



COMPARATIVE ASSESSMENT OF PERCEIVED FLOOD RESILIENCE DIMENSIONS IN A PUBLIC SCHOOL IN RIZAL PROVINCE

Engr. Edna Lyn Diaz Ngo

Master of Science in Construction Management / Part-Time Faculty

Polytechnic University of the Philippines / New Era University

Sta. Mesa, Manila / Quezon City, Metro Manila, Philippines

Email: eldiazngo@gmail.com

Abstract

Flooding remains one of the most frequent natural hazards affecting educational institutions in the Philippines, disrupting school operations, damaging infrastructure, and compromising the safety of students and school personnel. This study comparatively assessed the perceived dimensions of flood resilience of a selected public school in Rizal Province, focusing on Structural Resilience, Functional Continuity, and Preparedness and Management. A descriptive-comparative research design was employed involving 107 high school students selected through simple random sampling. Data were collected using a validated survey questionnaire and analyzed using descriptive statistics, including the mean, median, standard deviation, and interquartile range. The Friedman Test and Wilcoxon Signed-Rank Test were used to determine significant differences among the three flood resilience dimensions. The findings revealed a generally satisfactory level of perceived flood resilience. Preparedness and Management received the highest median rating, indicating well-established disaster preparedness and management practices, while Functional Continuity received the lowest, highlighting the need to strengthen the school's capacity to sustain educational operations during and after flood events. Significant differences were found among the three resilience dimensions, with Preparedness and Management differing significantly from both Structural Resilience and Functional Continuity. Based on the findings, a Recommendation Matrix and a Proposed Flood Resilience Action Plan were developed to support evidence-based decision-making and strengthen flood resilience in public schools. The study provides practical insights for the Department of Education, local government units, and school administrators in promoting resilient and sustainable learning environments.

Keywords: Flood resilience; Public schools; Structural resilience; Functional continuity; Preparedness and management; Disaster risk reduction; School resilience.



1. Introduction

1.1 Background of the Study

The Philippines, due to its geographical location and topography, is highly vulnerable to various natural disasters and calamities. In recent years, the country has experienced numerous catastrophic events, including storms, floods, landslides, earthquakes, volcanic eruptions, and even pandemics. These disasters have far-reaching consequences that extend beyond immediate physical damage, resulting in loss of life, injuries, disease outbreaks, destruction of property and infrastructure, displacement of communities, interruption of essential services, economic instability, and environmental degradation. The impact of these calamities is particularly severe among vulnerable and low-income communities, which often bear a disproportionate burden of human suffering.

The severity of a disaster is largely determined by the extent to which hazards affect society and the environment. Vulnerability to disasters is influenced not only by natural conditions but also by human decisions in shaping the built environment and social systems. Choices related to land use, housing construction, governance, infrastructure development, financial planning, and educational systems may either increase exposure to hazards or strengthen community resilience. Consequently, disaster resilience has become an essential component of sustainable development and public safety planning.

A notable example of the devastating impact of natural disasters in the Philippines was the widespread destruction caused by Typhoon Ulysses in November 2020. The municipality of Rodriguez in Rizal province was among the hardest-hit areas and was declared under a state of calamity due to severe flooding. According to the Rizal Provincial Disaster Risk Reduction and Management Office, more than 25,000 families, primarily from Rodriguez and the neighboring municipality of San Mateo, were displaced and forced to seek temporary shelter following the disaster.

In addition to flooding risks, Rizal province is situated in a geologically vulnerable area. Rodriguez, Rizal, lies between two active fault systems: the 100-kilometer West Valley Fault and the 10-kilometer East Valley Fault. Experts warn that movement along these fault lines could trigger a major earthquake, causing significant destruction in nearby communities. These environmental threats further emphasize the importance of resilient public infrastructure, particularly school buildings.

School buildings play a critical role in disasters because they serve not only as educational institutions but also as evacuation centers and community shelters. Their resilience, therefore, extends beyond structural integrity to include the capacity to maintain operations, ensure occupant safety, support emergency response efforts, and recover quickly from disasters. The resilience of school buildings is especially important because disruptions to education and unsafe learning environments can significantly affect the well-being and recovery of students, families, and communities.

The importance of resilient school buildings is further reinforced by their contribution to post-disaster recovery. Schools often become centers for relief distribution, temporary housing, and coordination of emergency response activities. Furthermore, the immediate resumption of educational services after a disaster helps restore normalcy and supports the psychological recovery of children and affected families. As such, resilient school infrastructure contributes not only to disaster response but also to long-term community stability and recovery.

Among the various natural hazards experienced in Rizal province, flooding remains one of the most frequent and disruptive events affecting schools and surrounding communities. Flooding caused by typhoons, prolonged rainfall, overflowing waterways, and inadequate drainage systems often results in class disruptions, damage to school facilities, displacement of residents, and the temporary conversion of schools into evacuation centers. These recurring incidents highlight the need to evaluate not only the structural safety of school buildings but also their ability to maintain operations and support emergency response during flood events.

In this context, flood resilience in public schools becomes an important area of assessment. Flood-resilient schools are expected to have structurally sound facilities, maintain functional continuity during emergencies, and implement effective preparedness and management systems to protect students, personnel, and community members. Evaluating these dimensions is essential in determining whether schools are adequately prepared to withstand and recover from flood-related disruptions.

This study, therefore, aims to assess the perceived flood resilience of public school buildings in Rizal province as evaluated by students. Specifically, the study examines flood resilience in terms of Structural Resilience, Functional Continuity, and Preparedness & Management. Through this assessment, the study seeks to identify strengths and gaps in existing flood resilience practices and provide recommendations that may contribute to safer educational environments and stronger disaster preparedness efforts within school communities.

1.2 Theoretical Framework

This study is anchored on the **Disaster Resilience Framework**, which highlights four fundamental dimensions of resilience: **Robustness, Redundancy, Resourcefulness, and Rapidity**. This framework was formally introduced by Michel Bruneau et al. (2003) in their seminal work on infrastructure resilience and has since been widely applied and expanded in disaster risk reduction and management studies.

Robustness refers to a system's inherent strength and capacity to withstand external stresses without significant degradation or loss of functionality (Bruneau et al., 2003). In the context of school infrastructure, this dimension emphasizes structural integrity, adherence to safety standards, and the ability of buildings to remain operational during and after hazard events such as earthquakes or typhoons.

Redundancy pertains to the availability of alternative systems, components, or strategies that ensure continuity of essential functions when primary systems fail (Bruneau et al., 2003). Applied to school settings, this may include backup power systems, multiple evacuation routes, and alternative learning or shelter spaces when primary facilities are compromised.

Resourcefulness is defined as the capacity to identify problems, prioritize actions, and mobilize resources effectively during and after disruptions (Bruneau et al., 2003). Within educational institutions, this includes emergency preparedness plans, trained personnel, coordination mechanisms, and access to financial and material resources for response and recovery.

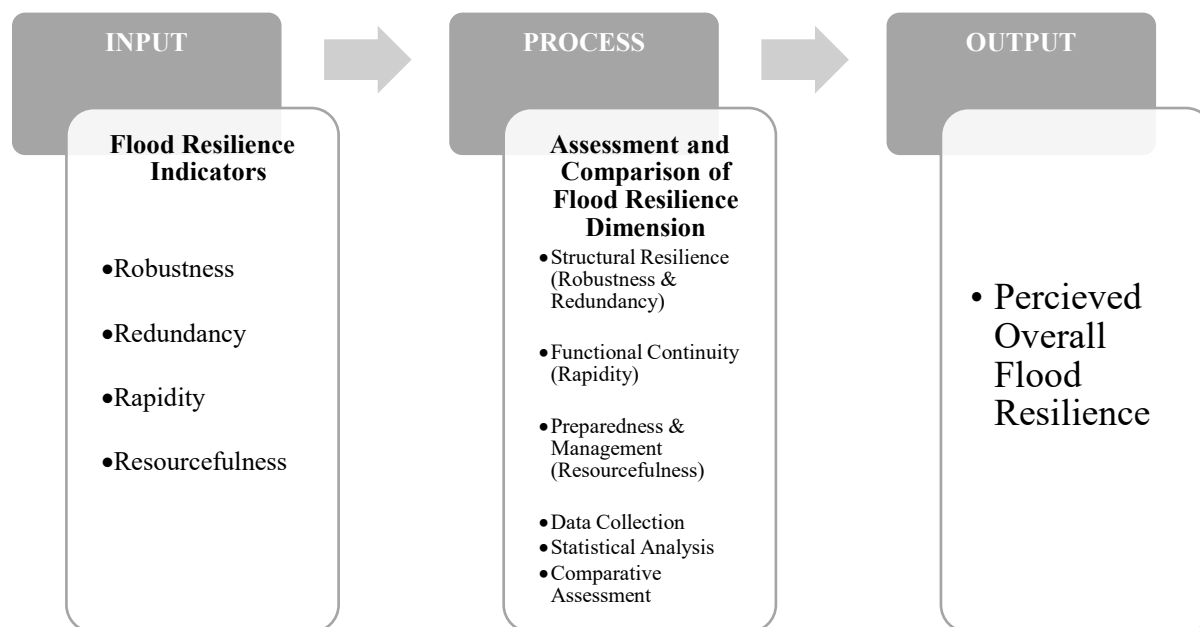
Rapidity refers to the speed at which a system can restore functionality, safety, and stability following a disruption (Bruneau et al., 2003). For schools, this dimension highlights how quickly educational services and community functions can resume after a disaster, minimizing disruption and ensuring continuity.

The application of this framework is further supported by broader disaster resilience literature. According to Susan L. Cutter et al. (2008), resilience encompasses not only the capacity to absorb impacts but also the ability to recover and adapt, reinforcing the multidimensional nature of the four Rs model. Similarly, the **United Nations Office for Disaster Risk Reduction** emphasizes resilience as the ability of systems and communities to resist, absorb, accommodate, and recover from hazards efficiently (UNDRR, 2015).

The framework is particularly relevant to the present study for several reasons. First, it provides a **holistic perspective**, enabling the assessment of school resilience beyond structural components to include operational capacity and recovery mechanisms. Second, it aligns with the **multi-hazard context of Rizal Province**, which is exposed to natural hazards such as earthquakes and typhoons. Third, it emphasizes not only the survival of infrastructure but also its continued functionality—an essential role of school buildings as both educational facilities and emergency evacuation centers. Lastly, it offers a strong foundation for **evidence-based policy recommendations**, guiding strategic investments and interventions to enhance school disaster resilience.

1.3 Conceptual Framework

Figure 1. *Conceptual Framework of Perceived Overall Flood Resilience in a Public-School Building*



The **4Rs Resilience Framework** conceptualizes resilience in terms of robustness, redundancy, resourcefulness, and rapidity. However, prior studies have noted that these dimensions are often interrelated and may not be empirically distinct across contexts, particularly in applied institutional settings (Cutter et al., 2008; Norris et al., 2008).

In the present study, empirical findings revealed a convergence among these dimensions within the school context. Specifically, items associated with robustness and redundancy did not emerge as separate constructs; instead, they loaded onto a single factor representing **structural resilience**. This aligns with existing literature emphasizing the integration of physical infrastructure and system capacity in institutional resilience (Bruneau et al., 2003).

Similarly, rapidity-related indicators clustered under **functional continuity**, reflecting the school's capacity to sustain and restore operations during and after flood events. In contrast, resourcefulness items formed a distinct factor corresponding to **preparedness and management**, underscoring the importance of coordination, communication, and planning in disaster readiness (Kapucu, 2008).

