

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

Ms. Syprose Ouma Akinyi¹, Dr. Micheal Kimotho², Dr. Rose Atoni³

¹Doctor of Philosophy in Educational Psychology, Faculty of Education, The Catholic University of Eastern Africa; P. O Box 908-30100, Eldoret, Kenya

^{2,3}senior Lecturer, Faculty of education, The Catholic University of Eastern Africa;

ABSTRACT: The study examined the influence of availability of early warning systems and disaster management in public senior schools in Uasin Gishu County, Kenya. It was guided by Chaos Theory and adopted a convergent parallel mixed-methods design. The study targeted 234 public senior schools, 234 principals, 234 School Infrastructure Committees, six Sub-County Directors of Education, and six Quality Assurance and Standards Officers. A sample of 103 senior schools, 103 principals, 14 School Infrastructure Committee members, six Sub-County Directors, and six Quality Assurance and Standards Officers was selected using stratified, simple random, purposive, and census sampling techniques. Questionnaires, interviews, and focus group discussions were used to collect data. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data were thematically analyzed. Findings established a statistically significant relationship between the availability of early warning systems and disaster management. The study recommended strengthening warning mechanisms, communication networks, emergency drills, staff training, and collaboration with relevant emergency agencies to enhance school preparedness and resilience.

KEYWORDS: Early Warning Systems, Disaster Management, Disaster Preparedness, Senior Schools.

INTRODUCTION

Early Warning Systems (EWS) refer to integrated and people-centred mechanisms designed to detect potential hazards, assess associated risks, and communicate timely warnings that enable individuals and institutions to take preventive action (Šakić Trogrlić, van den Homberg, Budimir & McQuistan, 2022). These systems function through four key components which include risk knowledge involves identifying hazards, mapping vulnerabilities and understanding potential risks; monitoring and warning services; dissemination and communication and finally response capability (Teku & Tariku, 2026). According to Yadav, Thalakiya, Srivastava, Yadav and Ostadtaghizadeh (2026), early warning systems enhance preparedness, support timely decision-making, and contribute to effective disaster risk reduction. According to a study conducted in Greece by Kalogiannidis et al. (2025), early warning systems significantly enhanced disaster risk reduction by improving forecasting, communication, public awareness, and response coordination. According to a study in South Africa by Krausche and Norrestam, (2025), indicated that delayed dissemination of warnings, inadequate resources, and insufficient stakeholder collaboration weaken system effectiveness, while strong local participation and training improve responsiveness. However, gaps remain in implementation, evaluation of school-based preparedness programs, and policy enforcement across different contexts, including Africa and Kenya (Achoka & Maiyo, 2020). Disaster management of schools on the other hand refers to structured and systematic approach to preparing for, responding to, and recovering from potential emergencies or disasters that could disrupt school operations and threaten the safety of students and staff. This approach includes activities and protocols designed to mitigate risks, establish preparedness procedures, implement immediate response measures, and support recovery efforts to restore a safe learning environment (UNESCO, 2017). Disaster management in schools typically involves risk assessment, resource planning, emergency drills, communication protocols, and collaboration with local authorities to ensure a coordinated response (Graham, Shirm, & Liggin, 2022). Disaster management in senior schools is guided by the principles of risk reduction, resilience building, and safety, with the goal of minimizing harm and ensuring continuity of education even in the face of crisis. According to Shaw and Oikawa (2024), effective school disaster management not only focuses on physical safety but also includes mental health support and community engagement to foster a holistic culture of preparedness.

Research has shown that schools with well-developed preparedness measures such as emergency response plans, regular safety drills, trained staff, and adequate safety equipment are able to respond promptly and effectively during disasters, thereby minimizing loss of life, injuries, and property damage (Vargas et al., 2021; UNESCO, 2021). According to (Letoo, 2024; Chesang & Kessio,

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

2025) numerous schools with weak preparedness systems face delayed responses, poor coordination, and greater losses during disaster events due to inadequate training and limited resources. Senior schools in Uasin Gishu County according to Muiruri, (2023), have recorded multiple serious cases. The incidences included fatal infrastructural failures such as the collapse of a pit latrine in Turbo Sub-County in July (2025) that resulted in the deaths of three pupils (Ndanyi, 2025). There was also another incidence of drowning incidents involving KCPE candidates in Ainabkoi Sub-County in December (2023) which was linked to inadequate supervision and weak risk assessment during school activities (Bii, 2023). In addition, frequent fire outbreaks have been reported across senior schools, which have led to destruction of property, disruption of learning, and occasional school closures (Odhiambo, 2025). These recurring disasters demonstrate not only the vulnerability of school infrastructure but also the severe consequences of inadequate preparedness (Mburu, 2025).

Disasters have increasingly threatened the safety and continuity of education systems globally, affecting schools through shootings, stampedes, earthquakes, bombings, and fires. In the United States, incidents such as the Robb Elementary School shooting in Uvalde, Texas, and the Marjory Stoneman Douglas High School shooting demonstrated the severe consequences of school-related violence, while China has experienced disasters including school stampedes, earthquakes, bombings, and dormitory fires that have resulted in deaths, injuries, school destruction, and disruption of learning. Natural disasters such as earthquakes, floods, hurricanes, and fires similarly continue to affect education systems regardless of a country's level of development, although experiences such as Sendai, Japan, demonstrate that strong preparedness programmes, community networks, and coordinated response mechanisms can reduce casualties and accelerate recovery (Widowati et al., 2021). In Kenya, recurrent school fires, including the Endarasha Primary School fire in 2024, Utimishi girl in 2026 and other incidents, have exposed persistent weaknesses in school safety, including inadequate fire-fighting equipment, overcrowding, insufficient training, poor infrastructure, and ineffective monitoring systems (Barbara & Mula, 2024; Ogetta, 2024; Ogemba, 2025).

Although the Ministry of Education's Safety Standards Manual provides guidelines for safety, disaster preparedness, infrastructure, health, sanitation, and child protection, implementation remains constrained by inadequate funding, limited capacity, and weak enforcement (Chepngeno, 2025; Emmaculate et al., 2022; Udali, 2020). Consequently, administrators' disaster planning is essential because it provides a proactive framework for identifying hazards, assessing risks, developing prevention and response procedures, conducting emergency drills, coordinating with relevant agencies, and ensuring continuity of learning during crises (Burde et al., 2016; Education Cannot Wait, 2023; İş & Karadaş, 2025). Therefore the current study was conducted to investigate the influence of early warning systems on school's disaster management in Uasin Gishu County, Kenya.

1.2 STATEMENT OF THE PROBLEM

Senior schools in Uasin Gishu County have experienced snowballing cases of fire incidents. The prevalence of disasters in the county is further underscored by specific events such as a dormitory fire at a School (2025), the destruction of a 189-capacity dormitory at a boys school during student protests (Cheloti, 2021), and a fire that damaged laboratory buildings at national school (Kipkenei, 2022; Ominde, 2022). Most of these incidents occurred in dormitories and other critical school facilities, causing significant property loss, disruption of learning, and, in some cases, temporary school closures. When disaster continue in schools, education system is severely disrupted, students' future threatened due to massive learning delay. Finally, parents may take children back leading to students drop out leading to child labour and early marriages.

The reviewed studies reveal several gaps in disaster preparedness and disaster management research in schools. Many studies were conducted outside Kenya, including in the United States (Bradshaw et al., 2022; Haupt, 2021; Fuller & La Sala, 2021; Tigges, 2018), England (Hodson et al., 2024), Turkey (Sarıgöz et al., 2025), Pakistan (Shah et al., 2020), Nigeria (Ofangbonmu et al., 2024), and Tanzania (Nestory, 2017). This limited the applicability of findings to the Kenyan context due to differences in educational systems. Other studies have employed different methodology limiting empirical generalization and statistical validation of findings (Muzani et al., 2022; Vásquez et al., 2018; Widowati et al., 2023; Ofangbonmu et al., 2024). In Kenya, studies have been conducted for example a study by Omari (2021) Nyeri County, Kenya and another study by Kioko (2020) in Makueni County, Kenya. The studies focused on only one aspect of disaster management. Therefore, the current study sought to bridge these gaps by examining school administrators' preparedness for disaster management in secondary schools in Uasin Gishu County, Kenya.

1.3 RESEARCH QUESTION

The study sought to answer the following research question

- i. How does early warning signs influence disaster management in public senior schools in Uasin Gishu County, Kenya?

1.4 NULL HYPOTHESIS

The following null hypothesis was tested:

H₀₁ Early warning signs has no significant influence on disaster management in public senior schools in Uasin Gishu County, Kenya.

THEORETICAL FRAMEWORK

The study was anchored on Chaos Theory, associated with Henri Poincaré, explains how complex systems exhibit unpredictable and nonlinear behaviour in which small changes in initial conditions can produce substantially different outcomes (Gleick, 1987). The theory emphasizes sensitivity to initial conditions, nonlinearity, self-organization, and the existence of underlying patterns within apparently chaotic systems. In disaster management, these principles suggest that minor differences in school preparedness, early warning systems can result in significant variations in disaster outcomes (Poincaré, as discussed in Gleick, 1987). The theory further emphasizes the importance of coordination and communication among learners, teachers, parents, Boards of Management, and other stakeholders throughout disaster preparedness, response, recovery, and mitigation (Coombs, 1999). Its application promotes recognition of emerging patterns in disaster situations.

