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Bridging the Knowledge Gap: Evaluating DRR Awareness Among Indigenous Trainee Teachers

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Abstract: Disasters have numerous effects on children, who are one of the most vulnerable groups in society. Increasing teachers' knowledge and awareness of Disaster Risk Reduction (DRR) can enhance the overall disaster resilience of the community. Teachers not only educate schoolchildren but also play a key role in shaping school policies and practices related to safety and emergency preparedness. Therefore, this study explores the introduction of DRR education to trainee teachers and evaluates their knowledge of DRR. A quantitative approach was employed to assess the knowledge of trainee teachers. A sample of indigenous trainee teachers from the Teacher's Training Institute participated in the study. Pre- and post-workshop questionnaires were distributed to participants during a capacity-building workshop, which engaged a total of 40 participants, aged between 18 and 24. Analysis of the pre- and post-workshop questionnaires revealed initial uncertainty among trainee teachers regarding their knowledge of DRR, with a significant increase in confidence after the workshop. After the workshop, there was a notable improvement in the ability to identify various hazards specific to Malaysia, indicating a rise in awareness and understanding. Trainee teachers expressed strong support for incorporating hazard education into the school curriculum, emphasizing its importance for future generations. Overall, the findings highlight the significance of educating both school students and teachers about DRR to enhance community resilience.

Keywords: Disaster Risk Reduction; Education; School; Teacher.

1.0 Introduction

Resilient communities can anticipate risks, mitigate their impact, and recover swiftly by surviving, adapting, and growing amidst disruptive changes (Norris et al., 2008; Fu & Zhang, 2024). Education plays a fundamental role in this strategy, and schools and teachers are key in building resilience, benefiting not only students but also the broader community (Johnson et al., 2016; Kawasaki et al., 2022). In this context, disaster education is an essential instrument. Education, at its core, goes beyond the simple transmission of knowledge. Children, as one of the most vulnerable groups when disaster strikes, are often at greater risk of trauma, injury, or even death. Therefore, it is vital for children to be seen, heard, and included in Disaster Risk Reduction (DRR) education. Equipping schoolchildren with disaster education can effectively provide them with the knowledge, skills, and behavioral changes necessary for disaster preparedness (Mitchell & Borchard, 2014). Integrating teacher resilience and well-being into the broader framework of community resilience is not only important but essential. As key figures for the younger generation, teachers' preparedness directly influences, or may significantly impact, the community's overall readiness.

The need to implement disaster education widely in schools in Malaysia is more pressing than ever. DRR education is indispensable for Malaysian schools, serving as a crucial measure to equip children with the knowledge and skills necessary to mitigate the impact of potential disasters. Disaster education for schoolchildren is key to building a disaster-resilient community (How et al., 2020; Mitchell & Borchard, 2014; Izumi & Shaw, 2014). Like many neighboring Southeast Asian countries, Malaysia is vulnerable to hazards such as floods, landslides, haze, and other disasters, making it crucial to integrate DRR into the school curriculum. Through DRR education, children can develop an understanding of disaster risks, learn appropriate responses, and build resilience in the face of adversity. It is vital for children to develop the right attitude toward disasters, as this enhances their understanding and ability to respond effectively. By fostering a culture of preparedness from a young age, Malaysian schools are expected to significantly contribute to building a more resilient society capable of effectively managing and responding to natural disasters.

In line with global DRR frameworks such as Agenda 21 (1992), the Hyogo Framework for Action (2005–2015), and the Sendai Framework for Disaster Risk Reduction (2015–2030), Malaysia has made slow progress in disaster education. According to How et al. (2020), the Malaysian government has initiated efforts to implement disaster education in schools. For instance, the "Safe School Programme," launched by Malaysia's Ministry of Education (MoE) in 2002, calls for support from families and local communities to reduce school violence and foster a culture of safety. One specific goal of the program is to improve understanding of safety-related procedures, such as emergencies, accidents, and disasters (Tie, 2005). Ismail et al. (2016) also noted that disaster preparedness is included in safety management circulars issued by the MoE. Despite these policies, the focus has been more on social issues, with limited efforts directed at educating students about disaster education. Most safety practices in schools are based on what each school considers most important (Ismail et al., 2016).