Overall, this three-factor structure offers a more parsimonious and contextually grounded representation of school disaster resilience, consistent with recommendations for construct refinement in scale development and validation (DeVellis, 2017; Kline, 2016).

1.4 Review of Related Literature

The following review of the literature and studies provides a comprehensive exploration of research on the disaster resilience of public-school buildings, with a particular focus on Rizal province and the broader Philippine context. This chapter aims to establish a solid theoretical and empirical foundation for the current study by examining existing knowledge, identifying gaps, and highlighting the significance of the research problem.

The literature review is organized thematically, covering key areas such as disaster risk reduction in educational infrastructure, the dual role of schools as learning centers and evacuation facilities, structural resilience to various natural hazards, and policy frameworks governing school building construction and maintenance. Both local and international studies are included to provide a well-rounded perspective on the subject.

1.4.1 Foreign Literature and Studies

Disaster Preparedness

Verheul & Dückers (2020) conducted a systematic review of definitions and operationalizations of disaster preparedness in hospitals. The study analyzed 40 articles published between 2005 and 2019, identifying 13 unique definitions and 22 operationalizations of disaster preparedness in hospitals across the literature. The definitions generally described preparedness as an action aimed at minimizing disaster consequences and adhering to quality criteria, while operationalizations focused on nine key components, including plans, equipment, training, coordination, and communication. The authors synthesized these findings to develop a comprehensive conceptual model of hospital disaster preparedness, comprising nine interconnected components and their enabling conditions.

The study identified a significant lack of consensus on how to define and measure hospital disaster preparedness. It highlighted the need for a more comprehensive and standardized approach to conceptualizing and assessing preparedness in healthcare settings. This gap in standardization is highly relevant to assessing school building disaster preparedness, underscoring the need to develop clear, comprehensive evaluation frameworks. The study's approach of synthesizing diverse definitions and operationalizations to create a more holistic model could be valuable for developing similar frameworks for school preparedness. Additionally, the identified components of preparedness, such as plans, equipment, and training, are likely applicable to school settings.

Khankeh et al. (2022) reviewed articles on health in emergencies and disasters in Iran published between 2015 and 2020. The results showed that most studies used quantitative methods (66.5%), while qualitative (11.6%) and mixed methods (2.6%) were less common. The research primarily focused on preparedness and mitigation phases of disaster management, with less attention to response and recovery. The most frequently studied hazards were traffic accidents, earthquakes, and floods. Key challenges identified in disaster management included insufficient manpower, poor database management, and diverse stakeholder attitudes. The study also found that the words "disaster" and "accident" were the most common keywords in the literature.

The study highlighted significant gaps in qualitative and mixed-methods research on disasters in Iran, as well as a limited focus on response and recovery phases of disaster management. It recommended more training on disaster research methods and increased support for researchers in this field. These gaps and recommendations are highly relevant for examining school building preparedness, suggesting the value of mixed-methods approaches and a comprehensive focus across all phases of disaster management. The study's findings on key challenges in disaster management, such as manpower and data issues, may also be applicable to school preparedness efforts. Furthermore, the emphasis on the need for more diverse research methodologies underscores the importance of a multifaceted approach to studying disaster preparedness across contexts, including schools.

Geronimo & Gonzaga (2021) assessed disaster mitigation and preparedness in rural communities in Cadiz City, Philippines. They surveyed 198 respondents from six rural communities, finding that communities were partially prepared overall, with higher preparedness levels for coastal, middle-income, and more populated areas. The study examined preparedness across four criteria: systems and structures, policies and plans, building competencies, and equipment and supplies. Key challenges identified included insufficient manpower, poor data management, and diverse stakeholder attitudes. The research also found that television and radio were the main sources of



information on disaster preparedness for community members. The study revealed that communities were more prepared for some hazards (such as earthquakes) than for others (such as floods and typhoons).

The study identified significant gaps in community-level preparedness, particularly in less-populated inland areas and certain types of hazards. It highlighted the need for more comprehensive preparedness planning and community education, particularly in lower-income areas and smaller communities. This is highly relevant to school preparedness, as schools are key community institutions that can play a crucial role in disaster education and planning. The study's findings on the importance of media in disseminating preparedness information could inform strategies for improving school-based disaster education programs. Additionally, the identified challenges in community-level disaster management, such as manpower and data issues, are likely relevant to school preparedness efforts. The study's approach to assessing preparedness across multiple criteria provides a useful framework that could be adapted to evaluate school preparedness.

Beyramijam et al. (2020) proposed a systematic review protocol to examine disaster preparedness among emergency medical service (EMS) providers. The protocol aimed to assess preparedness levels, identify key dimensions of preparedness, and explore strategies to enhance preparedness among EMS providers. The authors planned to search multiple databases for relevant studies published between 2005 and 2019, focusing on peer-reviewed articles that define or operationalize disaster preparedness in EMS settings. The protocol outlined a comprehensive methodology for data extraction and analysis, including quality assessment tools and thematic analysis techniques.

While it did not present results, the protocol highlighted significant gaps in comprehensive reviews of EMS provider preparedness. It emphasized the need to identify key preparedness components and strategies specific to the EMS context. This focus on systematically examining the preparedness of key emergency responders is highly relevant to assessing school preparedness, as schools may serve emergency functions during disasters and often interact with EMS providers in emergency situations. The protocol's approach to systematically reviewing and synthesizing preparedness literature could serve as a valuable model for conducting similar reviews in the context of school preparedness. Additionally, the emphasis on identifying key preparedness dimensions and enhancement strategies could inform the development of more comprehensive and effective preparedness programs for schools.

Dariagan et al. (2021) assessed the disaster preparedness of local governments in Panay Island, Philippines, surveying 92 municipalities. They found that municipalities were partially prepared overall, with higher preparedness levels for coastal and middle-income areas. The study examined preparedness across four criteria: systems and structures, policies and plans, building competencies, and equipment and supplies. Key challenges identified included insufficient manpower, poor data management, and diverse stakeholder attitudes. Interestingly, the research revealed that some areas were better prepared for certain hazards (such as earthquakes and forest fires) than for others (such as floods and typhoons), despite the latter being more frequent. The study also found that television was the most common mode of receiving information on disaster preparedness.

The study revealed significant gaps in preparedness for specific hazards and in certain geographic and economic areas. It highlighted the need for hazard-specific preparedness planning and more targeted efforts to improve preparedness in inland and lower-income areas. This multi-hazard, geographically differentiated approach to assessing preparedness is highly relevant to examining school preparedness across different contexts and for various hazards. The study's findings on the disparities in preparedness levels for different types of disasters could inform more nuanced approaches to school preparedness planning. Additionally, the identified challenges in local government preparedness, such as manpower and data management issues, are likely to be relevant to school preparedness efforts as well. The study's comprehensive approach to assessing preparedness across multiple criteria provides a valuable framework that could be adapted to evaluate and improve school disaster preparedness programs.



Disaster Readiness

In their systematic review of global disaster resilience themes and practices, Tiernan et al. (2018) noted a growing appreciation of resilience as a complex, social, economic, and physical concept. The study showed that resilience is built through the incorporation of community engagement and policy support; however, the implementation of these measures is not uniform across areas and domains. Throughout their study, the researchers noted that although there have been progressive changes in disaster management frameworks, challenges remain in stakeholder coordination, resource mobilization, and funding for preventive measures. These weaknesses were particularly apparent in areas with weak institutions and organizational structures, especially in terms of capacity to manage disaster risks and responses. The study also highlighted the need to build local capacity to fill these gaps, especially through community-based interventions and better policy enforcement structures.

This research is useful for disaster response because it establishes the importance of infrastructure protection in disaster risk reduction, especially for public facilities like schools. The focus on multi-dimensional resilience corresponds to attempts to meet both the design and organizational requirements for disaster risk reduction in public buildings, including their ability to resist and recover after disasters. As such, the study addresses funding and coordination gaps and offers practical recommendations to invest in areas that require support and to engage stakeholders as key partners in protecting vulnerable populations during disasters.

In a study by Khalilullah et al. (2023), the concept of structural resilience in buildings was examined, with particular emphasis on the use of modern engineering tools to enhance their resistance to natural disasters. The results showed that contemporary construction techniques, including incorporating disaster-resilient materials and new architectural designs, greatly improve a structure's ability to withstand adverse conditions such as earthquakes and typhoons. However, the study also showed that older buildings are at high risk because they do not meet current standards for building resilience. The study revealed that the main barriers were the high cost of implementing sophisticated construction practices and the limited capacity to do so in low-resource environments. These barriers frequently prevent the implementation of required modernization and retrofitting measures, resulting in many public and private buildings being insufficiently protected against disasters.

The fact that the study is based on the analysis of structural characteristics and the modernization process makes it relevant to the tasks of improving the readiness of public facilities for disasters. It stresses the need to retrofit existing buildings to comply with modern resilience codes, which is crucial for buildings used for learning and emergency centers. The study's focus on modernization costs and technical factors emphasizes the importance of funding and capacity development to enable communities to implement resilience measures without being hampered by budgetary and other technical limitations.

According to Fatma et al. (2020), there are several advantages to lifecycle-based structural interventions for disaster-prone buildings, with a focus on sustainability and costs throughout the lifecycle. The study also noted that the use of green materials and disaster-resistant features during retrofitting greatly improves buildings' ability to withstand natural disasters. As shown in this research, adopting a lifecycle perspective shows that these interventions not only enhance the structural lifespan but also improve community health by ensuring that vital infrastructure remains serviceable during disasters. However, using sustainable materials in retrofitting is cost-effective in the long run because maintenance costs are low. However, the study also revealed important barriers, including a lack of local professionals, a lack of familiarity with lifecycle methodologies, and inadequate funding, which hinder their adoption in vulnerable regions. Such challenges are even more apparent in LMICs with low technical know-how and financial capacity to address them, hence the need for capacity enhancement and resources.

This research is essential for improving disaster preparedness, as it provides a framework for enhancing the preparedness of public buildings, especially those used during disasters, such as schools and shelters. In line with



the goals of sustainable retrofitting, the study contributes to the creation of safer, longer-lasting public buildings that remain useful even under adverse conditions and, at the same time, lower operational costs. The results are consistent with the objectives of maintaining public infrastructure operations during disasters, emphasizing both safety and resilience. The identified barriers further support the necessity to devote funds and launch campaigns to promote the use of lifecycle-based approaches in DRM programs. Such approaches are crucial for developing infrastructure that is adequate for both normal and disaster-related demands, thereby promoting community recovery in the long run.

Domingo and Manejar (2018) have reviewed disaster preparedness and governance in the Philippines, focusing on LGUs in disaster risk reduction and management. They noted that while some LGUs have relatively improved funding for their disaster management systems, richer LGUs are found to have much better disaster risk reduction and preparedness. These differences were described as systematic, policy, organizational, and resource disparities, especially in rural and low-income settings. But the researchers pointed out that LGUs could be strategic partners in disaster preparedness if only they were supported by national organizations. The study also highlighted the need to improve the policy and financial preparedness of LGUs to close the gap between national disaster risk reduction and its actual implementation.

This study is particularly useful for initiatives that aim to increase the disaster resistance of public structures because of its focus on local administration in implementing preparedness strategies. The research identifies areas of poor coordination, inadequate resource mobilization, and poor policy execution in the context of DRRM and provides specific suggestions to enhance LGUs' disaster risk management capability. The results provide a rationale for developing targeted interventions to strengthen local governments and enhance the preparedness of public organizations, especially those that serve the most vulnerable populations in the event of a disaster. Moreover, the study establishes the need for synergy between national and local agencies in developing a harmonious disaster risk management framework that would contribute to stronger communities.

