



The Role of School Principals in Implementing Disaster Responsive Learning for Tidal Flood Resilience

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Abstract

Tidal flooding has become a recurring environmental challenge that affects educational sustainability in coastal areas of Indonesia. Schools located in disaster-prone regions require effective leadership to develop learning systems that enhance students' preparedness and resilience. This study aims to analyze the role of school principals in implementing disaster-responsive learning based on tidal flood risks at Tegaldowo Elementary School, Tirto District, Pekalongan Regency, Indonesia. This study employed a qualitative case study approach. Data were collected through semi-structured interviews, observations, and document analysis involving school principals, teachers, and school committee members. Data were analyzed using thematic analysis through data reduction, data display, and conclusion drawing, while data credibility was ensured through source and technique triangulation. The findings indicate that school principals play a strategic role in implementing disaster-responsive learning through four managerial functions: planning, organizing, actuating, and controlling. Principals develop programs based on local disaster risks, organize collaborative resources involving school stakeholders, encourage teachers to implement contextual learning related to tidal flood experiences, and conduct continuous monitoring and evaluation to ensure program sustainability. This study contributes to the development of the concept of school leadership for tidal flood resilience, highlighting the importance of adaptive and contextual educational leadership in disaster-prone areas. The findings imply that strengthening principals' managerial and instructional leadership capacities is essential for transforming schools into resilient learning environments capable of responding effectively to environmental risks.

Introduction

Climate change has become one of the most critical global challenges of the twenty-first century, generating profound environmental, economic, social, and educational consequences. One of its most visible impacts is the increasing occurrence of hydrometeorological hazards, including sea-level rise and recurrent tidal flooding (rob), which severely affect coastal communities. In disaster prone regions, schools are expected not only to deliver academic instruction but also to develop students' adaptive capacity and community resilience. Consequently, Disaster Risk Reduction Education (DRRE) has become an essential strategy for equipping younger generations with the knowledge, skills, and values required to understand disaster risks and respond effectively to environmental change (Yeon et al., 2020; Ao et al., 2021; Masocha., 2025).

Unlike sudden-onset disasters, tidal flooding is characterized by its recurrent and long-term nature, resulting from sea level rise, land subsidence, and climate change. Repeated inundation disrupts teaching and learning activities, damages educational infrastructure, and limits

students' access to education. These conditions require schools in coastal areas to develop adaptive educational systems that integrate disaster mitigation, preparedness, and resilience into routine learning and school management. Pour et al. (2020) argue that disaster adaptation should be embedded within educational systems as a long term resilience strategy rather than implemented as an emergency response.

Internationally, the importance of disaster-responsive education is reflected in the Comprehensive School Safety (CSS) Framework, which identifies safe learning facilities, school disaster management, and disaster risk reduction education as the three pillars of disaster-resilient schools (Petal et al., 2020; Chet et al., 2023; Shaw et al., 2021). Within this framework, disaster education is considered an integral component of educational governance rather than an additional programme. Empirical evidence consistently shows that integrating disaster risk reduction into school curricula improves students' preparedness while strengthening school safety culture (Rofiah et al., 2021; Amri et al., 2022; Sheehy et al., 2024). Likewise, Widowati et al. (2023) emphasize that effective disaster-safe schools require coherent policies, institutional commitment, planning, coordination, teacher capacity development, curriculum integration, monitoring, and evaluation.

Despite growing policy attention, the implementation of DRRE remains inconsistent. Disaster education is often delivered through fragmented activities that depend on individual teachers or short-term projects instead of being institutionalized within school management. A systematic review by Desilia et al. (2023) concludes that the sustainability of disaster education in Indonesia is strongly influenced by school leadership, teacher competence, institutional support, and educational policy. These findings indicate that disaster responsive education depends not only on curriculum development but also on the managerial capacity of school leaders to embed disaster preparedness into school culture.

Educational leadership literature increasingly recognizes school principals as key agents of organizational change. Beyond administrative responsibilities, principals are expected to function as instructional, transformational, and change leaders capable of responding to complex educational challenges. Transformational leadership enables principals to develop a shared vision, motivate teachers, foster innovation, and strengthen organizational adaptability (Leithwood et al., 2020). Similarly, Bush (2020) argues that effective school leadership requires the alignment of institutional vision, organizational resources, and stakeholder participation to achieve sustainable school improvement.