Malaysia has undertaken commendable initiatives in DRR education, recognizing its vital role in fostering resilience and preparedness among its population. The government has implemented various programs and policies aimed at integrating DRR into the national curriculum, ensuring that both students and educators are equipped with the knowledge and skills needed to mitigate disaster impacts. Collaborative efforts between government agencies, non-governmental organizations, and educational institutions have been instrumental in developing comprehensive DRR education frameworks tailored to Malaysia's specific needs and vulnerabilities. Additionally, Malaysia has actively participated in regional and international disaster management forums, sharing best practices and expertise to enhance its DRR efforts. By prioritizing DRR education, Malaysia demonstrates its commitment to building a safer and more resilient nation capable of addressing the challenges posed by natural disasters.

On the other hand, the Ministry of Education's efforts regarding disaster education have primarily involved collaboration with non-governmental organizations (NGOs). Current disaster education at the school level is mostly initiated by school authorities or NGOs connected to educational bodies (How et al., 2020). For example, the "School Preparedness Program Training of Trainers" (Embracing the Winds of Change, MERCY Malaysia 2017 Annual Report) is a joint effort between MERCY Malaysia and the MoE to train facilitators in school preparedness activities. This initiative marks a significant step toward implementing disaster education more effectively in schools. However, a study by Amri et al. (2017) suggests that while children express strong interest in learning about disasters and feel they know how to stay safe, most scored poorly on knowledge tests, particularly on topics like hygiene and fire safety. This highlights the gap between students' awareness

Article Journal of Asian Geography, 2024, Volume 4 (Issue 1), 54-64.
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of hazards and their actual knowledge of DRR. To address this, it is essential to conduct Training of Trainers (ToT) for trainee teachers to educate students systematically using well-established DRR modules.

Training of Trainers (ToT) is an effective way to disseminate DRR education to teachers (Izadkhah et al., 2012; Gökmenoğlu et al., 2021), providing development opportunities and building capacity (Izumi & Shaw, 2014). This approach aligns with Shift 4 of the Malaysian Education Blueprint (2013-2025), which emphasizes improving teachers' continuous professional development (CPD). In-service teachers can be introduced to DRR education through various methods, such as workshops, hands-on activities, and games. These trained teachers can then pass on the knowledge to other educators, creating a cost-effective, time-efficient way to spread disaster knowledge (Gökmenoğlu et al., 2021) and help promote disaster preparedness (How et al., 2020). This cascading method of training is an effective way to expand the number of trained teachers and integrate DRR education into higher education programs for future educators (Amri et al., 2017).

Training teachers and future educators in DRR is crucial for ensuring the effective implementation of DRR education in schools. Teachers play a central role in shaping students' attitudes, behaviors, and preparedness, making them essential agents of change in building disaster-resilient communities. By equipping teachers with the necessary knowledge and skills related to DRR, they can incorporate disaster preparedness and response strategies into their teaching practices. Moreover, trained teachers can advocate for DRR education within their schools and communities, fostering a culture of resilience and preparedness. Investing in teacher training not only enhances the quality of DRR education but also strengthens the overall resilience of communities, ensuring that children are better prepared to face and mitigate the impact of disasters.

The direct correlation between investment in higher education and Malaysia's remarkable economic growth reflects a positive trend in the increasing number of students attending higher education institutions (HEIs) (Reza, 2016). Public HEIs in Malaysia are highly sought after, with enrollment numbers steadily increasing compared to private HEIs. However, the number of students in Polytechnic Institutes and Teacher's Training Institutes appears to have plateaued over the past five years (2007–2011). Although no concrete evidence exists, the relatively low number of students opting for these institutions could explain why they have been overlooked in DRR education training. ToT in Teacher's Training Institutes is particularly important to prepare future teachers with adequate DRR knowledge. Therefore, besides public and private HEIs, Polytechnic and Teacher's Training Institutes should be prioritized in DRR education training, in alignment with the fourth United Nations Sustainable Development Goal (SDG), which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This study explores the introduction of DRR education to trainee teachers and evaluates their knowledge of DRR.