Geronimo and Gonzaga (2021) explored disaster prevention and response in rural communities and found that communities with higher incomes and population densities had better preparedness than smaller, less developed communities. The study found that higher preparedness levels were associated with factors such as greater resource endowments, stronger community involvement, and more extensive public education programs. On the other hand, inland and low-income areas were identified by the researchers as having high levels of risk due to limited access to disaster risk reduction information and products. The study also stressed the need for disaster education in relation to local planning and for involving stakeholders in the fight against these disparities.

The implications of these findings are especially important for disaster preparedness programs because they underscore the need for fair resource distribution and an appropriate focus on underserved areas. In this regard, the study is useful for understanding the directions for enhancing community preparedness, including education and community engagement in disaster planning. These findings are consistent with other goals to ensure that public structures, such as schools and community centers, can accommodate both normal and disaster-related activities. The focus on stakeholder involvement and the implementation of concrete measures highlights the need to enhance the capacity of local actors to strengthen the disaster preparedness system, which would be equally beneficial for all territories, both developed and developing.

School Facilities as Evacuation Centers

According to Save the Children (2017), the use of schools as temporary evacuation centers, especially in the Asia-Pacific region, requires a delicate balancing. Schools are the most common centers people turn to for shelter because they are easily accessible; this role exerts tremendous pressure on schools' primary function – education. This paper discusses several problems, such as population density, facility deterioration, and problems with the organization of safety for evacuees. Furthermore, the continued use of schools as shelters disrupts learning



activities and forces children out of classrooms and away from books. These challenges are why Save the Children is urging a more comprehensive approach to this problem, as well as clear policies that would not allow schools to be used as evacuation centers for extended periods, and the search for other shelters that would not have such consequences. It also emphasizes the need for pre-disaster planning, investment in dedicated evacuation facilities, and coordination among stakeholders to ensure efficient emergency response.

This policy brief is of particular interest for enhancing approaches to disaster preparedness and response in educational facilities. It offers useful recommendations on how to ensure that schools are used for both education and evacuation, but with adverse effects. In this way, Save the Children supports investments in other facilities and thus helps achieve a number of objectives related to protecting children's rights to education and to protection during emergencies. This approach is in consonance with long-term planning and resource mobilization to prevent the use of schools as shelters and to ensure that students' education is not disrupted by disasters. The report's focus on education and emergencies provides a perspective on regions that rely on schools during disasters.

Mutch (2015) provides an overview of the various roles of schools in disasters, on the basis of which the role of schools as emergency resources is explored. The study also highlights the dual role of schools as learning institutions and emergency shelters during disasters. This leads to conflict most of the time, especially when the needs of the evacuees are being weighed against the need to continue with normal schooling. The study provides examples of different kinds of disasters and how schools have addressed these issues through community involvement, prior to disaster planning, and efficient collaboration with local authorities. However, the study also reveals that for such initiatives to succeed, there is a need for resources, clear policies, and leadership support at the sub-national level.

The findings of this study are useful in understanding the problems related to the management of school facilities for evacuation purposes. These outcomes underline the importance of collaboration among government entities, school executives, and the public to ensure that schools are prepared to fulfill the roles they are required to play in emergencies. Consequently, this study contributes to the existing body of knowledge on disaster preparedness and the role schools play in supporting a community's recovery through policy development on effective strategies to implement before a disaster occurs. The focus on maintaining learning continuity while responding to an emergency aligns with the global call to build system resilience that prepares education systems for crisis response without losing sight of the core education agenda.

Tsioulou et al. (2021) discuss the possibility of schools serving as evacuation centers, using Cagayan de Oro, Philippines, as an example, with respect to structural integrity, accessibility, and resources. The study assesses schools' ability to effectively provide shelter during disasters and, at the same time, the effects of such use on the future of the school's structure and the delivery of education. This study shows that schools are the most available buildings during disasters, but when used frequently as shelters, they become damaged and cannot provide an adequate learning environment. The study also focuses on sustainable planning and the need for dedicated investment to reduce the pressure on schools. Further, it discusses the involvement of local authorities in ensuring that schools are provided with the necessary tools and resources to meet their dual mandate.

This study is significant for the management of disasters, especially in identifying the multiple uses of schools during disasters. In this regard, the study provides valuable insights into the advantages and disadvantages of adopting schools as evacuation centers and offers the following policy implications: Its focus on resources and planning aligns with the continuous improvement of disaster preparedness in schools to fulfill their educational and protective roles. This approach, in addition to meeting the current requirements of communities in emergencies, preserves the structural and functional condition of educational buildings.

The Department of Education (2024) also underscores the importance of the Ligtas Pinoy Centers Act in establishing specific evacuation centers across all LGUs in the Philippines. This historic policy is meant to



minimize the over-concentration of people, especially during disasters, in public schools so that educational institutions can effectively perform their core function of offering education. The announcement highlights the need for government investment and interagency cooperation to achieve this vision, especially in regions where populations are most vulnerable to natural disasters and need safe, usable shelters. The policy aims to tackle issues associated with the use of school facilities during disasters, such as structural collapse, transportation and movement complications, and the displacement of learners and instructors from their learning institutions.

This is a significant step toward improving disaster risk reduction and response in the Philippines. In prioritizing the construction of specialized evacuation facilities, the *Ligtas Pinoy Centers Act* complies with international standards and addresses the longstanding problem of dual-use facilities. The policy further enhances the protection of students' rights to continue their education without interruption and, at the same time, provides shelter to communities in the event of disasters. Its implementation is in line with sustainable disaster management, which ensures that the educational system is not INTERFERE with and that communities are ready for the impacts of natural disasters without compromising quality education or meeting the everyday needs of the people.

The *Philippine Star* (2023) raised awareness of challenges related to the use of schools as evacuation centers in the Philippines. The article points out the significant learning disruptions that stem from this practice, with an emphasis on areas prone to disasters, where schools are converted to other uses for extended periods. It discusses the pressures on institutions of learning, including physical structures, overcrowding, and management and security issues. The article advocates establishing alternative evacuation facilities to alleviate the burden on schools and ensure students' education remains uninterrupted. It also emphasizes the need for proactive disaster planning, including investments in dedicated infrastructure and the integration of disaster risk reduction measures in urban development plans.

This commentary is highly relevant to disaster preparedness efforts, as it underscores the practical and social consequences of relying on schools as shelters. By advocating for alternative solutions, the article contributes to the broader discourse on building disaster-resilient communities. Its emphasis on infrastructure investment and proactive planning resonates with ongoing efforts to enhance the capacity of local governments and reduce the dependency on educational institutions during emergencies. The *Philippine Star's* focus on protecting educational continuity and improving community preparedness aligns with global best practices and offers actionable insights for policymakers and stakeholders working to strengthen disaster resilience in vulnerable regions.

1.4.2 Local Literature and Studies

Local Literature and Studies:

The Philippines is a country prone to natural calamities; the question is when, not where. Creating a separate department for disaster preparedness and response is a first step toward enhancing the country's disaster resilience.

A systematic response to disaster response and preparedness began during the Marcos era. The Presidential Decree 1566 established the National Disaster Coordinating Council as the highest policymaking body for natural disasters. Nationwide decentralization movements began two decades ago. Disaster management and preparedness were entrusted to the Philippines' independent Local Governance Units in 1991. As a presidential entity, the National Disaster Coordinating Council's powers were severely diminished after devolution. Nearly four decades after the Marcos-era declaration, the *Philippine Disaster Risk Reduction and Management Act* superseded the National Disaster Coordinating Council. The NDRRMC was founded by a group of disaster management programs.

The NDRRMC's mandate to act jointly has grown ineffective. To show the NDRRMC's bureaucratic entanglement, RA 10121 establishes four pillars of disaster risk reduction: prevention, mitigation, preparedness, and response and recovery. The NDRRMC would then organize departmental responses around the pillars. On



the one hand, the DOST would coordinate OCD, DENR, and DPWH members for disaster prevention and mitigation; the DILG would coordinate and be advised by the PIA and OCD for disaster response; and the NEDA would lead efforts for disaster rehabilitation and recovery with NHA, OCD, DPWH, DOH, and DSWD.

In 2011, there were 18 floods and landslides, 12 typhoons (including Sendong), two volcanic eruptions, and one earthquake. Guha-Sapir et al. Last year's hurricane Bopha ravaged Mindanao, killing over 1000 people and destroying property, livelihoods, and infrastructure. Supertyphoon Haiyan (local name: Yolanda, category 5) killed 8,000 people and destroyed 1.2 million houses in 2013. (GFDRR, 2015; Campanero and Egargo 2017). Vinta and Urduja, which hit the Philippines before the end of 2017, killed or made hundreds missing and inflicted billions in damage. Tropical depression Usman brought floods and landslides that killed 126 people and damaged \$4 billion worth of agricultural products and infrastructure.

Macuha (2023) examined the physical vulnerability of public school buildings in Metro Manila that are frequently flooded. The study assessed the extent of flood hazards affecting school infrastructure by analyzing factors such as flood depth, structural integrity, and buildings' capacity to withstand flood impacts. The research found that numerous public schools are situated in flood-prone areas, making them highly susceptible to damage during heavy rainfall and extreme weather events. Flooding was shown to affect classrooms, learning facilities, electrical systems, and other essential components of school operations, resulting in disruptions to educational activities and increased repair and maintenance costs.

Furthermore, the study emphasized the importance of integrating flood-resilient infrastructure measures into school planning and development. Recommendations included upgrading building designs, improving drainage systems, elevating critical facilities, and incorporating disaster-resilient standards in school construction projects. The findings highlighted that the physical condition of school buildings plays a crucial role in ensuring continuity of education and the safety of students, teachers, and staff during floods. Strengthening school infrastructure was identified as a key strategy for enhancing overall disaster preparedness and resilience in educational institutions.

Lindawan (2024) investigated the level of disaster awareness, preparedness, and coping mechanisms among students, teachers, and school administrators in educational institutions within the Cordillera Administrative Region (CAR). The study sought to determine how stakeholders perceive disaster risks and how these perceptions influence their ability to respond effectively during emergencies. Results indicated that most participants possessed moderate to high levels of awareness regarding disaster risks, hazards, and safety protocols. This suggests that information dissemination programs, disaster risk reduction initiatives, and school-based awareness campaigns have contributed positively to enhancing stakeholders' knowledge of disaster preparedness.

Despite generally high levels of awareness, the study identified several challenges that hindered the effective implementation of disaster preparedness measures. These challenges included limited resources, insufficient emergency equipment, inadequate training opportunities, and gaps in the practical application of disaster response plans. Participants reported that while they were familiar with disaster preparedness concepts, their confidence in responding to actual emergencies varied due to resource and capacity constraints. The study also highlighted the coping mechanisms employed by schools, such as conducting regular drills, strengthening coordination among stakeholders, and promoting community participation in disaster risk reduction activities. These strategies were found to enhance resilience and improve schools' ability to adapt to disaster-related challenges.

Abregana (2025) examined the integration of Disaster Risk Reduction and Management (DRRM) education in public schools in Cebu, focusing on how disaster resilience concepts are incorporated into teaching, learning, and school-based preparedness programs. The study assessed schools' readiness to deliver DRRM-related instruction and evaluated the effectiveness of existing strategies for promoting disaster awareness and preparedness among students and educators. Findings revealed that while schools recognize the importance of DRRM education, its



implementation remains inconsistent due to various institutional and operational challenges. As a result, the full potential of DRRM education in building disaster-resilient school communities has not yet been fully realized.