EMPIRICAL REVIEW OF LITERATURE

Kalogiannidis, Kalfas, Kotsas, Papaevangelou and Chatzitheodoridis (2025) evaluated the effectiveness of early warning systems (EWS) in reducing loss of life during natural disasters in Greece using a survey of 353 environmental professionals and specialists. The findings showed that Greek EWS generally provide timely hazard warnings and contribute to community preparedness, although challenges remain in communicating the urgency of threats and ensuring reliable forecasts. Public awareness and education have improved understanding of warnings, but gaps persist in helping people know the appropriate actions to take. The study also found that technologies such as the Internet of Things (IoT) and artificial intelligence (AI) have improved hazard monitoring and forecasting, although accessibility remains limited for some vulnerable populations. The authors therefore recommend strengthening risk communication, public education, inclusive warning mechanisms, AI-supported forecasting, mobile alerts, social media, community engagement, and coordination among relevant authorities to improve the effectiveness of EWS and reduce disaster-related fatalities.

Yadav et al. (2026) conducted a scoping review of 81 studies from 3,039 records to examine the evolution and effectiveness of early warning systems (EWS) in disaster risk reduction across Southeast Asia. The review found that EWS have improved significantly since the 2004 Indian Ocean Tsunami, enhancing disaster preparedness, timely response, and reducing human and economic losses. However, challenges such as weak last-mile communication, limited multi-channel alerts, inadequate policy integration, and exclusion of vulnerable groups persisted. The study recommended strengthening community participation, communication technologies, and inclusive policy frameworks. However, the study relied on a systematic review of published literature rather than primary empirical data, creating a methodological gap that may limit the contextual applicability and generalizability of its findings. The current study therefore sought to address this gap through an empirical investigation of early warning systems and disaster risk reduction.

In Australia, Šakić Trogrlić, van den Homberg, Budimir and McQuistan, (2022) conducted a study to examine the role of Early Warning Systems (EWS) in disaster risk reduction. The study outlined that effective disaster risk management requires a clear understanding of hazards, exposure, vulnerability, and community capacity, and presents an eight-component framework for people-centered early warning systems that integrates risk knowledge, monitoring, communication, and response capabilities. It highlights the need for inclusive stakeholder involvement, evidence-based decision-making, and continuous performance evaluation to enhance system effectiveness. The findings further reveal existing gaps in current EWS, particularly in addressing social dimensions, multi-hazard contexts, and challenges related to funding, data availability, and coordination among stakeholders. The study concludes that strengthening early warning systems through an integrated, all-society approach is essential for improving disaster preparedness and reducing risks across vulnerable communities.

A systematic review was conducted by Teku and Tariku (2025) to examine the effectiveness of early-warning systems (EWS) and disaster risk reduction (DRR) strategies in improving rural food security in Sub-Saharan Africa under hydro-meteorological hazards. Guided by a PRISMA-based approach, the study finds that EWS and DRR interventions are effective in reducing vulnerability to droughts and floods when they are reliable, people-centered, and supported by timely financing and response mechanisms. Integrated approaches that combine early warnings with anticipatory actions such as cash transfers, climate-smart agriculture, and social protection measures are particularly impactful. However, challenges such as weak governance structures, underdeveloped infrastructure, limited communication to remote areas, and social inequalities hinder effectiveness. The study concludes that strengthening institutional frameworks, enhancing coordination, and promoting inclusive and technologically supported systems are essential for improving resilience and food security in rural communities (Teku & Tariku, 2025).

In India Sahana, Patel, Rehman, Rahaman, Masroor, Imdad and Sajjad (2023), examined the effectiveness of early warning systems and emergency preparedness in reducing cyclone-related losses in the Sundarban Biosphere Region. The study collected household-level data on disaster awareness, preparedness behaviors, and economic impacts, and analyzed the data using a Poisson distribution model. The findings revealed that weak early warning dissemination, delayed emergency responses, limited infrastructure, and low community awareness increased vulnerability to cyclone disasters. The study recommended improving early warning systems through timely, inclusive, and decentralized preparedness strategies. The study is relevant to the current research in Uasin Gishu County, Kenya, because it highlights the importance of effective early warning systems, localized risk education, and rapid

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

emergency response in reducing disaster impacts. However, the study focused on cyclone-prone coastal regions in India, while Uasin Gishu faces different hazards such as fires, floods, droughts, and political unrest. The findings therefore reveal a research gap regarding the effectiveness of early warning systems and preparedness mechanisms in senior schools, which the current study sought to address.

Kamaruddin (2024) investigated disaster preparedness design in secondary school environments, focusing on structural and strategic measures for building resilient school systems. Using a qualitative literature review approach, the study analyzed scholarly articles, policy documents, and government records. The findings identified four key components of school disaster preparedness: inter-agency coordination, information management, early warning systems, and education and training. The study emphasized that effective preparedness depends on strong collaboration, clear communication systems, regular drills, early warning technologies, and continuous training for students, teachers, and support staff. The study concluded that well-structured preparedness frameworks and proactive risk communication significantly reduced disaster impacts in schools. However, the research was mainly conceptual and lacked empirical evidence from specific contexts such as Sub-Saharan Africa. It also did not focus specifically on the preparedness and training of school administrators, who play a central role in disaster management in boarding schools. The current study in Uasin Gishu County, Kenya, addresses this gap by empirically examining how early warning systems influences disaster management readiness and response effectiveness in boarding senior schools.

In South Africa, Krausche and Norrestam (2025), conducted a study to explore how local actors enhanced early warning systems for fire on disaster preparedness in the Eastern Cape. The study focuses on (1) understanding how local actors such as fire services and Fire Protection Associations contribute to the design and enhancement of early warning systems for fires and (2) what preparedness measures are needed for the actors to be able to act efficiently to warnings. By examining their needs for timely and accurate information, the research highlights the importance of effective communication and collaboration among involved actors. Key findings highlight the importance of clearer role definitions, better communication and more inclusive collaboration. There is a need for more accurate and region-specific fire warnings, improved resources and ongoing training for actors at all levels. The study also emphasizes that while significant strides have been made toward proactive disaster management, funding and structural barriers continue to hinder the full effectiveness of these efforts. The results suggest that strengthening local response capabilities, involving more stakeholders in the design of EWS, and addressing resource gaps are crucial steps in enhancing disaster management in the region.

Trogrlić, van den Homberg, Budimir, McQuistan, Sneddon and Golding (2021) examined the role of Early Warning Systems (EWS) in disaster risk reduction and proposed an eight-component framework involving risk knowledge, monitoring systems, communication, response capability, governance, policy frameworks, community participation, and sustainability. The study emphasized that effective early warning systems should combine technical systems with social, institutional, and community-based capacities to ensure timely and actionable disaster responses. The study highlighted the significant gaps in disaster preparedness and early warning integration. Many schools lack disaster risk education, effective hazard monitoring systems, emergency response plans, regular safety drills, and strong communication links with disaster management agencies.

The findings also reveal inadequate stakeholder collaboration, limited funding for disaster preparedness infrastructure, and poor inclusion of vulnerable student groups in emergency planning. The study is relevant to the current research because it underscores the need for comprehensive, inclusive, and participatory disaster risk management frameworks in senior schools to strengthen preparedness, response, and resilience in disaster-prone environments.

Hassan, Mahmoud, and Ellingwood (2020) evaluated the adaptability of educational institutions after tremors of Natural calamities can have severe and enduring effects on towns' physical, financial, and social structures. Delayed recuperation of educational facilities after such catastrophes can cause catastrophic tension in youngsters, contribute to family migration, and impact stability in the community. Techniques for estimating and evaluating the restoration procedure of educational facilities and their reliance on additional support facilities have attracted little to no attention.

This study presents a new paradigm for evaluating a school system's functioning, recuperation, and adaptability in the aftermath of catastrophic earthquakes. The framework takes into account the amount as well as the quality of educational services offered, enrollment in schools, and personnel labor, as well as the interactions between different agents including as employees, pupils, parents, administration, and the general public. Centerville, an online experimentation community, is used to demonstrate how this structure might be applied. The effect on educational reopen rules on enrollment of pupils and the possibility of homeschooled is also explored. The accessibility of numerous enrollment possibilities for pupils, standby classrooms and operational utilities structures, and convenience of staff and supplies movement across institutions significantly strengthen the adaptability of the education.

The US Department of Education (ED) evaluates school safety in areas such as campuses brutality, drug misuse, preparedness for pandemics, hurricanes, and various other catastrophic events (ED.gov, 2011). The ED offers an action guide for managing emergencies at accredited educational facilities (U.S. State Department of Education, 2010), which includes many aspects of crisis management based on the four phases of the catastrophe cycle: mitigation measures readiness, reaction, and rehabilitation.

