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Delving into Science Teachers' Instructional Practices in Developing Learners' Competencies in Disaster Risk Assessment and Hazard Identification among Senior High School Students in Bayombong, Nueva Vizcaya

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Abstract

Disaster Risk Reduction and Management (DRRM) education has become an integral component of Science instruction in the Philippine K to 12 curriculum due to the country's vulnerability to natural and human-induced hazards. Science teachers play a crucial role in equipping learners with the knowledge, skills, and values necessary for disaster preparedness, hazard identification, and risk assessment. This study explored the instructional practices of Senior High School Science teachers in developing learners' competencies in Disaster Risk Assessment and Hazard Identification in public secondary schools in Bayombong, Nueva Vizcaya. Using a qualitative phenomenological research design, the study examined teachers' lived experiences, classroom practices, instructional challenges, and adaptive strategies. Participants were selected through purposive sampling, and data were gathered using semi-structured interviews, classroom observations, and document analysis. Braun and Clarke's (2021) thematic analysis guided the interpretation of the data. Five major themes emerged: (1) contextualizing disaster education through local hazard experiences; (2) promoting experiential and inquiry-based learning; (3) integrating community-based disaster preparedness activities; (4) addressing instructional challenges through resourcefulness and collaboration; and (5) strengthening disaster resilience through continuous professional learning. The findings revealed that Science teachers employed contextualized, learner-centered, and experiential instructional approaches that enhanced learners' competencies in disaster risk assessment and hazard identification. Despite challenges related to instructional resources, time constraints, and varying learner preparedness, teachers demonstrated adaptability and commitment to disaster education. The study underscores the need for sustained professional development, stronger school-community partnerships, and enhanced instructional resources to improve Disaster Risk Reduction and Management education in Senior High Schools.

Keywords:



Introduction

The Philippines is one of the world's most disaster-prone countries, frequently experiencing typhoons, earthquakes, volcanic eruptions, floods, landslides, and other natural hazards. These recurring disasters significantly affect lives, infrastructure, education, and local economies. Consequently, strengthening disaster preparedness and resilience has become a national priority, with education recognized as one of the most effective means of developing disaster-aware and resilient communities. Within the Philippine K to 12 Basic Education Program, Disaster Risk Reduction and Management (DRRM) concepts are integrated into Science education to develop learners' competencies in hazard identification, disaster risk assessment, preparedness, mitigation, response, and recovery (Department of Education [DepEd], 2016).

Science teachers play a vital role in translating these curriculum competencies into meaningful classroom experiences. Beyond teaching scientific concepts, they are expected to cultivate learners' critical thinking, risk awareness, environmental stewardship, and decision-making skills that enable them to respond appropriately to disaster situations. Effective instruction in Disaster Risk Assessment and Hazard Identification requires learner-centered pedagogies, contextualized instruction, experiential learning, and community-based activities that connect classroom knowledge with real-life disaster scenarios.

The province of Nueva Vizcaya presents a unique context for disaster education because of its geographical location and exposure to multiple hazards, including earthquakes, floods, landslides, and typhoons. These environmental conditions provide authentic learning opportunities for integrating local disaster experiences into classroom instruction. By utilizing community contexts, Science teachers can help learners better understand hazard characteristics, vulnerability factors, and appropriate disaster preparedness measures.

Despite the integration of DRRM concepts into the K to 12 curriculum, Science teachers continue to encounter challenges in teaching disaster-related competencies. These include limited instructional resources, inadequate simulation equipment, insufficient instructional time, varying learner experiences, and the need for continuous professional development in disaster education. Such challenges require teachers to adopt innovative instructional strategies that effectively develop learners' competencies while responding to the realities of their classrooms.

Previous studies have highlighted the importance of inquiry-based instruction, experiential learning, and contextualized teaching in promoting disaster awareness and preparedness. Teachers who integrate local disaster experiences, community resources, collaborative learning, and simulation activities create more meaningful learning experiences that strengthen learners' understanding of disaster risks and enhance community resilience. However, limited qualitative research has examined the instructional practices and lived experiences of Senior High School Science teachers in implementing Disaster Risk Assessment and Hazard Identification competencies, particularly within the local context of Nueva Vizcaya.