The study identified several gaps that hinder the effective integration of DRRM into the curriculum. These included inadequate teacher training on disaster risk reduction concepts, limited availability of instructional materials and learning resources, and weak collaboration between schools, local government units, and community stakeholders. Such challenges affect the quality and sustainability of resilience education initiatives. To address these issues, Abregana proposed a framework that emphasizes capacity-building programs for teachers, the development of contextualized learning materials, and stronger school-community partnerships. The framework also highlighted the need to embed resilience education as a fundamental component of school preparedness efforts, ensuring that learners and educators are equipped with the knowledge and skills needed to respond to and recover from disasters effectively.

Dela Peña (2025) developed a structural equation model to examine the factors influencing disaster readiness among public schools in the SOCCSKSARGEN region. The study aimed to identify the key determinants of preparedness and to establish the relationships among various dimensions of school resilience. Using quantitative methods and statistical modeling, the research assessed how organizational resilience, school safety measures, and school managers' practices contribute to a school's overall capacity to prepare for, respond to, and recover from disasters. The findings demonstrated that disaster readiness is not determined by a single factor but rather by the interaction of multiple organizational and institutional components.

The study revealed that organizational resilience, effective school safety programs, and proactive leadership practices significantly influence the level of disaster preparedness within schools. School managers who actively promoted risk-reduction initiatives, coordinated preparedness activities, and fostered a culture of safety were found to enhance their institutions' readiness. Furthermore, schools with strong organizational structures, clear disaster management policies, and established safety protocols exhibited higher levels of preparedness. The structural equation model validated the interconnectedness of these factors and highlighted the importance of leadership and organizational capacity in strengthening school resilience to various hazards and emergencies.

Maputol et al. (2025) explored the concept of educational resilience among disaster-prone schools in the Philippines, focusing on how educational institutions maintain learning continuity during and after disasters. The study examined the strategies schools employ to ensure teaching and learning continue despite disruptions from natural hazards. Through their analysis, the researchers highlighted that resilience in education extends beyond physical infrastructure to include schools' capacity to adapt, recover, and sustain essential services during times of crisis. The findings demonstrated that schools that proactively plan for disruptions are better positioned to minimize the negative impacts of disasters on students' learning experiences.

The study further emphasized the importance of anticipatory governance, institutional preparedness, and active community participation in strengthening educational resilience. Schools that foster collaboration among administrators, teachers, parents, local government units, and community organizations were found to have greater capacity to respond effectively to emergencies and recover more quickly from disaster-related disruptions. Additionally, the research underscored the value of adaptive capacity, including flexible learning delivery mechanisms, contingency planning, and effective resource management. These factors were identified as critical components in sustaining school operations and ensuring uninterrupted access to education during and after disasters, particularly in flood-prone communities.

Dela Cruz and Ormilla (2022) evaluated the implementation of Disaster Risk Reduction and Management (DRRM) programs in public elementary schools in Ifugao. The study assessed the extent to which schools have adopted disaster preparedness initiatives, implemented risk-reduction measures, and established mechanisms to respond to various hazards. Specifically, the researchers examined the levels of awareness among school



personnel regarding disaster planning, the adequacy of preparedness activities, and the effectiveness of school responses during emergency situations. The findings indicated that public elementary schools generally demonstrated a satisfactory level of DRRM program implementation, reflecting compliance with existing policies and guidelines related to disaster risk reduction in the education sector.

Despite the positive assessment, the study identified several areas that require further enhancement to strengthen overall disaster readiness. Among these were the need for more comprehensive preparedness activities, regular disaster response training, and increased capacity-building programs for teachers, administrators, and other school stakeholders. The researchers noted that while schools had established DRRM structures and conducted basic preparedness measures, gaps remained in the practical application of disaster management plans and the continuous development of disaster response competencies. The study emphasized that sustained training, resource allocation, and stakeholder engagement are essential to improving schools' ability to effectively prepare for and respond to disaster events.

Polinar and Gonzaga (2023) investigated the level of awareness and involvement of public school teachers in School-Based Disaster Risk Reduction Management (SDRRM) initiatives in Baybay City. The study aimed to determine how well teachers understand disaster risk reduction concepts and the extent of their participation in school-based preparedness and response activities. Recognizing teachers as key stakeholders in disaster management, the researchers examined their knowledge of disaster policies, emergency procedures, and risk reduction strategies, as well as their engagement in activities such as disaster drills, preparedness planning, and awareness campaigns. The findings revealed that teachers generally demonstrated a high level of awareness regarding disaster risk reduction measures and recognized the importance of their role in promoting school safety and preparedness.

The study also found that teachers actively participated in various SDRRM initiatives, contributing to the implementation of preparedness programs and the dissemination of disaster-related information within their schools. However, differences in the degree of involvement among respondents indicated that not all teachers had the same level of engagement in disaster management activities. Factors such as training opportunities, experience, and institutional support were identified as possible influences on participation levels. Consequently, the researchers emphasized the need for continuous professional development, regular capacity-building programs, and sustained support from school administrators to ensure consistent and meaningful teacher involvement in SDRRM efforts. Strengthening teacher competencies was viewed as essential for enhancing the overall resilience and preparedness of educational institutions.

Sarmiento and colleagues (2024) developed a framework for assessing flood-related social vulnerability in Metro Manila to identify the factors that influence communities' capacity to cope with and recover from flood hazards. The study adopted a multidimensional approach by examining indicators of exposure, susceptibility, and resilience. Exposure refers to the degree to which individuals and communities are exposed to flood risks, while susceptibility refers to the characteristics that increase the likelihood of adverse impacts. Resilience capacities, on the other hand, encompassed the resources, support systems, and adaptive mechanisms available to reduce vulnerability and facilitate recovery from flood events. Through this framework, the researchers provided a more comprehensive understanding of flood vulnerability beyond the physical aspects of hazard exposure.

The findings revealed that flood resilience is shaped not only by geographic location or the frequency of flooding but also by various social, economic, and institutional factors. Communities with stronger social networks, better access to resources, effective governance structures, and higher levels of preparedness demonstrated greater resilience despite being exposed to similar flood risks. Conversely, populations facing economic constraints, limited institutional support, and inadequate preparedness measures were found to be more vulnerable to the adverse effects of flooding. The study emphasized that vulnerability and resilience are interconnected concepts

influenced by multiple dimensions, highlighting the importance of addressing social and institutional capacities alongside physical risk reduction strategies.

Malahay (2025) examined the implementation of disaster preparedness programs in secondary schools in Negros Oriental, focusing on the extent to which schools have adopted measures to enhance safety and readiness for potential hazards. The study assessed various aspects of disaster preparedness, including planning, resource availability, stakeholder participation, and the integration of disaster risk reduction practices into school operations. By evaluating the experiences of school personnel and stakeholders, the research sought to identify both the strengths and challenges associated with implementing disaster preparedness initiatives in educational institutions. The findings indicated that while schools have made efforts to comply with disaster preparedness policies and guidelines, several obstacles continue to affect the effectiveness of these initiatives.

Among the major challenges identified were limited financial and material resources, difficulties in coordinating among stakeholders, and gaps in disaster education and training. The study found that insufficient emergency equipment, inadequate funding, and a lack of continuous capacity-building programs hindered schools' ability to fully implement preparedness measures. Furthermore, effective disaster management was often constrained by weak collaboration among schools, local government units, community organizations, and other relevant stakeholders. In response, the study emphasized the importance of strengthening partnerships and fostering greater community involvement in disaster preparedness activities. Enhanced coordination, regular training programs, and collaborative planning efforts were recommended to improve disaster readiness and build more resilient educational institutions.

Daminar et al. (2025) assessed the implementation of Republic Act No. 10121, also known as the Philippine Disaster Risk Reduction and Management Act of 2010, in public schools. The study focused on evaluating how educational institutions implement the four key thematic areas of disaster risk reduction and management: prevention and mitigation, preparedness, response, and recovery and rehabilitation. Through an examination of school policies, disaster management practices, and stakeholder involvement, the researchers sought to determine the extent to which public schools comply with national DRRM guidelines. The findings revealed that most schools demonstrated a generally satisfactory level of compliance with the provisions of the law, indicating that disaster risk reduction has become an integral part of school governance and operational planning.

Despite the overall compliance, the study identified significant differences among schools in terms of administrative capacity, resource availability, and the effectiveness of DRRM implementation. Some schools were found to have stronger disaster management structures, better access to resources, and more comprehensive preparedness programs, while others faced challenges related to limited funding, inadequate facilities, and insufficient personnel training. These disparities affected the quality and sustainability of disaster resilience initiatives across educational institutions. The researchers emphasized that effective implementation of Republic Act No. 10121 requires not only adherence to policies but also strong leadership, institutional support, and adequate resources to ensure that schools can effectively prepare for, respond to, and recover from disaster events.

1.5 Statement of the Problem

This study aimed to assess the perceived flood resilience of a public school as evaluated by students.

Specifically, it sought to answer the following questions:

1. What is the overall perceived flood resilience rating of students to a public school in Rizal?
2. What is the level of flood resilience in terms of: a. Structural Resilience; b. Functional Continuity; and c. Preparedness & Management?
3. Which flood resilience dimension obtained the highest and lowest ratings?

4. Is there a significant difference in the respondents' ratings among: a. Structural Resilience; b. Functional Continuity; and c. Preparedness & Management?
5. Which pairs of resilience dimensions significantly differ based on post hoc analysis?
6. Based on the findings of the study, what Flood Resilience Action Plan may be proposed to enhance the resilience of the selected public school?

1.6 Hypotheses

Based on the comparative assessment of flood resilience dimensions—structural resilience, functional continuity, and preparedness and management—the following hypotheses are formulated:

Overall Hypotheses

The overall hypotheses will be tested using the Friedman test to determine whether significant differences exist among the three flood resilience dimensions.

Null Hypothesis (H_0): There is no significant difference in the median ratings of respondents across the three flood resilience dimensions of public-school buildings in Rizal Province.

Pairwise Hypotheses

If the overall null hypothesis is rejected, post hoc pairwise comparisons are conducted using the Wilcoxon Signed-Rank Test with Bonferroni adjustment. The following null hypotheses were tested:

H_{01} : Structural resilience does not significantly differ from functional continuity in terms of perceived flood resilience.

H_{02} : Structural resilience does not significantly differ from preparedness and management in terms of perceived flood resilience.

H_{03} : Functional continuity does not significantly differ from preparedness and management in terms of perceived flood resilience.

Level of Significance

All statistical tests were conducted at a 0.05 level of significance. For the pairwise comparisons, a Bonferroni-adjusted alpha level of 0.0167 will be applied to control for Type I error.

1.7 Scope and Limitations of the Study

This study focuses on assessing the flood resilience of public elementary and secondary school buildings in Rizal Province. It examines three key dimensions—structural resilience, functional continuity, and preparedness and management—using a survey-based approach and document review to determine the level of preparedness and readiness of these facilities as evacuation centers. The study is limited to perception-based data and does not include actual structural or engineering testing of buildings. It excludes private schools and higher education institutions to maintain a consistent sample and is geographically confined to Rizal Province, which may limit generalizability to other regions. Additionally, the research emphasizes physical infrastructure and preparedness measures, with limited discussion of operational disaster response, training effectiveness, and detailed economic analysis. Despite these limitations, the study provides relevant insights and practical recommendations for improving the flood resilience of public-school buildings within the province.