The strategic importance of principal leadership becomes even more evident in disaster contexts. Schools exposed to environmental crises require leaders who can make adaptive decisions, coordinate stakeholders, manage organizational resources, and ensure learning continuity. Harris and Jones (2020) emphasize that educational leadership during crises requires adaptability, collaboration, effective communication, and context-sensitive decision-making. Likewise, Grissom and Condon (2021) argue that school leaders must strengthen organizational capacity while maintaining effective communication and responsive decision-making. Previous studies further demonstrate that school responses before, during, and after disasters largely depend on principals' abilities to mobilize resources, establish collaborative networks, and sustain educational services (Khalifa, 2020; Striepe & Cunningham, 2022; William & Liou, 2024). More recently, Akbaba & Altum (2025) highlight the principal's critical contribution to post-disaster recovery through crisis management, organizational coordination, and psychosocial support.

These perspectives reinforce the concept of disaster-resilient schools, which extends beyond protecting physical infrastructure to integrating disaster risk reduction into school policies,

organizational culture, teaching practices, and stakeholder collaboration. Strong leadership, teacher capacity, supportive policies, and curriculum integration are therefore fundamental to strengthening school resilience (Borowski & Stathopoulos, 2020; Golshani et al., 2020). Similarly, Tipler et al. (2017) identify principal leadership, competent teachers, preparedness exercises, risk communication, and community participation as essential characteristics of disaster-resilient schools, while Moriyama et al. (2020) and Nojang & Jensen (2020) emphasize the importance of organizational capacity and external collaboration. In coastal elementary schools, where tidal flooding is a recurring reality, disaster-responsive learning should connect students' lived experiences with scientific understanding of environmental risks, thereby fostering environmental literacy, preparedness, and adaptive behaviour (Masocha et al., 2025). Such contextual learning also strengthens relationships between schools and local communities while improving disaster preparedness and environmental awareness (Rofiah et al., 2021; Sheehy et al., 2024; Yeon et al., 2020; Ao et al., 2021).

Although previous studies have substantially advanced knowledge of disaster education, several important gaps remain. Existing research has primarily examined disaster preparedness among students, teacher competence, curriculum integration, disaster safe school programmes, and school resilience (Amri et al., 2022; Nojang et al., 2020; Borowski & Stathopoulos, 2020; Golshani et al., 2020; Widowati et al., 2023). Comparatively little attention has been given to how school principals perform their managerial functions in implementing disaster-responsive learning, particularly in schools experiencing recurrent tidal flooding where educational disruption is continuous rather than episodic. Understanding leadership practices in such contexts is therefore essential for strengthening disaster-resilient educational management.

This study addresses these gaps through a case study at SD Negeri Tegaldowo, Tirto District, Pekalongan Regency, Indonesia, an elementary school located in a coastal area that experiences recurring tidal flooding. Although the school has integrated tidal flood issues into learning activities and school programmes, these initiatives remain largely contextual and have not yet been fully institutionalized within school policies or long-term strategic planning. This context provides an opportunity to examine how school leadership contributes to developing disaster-responsive learning in a highly vulnerable educational environment.

The novelty of this study lies in positioning the school principal as the central actor in translating local disaster risks into adaptive educational policies and organizational practices. Integrating perspectives from educational management, transformational leadership, Disaster Risk Reduction Education, and the Comprehensive School Safety framework, this study examines how the principal performs the managerial functions of planning, organizing, actuating, and controlling to strengthen school resilience. Accordingly, the study aims to analyse the principal's role in implementing disaster-responsive learning for tidal flood resilience at SD Negeri Tegaldowo. The findings are expected to contribute to the growing literature on disaster-resilient educational leadership while providing practical recommendations for strengthening school management in disaster-prone coastal communities.