Understanding teachers' instructional experiences provides valuable insights into how disaster education is translated into classroom practice. It enables educators, school administrators, curriculum developers, and policymakers to identify effective pedagogical approaches, recognize implementation challenges, and develop responsive interventions that strengthen Disaster Risk Reduction and Management education.

Therefore, this study explored the instructional practices of Senior High School Science teachers in developing learners' competencies in Disaster Risk Assessment and Hazard Identification in public secondary schools in Bayombong, Nueva Vizcaya. Specifically, it examined teachers' instructional approaches, classroom experiences, challenges encountered, adaptive strategies, and insights that may contribute to strengthening disaster education and enhancing learners' disaster preparedness and resilience.

Review of Related Literature

Disaster Risk Reduction and Management Education

Disaster Risk Reduction and Management (DRRM) education has become an essential component of basic education due to increasing global vulnerability to natural hazards and climate-related disasters. The United Nations Office for Disaster Risk Reduction (UNDRR, 2015) emphasizes that disaster education develops learners' knowledge, skills, and attitudes necessary to reduce disaster risks and build resilient communities. In the Philippines, DRRM competencies are integrated into the K to 12 curriculum to promote preparedness, mitigation, response, and recovery through contextualized and competency-based instruction (DepEd, 2016).

Instructional Practices in Disaster Education

Effective disaster education emphasizes experiential learning, inquiry-based instruction, simulation activities, collaborative learning, and community engagement. Experiential learning enables learners to connect theoretical concepts with authentic disaster situations, thereby strengthening critical thinking, decision-making, and problem-solving skills (Kolb, 2015). Inquiry-based approaches encourage learners to investigate hazards, analyze risks, and develop evidence-based solutions to disaster-related problems.

Contextualized instruction also plays a significant role in disaster education. By integrating local hazards, historical disaster events, and community experiences into instruction, teachers make learning more meaningful and relevant while promoting disaster awareness and preparedness (Shaw et al., 2011).

Theoretical Framework

This study is anchored on Experiential Learning Theory by David Kolb (1984) and Constructivist Learning Theory by Lev Vygotsky (1978).

Kolb's Experiential Learning Theory posits that meaningful learning occurs through concrete experiences, reflective observation, conceptualization, and active experimentation. This theory supports disaster education by encouraging learners to participate in simulations, field observations, hazard mapping, and disaster preparedness activities.

Vygotsky's Constructivist Theory emphasizes that knowledge is constructed through social interaction, collaboration, and meaningful experiences. In disaster education, learners develop deeper understanding by engaging in collaborative investigations, community-based learning, and discussions of authentic disaster situations.

Together, these theories provide a strong foundation for understanding Science teachers' instructional practices in developing learners' competencies in disaster risk assessment and hazard identification.

Conceptual Framework

The study assumes that Science teachers' instructional practices influence the successful development of learners' competencies in Disaster Risk Assessment and Hazard Identification. Teachers employ contextualized instruction, experiential learning, inquiry-based activities, simulations, collaborative learning, and authentic assessment to facilitate meaningful learning experiences. These instructional practices, together with teachers' professional experiences and adaptive strategies, contribute to enhanced disaster preparedness, critical thinking, and resilience among Senior High School learners.

Statement of the Problem

This study explored the instructional practices of Senior High School Science teachers in developing learners' competencies in Disaster Risk Assessment and Hazard Identification in public secondary schools in Bayombong, Nueva Vizcaya.