2. Methods

2.1 Research Design

This study utilized a quantitative descriptive-comparative research design to assess the perceived flood resilience of a public school in Rizal Province. The descriptive component of the study was used to determine the overall level of perceived flood resilience and the mean ratings for the three resilience dimensions: Structural Resilience, Functional Continuity, and Preparedness and Management. Meanwhile, the comparative component was employed to determine whether significant differences existed among the respondents' ratings of the three flood resilience dimensions.

The study adopted a non-experimental approach because the researcher did not manipulate any variables; instead, data were gathered from respondents' perceptions and experiences regarding the flood resilience of their school. Since the same group of respondents evaluated all three resilience dimensions, the study involved repeated measures data. Consequently, the Friedman Test was used to determine whether significant differences existed among the three related constructs, while the Wilcoxon Signed-Rank Test was employed as a post hoc analysis to identify which specific pairs differed significantly.

The study focused on assessing perceived flood resilience in terms of Structural Resilience, Functional Continuity, and Preparedness and Management.

2.2 Locale of the Study

This study focused on Tagumpay National High School in Rizal province, which is very vulnerable to natural disasters like earthquakes, floods, and landslides because it is in the vicinity of the West Valley Fault and the East Valley Fault. Like many of the schools in the province, the school struggles with the issue of disaster preparedness because much of the facility was built years ago and might not have been built to modern standards of disaster-proof construction. The previous disasters like the devastating flood caused by Typhoon Ulysses in November 2020 revealed that the school structures and disaster risk reduction management were inadequate in addressing the safety and learning needs of the learners. The purpose of this study is to evaluate the school's vulnerability to hazards such as geophysical conditions, age and structural condition of the buildings and the current state of disaster preparedness. In this regard, the study aims to contribute relevant findings and recommendations that will be beneficial to the Tagumpay National High School as a model school in enhancing the disaster risk reduction management in other public schools in Rizal province.

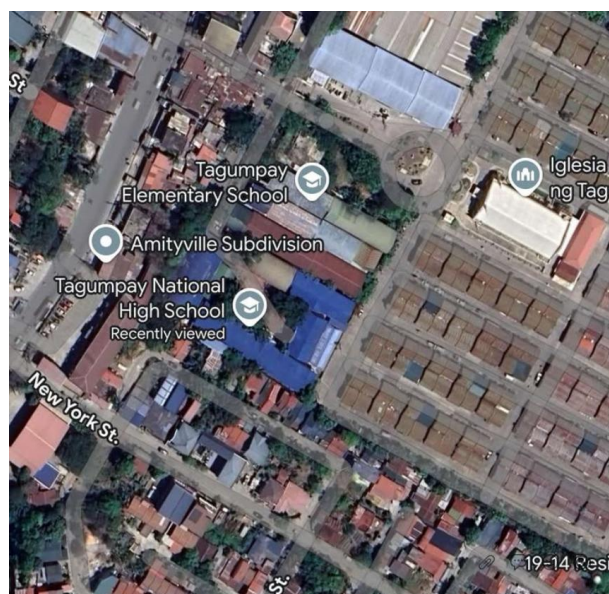


Figure 1. The Location Map of Tagumpay National High School

2.3 Respondents and Sampling Technique

The study's respondents comprised 107 officially enrolled junior and senior high school students at **Tagumpay National High School during School Year 2025–2026**. These students were selected through simple random sampling because they are the primary users and daily occupants of the school facilities and are directly affected by flood-related disruptions, emergency procedures, and disaster preparedness measures. The study employed simple random sampling in selecting the respondents. In this sampling technique, every student in the target population had an equal chance of being selected to participate in the study. The respondents were chosen randomly from the official list of enrolled students to minimize selection bias and ensure fair representation of the population.

To determine the minimum required sample size, the researcher conducted an a priori power analysis using G*Power version 3.1 for a repeated-measures ANOVA. The parameters used in the analysis included an effect size of 0.50, an alpha level of 0.05, statistical power of 0.80, and three repeated measures corresponding to the flood resiliency dimensions: Structural Resiliency, Functional Continuity, and Preparedness and Management.

The G*Power analysis indicated that a minimum sample size of 28 is sufficient to detect a moderate effect for the study. To ensure adequate statistical power and account for possible non-responses or incomplete questionnaires, the researcher included 107 student respondents in the final sample

2.4 Research Instrument

This study employed a structured questionnaire as the primary research instrument to assess respondents' experiences and perceptions of the disaster resilience of public school buildings, with a particular focus on flood events. The instrument consists of 20 carefully crafted questions addressing specific aspects of school building resilience and disaster preparedness, using a four-point Likert scale with response options coded as 1 for "Never," 2 for "Sometimes," 3 for "Often," and 4 for "Always." It consisted of statements related to flood resiliency, categorized into three dimensions:

The questionnaire contained a total of twenty (20) items distributed across the three dimensions:

Structural Resiliency (SR)

- Does the school building remain structurally sound during flood events?
- Does the school have effective flood prevention measures, such as proper drainage and elevated structures?
- Do you feel the school building is safe during flood events?
- Has the school undergone retrofitting to improve its resilience to floods?
- Is flood-related infrastructure, such as sandbags and barriers, available and maintained at the school?
- Do school buildings and facilities get inspected regularly for flood-related vulnerabilities?

Functional Continuity (FC)

- Are classrooms and other school facilities quickly usable after floods?
- Does the school serve as an effective evacuation center for the community during floods?
- Is there minimal disruption to classes due to flooding?
- Are important school records and equipment protected from flood damage?
- Are flood-prone areas within the school grounds clearly marked and avoided?
- Are exits and pathways always clear of obstruction during flood emergencies?
- Are parent and guardian communications effective during flooding events?

Preparedness and Management (PM)

- Is there a clear evacuation plan that students and staff are aware of?
- Are adequate emergency supplies available during flood events?
- Does the school conduct regular flood preparedness drills?
- Does the school have an early warning system for impending floods?
- Is flood safety included in students' education or drills?
- Are there designated staff members responsible for emergency coordination during floods?
- Has the community participated in joint flood drills with the school?

Prior to full implementation, the instrument underwent pilot testing to ensure clarity, effectiveness, and accuracy in data collection. To establish content validity, the questionnaire was evaluated by experts in disaster risk reduction, education, and research methodology. Their comments and suggestions were incorporated to improve the instrument's clarity, relevance, and appropriateness.

In addition, the internal consistency and reliability analysis revealed that the overall instrument achieved a Cronbach's alpha of 0.848, indicating good internal consistency. Among the constructs, Preparedness and Management demonstrated acceptable reliability ($\alpha = 0.786$), while Structural Resilience ($\alpha = 0.624$) and Functional Continuity ($\alpha = 0.618$) showed moderate internal consistency. Although the latter values are slightly below the conventional threshold of 0.70, they are deemed acceptable given the study's exploratory nature and the instrument's contextual adaptation. These results suggest that the instrument is sufficiently reliable for assessing the resilience of public school buildings.

Table 1 summarizes the instrument's internal consistency reliability.

**Table 1. Cronbach's Alpha for the Flood Resilience Questionnaire**

Construct	Cronbach's Alpha	Number of Items
Structural Resilience (SR)	.624	6
Functional Continuity (FC)	.618	7
Preparedness and Management (PM)	.786	7
Overall	.848	20

2.5 Data Gathering Procedures and Statistical Treatment

Prior to data collection, the researcher secured approval from the school administration and obtained the necessary permissions to conduct the study. A formal letter requesting permission to administer the survey questionnaire was submitted to the school principal.

After obtaining approval, the researcher coordinated with teachers and school officials on the survey schedule and administration. The respondents were informed about the purpose of the study, the voluntary nature of participation, and the confidentiality of their responses.

The researcher used simple random sampling to select respondents from the official list of enrolled students. The survey questionnaires were then distributed personally to the selected respondents.

The respondents were given sufficient time to answer the questionnaire honestly and completely. After the completed questionnaires were retrieved, the responses were checked for completeness and accuracy.

The collected data were encoded, organized, and analyzed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics, such as the mean, variance, and confidence intervals, were used to determine the level of perceived flood resiliency for the school and its three resiliency dimensions. Mean ranks were also computed to determine which resiliency dimension obtained the highest and lowest ratings.

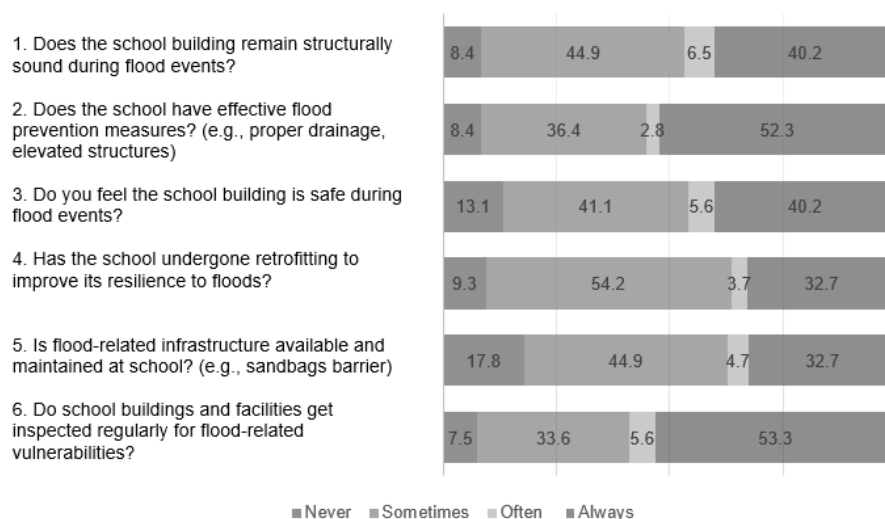
Since the same respondents evaluated the three resiliency dimensions, the Friedman Test was used to determine whether significant differences existed among Structural Resiliency, Functional Continuity, and Preparedness and Management. Furthermore, the Wilcoxon Signed-Rank Test was employed as a post hoc analysis to identify the specific pairs of dimensions that significantly differed.

3. Results

This chapter presents the statistical analysis, interpretation, and discussion of the data gathered in the study. The findings focus on the three dimensions of flood resilience, namely Structural Resilience (SR), Functional Continuity (FC), and Preparedness & Management (PM). Descriptive and inferential statistical tools were used to determine the level of resilience and identify significant differences among the variables.

3.1 Structural Resilience

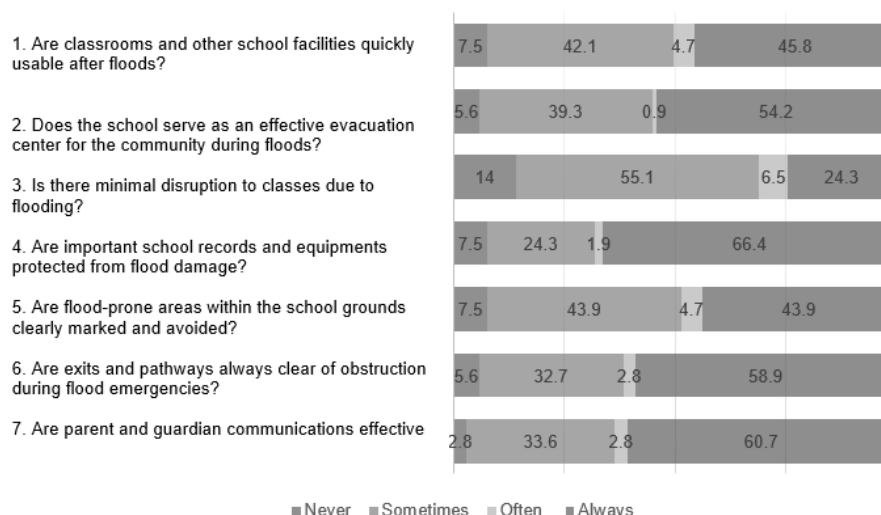
Figure 2. Percentage (%) of Structural Resilience Ratings of Students per Question



Across all six items, outright negative evaluation — represented by "Never" — constitutes a distinct minority, peaking at 17.8% for Question 5 and falling as low as 8.4% for Questions 1 and 2. However, the defining feature of the data is the concentration of "Sometimes" responses, which is the most frequent rating across all six items, most notably 54.2% for Question 4. Question 6 shows the highest structural confidence, with 58.9% combined "Often" and "Always" responses.