Methods

This study employed a qualitative approach using a case study design to examine the role of school principals in implementing disaster-responsive learning in elementary schools located in tidal flood-prone areas. A qualitative case study was considered appropriate because it enables an in-depth understanding of educational phenomena within their real-life contexts by exploring participants' experiences, perceptions, and interactions (Creswell & Poth, 2021; Yin, 2022). The research was conducted at SD Negeri Tegaldowo, Tirto District, Pekalongan Regency, Central Java, Indonesia. The school was purposively selected because it is situated

in a coastal area that experiences recurrent tidal flooding (*rob*), providing a relevant context for investigating school leadership in developing disaster-responsive learning.

Participants were selected through purposive sampling based on their direct involvement in school management, teaching and learning activities, and disaster preparedness programmes. The participants consisted of one school principal, six teachers representing different grade levels, eight students from upper elementary grades (Grades IV–VI), and three school committee/community representatives, resulting in a total of 18 participants. The principal was selected because of responsibility for overall school management and disaster-related decision-making. Teachers were selected based on their active involvement in curriculum implementation and disaster-responsive learning activities. Students were chosen because they had participated in disaster preparedness programmes and classroom learning related to tidal flood mitigation, while school committee members were selected due to their involvement in supporting school resilience programmes and community participation. Data collection continued until data saturation was achieved, indicated by the repetition of participants' responses and the absence of substantially new codes, categories, or themes during the final stages of interviews and observations (Creswell & Poth, 2021; Miles et al., 2020).

Data were collected through semi-structured interviews, direct observations, and document analysis to obtain comprehensive and contextual information regarding the implementation of disaster-responsive learning. Interviews explored participants' experiences and perspectives concerning the managerial role of the school principal, while observations focused on leadership practices, learning activities, disaster preparedness programmes, school facilities, and environmental conditions affected by tidal flooding.

Data collection was conducted from February to April 2026. Semi-structured interviews were conducted in two rounds involving all participants, resulting in 18 individual interview sessions. Each interview lasted approximately 40–60 minutes and was audio-recorded with participants' permission. The interviews explored school planning for disaster-responsive learning, leadership strategies, coordination among stakeholders, learning implementation, disaster preparedness activities, challenges encountered, and evaluation practices. Classroom and school observations were conducted repeatedly during learning activities and disaster preparedness programmes to examine leadership practices, teacher–student interactions, integration of disaster education into classroom instruction, school facilities, evacuation routes, disaster information boards, and environmental conditions related to recurrent tidal flooding.

Document analysis was conducted to examine school policies, strategic plans, annual programmes, lesson plans, disaster preparedness documents, and other relevant records that supported the implementation of disaster-responsive learning. Specifically, the documents analyzed included the school's annual work programme, School Activity and Budget Plan (RKAS), lesson plans (RPP/teaching modules), principal supervision reports, meeting minutes, school disaster preparedness programme documents, student activity reports, disaster simulation documentation, photographs of school activities, and official school policies related to disaster risk reduction. These documents were used to verify and complement information obtained from interviews and observations.

In qualitative inquiry, the researcher served as the primary research instrument responsible for determining the research focus, collecting data, interpreting findings, and constructing meanings throughout the research process (Creswell & Poth, 2021). To ensure systematic data collection, interview protocols, observation sheets, and document analysis guidelines were developed based on the research framework concerning the managerial functions of planning, organizing, actuating, and controlling in disaster-responsive learning implementation.

Employing multiple data sources enabled methodological triangulation and strengthened the credibility of the findings (Creswell & Poth, 2021).

Data analysis followed the interactive model proposed by Miles et al. (2020), consisting of data condensation, data display, and conclusion drawing and verification. During data condensation, information obtained from interviews, observations, and documents was selected, coded, categorized, and organized according to the research focus.

The coding process began with open coding to identify meaningful units from interview transcripts, observation notes, and documentary evidence. Similar codes were subsequently grouped through axial coding into broader categories reflecting the managerial functions of planning, organizing, actuating, and controlling. Finally, selective coding was employed to develop overarching themes that explained the role of school principals in implementing disaster-responsive learning. Coding and thematic development were conducted iteratively throughout the research process. To enhance analytical rigor, coding results and emerging themes were independently reviewed and discussed among the research team until consensus was achieved regarding the interpretation of the findings.