Specifically, it sought to answer the following questions:

1. How do Science teachers describe their instructional practices in developing learners' competencies in Disaster Risk Assessment and Hazard Identification?
2. What learner-centered instructional strategies do Science teachers employ in teaching disaster-related concepts?
3. What challenges do teachers encounter in teaching Disaster Risk Assessment and Hazard Identification?
4. How do Science teachers address the challenges encountered in developing learners' disaster-related competencies?
5. What insights may be drawn to strengthen Disaster Risk Reduction and Management instruction in Senior High School Science?

Methodology

Research Design

This study employed a qualitative phenomenological research design to explore the lived experiences of Senior High School Science teachers in developing learners' competencies in Disaster Risk Assessment and Hazard Identification. Phenomenology was appropriate because it sought to understand teachers' instructional practices, classroom experiences, challenges, and adaptive strategies in teaching disaster-related concepts (Creswell & Poth, 2018).

Research Locale

The study was conducted in the public secondary schools of Bayombong, Nueva Vizcaya. The municipality is vulnerable to various natural hazards such as typhoons, floods, landslides, and earthquakes, making it an appropriate setting for examining the implementation of Disaster Risk Reduction and Management (DRRM) competencies in Senior High School Science.

Research Participants

The participants consisted of Senior High School Science teachers handling Disaster Risk Assessment and Hazard Identification under the K to 12 curriculum. Purposive sampling was employed to select

teachers with direct teaching experience in the subject. Participant selection continued until data saturation was achieved.

Research Instrument

A researcher-developed semi-structured interview guide served as the primary instrument for data collection. The interview guide was validated by experts in Science Education and Qualitative Research. To enhance the credibility of the findings, classroom observations and document analysis of lesson plans, instructional materials, and assessment tools were also conducted.

Data Gathering Procedure

Approval to conduct the study was obtained from the Schools Division Office, school administrators, and participating teachers. After securing informed consent, individual semi-structured interviews lasting approximately 45–60 minutes were conducted and audio-recorded. Classroom observations and document analysis were carried out to validate the interview data. All interviews were transcribed verbatim and verified through member checking.

Data Analysis

The collected data were analyzed using Braun and Clarke's (2021) thematic analysis, following six phases: familiarization with the data, coding, theme generation, theme review, theme definition, and report writing. Emergent themes were supported by participants' verbatim responses and interpreted using relevant literature on Science education and disaster risk reduction.

Trustworthiness of the Study

The rigor of the study was established using Lincoln and Guba's (1985) criteria of credibility, transferability, dependability, and confirmability. Credibility was ensured through member checking, triangulation of interviews, classroom observations, and document analysis. Thick descriptions, peer debriefing, and an audit trail further strengthened the trustworthiness of the findings.

Ethical Considerations

The study strictly observed ethical standards in educational research. Approval was secured from the appropriate educational authorities before data collection. Participation was voluntary, and informed consent was obtained from all participants. Confidentiality and anonymity were maintained through the use of pseudonyms, and all data were used solely for research purposes. Participants were informed of their right to withdraw from the study at any time without penalty.

Findings and Discussion

The analysis of the participants' narratives generated five major themes that describe the instructional practices of Senior High School Science teachers in developing learners' competencies in Disaster Risk Assessment and Hazard Identification. This section presents the first two emergent themes supported by participants' verbatim responses and relevant literature.

Theme 1: Contextualizing Disaster Risk Concepts through Local Hazard Experiences

One of the dominant instructional practices identified was the contextualization of disaster risk concepts using local hazard experiences and community situations. Participants emphasized that learners better understand disaster-related concepts when lessons are connected to disasters they have personally experienced within their communities.

One participant shared:

"Mas nagiging makahulugan ang talakayan kapag ginagamit namin ang mga karanasan ng mga estudyante tuwing bagyo, baha, at lindol bilang halimbawa sa hazard identification." (Participant 2)

Another participant explained:

"I encourage students to identify hazard-prone areas in their barangay. They become more interested because they can relate the lesson to their own surroundings." (Participant 6)

Teachers also integrated local disaster events into classroom discussions to strengthen learners' understanding of disaster risks.