2.0 Materials and Methodology

This study utilized a quantitative approach to explore the knowledge of trainee teachers. A sample of indigenous trainee teachers from the Teacher's Training Institute (IPG) at Tengku Ampuan Afzan Campus in Pahang participated in this pilot case study. IPG was selected as a pilot case because it is one of the public higher education institutions that often overlooks conducting training in DRR education for students. The Training of Trainers (ToT) in Teacher's Training Institutes is especially important for preparing future teachers with adequate DRR knowledge. Forty trainee teachers from various backgrounds participated in this research, forming a cohort of indigenous trainee teachers capable of delivering DRR knowledge to their vulnerable communities and students. Besides being part of the school community in the future, the indigenous trainee teachers may play a vital role in their communities by integrating DRR knowledge with traditional practices and local knowledge, making disaster preparedness more culturally relevant and effective for their communities. Overall, DRR education for indigenous trainee teachers is essential for building resilient, informed, and proactive communities capable of withstanding and recovering from disasters, not just in schools but also elsewhere.

A pre- and post-questionnaire were distributed to the participants during a capacity-building workshop. The pre-questionnaire was distributed prior to the workshop. Both questionnaires included close-ended and open-ended questions designed to assess the participants' knowledge of disasters, DRR, and types of hazards. The pre-workshop questionnaire consisted of 17 questions (designated as Q1-Q17), while the post-workshop questionnaire comprised 20 questions (designated as Q1-Q20). The discrepancy in the question count between the pre- and post-questionnaires also considered the respondents' understanding of the workshop content that had been delivered. Specifically, Q1 and Q2 in both questionnaires pertain to demographic information, while the remaining questions address workshop-related content. A total of 40 participants, aged between 18 and 24, engaged in the workshop by completing both pre- and post-questionnaires. Findings derived from the responses to both questionnaires have been categorized into three distinct subdivisions: (i) knowledge about disaster and DRR, (ii) types of hazards, and (iii) perspectives of trainee teachers towards DRR in Malaysia. The questionnaire results were entered and analyzed using Microsoft Excel.

3.0 Results and Discussion

The study involved 40 indigenous trainee teachers, aged between 18 and 24, representing diverse backgrounds, with 15 males and 25 females participating. The respondents' answers to both questionnaires have been analyzed based on three distinct subdivisions: knowledge of disasters and disaster risk reduction (DRR), types of hazards, and trainee teachers' perspectives on DRR in Malaysia.

3.1 Knowledge towards disaster and DRR

In the pre- and post-workshop questionnaires, only Q3 and Q4 were considered to evaluate the trainee teachers' knowledge of disaster and DRR. Prior to the workshop, 28 participants answered that they knew what DRR is, while 12 did not know about DRR. However, when asked to rate their level of knowledge about DRR, 21 participants selected 'not sure,' and only 1 chose 'very high' (Table 1). This suggests that the trainee teachers may believe they know about DRR, but they are uncertain whether they possess the correct knowledge. After the workshop, the teachers were asked to respond to an open-ended question about disasters, and most of them were able to provide a brief answer reflecting their general understanding of disasters. When asked to rate their knowledge of DRR, 24 of them confidently chose 'high' as their level of knowledge (Table 2).

This observation indicates a potential discrepancy between perceived and actual understanding among the trainee teachers. Following the workshop, participants completed the post-workshop questionnaire, which included an open-ended question regarding disasters. The majority of respondents were able to provide concise explanations reflecting their general understanding of disasters. Notably, when asked to rate their level of knowledge on DRR, 24 participants expressed confidence by selecting 'high' (see Table 2). This shift in self-assessment suggests a positive impact of the workshop on the participants' perception of their DRR knowledge.

Journal of Asian Geography, 2024, Volume 4 (Issue 1), 54-64.
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Table 1: Level of knowledge towards DRR of trainee teachers before the workshop.

No.	Level of Knowledge	No. of participants
1.	Very Low	4
2.	Low	7
3.	Not Sure	21
4.	High	7
5.	Very High	1

Table 2: Level of knowledge towards DRR of trainee teachers after the workshop.

No.	Level of Knowledge	No. of participants
1.	Very Low	0
2.	Low	1
3.	Not Sure	1
4.	High	24
5.	Very High	14

3.2 Type of Hazards

According to a 2020 technical report by the United Nations Disaster Risk Reduction (UNDRR), hazards can be classified into six categories: biological hazards, environmental hazards, geological or geophysical hazards, hydrometeorological hazards, technological hazards, and societal hazards. Sometimes, it is difficult to isolate or characterize hazard events, as one hazard can trigger another. For example, heavy rainfall can lead to a landslide, or a volcanic eruption can cause a landslide and trigger a tsunami. However, in this subdivision, we focus on climatic hazards (similar to hydrometeorological hazards), geological hazards, technological hazards, and biological hazards only.