The organized data were subsequently presented through narrative descriptions and thematic categories to facilitate the identification of patterns and relationships among leadership practices and disaster-responsive learning implementation. Finally, conclusions were drawn and continuously verified by comparing emerging interpretations with evidence obtained from multiple data sources throughout the research process. To enhance the trustworthiness of the findings, source triangulation was applied by comparing information from different participants, while methodological triangulation was conducted by integrating evidence from interviews, observations, and document analysis.

Specifically, findings from interviews were systematically compared with observation records and documentary evidence to identify consistency, convergence, and discrepancies across data sources. Member checking was conducted by sharing summaries of the preliminary findings with the school principal and several teacher participants to confirm the accuracy of interpretations. Peer debriefing was also undertaken through discussions among the research team regarding coding decisions, thematic development, and interpretation of findings. Furthermore, an audit trail documenting research procedures, coding processes, analytical decisions, and data management was maintained throughout the study to strengthen the dependability and confirmability of the research.

Ethical considerations were carefully observed throughout the study. Prior to data collection, formal permission was obtained from the school principal to conduct the research. All participants voluntarily agreed to participate after receiving clear information regarding the research objectives, procedures, potential benefits, and their right to withdraw at any stage without consequences. Written informed consent was obtained from all adult participants, while written parental consent and student assent were secured before involving students in interviews and observations. Participants' identities were anonymized through pseudonyms, and all research data were treated confidentially and used solely for academic purposes.

Through these procedures, the study generated an in-depth understanding of how school principals perform managerial functions in planning, organizing, actuating, and controlling disaster-responsive learning to strengthen school resilience in response to recurrent tidal flooding.

Results and Discussion

Strategic Planning of Disaster-Responsive Learning by the School Principal

The findings indicate that the principal played a strategic role in planning disaster-responsive learning by integrating local tidal flood risks into school policies and instructional programmes. Planning was developed based on the school's long experience of recurrent tidal flooding and focused on improving students' disaster knowledge, preparedness, and adaptive behaviour. The principal explained:

“The objectives of disaster-responsive learning were formulated based on the actual conditions experienced at SD Negeri Tegaldowo. Students need to understand the causes and impacts of tidal flooding as well as the appropriate actions to take during flood events. Therefore, the programme emphasizes both knowledge and preparedness.” (Principal, Interview, May 12, 2026).

Teachers confirmed that disaster-responsive learning was collaboratively planned through curriculum meetings at the beginning of each semester. Disaster topics were integrated into thematic instruction by connecting science, social studies, and civic education with local environmental conditions. Students also acknowledged that classroom learning frequently discussed tidal flooding because it reflected their daily experiences, while school committee members stated that parents were regularly informed about preparedness programmes through coordination meetings.

Observation findings showed that teachers consistently introduced lessons using examples of recent tidal flooding and local environmental issues. Document analysis further demonstrated that the Annual School Programme, School Activity and Budget Plan (RKAS), disaster preparedness programme, and lesson plans explicitly incorporated disaster awareness, evacuation procedures, and environmental literacy into instructional objectives.

Organizing School Resources and Collaborative Networks

The organizing function was reflected in the principal's ability to coordinate teachers, optimise available facilities, and strengthen collaboration with parents and the school committee despite limited financial resources. The principal stated:

“Although the school has limited financial resources, teachers integrate disaster-responsive learning into their subjects, while classrooms, the school yard, and simple instructional media are used for preparedness activities and simulations.” (Principal, Interview, May 12, 2026).

Teachers explained that responsibilities for classroom instruction, disaster simulations, and preparedness activities were distributed across grade levels, enabling disaster education to become a shared responsibility rather than the task of individual teachers. School committee representatives confirmed that communication with parents was maintained through meetings and school communication groups before preparedness activities were implemented. Students also described their active participation during evacuation drills, including assisting classmates and following designated evacuation procedures.

Observations revealed collaborative disaster preparedness activities involving teachers, students, parents, and committee members. Clearly marked evacuation routes, assembly points, disaster information boards, and simple emergency facilities supported these activities. Documentary evidence, including organisational structures, annual work programmes, meeting minutes, and disaster preparedness schedules, further confirmed that stakeholder

responsibilities and preparedness activities had been formally incorporated into school management.

