. For pupils under the age of 18, permission was obtained from school authorities and the relevant educational administration prior to data collection. Participation was voluntary, and respondents were informed of the objectives of the study their right to withdraw at any time, and the confidentiality of the information provided.

Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Data are not publicly available due to privacy and confidentiality considerations related to the participants.

Author Contributions

Halidou KAFANDO: Conceptualization, methodology, data collection, data analysis, interpretation of results, writing original draft preparation and manuscript revision.

Abou Abdoulaye SOW: Data analysis, interpretation of results, writing original draft preparation and manuscript revision

Abdoulaye SAWADOGO: Data analysis, interpretation of results and manuscript revision

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