3.2 Functional Continuity

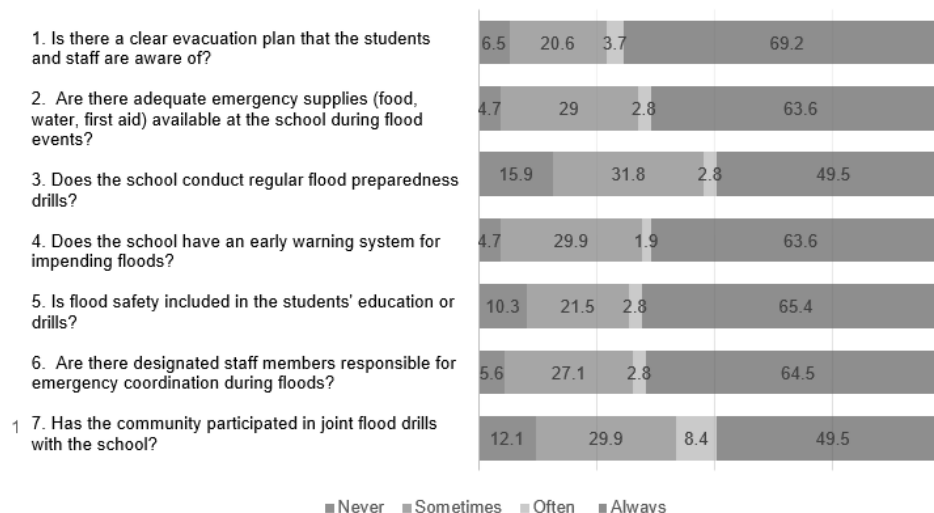
Figure 3. Percentage (%) of Functional Continuity Ratings of Students per Question



The very low percentage of "Never" responses across all seven items (as low as 2.8% for Question 7) indicates that flood events do not cause a complete collapse of school operations. The high concentration of "Sometimes" responses, peaking at Question 3 (55.1%), indicates that operational continuity is conditional. The school achieves its highest rating on Question 4, where 66.4% of respondents report that important school records and equipment are "Always" protected from flood damage, with only 7.5% selecting "Never."

3.3 Preparedness and Management

Figure 4. Percentage (%) of Preparedness and Management Ratings of Students per Question



Unlike the two previous constructs, "Always" is the most frequent response across all seven Preparedness and Management items, ranging from 49.5% to 69.2% of responses. Question 1 (awareness of evacuation plans)

obtained the highest positive rating, with 69.2% of students selecting "Always" and only 6.5% selecting "Never," followed by 65.4% of respondents rating flood safety education as "Always" provided. The weakest points in this construct are Question 3 and Question 7, both concerning the physical execution of drills rather than planning or education.

3.4 Descriptive Statistics of Flood Resilience Dimensions

Table 2. Descriptive Statistics of Flood Resilience Dimensions in a Public-School Building in Rizal Province

Variable	Mean	Median	SD	IQR	95% CI (Lower)	95% CI (Upper)
Structural Resilience (SR)	2.87	3.00	0.64	1.00	2.75	2.99
Functional Continuity (FC)	2.90	2.86	0.59	0.86	2.79	3.01
Preparedness & Management (PM)	3.17	3.42	0.72	1.00	3.03	3.31
Flood Resilience (Overall)	2.98	3.00	0.54	0.80	2.88	3.09

Table 2 above presents the descriptive statistics for the respondents' perceived flood resilience of the public school in terms of Structural Resiliency (SR), Functional Continuity (FC), and Preparedness and Management (PM). Among the three dimensions, Preparedness and Management (PM) obtained the highest median score (Mdn = 3.42, IQR = 1.0), followed by Structural Resiliency (SR) (Mdn = 3.0, IQR = 1.0), and Functional Continuity (FC) (Mdn = 2.86, IQR = 0.86). The overall perceived flood resilience of the school yielded a median score of 3.0 (IQR = 0.80).

Based on the Likert scale interpretation, most dimensions fall between "Sometimes" and "Often," while Preparedness and Management fall between "Often" and "Always." This suggests that respondents generally viewed flood resilience measures and practices as commonly implemented within the school, with preparedness-related

3.5 Test of Normality

Prior to conducting inferential analysis, normality tests were performed to determine the appropriate statistical test for comparing Structural Resilience (SR), Functional Continuity (FC), and Preparedness and Management (PM).

Table 3. Tests of Normality of the Three Flood Resilience Dimensions

Variable	Kolmogorov–Smirnov			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SR	.114	107	.002	.969	107	.013
FC	.112	107	.002	.967	107	.010
PM	.194	107	<.001	.898	107	<.001

The Kolmogorov-Smirnov and Shapiro-Wilk tests, as shown in Table 3, indicated that none of the three variables were normally distributed. Specifically, SR (KS $p = .002$; SW $p = .013$), FC (KS $p = .002$; SW $p = .010$), and PM (KS $p < .001$; SW $p < .001$) all showed significance values below the 0.05 level. Non-parametric tests (Friedman Test, Wilcoxon Signed-Rank Test) were therefore used for the comparative analysis.

3.6 Comparison of Flood Resilience Dimensions (Friedman Test)

Table 4. Friedman Test Result for Perceived Flood Resilience Dimensions

Dimension	Mean Rank
SR	1.83
FC	1.83
PM	2.34

Test Statistics	
N	107
Chi-Square	19.886
df	2
Asymp. Sig.	<.001

As shown in Table 4, the Friedman Test result rejected the null hypothesis (H_0), which stated that there is no significant difference in respondents' ratings across the three flood resilience dimensions. The obtained p -value ($< .001$) is lower than the 0.05 level of significance, indicating that at least one flood resilience dimension significantly differs from the others.

3.7 Post Hoc Pairwise Comparisons (Wilcoxon Signed-Rank Test)

Following the significant Friedman Test result, pairwise comparisons were performed using the Wilcoxon Signed-Rank Test. To control the family-wise error rate from multiple comparisons, the Bonferroni correction was applied. With three pairwise comparisons conducted among SR, FC, and PM, the adjusted significance threshold was set at $p < 0.017$ ($0.05 \div 3$).

Structural Resilience (SR) vs. Functional Continuity (FC)

Table 5. Wilcoxon Signed-Rank Test — Structural Resilience (SR) and Functional Continuity (FC)

Hypothesis Test Summary	
Null hypothesis	The median of differences between SR and FC equals 0.
Test	Related-Samples Wilcoxon Signed-Rank Test
Total N	107

Test statistic	2798.500
Standard error	308.291
Standardized test statistic (Z)	.222
Asymptotic sig. (2-sided)	.824
Decision	Retain the null hypothesis

The Wilcoxon Signed-Rank Test (Table 5) revealed no statistically significant difference between Structural Resilience (SR) and Functional Continuity (FC), $Z = 0.222$, $p = .824$. Since the p-value exceeded the Bonferroni-adjusted significance level of 0.017, the null hypothesis was retained. This finding suggests that respondents perceived SR and FC at relatively similar levels. The similarity in responses may indicate that both infrastructure resilience and operational continuity share comparable strengths and limitations in the context of flood resilience.

Since the obtained Asymptotic Sig (2-sided t-test), which is p-value (.824), is greater than the Bonferroni-adjusted significance level of .017, the stated null hypothesis (H_{01}) here is relatively accepted (or more precisely, retained in order of the analysis). Therefore, no statistically significant difference exists between the two factors in the study from Structural Resilience and Functional Continuity based on the respondents' assessments. This indicates that respondents, again, perceived both dimensions at relatively similar levels of flood resilience.

Preparedness and Management (PM) vs. Functional Continuity (FC)

Table 6. Wilcoxon Signed-Rank Test — Preparedness and Management (PM) and Functional Continuity (FC)

Hypothesis Test Summary	
Null hypothesis	The median of differences between PM and FC equals 0.
Test	Related-Samples Wilcoxon Signed-Rank Test
Total N	107
Test statistic	1155.000
Standard error	260.144
Standardized test statistic (Z)	-3.961
Asymptotic sig. (2-sided)	<.001
Decision	Reject the null hypothesis

The Wilcoxon Signed-Rank Test (Table 6) revealed a statistically significant difference between Preparedness & Management (PM) and Functional Continuity (FC), $Z = -3.961$, $p < .001$, which is lower than the Bonferroni-adjusted significance level of 0.017. The negative Z value indicates that FC scores were generally lower than PM scores. This finding is further supported by the higher mean rank obtained by PM (2.34) compared to FC (1.83), suggesting that respondents rated preparedness and management practices more favorably than functional

continuity measures. The results imply that although preparedness strategies and disaster management systems are relatively well established, the continuity of operations and services during flood events may still require improvement.

Structural Resilience (SR) vs. Preparedness and Management (PM)

Table 7. Wilcoxon Signed-Rank Test — Structural Resilience (SR) and Preparedness and Management (PM)

Hypothesis Test Summary	
Null hypothesis	The median of differences between SR and PM equals 0.
Test	Related-Samples Wilcoxon Signed-Rank Test
Total N	107
Test statistic	3865.000
Standard error	290.765
Standardized test statistic (Z)	4.609
Asymptotic sig. (2-sided)	<.001
Decision	Reject the null hypothesis

Lastly, the comparison between Structural Resilience (SR) and Preparedness & Management (PM), as shown in Table 7, also revealed a statistically significant difference ($Z = 4.609$, $p < .001$), which is lower than the Bonferroni-adjusted significance level of 0.017. Based on the direction of the results and the rank patterns observed across the variables, Preparedness & Management (PM) was found to have higher ratings than Structural Resilience (SR). This indicates that respondents perceived preparedness-related actions, emergency planning, and management strategies to be more developed or effective than the system's structural capacity and physical resilience. The findings suggest that while preparedness mechanisms are relatively strong, improvements in infrastructure resilience and structural mitigation measures may still be necessary to enhance overall flood resilience.

Since the obtained p-value ($< .001$) listed in the actual results is lower than the Bonferroni-adjusted significance level of .017, the null hypothesis (H_0) is clearly rejected. This indicates that Preparedness and Management significantly differ from Structural Resilience in the study. The findings suggest that respondents perceived preparedness-related measures to be stronger than the school's ability to maintain operational continuity during flood events, given the circumstances and benefactors.