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

These elements involve putting together an effective catastrophe squad, detecting dangers, flaws, and threats, executing risk assessments, and developing and implementing a practical evacuation strategy. University terrorism has been a big worry given that the tragic event of the Virginia Tech university massacre, resulting in numerous fatalities and hospitalizations. In 2010, the ED, the US Secret Service, and the FBI collaborated to create the campus assault communicate (Drysdale, Modzeleski, and Simons, 2020), and this was made public to demonstrate the extensive the context of higher education societal catastrophes, which involves where and why violence occurs, as well as how to mitigate responding to such occurrences.

The Department of Education has compiled extensive material on how to prepare schools for emergencies, including natural catastrophes and social situations. Practical recommendations and frameworks have been demonstrated, allowing school administrators to run their own disaster education courses and strategies. FEMA provides an online toolbox for schools to use as a disaster education reference, as well as a large quantity of forms, surveys, and course instructions to help teachers train themselves and their students to prepare for disasters. However, due to the decentralized nature of the school system, the application of norms and regulations varies by school. Under this approach, some schools may have well-developed emergency preparedness plans, while others may not.

Amri (2019) did research to evaluate the hurdles associated with delivering education on disaster risk reduction in Indonesia. This thesis looks on the execution of disaster risk reduction education in Indonesian schools. DRR education initiatives have been pushed into being one of the cornerstones for lifesaving efforts and reducing losses due to disasters throughout the decade prior, according to different research that found favorable results. Fortunately, the majority of these investigations were conducted in advanced nations. There are still a few studies in poor nations looking into the possibilities and difficulties of implementing DRR education in schools. The study employs a case study approach to investigate the scaling up and sustainability of DRR education in Indonesian schools.

The literature on DRR education with children and kid engagement in DRR is critically reviewed to document the strengths and flaws in both lines of study. Based on the review, a new research method for assessing the execution of DRR edifying initiatives was devised. This novel approach is utilized to investigate DRR education in Jakarta, Indonesia, a rapidly expanding megacity that is very vulnerable to disasters, including floods and fire threats. This study gathered the viewpoints of children, teachers, and non-governmental organizations on the problems of scaling up the implementation of DRR education in schools. The investigation uncovered seven main concerns and made numerous strategic recommendations for moving forward. These key challenges may be present in many other developing and developed countries; therefore, the proposed remedies may be applicable outside Indonesia. In China, Zhu and Zhang (2017) carried out an investigation of disaster education in elementary and senior schools: evidence. The importance of school-based disaster education in minimizing natural disasters has received widespread attention around the world. Following the Wenchuan earthquake in 2008, primary and senior schools in China prioritized disaster preparedness education. However, the outcome is unclear as of yet. As a result, we recently conducted a relatively broad survey in Beijing, Hunan, Guangdong, and Sichuan, gathering viewpoints from both students and teachers in order to investigate their attitudes, gains, and expectations. The findings reveal that, first, there is a consensus that school-based disaster education should be strengthened to raise students' knowledge and capability to deal disasters.

Second, school-based disaster education has had an overall beneficial impact in recent years, however 18% of pupils report that their schools have not implemented catastrophe curricula or are unsure about it. Third, practically all teachers believe that schools should create catastrophe-related curriculum, combine disaster education curricula into mandatory curricula, and create unique textbooks for disaster education. Finally, most teachers believe that school-based disaster education has a limited impact on students' disaster preventive awareness and capability; in particular, disaster education primarily imparts knowledge while lacking attractiveness and local aspects.

Torani, Majd, Maroufi, Dowlati, and Rahim (2019) conducted a review on the importance of education in catastrophes and emergencies. Disasters and emergencies have become increasingly common around the world. Today, with technological innovation, learning information and applying it in the arena of action is viewed as the only viable strategy to prevent calamities or mitigate their impacts. The current study sought to examine the significance of education as well as the impact of various education strategies on catastrophe risk reduction and preparedness in vulnerable populations.

To achieve this goal, various papers indexed in PubMed, Web of Science, Google Scholar, Scopus, Science Direct, and ProQuest were searched. The analysis was restricted to peer-reviewed articles in English released between 1990 and 2017. In addition, each of the chosen articles were checked for relevant citations. Two investigators evaluated their carried out experiments separately. The primary search yielded 128 relevant references. After deleting duplication and items unrelated regarding the abstraction review, 41 reference were selected for inclusion. After further inspection, 31 references that did not fulfill the inclusion index were removed from the study.

Disaster awareness attempts to empower people and their neighborhoods with information so that they can take steps to lessen their susceptibility towards catastrophes. The subject of how trained individuals can be ready to face catastrophes and respond effectively has undergone thoroughly studied over the last several decades. According to the findings, disaster enlightenment constitutes a working, functioning, and cost-effective strategy for managing risks. According to some research, it is critical for those with

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

vulnerabilities to understand about catastrophes. There are various approaches for educating vulnerable people, but none are superior to others. Trained individuals are able to better defend themselves and others. In this regard, extensive educational initiatives must be planned and designed to prepare communities for calamities.

In England, Hodson, Pearce, Amlot, and Rogers (2023) examined educational preparedness resources used in schools to improve readiness for severe and extreme events. Using a systematic review of academic and grey literature, the study identified twenty-six educational resources focused on disaster preparedness and first-aid training for students. Most resources were developed by national or international organizations and were intended to support stand-alone lessons or supplement the national curriculum. The findings highlighted that schools are important platforms for promoting disaster preparedness among children and young people, who are often highly vulnerable during emergencies.

However, the study found little evidence of rigorous evaluation of the effectiveness of these preparedness resources in improving disaster readiness knowledge among school populations. The research also emphasized the need for further studies to better understand school preparedness needs and improve readiness for extreme events. The study is relevant to the current research in Uasin Gishu County, Kenya, because it underscores the importance of disaster preparedness education, training resources, and structured school-based readiness programs in strengthening disaster management and resilience in senior schools.

Balurani (2023) examined the level of disaster risk reduction and management (DRRM) program implementation in public elementary schools as the foundation for a planned 'our school, our safe zone' program. The investigation sought to establish the level of Disaster Risk Reduction and Management (RDDM) Program Implementation in the three districts of Polomolok, South Cotabato. A cross-sectional survey was used in this study. The responders were 40 school district coordinators from Polomok's South, West, and East districts in South Cotabato. It was discovered that the level of Disaster Risk Reduction and Management in Districts 1 and 2 was high in terms of prevention and migration.

In terms of preparedness, DRRM implementation was high in District 1, moderate in District 3, and low in District 2. In terms of disaster response, Districts 1, 2, and 3 demonstrated high levels of DRRM implementation. In terms of recovery and rehabilitation, DRRM implementation was high in Districts 2 and 3, and moderate in District 1. To address the study's gaps, a proposed 'Our School, Our Safe Zone' initiative was developed.

Amlii (2019) investigates the efficacy of fire disaster management policies in managing fire outbreaks in Tanzanian senior schools. Despite legislative guidelines, fire disasters have continued to occur in Tanzania's senior schools over the years. This paper is thus based on a study that was conducted to answer the research question: Why do fire disasters continue to occur in Tanzania's senior schools despite the existence of policy directives issued by the Ministry of Education, Science, and Technology (MoEST) to address the issue? The study used critical policy analysis theory to assess the effectiveness of policy directives for managing fire outbreaks in senior schools in three Tanzanian areas, namely Iringa, Mbeya, and Kilimanjaro, as well as the MoEST headquarters.

The researcher used purposive sampling techniques to select 116 subjects from Regional College Quality Assurers (ZSQAs), Regional galleries Enrichment Officers (REOs), District Secondary Education Officers (DSEOs), School Board Members (SBMs), Heads of Schools (HoSs), teachers and students, and the Commissioner of Education (CoE). The participants' information was acquired through face-to-face interviews and Focused Group Discussions (FGDs). According to the study, MoEST's measures have done little to reduce the occurrence of fire outbreaks in the country's senior schools.

The situation was exacerbated by the ministry's lack of initiatives to guarantee that the policies released are well understood by the implementers (Heads of School, instructors, and students) at the secondary school level. Furthermore, the current system largely fails to address time-consuming problems such as a lack of accountability, close follow-up, and school authorities providing an enabling environment to allow the seamless implementation of policy directives. To reduce the frequency of fire disaster events, the study recommends consistent policy formulation and implementation, as well as capacity building among key implementers at the secondary school level.

Achoka and Maiyo (2020) focused on the importance of education on national development, citing horrible calamities in western Kenya. Natural disasters have demonstrated a positive tendency, with annual incidence of disaster events increasing across the continent. Approximately two-thirds of Western Kenya's 3.3 million inhabitants live in poverty, trapping the region in a cycle that prevents long-term growth. When a calamity strikes, schools in the region are unable to operate normally. In the third term of 2007, many schools were unable to open owing to flooding; children were transferred to other schools, while others dropped out of the system. Access to adequate water, sanitation, quality education, and HIV/AIDS awareness, as well as microeconomic development, are critical for raising the population's standard of living. This study looks into the horrible events in the region and assesses their impact on education and national development.