Principal Leadership in Implementing Disaster Responsive Learning

The findings reveal that the principal acted as an instructional leader by encouraging teachers to implement contextual disaster-responsive learning connected to students' direct experiences of tidal flooding. The principal explained:

“Teachers are encouraged to relate learning materials to students' daily experiences and use real examples from the surrounding environment so that disaster education becomes meaningful and relevant.” (Principal, Interview, May 12, 2026).

Teachers reported that they regularly used discussions, environmental observations, local flood cases, and collaborative learning activities to connect disaster concepts with students' daily lives. Students confirmed that these learning activities helped them understand evacuation procedures, disaster risks, and appropriate responses during tidal flooding. School committee members also observed that students increasingly shared disaster preparedness knowledge with their families after participating in school learning activities.

Classroom observations showed that students actively participated in discussions, environmental investigations, and evacuation simulations. Teachers consistently integrated local disaster experiences into classroom instruction, while document analysis confirmed that lesson plans, teaching modules, and simulation reports systematically incorporated contextual disaster education and experiential learning activities.

Monitoring and Evaluation of Disaster Responsive Learning Programmes

The principal implemented the controlling function through regular instructional supervision, programme monitoring, and reflective evaluation aimed at improving instructional quality. The principal stated:

“During classroom observations, I evaluate teaching methods, student participation, and instructional strategies. Afterwards, we discuss the findings together to identify solutions and improve future learning.” (Principal, Interview, May 12, 2026).

Teachers confirmed that supervision focused on improving contextual teaching practices through reflective discussions rather than administrative inspection. Students explained that disaster learning was evaluated through discussions, practical demonstrations, assignments, and evacuation simulations, while school committee representatives stated that programme evaluation results were communicated during coordination meetings with parents.

Observation findings demonstrated that the principal regularly monitored classroom learning and preparedness activities, followed by reflective discussions with teachers and students after evacuation simulations. Documentary evidence from supervision reports, programme evaluation documents, meeting minutes, and student assessment records confirmed that evaluation results were systematically documented and used to improve subsequent disaster-responsive learning activities.

Table 1. Summary of Data Triangulation Results

Focus	Interview Evidence	Observation Evidence	Documentary Evidence	Main Findings
Planning	Principal, teachers, students, and committee	Lessons connected disaster issues	Annual programme, RKAS, lesson	Disaster-responsive planning

	confirmed contextual planning based on tidal flood risks.	with local environmental conditions.	plans, preparedness programme.	integrated risk reduction into school management.
Organizing	Stakeholders collaborated in preparedness activities.	Evacuation drills and collaborative resource use were observed.	Organisational structure, meeting minutes, preparedness schedules.	Collaborative governance strengthened school preparedness.
Actuating	Teachers implemented contextual and experiential disaster learning.	Active classroom participation and evacuation simulations were observed.	Teaching modules, lesson plans, simulation reports.	Instructional leadership supported disaster-responsive learning.
Controlling	Continuous supervision, monitoring, and evaluation were conducted.	Classroom supervision and reflective evaluation were observed.	Supervision reports, evaluation documents, student assessments.	Continuous quality improvement sustained programme implementation.

Triangulation across interviews, observations, and documentary evidence demonstrated consistent findings for all four managerial functions. Evidence from different participant groups and data sources converged to show that disaster-responsive learning had been systematically integrated into planning, organizing, implementation, and evaluation processes. This consistency strengthens the credibility of the findings and confirms that disaster-responsive learning at SD Negeri Tegaldowo was implemented through an integrated educational management approach.