4. Discussion

The findings indicate that among the three dimensions of flood resilience, Preparedness and Management (PM) was perceived as the most evident within the school. This finding supports the study of **Geronimo and Gonzaga (2021)**, who found that disaster preparedness activities, stakeholder coordination, and continuous education significantly enhance institutional resilience. Likewise, **Verheul and Dückers (2020)** emphasized that organizations with well-established preparedness systems demonstrate greater disaster readiness. This suggests that respondents recognize the existence of established protocols, planning activities, and management practices for flood risk reduction. In disaster resilience literature, preparedness is often emphasized as a critical factor in minimizing disruption and ensuring effective response during hazard events. The relatively higher median rating for PM suggests that the school may have more visible or more frequently implemented activities, such as emergency planning, awareness campaigns, or coordination mechanisms, compared with other resilience dimensions.

In contrast, Functional Continuity (FC) and Structural Resiliency (SR) obtained slightly lower median scores, though still within the "Sometimes" to "Often" range. This finding is consistent with **Maputol et al. (2025)**, who emphasized that continuity of educational services remains one of the most challenging aspects of disaster resilience because schools often experience interruptions during hazard events. For Structural Resilience, the result agrees with **Khalilullah et al. (2023)**, who stated that continuous infrastructure improvement and retrofitting significantly contribute to disaster-resilient public buildings. This may suggest that while systems and facilities are generally perceived as adequate, there may still be limitations in maintaining uninterrupted school operations during flood events and in the physical robustness of school infrastructure. Structural resiliency reflects long-term investments in building safety and infrastructure quality, which may require more resources and planning compared to preparedness activities. Similarly, functional continuity depends on the school's ability to sustain learning processes during disruptions, which can be influenced by both physical infrastructure and administrative capacity.

Overall, the median rating indicates that the school is generally perceived to have moderate to high flood resilience, with preparedness-related practices being the most developed aspect. This pattern implies that while the school demonstrates awareness and readiness to manage flood risks, further improvements may be needed to strengthen infrastructure resilience and ensure uninterrupted educational delivery during flood-related disruptions.

Taken together, these results support the Disaster Resilience Framework underpinning this study: Preparedness and Management — which maps most closely onto resourcefulness — was the most strongly and consistently endorsed dimension, while Functional Continuity and Structural Resilience, which draw more heavily on physical infrastructure and sustained investment, lagged behind. This pattern is consistent with the Friedman and Wilcoxon results reported in Section 3.6–3.7, which found Preparedness and Management significantly higher than both other dimensions, while Structural Resilience and Functional Continuity did not significantly differ from each other.

5. Conclusion and Recommendations

5.1 Conclusion

Based on the study's findings, the Friedman Test revealed a statistically significant difference among the three flood resilience dimensions: Structural Resilience (SR), Functional Continuity (FC), and Preparedness and Management (PM). Subsequent pairwise comparisons using the Wilcoxon Signed-Rank Test showed that Structural Resilience differed significantly from Preparedness and Management, and that Functional Continuity likewise differed significantly from Preparedness and Management. However, no significant difference was found between Structural Resilience and Functional Continuity.

Overall, Preparedness and Management (PM) emerged as the strongest flood resilience dimension, indicating that respondents generally perceive the school's planning, preparedness initiatives, and disaster management strategies to be well established. In contrast, Functional Continuity (FC) obtained the lowest rating, suggesting that the school's ability to sustain essential operations and educational services during and after flood events requires further improvement. Although Structural Resilience (SR) received a relatively favorable assessment, it ranked slightly higher than Functional Continuity, indicating that while respondents perceive the school's physical infrastructure as generally adequate, opportunities remain to further strengthen its resilience to flood-related hazards.

These findings suggest that although the school demonstrates strong disaster preparedness and management practices, greater attention should be given to improving operational continuity during emergencies while continuously enhancing the resilience of its physical infrastructure. Overall, a more integrated approach that balances preparedness, structural resilience, and continuity planning is essential to strengthen the school's overall flood resilience.

5.2 Summary of Recommendations

To facilitate the presentation of the proposed interventions, **Table 8** summarizes the study's major findings, corresponding recommendations, responsible stakeholders, and supporting literature. The detailed discussion of each recommendation is presented in the succeeding sections.

Table 8. Summary of Recommendations Based on the Findings of the Study

Key Finding	Recommendation	Responsible Stakeholders	Supporting Literature
Functional Continuity (FC) obtained the lowest perceived rating among the three flood resilience dimensions.	Strengthen continuity planning by establishing backup communication systems, alternative learning delivery mechanisms, digital records management, recovery procedures, and regular continuity simulation.	DepEd, School Administrators, School DRRM Committee	Bruneau et al. (2003); Verheul & Dückers (2020)
Structural Resilience (SR) received a favorable assessment but ranked slightly higher	Conduct periodic structural vulnerability assessments, prioritize retrofitting of vulnerable facilities, improve drainage systems, reinforce	DepEd, LGU, Municipal Engineering Office, LDRRMO, School Administration	Bruneau et al. (2003); Khalilullah et al. (2023)

than Functional Continuity (FC).	critical infrastructure, and ensure compliance with disaster-resilient building standards.		
Preparedness and Management (PM) received the highest perceived rating among the three dimensions.	Sustain and continuously improve disaster preparedness through regular training, simulation exercises, periodic evaluation of emergency response plans, and stakeholder participation.	DepEd, School Administration, School DRRM Committee, LDRRMO	Verheul & Dückers (2020); Geronimo & Gonzaga (2021)
Significant differences were observed among the three flood resilience dimensions.	Adopt an integrated resilience framework that systematically aligns structural resilience, operational continuity, and preparedness initiatives through coordinated planning and implementation.	DepEd, School Administration, LGU, DRRM Offices	Bruneau et al. (2003); Cutter et al. (2008)
Variations in resilience dimensions indicate the need for stronger institutional support and sustained investment.	Strengthen disaster risk reduction policies, integrate resilience objectives into school planning documents, and prioritize adequate allocation of financial, technical, and human resources.	DepEd, LGUs, School Administration, Policymakers, LDRRMO	Domingo & Manejar (2018); Tiernan et al. (2018)
Further validation of the proposed framework is necessary.	Conduct future studies involving multiple schools, stakeholders, hazard contexts, and research methodologies to further validate and refine the proposed flood resilience framework.	Future Researchers, Higher Education Institutions, Research Organizations	DeVellis (2017); Kline (2016)

5.3 Detailed Recommendations

1. Strengthen Functional Continuity (FC)

Since Functional Continuity (FC) obtained the lowest perceived rating among the three flood resilience dimensions, strengthening the school's ability to sustain essential operations during and after flood-related emergencies should be prioritized. Although the school demonstrates existing preparedness measures, the findings suggest that additional efforts are needed to ensure the uninterrupted delivery of educational services, administrative functions, and student support during disaster situations.

To strengthen functional continuity, the Department of Education (DepEd), school administrators, and the School Disaster Risk Reduction and Management (DRRM) Committee should develop, regularly review, and update comprehensive School Continuity Plans. These plans should include procedures for maintaining teaching and learning activities, administrative operations, communication systems, and student support services during and after flood events. Schools are likewise encouraged to establish backup communication systems, adopt alternative

learning delivery mechanisms when face-to-face classes are disrupted, secure essential records through digital backup systems, and conduct regular continuity simulation exercises to evaluate the effectiveness of continuity procedures and identify areas for improvement.

This recommendation is directly supported by the study's findings, which identified Functional Continuity as the dimension requiring the greatest improvement among the three flood resilience dimensions. Strengthening continuity planning is expected to minimize disruptions to educational services, improve institutional preparedness, and enhance the school's capacity to recover efficiently from flood-related emergencies while maintaining essential operations.

Furthermore, this recommendation is consistent with the Disaster Resilience Framework of Bruneau et al. (2003), which emphasizes the importance of resourcefulness and rapidity in sustaining critical functions and facilitating recovery following disasters. It is likewise supported by Verheul and Dückers (2020), who highlighted that resilient institutions should complement emergency preparedness with effective continuity planning to ensure that critical organizational functions are maintained before, during, and after disaster events.

2. Sustain and Enhance Structural Resilience (SR)

Although Structural Resilience (SR) received a relatively favorable assessment, continuous enhancement of the school's physical infrastructure remains essential to further strengthen its capacity to withstand flood-related hazards. The findings indicate that while respondents generally perceive the school's structural condition positively, maintaining and improving resilient infrastructure is necessary to support long-term disaster resilience.

The Department of Education (DepEd), in collaboration with the Local Government Unit (LGU), the Municipal Engineering Office, and the Local Disaster Risk Reduction and Management Office (LDRRMO), should conduct periodic structural vulnerability assessments to identify infrastructure deficiencies and prioritize appropriate mitigation measures. Based on the assessment results, schools should implement structural retrofitting where necessary, improve drainage systems, reinforce critical facilities, elevate flood-prone utilities whenever feasible, and ensure compliance with applicable building codes and disaster-resilient design standards.

This recommendation is supported by the study's findings, which indicate that Structural Resilience remains an important component of overall flood resilience despite receiving a more favorable assessment than Functional Continuity. Continuous investment in resilient infrastructure is expected to reduce the vulnerability of school buildings, improve occupant safety during flood events, and strengthen the school's ability to continue serving as both an educational institution and, when necessary, an emergency evacuation facility.

Furthermore, this recommendation is consistent with the Disaster Resilience Framework of Bruneau et al. (2003), which identifies robustness as a fundamental characteristic of resilient infrastructure. It is also supported by Khalilullah et al. (2023), who emphasized that continuous infrastructure enhancement and resilient engineering practices significantly improve public facilities' capacity to withstand natural hazards and support long-term resilience.

3. Sustain and Enhance Preparedness and Management (PM)

Preparedness and Management (PM) received the highest rating among the three flood resilience dimensions, indicating that respondents generally perceived the school's disaster preparedness initiatives, emergency planning, and management practices as well-established. Despite this positive finding, disaster preparedness should remain a continuous process that evolves in response to emerging hazards, changing environmental conditions, and advances in disaster risk reduction strategies.



To sustain and further strengthen preparedness and management practices, the Department of Education (DepEd), school administrators, and the School Disaster Risk Reduction and Management (DRRM) Committee should regularly review and update disaster preparedness plans, emergency response protocols, and evacuation procedures to ensure their continued relevance and effectiveness. Schools should conduct periodic disaster preparedness training, simulation exercises, and capacity-building programs involving students, teachers, non-teaching personnel, parents, and local emergency response agencies. Furthermore, post-drill evaluations and after-action reviews should be institutionalized to identify strengths, address operational gaps, and continuously improve emergency preparedness programs.

This recommendation is directly supported by the study's findings, which identified Preparedness and Management as the strongest dimension of perceived flood resilience. Maintaining this strength through continuous evaluation, stakeholder participation, and regular capacity-building activities will help ensure that disaster preparedness programs remain effective and responsive to evolving risks while complementing improvements in structural resilience and functional continuity.

This recommendation is likewise supported by Verheul and Dückers (2020), who emphasized that disaster preparedness requires continuous planning, coordination, training, and evaluation rather than one-time implementation. Similarly, Geronimo and Gonzaga (2021) highlighted that sustained community participation, disaster education, and regular preparedness activities significantly strengthen institutional disaster resilience and emergency readiness.

4. Adopt an Integrated Resilience Framework

The study's findings revealed significant differences among Structural Resilience, Functional Continuity, and Preparedness and Management, indicating that the three dimensions of flood resilience are not equally developed. While Preparedness and Management demonstrated relatively stronger performance, Structural Resilience and Functional Continuity require further improvement. These variations highlight the importance of adopting a comprehensive and integrated approach to resilience rather than implementing isolated interventions.