RESEARCH METHODOLOGY

The study adopted a convergent parallel mixed-methods design, whereby quantitative and qualitative data were collected concurrently, analyzed separately, and subsequently compared and integrated to provide a comprehensive understanding of the problem. The target population comprised 234 senior schools, 234 principals, 234 School Infrastructure Committees (SICs), six Sub-County Directors of Education, and six Quality Assurance and Standards Officers (QASOs). A sample of 149 senior schools

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

and 149 principals was selected using stratified and simple random sampling for schools and purposive sampling for principals. In addition, 24 SICs, six Sub-County Directors, and six QASO officials were purposively selected. The schools were stratified according to C1, C2, C3, and C4 categories to ensure representation of different school types.

Data were collected using questionnaires, in-depth interview guides, and focus group discussion guides. The questionnaire for principals consisted measured early warning systems, and disaster management. Interviews were conducted with Sub-County Directors and QASO officials, while FGDs were conducted with School Infrastructure Committees. Instrument validity was established through expert review and content validity, with the reported Content Validity Ratio being 1.00 for the major variables. Construct validity was assessed using factor analysis, while face validity was evaluated by supervisors. A pilot study involved 15 principals, two SIC committees, one Sub-County Director, and one QASO official. Reliability was assessed using the test-retest method, with reliability coefficients ranging from .821 to .890 for the major independent variables and .864 for disaster management, indicating acceptable reliability. Quantitative data were analyzed using frequencies, percentages, means and standard deviations, while Analysis of Variance (ANOVA) was used for inferential testing of the hypotheses. Qualitative data from interviews and FGDs were coded and analyzed thematically, with findings presented through narrative descriptions. Ethical procedures included obtaining NACOSTI approval and relevant county authorization, informed consent, confidentiality, anonymity, voluntary participation, and secure data storage.

STUDY FINDINGS

The study sought to establish the effect of early warning systems on disaster management in senior schools in Uasin Gishu County. The findings were summarized and presented in Table 1.

Table 1: Early Warning Systems and Disaster Management

Statement	Never n (%)	Rarely n (%)	Sometimes n (%)	Often n (%)	Always n (%)	Mean
The school receives early warning alerts about floods, disease outbreaks, landslides and storms	20 (15.9%)	25 (19.8%)	29 (23.0%)	31 (24.6%)	21 (16.7%)	3.06
Early warning messages are communicated to the schools	14 (11.2%)	27 (21.6%)	23 (18.4%)	35 (28.0%)	26 (20.8%)	3.26
The school has designated personnel who receive and act on early warning alerts	29 (23.0%)	36 (28.6%)	23 (18.3%)	19 (15.1%)	19 (15.1%)	2.71
The school has a documented protocol for responding to early warnings	24 (19.2%)	31 (24.8%)	35 (28.0%)	14 (11.2%)	21 (16.8%)	2.82
After receiving early warning alerts, the school activates emergency plans	23 (18.3%)	29 (23.0%)	27 (21.4%)	19 (15.1%)	28 (22.2%)	3.00
The school mobilizes emergency response resources after receiving early warning alerts	19 (15.1%)	26 (20.6%)	39 (31.0%)	17 (13.5%)	25 (19.8%)	3.02
The school conducts drills in response to early warning alerts	26 (20.6%)	28 (22.2%)	32 (25.4%)	19 (15.1%)	21 (16.7%)	2.85
Our school is part of an official early warning system/network	34 (27.0%)	21 (16.7%)	30 (23.8%)	21 (16.7%)	20 (15.9%)	2.78
School staff are trained to respond to different types of disaster alerts	17 (13.6%)	33 (26.4%)	46 (36.8%)	10 (8.0%)	19 (15.2%)	2.85

Source: Survey Data, 2026

The findings on early warning systems within the schools provide a comprehensive view of the extent to which institutions receive, process, and respond to disaster alerts, as well as the readiness of staff and infrastructure to act on such warnings. Data were collected across multiple indicators, including the reception of early warning alerts, communication of messages, presence of designated personnel, documented response protocols, activation of emergency plans, mobilization of resources, drills in response to alerts, participation in official networks, and staff training. The results, summarized in Table 16, reflect both strengths and gaps in early warning preparedness.

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

The findings on early warning systems and disaster preparedness in schools reveal moderate awareness and implementation of disaster response measures, although several gaps still exist. The results indicate that schools are somewhat exposed to early warning information, but institutional preparedness and response mechanisms remain inadequate in many cases. The study established that schools moderately receive early warning alerts concerning floods, disease outbreaks, landslides, and storms, as reflected by a mean score of 3.06. Specifically, 20 respondents (15.9%) indicated that they never and 25 (19.8%) indicated that their schools rarely received such alerts, while 31 respondents (24.6%) indicated often and 21 (16.7%) always received alerts. This suggests that although some schools benefit from disaster alert systems, others may not have reliable access to timely warning information, thereby increasing their vulnerability to disasters.

“An Sub County Director 001/2026 said

“Majority of the senior schools occasionally receive early warning alerts about disasters such as floods, disease outbreaks, storms, and landslides through government communication channels, local administration, and sometimes through media platforms.

However, there is limited action on the part of school. Maybe because of proper direction from the Ministry of Education Directions. (13th March, 2026).

Similarly, the communication of early warning messages to schools recorded a relatively higher mean score of 3.26 on a rating scale where 1 represented “Never” and 5 represented “Always.” A total of 35 respondents (28.0%) indicated that early warning messages are often communicated to schools, while 26 respondents (20.8%) stated that such messages are always communicated. In contrast, 14 respondents (11.2%) reported that warning messages are never communicated, while 27 respondents (21.6%) indicated that they are rarely communicated. These findings imply that communication channels for disaster alerts exist in many schools, which is essential in ensuring timely dissemination of information. Effective communication enables schools to make informed decisions and prepare adequately before disasters occur.

Another Sub County Director 006/2026 said

“Early warning information is often disseminated through county education offices and security coordination meetings, after which schools are expected to take precautionary measures. However, the flow of information is not always timely, and in some cases, schools receive alerts after the risks have already intensified. (30th March, 2026).

A Member in SIC committee Focus Group Discussion 014/2026 said:

“Though all senior schools are supposed to have disaster management committees, in practice and their roles clearly defined. Majority of the senior schools do not have the committees and the responsibility of handling the early warning alerts and responses are often left to the principals, deputy principals and other senior teachers, but they are often overburdened with administrative duties.” (26th February, 2026).

However, the findings pointed to weaknesses in institutional preparedness regarding disaster management. On whether schools have designated personnel responsible for receiving and responding to early warning alerts, the study recorded a low mean score of 2.71 on a scale where 1 represented “Never” and 5 represented “Always.” A majority of respondents, including 29 (23.0%) who indicated “Never” and 36 (28.6%) who indicated “Rarely,” reported that their schools do not have specifically assigned personnel for handling early warning alerts. Only 19 respondents (15.1%) stated that such personnel are often available, while another 19 (15.1%) reported that they are always available. These findings suggest that many schools lack clear coordination and leadership structures for disaster response, which may hinder timely decision-making and reduce the effectiveness of emergency response measures during disasters.

A QUASO Official 002/2026 Said;

“Communication networks exist, but not all schools are adequately linked to the official disaster communication systems, which sometimes leads to delays or inconsistencies in the dissemination of warnings” (25th March, 2026).

The study further revealed inadequate documentation of disaster response procedures within schools. Regarding the existence of documented protocols for responding to early warning alerts, the mean score was 2.82. A considerable proportion of respondents, including 24 (19.2%) who indicated “Never” and 31 (24.8%) who indicated “Rarely,” reported that their schools lacked documented response protocols. In contrast, 14 respondents (11.2%) stated that such protocols often exist, while 21 (16.8%) indicated that they always exist. These findings suggest that many schools may handle disasters in an uncoordinated manner due to the absence of formal guidelines and procedures, which may increase confusion, delays, and risks during emergencies.

On the activation of emergency plans after receiving warning alerts, the study recorded a mean score of 3.00, indicating a moderate level of preparedness. A total of 19 respondents (15.1%) reported that schools often activate emergency plans, while 28 (22.2%) indicated that schools always activate them after receiving alerts. However, 23 respondents (18.3%) stated that schools never activate emergency plans, and 29 (23.0%) reported that they rarely do so. These findings imply that although some schools take action after receiving disaster warnings, the implementation of emergency response plans remains inconsistent across institutions, thereby limiting the effectiveness of preparedness efforts.

A SIC Committee Member for Focus Group Discussion 019/2026 said;

“When the school receive warnings are received, the principal usually relays the information to staff and learners during assemblies or staff meetings. However, the communication process is often informal limiting the principal’s action on them.” (16th February, 2026).

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

The mobilization of emergency response resources after receiving warning alerts demonstrated a moderate level of preparedness, with a mean score of 3.02. A total of 17 respondents (13.5%) indicated that schools often mobilize emergency response resources, while 25 respondents (19.8%) stated that schools always do so. In contrast, 19 respondents (15.1%) reported that schools never mobilize such resources, and 26 (20.6%) indicated that they rarely do so. Additionally, 39 respondents (31.0%) remained neutral, suggesting uncertainty or inconsistency in emergency resource mobilization practices. These findings imply that many schools may not have sufficient emergency supplies, equipment, or logistical arrangements readily available to effectively respond during disasters.