One participant stated:

"Kapag pinag-uusapan namin ang landslide o flooding, ginagamit namin ang mga nangyari mismo sa Nueva Vizcaya upang mas maunawaan nila ang sanhi, epekto, at mga paraan ng pag-iwas." (Participant 4)

These findings indicate that contextualized instruction enables learners to connect theoretical concepts with real-life disaster situations. By relating lessons to local hazards, teachers enhance learners' awareness of community risks and strengthen their capacity to identify potential hazards and appropriate preparedness measures.

The findings support Vygotsky's Constructivist Learning Theory (1978), which emphasizes that meaningful learning occurs when knowledge is constructed through authentic social and environmental experiences. Likewise, Shaw et al. (2011) argued that contextualizing disaster education using local experiences strengthens learners' disaster awareness and promotes community resilience.

Theme 2: Promoting Experiential and Inquiry-Based Learning for Disaster Preparedness

Another major instructional practice that emerged was the use of experiential and inquiry-based learning to develop learners' competencies in disaster risk assessment and hazard identification. Participants explained that they encouraged learners to actively investigate disaster scenarios, analyze risks, and participate in simulations rather than relying solely on lectures.

One participant remarked:

"Hindi sapat ang lecture lamang. Mas natututo ang mga estudyante kapag sila mismo ang nagsasagawa ng hazard mapping at disaster simulation activities." (Participant 1)

Another participant shared:

"Pinapagawa ko sila ng group investigations tungkol sa mga hazard sa kanilang komunidad at pagkatapos ay ipinapakita nila ang kanilang risk assessment." (Participant 8)

Teachers also highlighted the value of disaster drills and field-based activities.

As one participant explained:

"Kapag may earthquake at fire drills, ipinapaliwanag namin ang siyentipikong dahilan kung bakit mahalaga ang bawat hakbang upang maintindihan nila ang tamang pagtugon sa sakuna." (Participant 5)

Participants observed that experiential learning enhanced learners' critical thinking, decision-making, collaboration, and disaster preparedness. By engaging in authentic activities, learners developed a deeper understanding of hazards and became more confident in applying disaster risk reduction principles in real-life situations.

These findings are consistent with Kolb's Experiential Learning Theory (1984), which emphasizes that knowledge is best acquired through concrete experiences, reflection, and active experimentation. Similarly, UNDRR (2015) emphasized that experiential disaster education strengthens disaster preparedness and resilience by enabling learners to apply theoretical knowledge in practical situations.

Discussion

The first two themes demonstrate that Senior High School Science teachers employ contextualized, experiential, and inquiry-based instructional practices in developing learners' competencies in Disaster Risk Assessment and Hazard Identification. By integrating local disaster experiences, community hazards, hazard mapping, simulations, and collaborative investigations, teachers make disaster education more relevant and meaningful for learners.

These instructional practices not only improve learners' understanding of disaster concepts but also strengthen critical thinking, problem-solving, risk assessment, and preparedness skills. The findings affirm that effective Disaster Risk Reduction and Management (DRRM) education extends beyond classroom instruction by engaging learners in authentic experiences that prepare them to respond responsibly to hazards and contribute to building disaster-resilient communities.

Theme 3: Integrating Community-Based Disaster Preparedness Activities

Participants emphasized that community-based learning experiences were essential in helping learners understand disaster risks within their local environment. They integrated activities such as hazard mapping, community observations, risk assessments, and disaster preparedness campaigns to enable learners to apply classroom concepts to real-life situations.

One participant shared:

"Pinapalabas namin ang mga estudyante upang tukuyin ang mga hazard-prone areas sa kanilang barangay. Mas nagiging totoo ang kanilang pagkatuto kapag nakikita nila mismo ang mga panganib sa kanilang komunidad." (Participant 3)

Another participant explained:

"Kasama sa aming mga gawain ang paggawa ng community hazard maps at disaster preparedness plans na maaaring magamit ng kanilang pamilya." (Participant 7)

Teachers observed that involving learners in community-based activities improved their understanding of vulnerability, exposure, and disaster preparedness while strengthening their sense of social responsibility.