The findings demonstrate that strategic planning constituted the foundation for implementing disaster-responsive learning by integrating recurrent tidal flood risks into school policies, curriculum planning, and instructional activities. Rather than functioning solely as an administrative process, planning reflected the principal's capacity to transform local environmental challenges into educational opportunities. The integration of interviews, classroom observations, and documentary evidence indicates that disaster preparedness was systematically embedded within school programmes and supported by teachers, students, parents, and the school committee. This finding suggests that effective leadership in disaster-prone schools depends on aligning contextual risk identification with educational objectives and stakeholder participation rather than treating disaster education as a supplementary programme. These findings support Leithwood et al. (2020), who emphasize that effective school leadership requires a shared vision, organizational capacity, and systematic school improvement. The principal demonstrated these characteristics by integrating disaster risk reduction into school planning and ensuring that preparedness became part of routine educational management. This finding is also consistent with the Comprehensive School Safety Framework, which positions school policy, disaster management, and disaster risk reduction education as complementary components of resilient schools. Similarly, Widowati et al. (2023) argue that disaster preparedness should be institutionalized through integrated policies, stakeholder participation, and continuous evaluation. The findings further reinforce

previous studies highlighting curriculum integration and institutional commitment as essential factors for Disaster Risk Reduction Education (Amri et al., 2022; Rofiah et al., 2021; Sheehy et al., 2024). Likewise, Muzani et al. (2022) emphasize that organizational capacity and risk communication determine the effectiveness of school preparedness. At SD Negeri Tegaldowo, these elements were reflected in the use of recurring tidal flood experiences as the primary reference for educational planning, enabling disaster education to become relevant to students' daily lives. The findings are also aligned with Shah et al. (2020), Opabola et al. (2023), and Khusnani et al. (2023), who argue that sustainable disaster preparedness begins with strategic planning that reflects local hazards and integrates disaster risk reduction into long-term school development. However, the present study extends these perspectives by demonstrating that contextual planning becomes more effective when local disaster experiences are transformed into authentic learning resources through collaboration among teachers, students, parents, and the wider community. Consequently, strategic planning should be understood not merely as policy formulation but as risk-informed educational leadership that aligns school management, curriculum development, and community participation to strengthen long-term school resilience.

The findings indicate that the implementation of disaster-responsive learning depended on the principal's ability to organize school resources and establish collaboration among teachers, students, parents, the school committee, and the surrounding community. Although financial resources were limited, preparedness activities were sustained through effective coordination, shared responsibilities, and the utilization of existing school facilities. The triangulation of interview, observation, and documentary evidence demonstrates that collaboration was consistently reflected in classroom instruction, evacuation simulations, communication with parents, and school preparedness programmes. These findings indicate that organizational resilience was primarily built through leadership and stakeholder engagement rather than material resources alone. This finding reinforces the whole-school approach to Disaster Risk Reduction Education, which considers disaster preparedness a shared institutional responsibility rather than the responsibility of individual teachers (Sheehy et al., 2024; Rofiah et al., 2021). It also supports Harris and Jones (2020), who argue that schools facing uncertainty require collaborative leadership characterized by adaptability, flexibility, and stakeholder participation. The principal demonstrated these characteristics by coordinating teacher responsibilities, strengthening communication with families, and promoting active participation from the school community. Furthermore, the findings are consistent with Nojang and Jensen (2020), who identify policy, communication, human resources, and community involvement as key components of school preparedness. Similar conclusions were reported by Ronan et al. (2020) and Moriyama et al. (2020), who emphasize that participatory disaster education strengthens relationships between schools and communities while improving preparedness in disaster-prone areas. Likewise, Cutter et al. (2021) argue that community resilience depends on the ability of local institutions to mobilize collaborative networks, while Auliagisni et al. (2022) highlight the importance of partnerships between schools, families, and communities in strengthening flood preparedness. Recent evidence from Kuncoro et al. (2026) also demonstrates that Disaster Safe Educational Unit programmes become more sustainable when supported by collaborative governance and institutional resource management. The present study contributes additional insight by showing that collaborative governance operated simultaneously at managerial and instructional levels. Organizational collaboration was evident not only in the coordination of teachers and community stakeholders but also in students' active participation during classroom learning, environmental observations, and evacuation simulations. This indicates that disaster-responsive learning is strengthened when leadership integrates administrative coordination

with participatory educational practices. Accordingly, the organizing function extends beyond allocating human and physical resources to building social capital that supports institutional resilience and educational continuity in coastal schools experiencing recurrent tidal flooding.