The findings further revealed that disaster drills are not consistently conducted in schools, as reflected by a mean score of 2.85. The findings revealed that 26 respondents (20.6%) indicated that schools never conduct drills in response to warning alerts, while 28 respondents (22.2%) stated that they rarely do so. Only 19 respondents (15.1%) reported that drills are often conducted, and 21 (16.7%) indicated that they are always conducted. These findings suggest that students and staff may not be adequately prepared to respond effectively during actual emergencies because opportunities for practical simulations and rehearsals are limited.

Participation in official early warning systems or disaster networks was also found to be relatively low, with a mean score of 2.78. A total of 34 respondents (27.0%) reported that their schools are never part of official warning systems, while 21 respondents (16.7%) indicated that schools are rarely involved. Conversely, 21 respondents (16.7%) stated that schools are often part of such networks, and 20 (15.9%) indicated that they are always involved. These findings suggest that many schools are not formally integrated into national or regional disaster management systems, which may limit their access to reliable, timely, and coordinated disaster information.

Lastly, the study established that training of school staff on responding to different types of disaster alerts remains inadequate, with a mean score of 2.85. The findings revealed 17 respondents (13.6%) stated that staff are never trained, while 33 respondents (26.4%) reported that staff are rarely trained to handle disaster alerts. Only 10 respondents (8.0%) indicated that staff are often trained, whereas 19 respondents (15.2%) stated that staff are always trained. Furthermore, 46 respondents (36.8%) gave neutral responses, which may indicate uncertainty regarding the extent of staff preparedness. These findings imply that inadequate staff training may negatively affect effective disaster response, coordination, and decision-making during emergencies within schools.

Overall, the results demonstrate that although schools have some level of access to early warning information, substantial improvements are still required in areas such as personnel designation, staff training, disaster drills, documentation of response protocols, resource mobilization, and integration into official early warning systems in order to strengthen disaster preparedness and response capacity in schools.

Another QUASO Official 004/2026 said:

“In majority of the senior schools there are no designated personnel specifically responsible for receiving and coordinating responses to early warning alerts. This often place the principals in strained position of receiving and coordinating alerts responses. The principals are often overburdened with administrative duties.” (24th March 2026)

Overall, the findings reveal a pattern of moderate preparedness, with strengths in communication of alerts and mobilization of resources when alerts are received. However, significant gaps remain in institutional roles, documentation, integration with official networks, staff training, and regular drills. Schools that lack designated personnel, formal protocols, or consistent participation in early warning systems face elevated risk during disasters. Similarly, irregular drills and limited staff preparedness constrain the ability to translate alerts into effective action.

The findings are consistent with broader literature on disaster preparedness in educational institutions. Studies in similar contexts have found that while early warning systems and communication channels may exist, their effectiveness is often limited by inadequate institutional frameworks, low staff capacity, and insufficient integration with formal networks. For instance, research has highlighted that institutional ownership, clear procedures, and routine exercises are critical determinants of effective emergency response (Bradshaw et al., 2022; Bahmani et al., 2023).

From a practical perspective, the results underscore the need for multi-level interventions. Schools should establish dedicated early warning teams, maintain documented protocols, conduct regular drills, and ensure staff training programs are ongoing and comprehensive. Integration with regional or national early warning systems is essential to ensure that alerts are timely, accurate, and actionable. Resource mobilization should be standardized and routinely tested to avoid delays in response. Finally, schools should implement monitoring and evaluation mechanisms to assess the effectiveness of alert reception, communication, and response over time.

The highest mean score ($M = 3.26$) indicates that early warning messages are communicated to schools, suggesting relatively better communication channels. Moderate scores were observed in receiving early warning alerts ($M = 3.06$), mobilizing emergency resources ($M = 3.02$), and activating emergency plans ($M = 3.00$). Lower scores were recorded in having designated personnel for early warnings ($M = 2.71$) and membership in official early warning networks ($M = 2.78$), indicating institutional gaps. Training of staff and conducting drills in response to alerts ($M = 2.85$) remain moderate, suggesting a need for strengthening preparedness capacity.

According to one SIC focus group discussion 024/2026 committee member,

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

“In our school the warning on impending disaster is often passed verbally to staff and students, but there are no structured communication channels or written guidelines on how the alerts should be handled.” (23rd February, 2026).

The findings from the study on early warning systems in Uasin Gishu County schools provide a nuanced understanding of institutional readiness and capacity to respond to disaster alerts. Reception of early warning alerts scored moderately ($M = 3.06$), indicating that while some schools regularly receive notifications of hazards such as floods, storms, and disease outbreaks, a substantial proportion experience irregular or delayed alerts, limiting their ability to act promptly. Communication of messages scored the highest ($M = 3.26$), reflecting relatively functional channels for disseminating alerts once received, though inconsistencies in coverage highlight the need for redundant and reliable platforms to ensure universality.

Significant institutional gaps emerged in the presence of designated personnel ($M = 2.71$) and documented response protocols ($M = 2.82$), suggesting that many schools lack structured responsibility and standardized procedures to translate alerts into effective action. Activation of emergency plans ($M = 3.00$) and mobilization of resources ($M = 3.02$) showed moderate operational readiness, but variability in implementation underscores the inconsistency in preparedness practices. Drills ($M = 2.85$) and staff training ($M = 2.85$) were also moderate, indicating that routine practice and capacity-building remain insufficient to ensure effective response during actual emergencies. Participation in official early warning networks scored low ($M = 2.78$), highlighting systemic disconnection from formal monitoring and alert systems, which can delay timely responses and reduce institutional resilience.

Collectively, these findings reveal that while schools demonstrate some capacity in communicating and deploying resources in response to early warnings, weaknesses in leadership, documentation, training, and network integration significantly constrain overall effectiveness. Schools without designated personnel, clear protocols, and routine drills face heightened vulnerability, particularly in boarding contexts where administrators are responsible for student welfare at all hours. These results are consistent with broader literature, which emphasizes that institutional ownership, clear procedures, and continuous practice are critical determinants of effective school-based disaster management (Bradshaw et al., 2022; Bahmani et al., 2023).

The implications are clear: enhancing early warning system effectiveness in schools requires multi-level interventions. Establishing dedicated teams for alert reception and response, maintaining updated and accessible protocols, conducting frequent drills, and implementing comprehensive staff training are essential. Integration with regional and national early warning networks is critical to ensure timely and verified alerts, while systematic resource mobilization and monitoring mechanisms can improve response consistency. Addressing these gaps through policy enforcement, capacity-building, and institutionalized preparedness frameworks is vital to strengthen resilience, safeguard students and staff, and ensure coordinated, rapid responses to disasters. Ultimately, the findings highlight the importance of moving beyond the mere presence of early warning systems toward fully operational, well-practiced, and institutionally embedded disaster preparedness within schools.

Table 2: ANOVA on Early Warning Systems and Disaster Management

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1733.522	32	54.173	3.026	.000
Within Groups	1790.400	100	17.904		
Total	3523.655	132			

Source: Survey Data, 2026

The ANOVA results further reveal a significant relationship between early warning systems and disaster management. The analysis indicates that the between-groups sum of squares was 1733.522 with 32 degrees of freedom, resulting in a mean square of 54.173. The within-groups sum of squares was 1020.533 with 57 degrees of freedom, producing a mean square of 17.904. The computed F-value was 3.026 with a significance level of .000. The significance level, being far below 0.05, demonstrates that the differences in disaster management outcomes across varying levels of early warning system implementation are statistically significant.

This finding suggests that schools that effectively receive, interpret, and act upon early warning alerts are better prepared to manage disasters and minimize potential losses. Early warning systems provide crucial information about impending hazards such as floods, storms, disease outbreaks, or other emergencies, enabling institutions to initiate timely preventive measures such as evacuation, resource mobilization, or activation of emergency plans. Schools that are well integrated into official early warning networks and possess reliable communication channels are therefore more capable of protecting students and staff during disaster events.

In contrast, schools that lack access to reliable warning systems or fail to respond effectively to alerts are likely to face greater risks during emergencies. Taken together, these ANOVA results demonstrate that resource management, risk management, and early warning systems are all statistically significant determinants of effective disaster management in schools. Each of these components contributes to institutional preparedness in a different but complementary manner. Resource management ensures the availability of physical and logistical support needed during emergencies, risk management enables schools to identify and mitigate potential threats before disasters occur, and early warning systems provide timely information that allows institutions to activate appropriate response measures.

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

The statistically significant relationships observed in the analysis therefore highlight the importance of adopting a comprehensive and integrated disaster management approach within educational institutions. Strengthening these three areas through improved planning, policy implementation, training, and coordination with external disaster management agencies can significantly enhance the resilience of schools and reduce the potential impact of disasters on the school community.

A Sub County Director 003/2026 said:

“Many schools have emergency procedures mainly focused on fire outbreaks, while protocols for other hazards such as floods, epidemics, or landslides are rarely documented. Therefore, when alerts are received, schools often rely on ad hoc decisions rather than structured response procedures.” (16th March, 2026)

A QUASO Official 002/2026 said:

“Many schools lack basic preparedness resources such as first aid supplies, evacuation equipment and safe assembly points. As a result, even when warnings are received, the schools’ capacity to respond effectively remains limited.” (10th March, 2026).