In this section, our analysis focuses exclusively on responses to inquiries Q5-Q10 and Q13-Q16 from the pre-workshop questionnaire, and Q5-Q9 and Q11-Q19 from the post-workshop questionnaire. Prior to the workshop, trainee teachers predominantly cited climatic hazards as the most recognized type of hazard, followed by geological and biological hazards, with technological hazards receiving minimal mention. Responses regarding examples of hazards specific to Malaysia primarily centered on floods and landslides in various states, which are recurring annual occurrences. Following the workshop, a notable shift in responses was observed, with trainee teachers offering a broader range of hazard examples. These included instances such as toxic waste pollution at Sungai Kim Kim and bauxite pollution in Kelantan, indicating an enhanced awareness of less conventional hazards prevalent in Malaysia after the workshop.

Additionally, they were asked to select one or more examples of hazards (out of 12 provided options) according to their types of hazards in the pre- and post-workshop questionnaires. The 12 options included flood, haze, storm, drought, tropical cyclone, volcanic eruption, tsunami, chemical explosion, earthquake, landslides, virus outbreak, and vehicle accident. Correct answers are highlighted in green, while incorrect answers are highlighted in red.

The following sections present the results for each type of hazard:

3.2.1 Climatic Hazards

Climatic hazards are associated with potentially hazardous weather and hydrometeorological events that could harm humans, property, livelihoods, resources, and the environment (Hobbs, 1987). As shown in Figure 1, 'floods' had the highest frequency of responses, followed by drought, storm, and haze. 'Tropical cyclone' and 'tsunami' received 16 and 17 responses, respectively. Slightly more participants chose 'tsunami,' which is a geological hazard, suggesting that some participants did not fully understand climatic hazards prior to the workshop. Figures 1 and 2 display the hazards chosen by the participants. Fortunately, the frequency of incorrect responses dropped significantly after the workshop, indicating that the trainee teachers had a better understanding of climatic hazards post-workshop. However, there was still a slightly higher frequency of responses for 'tsunami,' implying that some participants continued to have difficulty identifying 'tsunami' as a geological hazard.

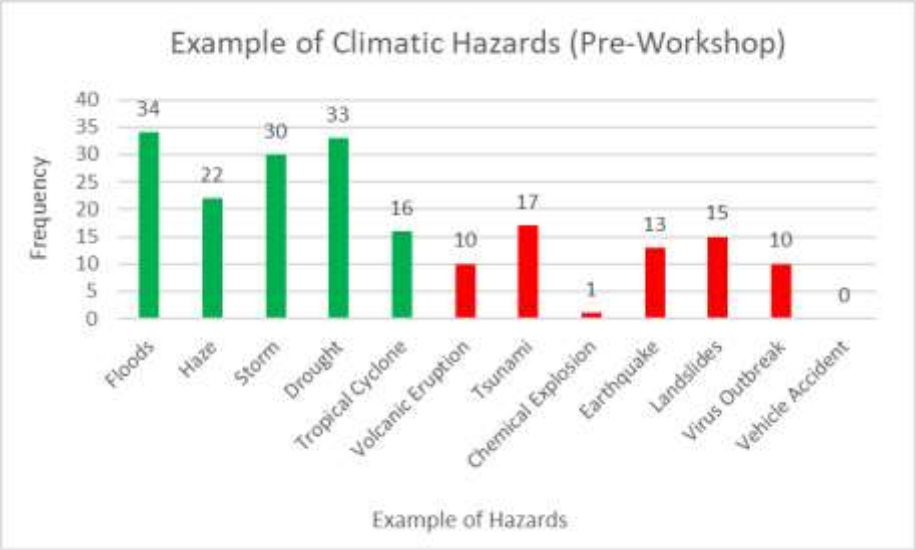

Figure 1: The frequency of answers for climatic hazards before the workshop

Article Journal of Asian Geography, 2024, Volume 4 (Issue 1), 54-64.
https://doi.org/10.36777/jag2025.4.1.7