These findings support Shaw et al. (2011), who emphasized that community-based disaster education develops learners' capacity to identify hazards, assess risks, and actively participate in building disaster-resilient communities. Likewise, the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015) recognizes education as a critical strategy for enhancing disaster resilience through community participation and risk awareness.

Theme 4: Addressing Instructional Challenges through Resourcefulness and Collaboration

Another significant theme that emerged was teachers' resourcefulness and collaborative problem-solving in overcoming instructional challenges. Participants reported limitations in instructional materials, simulation equipment, and learning resources but consistently adapted their teaching practices to ensure meaningful learning experiences.

One participant remarked:

"Hindi sapat ang mga kagamitan kaya gumagamit kami ng improvised materials, videos, at actual case studies upang maipakita ang iba't ibang hazards." (Participant 5)

Another participant stated:

"Nakikipagtulungan kami sa MDRRMO at iba pang ahensya upang magkaroon ng resource speakers at practical demonstrations." (Participant 9)

Teachers also shared instructional materials and lesson plans during Learning Action Cell (LAC) sessions and departmental meetings.

As one participant explained:

"Malaking tulong ang collaboration sa kapwa guro dahil nakakapagbahagi kami ng mga strategies at learning resources." (Participant 2)

These findings indicate that collaboration and instructional innovation enabled teachers to address resource limitations while maintaining the quality of disaster education.

The findings are supported by Fullan (2020), who emphasized that collaboration and collective professional learning strengthen teachers' capacity to implement educational reforms effectively. Similarly, Darling-Hammond et al. (2020) highlighted that adaptive instructional practices enable teachers to respond effectively to diverse classroom contexts and resource constraints.

Theme 5: Strengthening Disaster Resilience through Continuous Professional Learning

The final theme highlights the importance of continuous professional development in enhancing teachers' competence in disaster education. Participants acknowledged that seminars, webinars, Learning Action Cell (LAC) sessions, and partnerships with disaster management agencies enhanced their confidence and instructional effectiveness.

One participant shared:

"Ang mga seminar tungkol sa DRRM ay malaking tulong upang maging updated kami sa mga bagong impormasyon at teaching strategies." (Participant 6)

Another participant explained:

"Patuloy kaming natututo sa mga training kasama ang MDRRMO at DepEd upang mas mapabuti ang pagtuturo ng disaster preparedness." (Participant 10)

Participants emphasized that continuous learning enabled them to integrate current disaster risk reduction policies, emerging hazards, and innovative instructional approaches into classroom instruction.

These findings support DuFour and Fullan (2013), who emphasized that professional learning communities foster instructional improvement through collaboration and shared expertise. Likewise, UNESCO (2021) emphasized that teachers' continuous professional development is essential for strengthening disaster risk reduction education and building resilient schools.

Integrative Discussion

The findings reveal that Senior High School Science teachers employ contextualized, experiential, inquiry-based, and community-centered instructional practices in developing learners' competencies in Disaster Risk Assessment and Hazard Identification. By integrating local disaster experiences, hazard mapping, simulations, collaborative investigations, and community engagement, teachers provide authentic learning experiences that enable learners to understand disaster risks and develop appropriate preparedness strategies.

Despite challenges related to instructional resources, limited time, and varying learner readiness, participants demonstrated professionalism, creativity, and adaptability by utilizing localized materials, collaborating with colleagues and disaster management agencies, and continuously improving their instructional practices through professional learning opportunities. These adaptive strategies contributed to the effective implementation of disaster education and strengthened learners' critical thinking, risk assessment, and decision-making skills.

Therefore, the findings suggest that successful Disaster Risk Reduction and Management (DRRM) instruction depends not only on curriculum implementation but also on teachers' instructional competence, community partnerships, institutional support, and continuous professional development. Strengthening these areas can enhance learners' disaster preparedness, promote a culture of safety, and contribute to the development of resilient schools and communities.