Another SIC Committee Member 020/2026 said:

“Although we receive alerts through the education office or local administration, there is still a need to strengthen coordination between schools and official disaster management structures. This can be achieved through training of school staff on disaster response remains inadequate.” (10th February, 2026).

The findings supported the findings of Yadav, et al., (2026), which investigate the effectiveness of early warning systems (EWS) in disaster risk reduction within Southeast Asian countries. The findings indicate that effective EWS substantially reduced disaster impacts by improving preparedness, enabling timely responses, and lowering economic and human losses. However, persistent challenges remained which included weak last-mile communication, limited multi-channel alert systems, insufficient policy integration, and exclusion of vulnerable populations.

The findings also mirrored the findings of a study in Australia, by Šakić et al., (2022) which examined the role of Early Warning Systems (EWS) in disaster risk reduction. The study outlined that effective disaster risk management requires a clear understanding of hazards, exposure, vulnerability, and community capacity, and presents an eight-component framework for people-centered early warning systems that integrates risk knowledge, monitoring, communication, and response capabilities. It highlights the need for inclusive stakeholder involvement, evidence-based decision-making, and continuous performance evaluation to enhance system effectiveness.

The findings were also in line with Teku and Tariku (2025) study on the effectiveness of early-warning systems (EWS) and disaster risk reduction (DRR) which indicated that EWS helped to reduce vulnerability to disasters especially when the EWS are reliable, people-centered, and supported by timely financing and response mechanisms. However, challenges such as weak governance structures, underdeveloped infrastructure, limited communication to remote areas, and social inequalities hinder effectiveness.

The findings also supported a study in India by Sahana, et al.,(2023) which examined the effectiveness of early warning systems and emergency preparedness in reducing cyclone-related losses in the Sundarban Biosphere Region. The findings revealed that weak early warning dissemination, delayed emergency responses, limited infrastructure, and low community awareness increased vulnerability to cyclone disasters.

The findings also supported the study in Indonesia by Opabola, et al., (2023) which examined disaster preparedness and post-disaster recovery mechanisms in strengthening the resilience of school infrastructure. The study found that effective disaster recovery requires early-response funding, stakeholder collaboration, and strengthened local capacity for self-organization. The researchers emphasized the importance of evidence-based policies and coordinated community and government efforts in promoting sustainable and resilient reconstruction of educational infrastructure.

The findings also concurred with a study by Kamaruddin (2024) on disaster preparedness design in secondary school environments, focusing on structural and strategic measures for building resilient school systems. Using a qualitative literature review approach, the study analyzed scholarly articles, policy documents, and government records. The findings identified four key components of school disaster preparedness: inter-agency coordination, information management, early warning systems, and education and training. The study emphasized that effective preparedness depends on strong collaboration, clear communication systems, regular drills, early warning technologies, and continuous training for students, teachers, and support staff. The study concluded that well-structured preparedness frameworks and proactive risk communication can significantly reduce disaster impacts in schools.

The findings were in line with Troglič, et al., (2021) examined the role of Early Warning Systems (EWS) in disaster risk reduction. The study established that voluminous schools were deficient of disaster risk education, effective hazard monitoring systems, emergency response plans, regular safety drills, and strong communication links with disaster management agencies. The findings also reveal inadequate stakeholder collaboration, limited funding for disaster preparedness infrastructure, and poor inclusion of vulnerable student groups in emergency planning.

CONCLUSIONS

The study concludes that public senior schools in Uasin Gishu County have basic capacity to receive and communicate early warnings, but gaps existed in availability of trained personnel, response protocols, emergency drills, and integration of official

Influence of Early Warning Systems on Disaster Management in Public Senior Schools in Uasin Gishu County, Kenya

warning systems in disaster preparedness. The study recommends the establishment and strengthening of effective early warning systems within schools by integrating official disaster information networks with national and county disaster management agencies. The study also recommended that schools should strengthen staff capacity, allocating adequate resources, clarifying responsibilities, conducting regular drills, and linking schools with official disaster management networks are therefore essential for improving school resilience, protecting learners and staff, and ensuring timely and coordinated disaster response..

REFERENCES

- 1) Adhiambo, O. E. (2025). Fire Disaster Preparedness in Senior schools: A Study in Uasin Gishu County. Unpublished thesis of University of Eldoret.
- 2) Ananda, P., Simatwa, E. M. W. & Juma, S. (2022). Contribution Of Principals To School Disaster Management Preparedness in Secondary schools In Kakamega County, Kenya. *International Journal of Scientific and Research Publications*, 12, (1),pp 12163-12179.
- 3) Ansah, F. O., Assem, H. D., Ossei-Anto, T. A., Acheampong, A., & Owusu, M. (2024). Evaluating the Availability and Effectiveness of Safety Equipment in Chemistry Laboratories at Public Colleges of Education in Ghana. *Creative Education*, 15, 2224-2257. <https://doi.org/10.4236/ce.2024.15101>
- 4) Ansah, F. O., Assem, H. D., Ossei-Anto, T. A., Acheampong, A., & Owusu, M. (2024). Evaluating the Availability and Effectiveness of Safety Equipment in Chemistry Laboratories at Public Colleges of Education in Ghana. *Creative Education*, 15, 2224-2257. <https://doi.org/10.4236/ce.2024.15101>
- 5) Aroja, J. M. A., & Calos, N. T. (2026). Resource mobilization strategies on disaster risk management implementation of public school teachers. *International Journal of Novel Research and Development*, 11(4), b130. <https://www.ijnrd.org>
- 6) Asheim, M., Fossum, S., Reedtz, C., Handegaard, B. H., & Martinussen, M. (2020). Examining the incredible years teacher classroom management program in a regular Norwegian school setting: Teacher-reported behavior management practice, problem behavior in classroom and school environment, teacher self and collective efficacy, and classroom climate. *Sage Open*, 10, 21582440209.
- 7) Atillo F.F., Batao, H.S., Giger, V.M.D. & Elesio, J.M. (2025). School heads' crisis leadership: experiences in managing natural disasters and school Emergencies. *school heads' crisis leadership: experiences in managing natural. Disasters School Emergencies*. 2025;165(1):14. [[Google Scholar](#)]
- 8) Austin, M. J., & Reynolds, B. A. (2018). Emergency preparedness and disaster response in K-12
- 9) Badin, P., & Hamid, H. (2022). Risk management theory and model in teacher characters building course: A literature review. *ANP Journal of Social Sciences and Humanities*, 3(1), 10–18. <https://doi.org/10.53797/anp.jssh.v3i1.2.2022>.
- 10) Bradshaw, C. P., Debnam, K. J., Kush, J. M., & Lindstrom Johnson, S. (2022). Planning for a Crisis, but Preparing for Every Day: What Predicts Schools' Preparedness to Respond to a School Safety Crisis? *Frontiers in Communication*, 7, Article 765336. <https://doi.org/10.3389/fcomm.2022.765336>
- 11) Bullock JA, Haddow GD, Coppola DP. (2022). Mitigation, Prevention, and Preparedness. *Introduction to Homeland Security*. 2013:435–94. doi: 10.1016/B978-0-12-415802-3.00010-5. Epub 2012 Jul 27. PMID: PMC7158272.
- 12) Chaaya, C., Devi Thambi, V., Sabuncu, Ö., Abedi, R., Osman Ahmed Osman, A., Uwishema, O., & Onyeaka, H. (2022). Ukraine - Russia crisis and its impacts on the mental health of Ukrainian young people during the COVID-19 pandemic. *Annals of medicine and surgery* (2012), 79, 104033. <https://doi.org/10.1016/j.amsu.2022.104033>
- 13) Cheloti, M. (2021). Kipkabus Boys Closed after Dormitory is Razed down. <https://www.uasingishunews.co.ke/kipkabus-boys-closed-after-dormitory-is-razed-down/>
- 14) Cheloti, M. (2021). Kipkabus Boys Closed after Dormitory is Razed down. <https://www.uasingishunews.co.ke/kipkabus-boys-closed-after-dormitory-is-razed-down/>
- 15) Chemeli, M. J. (2017). School Safety And Emergency Preparedness: An Assessment Of Senior schools In Nandi North District, Kenya. Unpublished Master Of Philosophy In Education Administration of Moi University
- 16) Chepngeo, D. (2025). Implementation of school safety standards manual in public and private senior schools in Kericho County, Kenya: A comparative study (Master's thesis, Kenyatta University).
- 17) Chepngeo, D. (2025). Implementation of school safety standards manual in public and private senior schools in Kericho County, Kenya: A comparative study (Master's thesis, Kenyatta University).
- 18) Chesang, K. F., & Kessio, D. (2025). Safety preparedness and the implementation of safety standards guidelines in public senior schools at Nandi County, Kenya. *Africa Journal of Technical and Vocational Education and Training*, 10(2). <https://doi.org/10.69641/afritvet.2025.102197>
- 19) Dashti, S., Caglayan, B. O., & Dashti, N. (2025). Post-earthquake fire resistance in structures: A review of current research and future directions. *Applied Sciences*, 15(6), Article 3311. <https://doi.org/10.3390/app15063311>
- 20) Dashti, S., Caglayan, B. O., & Dashti, N. (2025). Post-earthquake fire resistance in structures: A review of current research and future directions. *Applied Sciences*, 15(6), Article 3311. <https://doi.org/10.3390/app15063311>