The findings demonstrate that the principal played a pivotal role in translating disaster-responsive policies into contextual classroom practices. Through continuous instructional guidance, teachers were encouraged to integrate students' experiences of recurrent tidal flooding into everyday learning, making disaster education relevant to the local environment rather than an isolated topic. Evidence from interviews, classroom observations, and instructional documents indicates that contextual learning, environmental observation, collaborative discussion, and evacuation simulations became integral components of classroom practice. These findings suggest that instructional leadership was essential in ensuring that disaster-responsive learning moved beyond policy into meaningful educational experiences that strengthened students' knowledge, preparedness, and environmental awareness. These findings support Bush (2020), who argues that school principals are responsible not only for organisational management but also for improving teaching quality through instructional leadership and teacher professional development. Likewise, Masocha et al. (2025) emphasize that Disaster Risk Reduction Education should adopt participatory and experiential learning approaches that enable students to construct knowledge through direct engagement with environmental challenges. Similar conclusions were reported by Borowski and Stathopoulos (2020), Gomes et al. (2022), and Atmojo (2021), who found that contextual disaster education enhances students' preparedness, practical skills, and adaptive behaviour while strengthening teachers' capacity to deliver meaningful disaster-responsive instruction. The present study extends these findings by demonstrating that instructional leadership serves as the critical mechanism linking strategic planning with classroom implementation. Rather than merely encouraging teachers to include disaster topics in lessons, the principal continuously facilitated instructional innovation through supervision, collaborative reflection, and contextual pedagogy. Consequently, students experienced disaster education as an authentic learning process closely connected with their daily lives. This finding highlights that sustainable disaster-responsive learning depends on leadership that simultaneously strengthens teacher capacity, student participation, and contextual curriculum implementation.

The findings reveal that continuous supervision, programme monitoring, and reflective evaluation enabled disaster-responsive learning to remain sustainable within routine school management. Supervision was not limited to administrative inspection but focused on improving instructional quality through constructive feedback, reflective discussion, and evidence-based programme improvement. Interview, observation, and documentary evidence consistently showed that evaluation results informed subsequent learning activities, disaster simulations, and programme refinement, demonstrating that monitoring functioned as a process of continuous organisational learning rather than periodic assessment.

These findings are consistent with Widowati et al. (2023), who argue that disaster-resilient schools require continuous evaluation to institutionalise disaster risk reduction within school culture. Likewise, Hodson et al. (2024) and Tolentino (2021) emphasize that programme monitoring and instructional supervision are fundamental for maintaining preparedness and improving educational quality. Shah et al. (2020) further explain that sustainable school emergency preparedness depends on regular monitoring and organisational learning capable of improving institutional responsiveness toward future disasters. The present findings provide additional evidence that monitoring and evaluation contribute not only to programme accountability but also to organisational adaptation. Continuous supervision enabled teachers to refine instructional practices, while reflective discussions following classroom observations

and evacuation simulations facilitated collective learning among school stakeholders. Accordingly, the controlling function should be understood as a strategic leadership process that integrates supervision, reflection, and continuous improvement to strengthen both educational quality and school resilience in disaster-prone environments.

The findings culminate in a conceptual model of School Leadership for Tidal Flood Disaster Resilience, which integrates the four managerial functions of planning, organizing, actuating, and controlling into a coherent framework for implementing disaster-responsive learning. Strategic planning provides the institutional direction by integrating local disaster risks into school policies and curriculum. Organizing strengthens institutional capacity through collaboration among teachers, students, parents, the school committee, and the wider community. Instructional leadership ensures that disaster preparedness is translated into contextual classroom practice, while continuous supervision and evaluation promote organisational learning and programme sustainability. Unlike previous studies that predominantly examine disaster preparedness from the perspectives of curriculum implementation, student preparedness, or school safety programmes, this study positions the school principal as the central actor responsible for institutionalising disaster risk reduction through integrated educational management. This interpretation is consistent with Williams and Liou (2024), who argue that effective school leaders in times of crisis require competencies in strategic decision-making, instructional leadership, organisational coordination, and adaptive governance. Similarly, Kuncoro et al. (2026) demonstrate that sustainable Disaster Safe Educational Unit programmes depend on leadership capable of integrating management, collaboration, and continuous organisational learning.