Conclusion

This study explored the instructional practices of Senior High School Science teachers in developing learners' competencies in Disaster Risk Assessment and Hazard Identification in public secondary schools in Bayombong, Nueva Vizcaya. The findings revealed that teachers employ learner-centered, contextualized, experiential, and inquiry-based instructional approaches that enable learners to understand disaster concepts and apply them to real-life situations. By integrating local hazard experiences, community-based activities, simulations, and collaborative learning, teachers foster learners' critical thinking, decision-making, and disaster preparedness skills.

Five major themes emerged from the study: contextualizing disaster risk concepts through local hazard experiences, promoting experiential and inquiry-based learning, integrating community-based disaster preparedness activities, addressing instructional challenges through resourcefulness and collaboration, and strengthening disaster resilience through continuous professional learning. These instructional practices demonstrate teachers' commitment to developing learners who are knowledgeable, prepared, and capable of responding appropriately to disaster risks despite challenges related to instructional resources, time constraints, and varying learner readiness.

The study concludes that the effective development of learners' competencies in Disaster Risk Assessment and Hazard Identification depends not only on the prescribed curriculum but also on teachers' instructional competence, innovation, collaboration, and continuous professional growth. Strengthening these dimensions will enhance the quality of Disaster Risk Reduction and Management (DRRM) education and contribute to building disaster-resilient schools and communities.

Implications of the Study

The findings underscore the significant role of Science teachers in advancing Disaster Risk Reduction and Management education through meaningful and contextualized instructional practices. Schools should strengthen support systems by providing updated instructional materials, simulation equipment, and opportunities for experiential learning. School administrators should also encourage stronger partnerships with Local Disaster Risk Reduction and Management Offices (LDRRMOs), emergency response agencies, and community organizations to enrich classroom instruction with authentic disaster preparedness activities.

The study further highlights the importance of continuous professional development. Regular training, Learning Action Cell (LAC) sessions, and collaborative professional learning can enhance teachers' competencies in disaster education, enabling them to deliver relevant, engaging, and evidence-based instruction. The findings also provide useful insights for curriculum developers and policymakers in strengthening the integration of DRRM concepts within the Science curriculum.

Recommendations

Based on the findings and conclusions, the following recommendations are proposed:

1. **The Department of Education** should provide continuous professional development programs focusing on Disaster Risk Reduction and Management (DRRM), inquiry-based instruction, contextualized teaching, and disaster education pedagogy.
2. **School administrators** should strengthen institutional support by providing adequate instructional resources, simulation equipment, digital learning materials, and opportunities for field-based and community-centered disaster learning activities.
3. **Science teachers** should continue utilizing contextualized, experiential, and inquiry-based instructional strategies while integrating local disaster experiences and community resources into classroom instruction to strengthen learners' disaster preparedness and resilience.
4. **Schools** should strengthen partnerships with Local Disaster Risk Reduction and Management Offices (LDRRMOs), the Office of Civil Defense (OCD), the Philippine Red Cross, and other community organizations to provide authentic learning experiences through drills, simulations, seminars, and hazard mapping activities.
5. **Curriculum developers** should continuously review and enhance DRRM competencies by incorporating current disaster risk reduction policies, climate change adaptation, community resilience, and emerging environmental hazards into the Senior High School Science curriculum.
6. **Future researchers** are encouraged to conduct similar qualitative or mixed-method studies in different regions to further examine instructional practices, learner outcomes, and school-community partnerships in Disaster Risk Reduction and Management education.

The study emphasizes that developing learners' competencies in Disaster Risk Assessment and Hazard Identification requires collaborative efforts among teachers, school leaders, policymakers, *Studies in Interdisciplinary Horizons*

disaster management agencies, and local communities. Through sustained professional development, strong institutional support, and meaningful community engagement, schools can cultivate disaster-ready learners who are capable of making informed decisions and contributing to safer, more resilient communities.

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