- 21) Du L. J. (2022). The crisis of international education students and responsive service in and after COVID-19 pandemic. *Frontiers in psychology*, 13, 1053512. <https://doi.org/10.3389/fpsyg.2022.1053512>.
- 22) Emmaculate, K., Kombo, K., & Gathara, P. M. (2022). Challenges Facing the Implementation of Government Policies on Sanitation in Primary Schools in Nakuru County, Kenya. *The International Journal of Humanities & Social Studies*, 10(2).
- 23) Fuller, R. P., & La Sala, A. (2021). Crisis communication preparedness practices among U.S. charitable organizations: Results from a national survey. *SAGE Open*, 11(2). <https://doi.org/10.1177/21582440211014516>
- 24) Fuller, R. P., & La Sala, A. (2021). Crisis communication preparedness practices among U.S. charitable organizations: Results from a national survey. *SAGE Open*, 11(2). <https://doi.org/10.1177/21582440211014516>
- 25) Garcia, J., & Espiritu, D. (2025). Crisis management preparedness of school heads in the implementation of DRRM in basic education in Second Congressional Districts Division of Camarines Sur. *Psychology and Education: A Multidisciplinary Journal*, 49(3), 266–296. <https://doi.org/10.70838/pemj.490301>
- 26) Geng, S., Gong, Y., Hou, H. (2024).. Resource management in disaster relief: a bibliometric and content-analysis-based literature review. *Ann Oper Res* **343**, 263–292 (2024). <https://doi.org/10.1007/s10479-024-06324-7>
- 27) Gitakama, T. (2016, July 28). Find Out Why Head teachers Stormed Police Station in Uasin Gishu. *Radio Jambo*. <https://radiojambo.co.ke/habari/2016-07-28-find-out-why-headteachers-stormed-police-station-in-uasin-gishu/>
- 28) Gittell, J. H. (2016). *Transforming relationships for high performance: The power of relational coordination*. Stanford Business Books.
- 29) Graham, J., Shirm, S., & Liggin, R. (2022). Disaster preparedness in schools. *Journal of School Health*, 76(9), 435-438.
- 30) Graham, J., Shirm, S., & Liggin, R. (2022). Disaster preparedness in schools. *Journal of School Health*, 76(9), 435-438.
- 31) Haddow, G., Bullock, J., & Coppola, D. P. (2020). *Introduction to Emergency Management*. 7th edition. Elsevier.
- 32) Haupt, B. (2021). The Use of Crisis Communication Strategies in Emergency Management. *Journal of Homeland Security and Emergency Management*, 18(2), 125-150. <https://doi.org/10.1515/jhsem-2020-0039>
- 33) Heagele T. N. (2016). Lack of Evidence Supporting the Effectiveness of Disaster Supply Kits. *American journal of public health*, 106(6), 979–982. <https://doi.org/10.2105/AJPH.2016.303148>
- 34) Hodson, A., Pearce, J. M., Amlôt, R., & Rogers, M. B. (2024). Delivering extreme event preparedness education in schools: A systematic review of educational preparedness resources available in England. *International Journal of Disaster Risk Reduction*, 100, 104171. <https://doi.org/10.1016/j.ijdr.2023.104171>
- 35) Howard, R., & Jones, K. (2019). School Infrastructure Committees and Emergency Preparedness: Lessons from U.S. Public Schools. *Disaster Prevention and Education Quarterly*, 8(4), 89-106.
- 36) Ibrahim, M. M., Jibril, A., Razak, A. A. A., & Nukpezah, R. N. (2021). First-aid resources availability and attitudes of senior high school students in Tamale Metropolis, Ghana. *Asian Journal of Medicine and Health*, 19(9), 9–16. <https://doi.org/10.9734/AJMAH/2021/v19i930362> (journalajmah.com)
- 37) Ibrahim, M. M., Jibril, A., Razak, A. A. A., & Nukpezah, R. N. (2021). First-aid resources availability and attitudes of senior high school students in Tamale Metropolis, Ghana. *Asian Journal of Medicine and Health*, 19(9), 9–16. <https://doi.org/10.9734/AJMAH/2021/v19i930362> (journalajmah.com)
- 38) İş, E., & Karadaş, H. (2025). Investigation of disaster management perceptions of school administrators: The case of Kahramanmaraş earthquake. *Acta Psychologica*, 260, 105613.
- 39) Kahwa, R. J. (2022) Fire emergency preparedness at schools: A case study for senior schools in Moshi Rural District, Kilimanjaro Region, Tanzania (Master's thesis, University of the Free State)..
- 40) Kahwa, R. J. (2022) Fire emergency preparedness at schools: A case study for senior schools in Moshi Rural District, Kilimanjaro Region, Tanzania (Master's thesis, University of the Free State)..
- 41) Kalogiannidis, S., Kalfas, D., Kotsas, S., Papaevangelou, O., & Chatzitheodoridis, F. (2025). Evaluating the effectiveness of early warning systems in reducing loss of life in natural disasters: A case study of Greece. *Journal of Risk Analysis and Crisis Response*, 15(1), 1–33. <https://doi.org/10.54560/jracr.v15i1.547> (jraccr.com)
- 42) Kambuga, Y. M. (2023). Disaster Management in Tanzanian Senior schools: An Assessment of Disaster Risk Preparedness and Mitigation Strategies. *Journal of Education for Sustainable Innovation*, 1(2), 113–123. <https://doi.org/10.56916/jesi.v1i2.577>
- 43) Kapur, R. (2019). Impact of resource utilization in education. Independent researcher.
- 44) Kipkinei, B. (2022, May 21). Gutted science labs at Moi Girls Eldoret to be rebuilt. Kenya News Agency.
- 45) Kipkinei, B. (2022, May 21). Gutted science labs at Moi Girls Eldoret to be rebuilt. Kenya News Agency.
- 46) Kothari, C. R., & Garg, G. (2019). *Research methodology: Methods and techniques* (4th ed.). New Age International Publishers.
- 47) Krausche, W., & Norrestam, H. (2025). Enhancing early warning systems for fire: The role of local actors in disaster preparedness in the Eastern Cape, South Africa (Master's thesis, Lund University). Lund University Publications. <http://lup.lub.lu.se/student-papers/record/9209147> (lup.lub.lu.se)