The principal contribution of this study lies in extending the concept of disaster-responsive educational leadership by demonstrating that school resilience emerges through the interaction of four interconnected managerial functions rather than through isolated disaster education initiatives. Disaster-responsive learning becomes sustainable when strategic planning, collaborative governance, instructional leadership, and continuous quality improvement operate as an integrated leadership system. This perspective contributes to educational leadership literature by positioning disaster risk reduction as an institutional leadership responsibility instead of solely a curricular or emergency management issue.

Practically, the proposed framework offers guidance for school leaders in disaster-prone coastal regions seeking to integrate disaster risk reduction into school governance, curriculum implementation, teacher professional development, stakeholder collaboration, and quality assurance systems. By embedding disaster preparedness within routine educational management, schools can enhance educational continuity, strengthen community resilience, and improve their capacity to respond adaptively to recurring tidal flooding.

Accordingly, this study contributes to the development of the concept of disaster-resilient educational leadership, which conceptualises school leadership as an integrated managerial process that aligns educational management with local disaster risk adaptation to ensure sustainable disaster-responsive learning and long-term school resilience in coastal communities affected by recurrent tidal flooding.

Conclusion

This study concludes that the school principal plays a strategic role in implementing disaster-responsive learning for tidal flood resilience through the effective application of the four fundamental management functions: planning, organizing, actuating, and controlling. In the context of SD Negeri Tegaldowo, an elementary school located in a coastal area vulnerable to

recurrent tidal flooding, the principal functions not only as an administrative manager but also as a transformational leader who promotes a culture of disaster preparedness and strengthens school resilience.

With respect to the planning function, the principal developed disaster-responsive learning programmes based on local risk assessments and the educational needs of the school community. Disaster-related issues were systematically integrated into school programmes and classroom instruction to ensure that learning reflected the environmental realities experienced by students. In terms of organizing, the principal established a collaborative management system by engaging teachers, students, the school committee, parents, and the local community while optimizing available human and material resources. Regarding the actuating function, the principal demonstrated instructional leadership by providing guidance, motivation, and professional support that enabled teachers to implement contextual learning based on students' lived experiences of recurring tidal flooding. Finally, through the controlling function, the principal conducted continuous instructional supervision, programme monitoring, evaluation, and follow-up actions to ensure programme effectiveness and support ongoing improvement.

The findings of this study propose the concept of School Leadership for Tidal Flood Resilience, a leadership model that integrates risk based awareness, collaborative capacity, contextual instructional leadership, and continuous improvement to strengthen disaster-resilient schools. This conceptual model extends previous studies that have predominantly focused on students' disaster preparedness by demonstrating that the school principal serves as the central actor in transforming local disaster risks into a comprehensive educational management agenda. Accordingly, the study contributes to the advancement of the concept of disaster resilient educational leadership, emphasizing the integration of school management functions with disaster risk reduction strategies to promote educational continuity and long-term organizational resilience.

From a practical perspective, the findings suggest that schools located in disaster-prone areas should strengthen the leadership capacity of school principals to systematically manage disaster education. Professional development initiatives should therefore focus on enhancing principals' competencies in disaster risk management, adaptive leadership, and collaborative governance. Furthermore, disaster-responsive education should be continuously integrated into the curriculum, school policies, and school culture to ensure that students develop the knowledge, attitudes, and practical skills necessary to anticipate, respond to, and adapt to environmental hazards.

Despite providing an in-depth understanding of the principal's role in implementing disaster-responsive learning within the context of a coastal elementary school, this study has several limitations. First, the research employed a single-case study design, which may limit the generalizability of the findings to other educational settings. Future studies are therefore encouraged to conduct comparative research across multiple coastal schools with different disaster risk characteristics or to employ quantitative and mixed-methods approaches to examine the relationships among school leadership, disaster preparedness culture, organizational resilience, and educational outcomes. Such investigations would provide broader empirical evidence for refining and validating the proposed School Leadership for Tidal Flood Resilience model in diverse educational contexts.

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