To address this imbalance, the Department of Education (DepEd), school administrators, and relevant local government agencies should adopt an integrated resilience framework that systematically aligns infrastructure improvement, operational continuity planning, and disaster preparedness initiatives within a unified disaster risk reduction strategy. This may include integrating resilience objectives into school improvement plans, coordinating infrastructure investments with emergency preparedness programs, establishing inter-agency collaboration among key stakeholders, and regularly monitoring the implementation and effectiveness of resilience initiatives through periodic assessments and evaluations.

This recommendation is directly supported by the study's findings, which demonstrate that strengthening a single dimension of resilience is insufficient to achieve comprehensive disaster readiness. A coordinated approach that simultaneously enhances structural capacity, operational continuity, and preparedness measures is more likely to improve the school's overall resilience against flood-related hazards.

Furthermore, this recommendation is consistent with the Disaster Resilience Framework proposed by Bruneau et al. (2003), which emphasizes that disaster resilience is achieved through the combined interaction of robustness, redundancy, resourcefulness, and rapidity. Likewise, Cutter et al. (2008) emphasized that resilience should be viewed as a multidimensional concept requiring coordinated efforts across physical, organizational, and social systems to effectively reduce disaster risks and enhance long-term recovery.



5. Enhance Policy Development and Resource Allocation

The findings of the study indicate that while disaster preparedness and management practices are relatively well-established, improvements in structural resilience and functional continuity remain necessary to achieve a more balanced level of flood resilience. These findings highlight the need for institutional policies that not only strengthen preparedness programs but also prioritize long-term investments in resilient infrastructure and continuity planning.

To address these concerns, the Department of Education (DepEd), Local Government Units (LGUs), Local Disaster Risk Reduction and Management Offices (LDRRMOs), and school administrators should review and strengthen existing disaster risk reduction and management policies by incorporating more comprehensive provisions on structural resilience, continuity planning, infrastructure maintenance, and emergency preparedness. Schools are likewise encouraged to integrate flood resilience objectives into their School Improvement Plans (SIPs), Annual Implementation Plans (AIPs), and other institutional planning documents to ensure that resilience initiatives are systematically implemented, regularly monitored, and adequately funded.

Furthermore, policymakers should prioritize allocating financial, technical, and human resources to infrastructure improvements, preventive maintenance, disaster preparedness programs, and capacity-building initiatives. Establishing regular coordination among educational institutions, local government agencies, engineering offices, and emergency management organizations will also facilitate more effective planning, implementation, and evaluation of flood resilience initiatives.

This recommendation is directly supported by the study's findings, which demonstrate the importance of building resilience through coordinated institutional efforts rather than isolated interventions. Strengthening policy implementation and ensuring adequate resource allocation will enable schools to improve their capacity to withstand, respond to, and recover from flood-related hazards while maintaining safe learning environments.

This recommendation is supported by Domingo and Manejar (2018), who emphasized the critical role of local government support, policy implementation, and institutional coordination in strengthening disaster risk reduction initiatives. Similarly, Tiernan et al. (2018) highlighted that effective disaster resilience depends on sustained policy support, stakeholder collaboration, and adequate resource mobilization to strengthen institutional capacity before, during, and after disaster events.

6. Future Research Directions

While this study provides valuable insights into the perceived flood resilience of a public school in Rizal Province, several opportunities remain for future research to further strengthen the understanding and assessment of disaster resilience in educational institutions. Future studies are encouraged to replicate and validate the proposed three-factor flood resilience framework across different geographical locations, educational settings, and hazard-prone communities to assess its applicability and generalizability. Comparative studies involving multiple schools, provinces, or regions may also be conducted to identify contextual differences in resilience practices and determine how institutional, environmental, and socio-economic factors influence flood resilience.

Future researchers are likewise encouraged to broaden the scope of respondents to include school administrators, teachers, non-teaching personnel, parents, engineers, local government officials, and disaster risk reduction practitioners. Incorporating the perspectives of multiple stakeholders may provide a more comprehensive understanding of disaster resilience and help identify practical challenges and opportunities that may not be fully captured by student perceptions alone.

In addition, future studies may employ mixed-methods or longitudinal research designs to complement quantitative findings with qualitative insights and monitor changes in flood resilience over time. Researchers may

also integrate engineering-based assessments, geographic information systems (GIS), hazard mapping, and structural vulnerability analyses to provide objective evaluations of school infrastructure alongside perception-based assessments. Such approaches may contribute to the continuous refinement of flood resilience assessment tools and support the development of more evidence-based disaster risk reduction policies, infrastructure planning, and resilience-building strategies for educational institutions.

Ultimately, future studies may contribute to refining disaster resilience assessment frameworks and provide stronger empirical evidence to support disaster risk reduction policies, resilient school infrastructure planning, and sustainable resilience-building initiatives within educational institutions.

5.4 Proposed Flood Resilience Action Plan

Based on the study's findings and recommendations, the following Flood Resilience Action Plan is proposed to guide the implementation of strategies to enhance the flood resilience of Tagumpay National High School.

Table 9. Proposed Flood Resilience Action Plan

Objective	Key Activities	Responsible Office	Time Frame	Expected Output	Success Indicator
Strengthen Functional Continuity	Develop and implement a School Continuity Plan	School DRRM Committee, School Administration	Within 6 months	Approved School Continuity Plan	Continuity Plan adopted and implemented
Improve Structural Resilience	Conduct a structural vulnerability assessment and retrofit flood-prone facilities	DepEd, LGU, Municipal Engineering Office	Annually	Safer school buildings	Reduced structural vulnerabilities
Enhance Preparedness & Management	Conduct quarterly flood drills and update emergency plans	School DRRM Committee	Quarterly	Updated DRRM Plan	At least four drills conducted annually
Integrate Flood Resilience in School Planning	Include resilience program in School Improvement Plan (SIP) and Annual Implementation Plan (AIP)	School Administration	Every school year	Updated SIP/AIP	Flood resilience incorporated into the approved SIP and AIP
Strengthen Coordination	Coordinate with LGU, DRRM, parents, and community partners	School Administration, LGU	Semi-annually	Memoranda of Agreement and coordination meetings	Increased stakeholder participation
Monitoring and Evaluation	Review implementation of the action plan and evaluate outcomes	School DRRM Committee	Every year	Annual Monitoring Report	Improvement in flood resilience assessment



Overall Success Indicator: Improved implementation of flood resilience initiatives and enhanced preparedness, continuity of operations, and structural resilience in the selected public school, as evidenced by periodic monitoring and evaluation

Implementation Guidelines: The proposed Flood Resilience Action Plan may be adopted by the school administration as part of its Disaster Risk Reduction and Management (DRRM) program. The implementation shall be coordinated with the Department of Education (DepEd), the Local Government Unit (LGU), and the Local Disaster Risk Reduction and Management Office (LDRRMO). The action plan should be reviewed annually to monitor progress, assess effectiveness, and incorporate improvements in response to emerging flood risks and institutional needs.



References

- Abregana, J. (2025). Enhancing the integration of DRRM education in the curriculum: A framework for disaster-resilient schools. *Psychology and Education: A Multidisciplinary Journal*, 44(9), 1273–1285.
- Beyramijam, M., Khankeh, H. R., Farrokhi, M., Ebadi, A., Masoumi, G., & Aminizadeh, M. (2020). Disaster preparedness among emergency medical service providers: A systematic review protocol. *Emergency Medicine International*.
- CNN Philippines Staff. (2020, November 13). Over 25,000 families in Rizal evacuated due to Ulysses.
- Cresencio, M., & Yabut, E. (2023). Implementation of school disaster risk reduction in coastal schools: Basis for a plan of action. *Journal of Education and E-Learning Research*, 10(2), 270–277.
- Daminar, N. L., & Cabonce, C. B. (2026). Extent of implementation of the Disaster Risk Reduction and Management Act (RA 10121) in the schools of Cabadbaran City, Philippines. *Jambá: Journal of Disaster Risk Studies*, 18(1), Article 1991.
- Dariagan, J., Atando, R., & Asis, J. L. B. (2021). Disaster preparedness of local governments in Panay Island, Philippines. *Natural Hazards*.
- Dela Cruz, R. D., & Ormilla, R. C. G. (2022). Disaster risk reduction management implementation in the public elementary schools of the Department of Education, Philippines. *International Journal of Disaster Risk Management*, 4(2), 1–15.
- Dela Peña, V. C. (2025). A structural equation model on the disaster readiness of public schools in SOCCSKSARGEN, Philippines. *International Journal of Research and Innovation in Social Science*, 9(2), 4061–4068.
- Department of Education. (2024). DepEd hails passage of law requiring evacuation centers in every LGU.
- Domingo, S., & Manejar, A. (2018). Disaster preparedness and local governance in the Philippines. *Philippine Institute for Development Studies*.
- Fatma, S. K., Martínez-Vázquez, P., & Baniotopoulos, C. (2020). Sustainable structural intervention methodology for vulnerable buildings from a lifecycle perspective. *IOP Conference Series: Earth and Environmental Science*, 410(1), Article 012051.
- Geronimo, M. C., & Gonzaga, M. L. (2021). Exploring disaster mitigation and preparedness of rural communities. *International Journal of Environmental Studies*, 14(1).
- Khalilullah, M., Carmichael, D. G., & Shen, X. (2023). Resilience and systems—A building structure case example. *Buildings*, 13(6).
- Khankeh, H. R., Momtaz, Y. A., Saatchi, M. M., Khazaei, A., Naboureh, A., Mortazavi, M., & Ahmadi, S. (2022). A comprehensive review of the articles published in the field of health in emergencies and disasters in Iran. *Pan African Medical Journal*.
- Lindawan, B. R. (2024). School resilience in the face of disaster risk: Awareness, challenges, and coping mechanism. *Studies in Technology and Education*, 3(3).
- Macuha, R. (2023). Evaluating the physical vulnerability of public school buildings against flooding in Metro Manila, Philippines. *ASEAN Engineering Journal*, 13(2), 119–133.



Mutch, C. (2015). The role of schools in disaster preparedness, response and recovery: What can we learn from the literature? *Pastoral Care in Education*, 33(1), 5–22.

Philippine Daily Inquirer. (2020, January 15). 67 schools turned into evacuation centers.

Philippine Star. (2023, January 30). Why the Philippines needs to stop using schools as evacuation centers.

Polinar, S. M. M., & Gonzaga, M. V. A. (2023). Selected public school teachers' awareness and involvement in school-based disaster risk reduction management measures. *Journal of Current Science and Research Review*, 1(4).

Save the Children. (2017). Limiting and planning for schools as temporary evacuation centres in emergencies. Asia Pacific Coalition for School Safety.

Sarmiento, J. P., et al. (2024). A systematic framework for assessing social vulnerability to flood for integrated flood risk management: A case study in Metro Manila, Philippines. *International Journal of Disaster Risk Reduction*, 112, 104778.

Tiernan, A., Drennan, L., Nalau, J., Onyango, E., Morrissey, L., & Mackey, B. (2018). A review of themes in disaster resilience literature and international practice since 2012. *Disaster Prevention and Management*, 27(2), 137–152.

Tsioulou, A., Faure Walker, J., Lo, D. S., & Yore, R. (2021). A method for determining the suitability of schools as evacuation shelters and aid distribution hubs following disasters: Case study from Cagayan de Oro, Philippines. *Natural Hazards*, 105, 1835–1859.

Verheul, M. L., & Dückers, M. L. (2020). Defining and operationalizing disaster preparedness in hospitals: A systematic literature review. *Prehospital and Disaster Medicine*, 35(1), 61–68.