- 48) Kusiima, H. (2014). Assessment of Fire Safety Preparedness in Boarding Senior schools of Kakiri Sub-County in Wakiso District (Doctoral dissertation, International Health Sciences University.).
- 49) Letoo, S. (2024, September 8). Kenyan schools ill-prepared for fires, Auditor-General report shows. **Citizen Digital**. <https://www.citizen.digital/article/kenyan-schools-ill-prepared-for-fires-auditor-general-report-shows-n3>.
- 50) Letoo, S. (2024, September 8). Kenyan schools ill-prepared for fires, Auditor-General report shows. **Citizen Digital**. <https://www.citizen.digital/article/kenyan-schools-ill-prepared-for-fires-auditor-general-report-shows-n3>.
- 51) Malemba, S. A., Pepela, M. M., & Moses, A. (2024). Causes of vulnerability to disasters in public senior schools in Nairobi County, Kenya. *African Journal of Empirical Research*, 5(4), 1518–1530. <https://ajernet.net>
- 52) Matara, H. (2024, September 14). School heads face legal action under proposed student safety legislation. *Name of News Outlet*. URL
- 53) Mbawala, R. G., & Otieno, K. O. (2023). Effects of disaster management towards academic achievement in public senior schools in Arusha District. *Journal of Research Innovation and Implications in Education*, 7(3), 257–269. <http://www.jriiejournal.com>
- 54) Mburu, A. M. (2025). Impacts of institutional child protection policies on the safety and wellbeing of learners in international schools in Kenya. *International Academic Journal of Arts and Humanities*, 2(1), 56-85.
- 55) Munyiri, I. N., Thinguri, R. W., & Edabu, P. (2020). Influence of school resources allocation on disaster risk management in public senior schools in Nairobi City County, Kenya. *African Journal of Education and Practice*, 5(1, No. 3), 33–48. <https://www.iprjb.org>
- 56) Mururi, S. (2017). Resource management for disaster in senior schools in Ruiru Kiambu County, Kenya. *International Journal of Education and Human Developments*, 3(4), 52.
- 57) Ndanyi, M. (2024, May 5). Uasin Gishu assesses state of schools after the floods. *The Star*. <https://www.the-star.co.ke/news/2024-05-05-uasin-gishu-assesses-state-of-schools-after-the-floods/>
- 58) Ndanyi, M. (2024, May 5). Uasin Gishu assesses state of schools after the floods. *The Star*. <https://www.the-star.co.ke/news/2024-05-05-uasin-gishu-assesses-state-of-schools-after-the-floods/>
- 59) Ndanyi, M. (2025, July 10). Three pupils die in Uasin Gishu school pit latrine tragedy. *The Star Newspaper*. URL
- 60) Nestory, E. (2017). Fire Disaster Preparedness In Senior schools A Case Study Of Ilala Municipal Council. Unpublished MSc (Applied Epidemiology) Dissertation Muhimbili University of Health and Allied Sciences.
- 61) NTV Kenya. (2025). Three pupils die after latrine collapse at school in Uasin Gishu.
- 62) NTV Kenya. (2025). Three pupils die after latrine collapse at school in Uasin Gishu.
- 63) Obied, T. (2020). Role of School Administration in Providing an Attractive and Safe School Environment to Students under Vision 2030. *Propósitos y Representaciones*, 8 (SPE3), e748. Doi: <http://dx.doi.org/10.20511/pyr2020.v8nSPE3.748>
- 64) Ogemba, O. P. (2025). An assessment of Emergency Fire Disaster Preparedness in Public and private senior schools in Kenya. A comparative study. *Indonesian Journal of Education* 4(3), 406-422.
- 65) Ogetta, D. (2024). Hillside Endarasha Academy tragedy: DPP orders investigation, promises swift action. *Nation Media Group*.
- 66) Omari, H. (2021). Principals' administrative safety strategies influencing disaster management in public senior schools in Nyeri County, Kenya (Unpublished doctoral dissertation). Maasai Mara University, Kenya.
- 67) Ominde, T. (2022). Moi Girls Eldoret school Fire was caused by lab Chemicals. *Nation.africa/kenya/counties/uasin-gishu/moi-girls-eldoret-school-fire-was-caused-by-lab-chemicals-police-say-3824960*.
- 68) Onana, V. (2021). Reasons For The Increasing Cases Of Indiscipline In Kenyan Schools. Available at <https://www.onana.co.ke/reasons-for-the-increasing-cases-of-indiscipline-in-kenyan-schools/>
- 69) Osanya, C. (2021, November 1). Students of Kipkabus Boys High School in Uasin Gishu torch dormitory over poorly cooked ugali. *K24 Digital*. <https://www.k24tv.co.ke/news/students-of-kipkabus-boys-high-school-in-uasin-gishu-torch-dormitory-over-poorly-cooked-ugali-49344/>
- 70) Pfefferbaum, B., Newman, E., Nelson, S.D., Liles, B.D., Tett, R.E., Varma, V., & Nitiéma, P. (2016). "The burden of disaster: Part I. Challenges and opportunities within disaster preparedness and response." *International Journal of Emergency Mental Health and Human Resilience*, 17(1), 204–209.
- 71) Ruttoh, J. (2019, July). Fire preparedness in senior schools in Eldoret West Sub-County, Uasin-Gishu County, Kenya. *Journal of Education, Society and Behavioural Science*, 31(2), 1–12. <https://doi.org/10.9734/jesbs/2019/v31i230149>
- 72) Sahana, M., Patel, P. P., Rehman, S., Rahaman, M. H., Masroor, M., Imdad, K., & Sajjad, H. (2023). Assessing the effectiveness of existing early warning systems and emergency preparedness towards reducing cyclone-induced losses in the Sundarban Biosphere Region, India. *International Journal of Disaster Risk Reduction*, 90, 103645. <https://doi.org/10.1016/j.ijdrr.2023.103645>

- 73) Šakić Trogrlić, R., van den Homberg, M., Budimir, M., McQuistan, C., Sneddon, A., Golding, B. (2022). Early Warning Systems and Their Role in Disaster Risk Reduction. In: Golding, B. (eds) Towards the “Perfect” Weather Warning. Springer, Cham. https://doi.org/10.1007/978-3-030-98989-7_2 https://doi.org/10.1007/978-3-030-98989-7_2
- 74) Sarigöz, O., Yıldırım, B., & Bingöl, G. (2025). Challenges faced by school administrators in primary schools after disasters. *Problems of Education in the 21st Century*, 83(1), 101.
- 75) Sayed Y, Singh M, Bulgrin E, Henry M, Williams D, Metcalfe M, et al. Teacher support, preparedness and resilience during times of crises and uncertainty: COVID-19 and education in the Global South. *J Educ (South Africa)*. 2021; 9899: 125–154.
- 76) Sakurai, M., & Murayama, Y. (2019). Information technologies and disaster management–Benefits and issues. *Progress in Disaster Science*, 2, 100012.
- 77) Sinha, A., Kumar, P., Rana, N.P. et al. Impact of internet of things (IoT) in disaster management: a task-technology fit perspective. *Ann Oper Res* 283, 759–794 (2019). <https://doi.org/10.1007/s10479-017-2658-1>
- 78) Suharto, N. T., Ph, S., and Jaedun, A. (2020). The effectiveness of a school-based disaster risk reduction program in indonesia: a case study in the klaten regency’s junior high schools. *Int. J. Innovation* 12:14.
- 79) Sun, W., Bocchini, P. & Davison, B.D. Applications of artificial intelligence for disaster management. *Nat Hazards* 103, 2631–2689 (2020). <https://doi.org/10.1007/s11069-020-04124-3>
- 80) Syamsidik, Oktari, R. S., Nugroho, A., Fahmi, M., Suppasri, A., Munadi, K., et al. (2021). Fifteen years of the 2004 Indian Ocean Tsunami in Aceh-Indonesia: mitigation, preparedness and challenges for a long-term disaster recovery process. *Int. J. Disaster Risk Reduction* 54:102052. doi: 10.1016/j.ijdr.2021.102052
- 81) Teku, D., & Tariku, G. D. (2026). Effectiveness of early-warning systems and disaster risk reduction for rural food security under hydro-meteorological hazards in Sub-Saharan Africa: systematic review. *International Journal of Sustainable Development & World Ecology*, 33(1), 101–122. <https://doi.org/10.1080/13504509.2025.2595056>
- 82) Tigges, J. M. (2018). "Emergency preparedness: An analysis of Iowa high school emergency preparedness plans". Graduate Theses and Dissertations. 10947. <https://lib.dr.iastate.edu/etd/10947>
- 83) Too, N. (2016, July 13). A school's dormitory burns at Moi's bridge. Hivisasa. <https://hivisasa.com/posts/a-schools-dormitory-burns-at-mois-bridge>
- 84) Trogrlić, R. Š., van den Homberg, M., Budimir, M., McQuistan, C., Sneddon, A., & Golding, B. (2021). Early Warning Systems and Their Role in Disaster Risk Reduction. In *World Disasters Report 2021*. International Federation of Red Cross and Red Crescent Societies.
- 85) Uasin Gishu County Government. (2025). County disaster management committee assessments on flood-affected schools.
- 86) Uasin Gishu County Government. (2025). County disaster management committee assessments on flood-affected schools.
- 87) Udali, A. J. (2020). Learners and staff awareness on school safety measures in public boarding senior schools in Trans-Nzoia County, Kenya. *European Journal of Education Studies*, 7(12).
- 88) UNESCO. (2017). *A Guide to School Disaster Management: Strengthening Resilience in the Education Sector*. UNESCO Publishing.
- 89) United Nations Office for Disaster Risk Reduction. (2017). *Comprehensive school safety*. Retrieved June 3, 2020, from <https://www.undrr.org/publication/comprehensive-school-safety>
- 90) Vásquez, A., Marinkovic, K., Bernaldes, M., León, J., González, J., & Castro, S. (2018). Children’s views on evacuation drills and school preparedness: Mapping experiences and unfolding perspectives. *International Journal of Disaster Risk Reduction*, 28, 165–175. <https://doi.org/10.1016/j.ijdr.2018.03.001>
- 91) Widowati, E., Hendriyani, R., Nugroho, E., Lee, A., Qin, W., & Info, A. (2023). Children’s safety education model through child-friendly games. *Jurnal Kesehatan Masyarakat*, 14(2), 157–162.
- 92) Widowati, E., Istiono, W., & Husodo, A. H. (2021). The development of disaster preparedness and safety school model: A confirmatory factor analysis. *International Journal of Disaster Risk Reduction*, 53, 102004
- 93) Widowati, E., Koesyanto, H., & Sugiharto, S. (2018). The application of safety education in primary school directorate in Indonesia. *Journal of Education and Learning (Edu-Learn)*,
- 94) World Population Review (2022). *School Shootings by Country 2022*. Available at <https://worldpopulationreview.com/country-rankings/school-shootings-by-country>
- 95) Xie, K.; Song, Y.; Liu, J.; Liang, B.; Liu, X. (2018). Stampede prevention design of primary school buildings in china: A sustainable built environment perspective. *Int. J. Environ. Res. Public Health* 2018, 15, 1517.
- 96) Yadav, N., Thalakiya, R., Srivastava, S., Yadav, N., & Ostadtaghizadeh, A. (2026). Scoping review of early warning systems in improving disaster risk outcomes: perspective from evolution to usage in Southeast Asian countries. *BMC public health*, 26(1), 616. <https://doi.org/10.1186/s12889-026-26292>