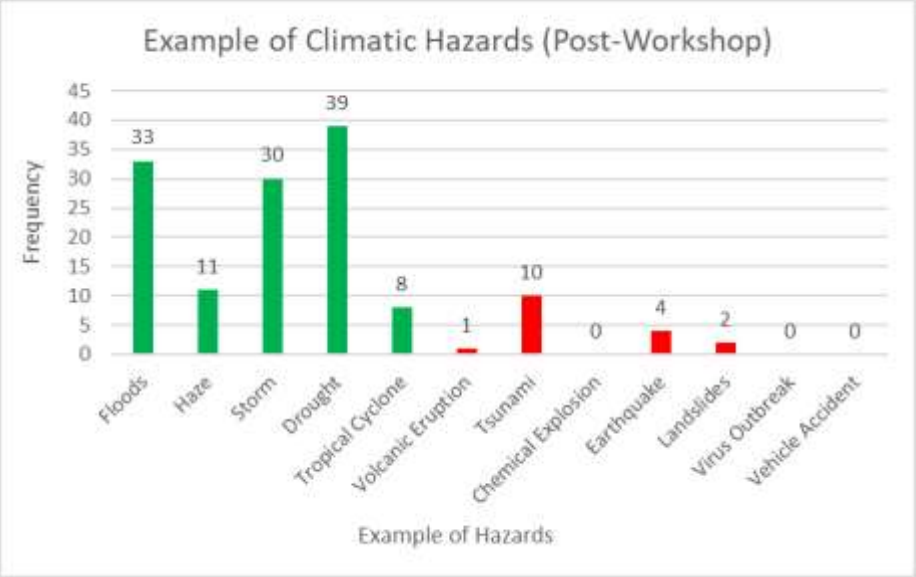

Figure 2: The frequency of answers for climatic hazards after the workshop.

Furthermore, participants were asked to respond to open-ended questions regarding actions to be taken during and after flooding in both questionnaires. Predominantly, responses indicated a consensus that individuals should relocate to higher ground during flood events and collaborate to rehabilitate affected residences and infrastructure afterward. These responses collectively suggest that participants possess a solid understanding of appropriate measures to take in response to flood occurrences, likely influenced by the frequency of such events in Malaysia. To assess participants' comprehension and focus, they were prompted to identify factors that are not responsible for climatic hazards. As depicted in Figure 3, the majority of respondents accurately recognized that climatic hazards do not stem from plate tectonic movements, demonstrating a clear understanding of the principles distinguishing climatic phenomena.

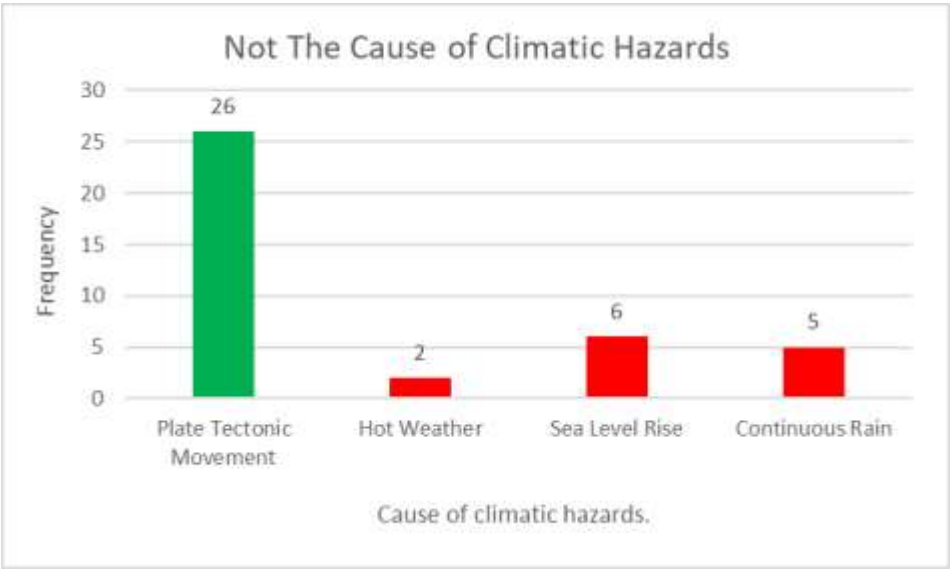

Figure 3: The frequency of answers for not the cause of climatic hazards

3.2.2 Geological Hazards

Similarly, participants were presented with the same set of 12 options to select those they deemed most representative of geological hazards. Geological hazards are defined as geological conditions, processes, or potential events that pose threats to the health, safety, or welfare of communities (Lundgren, 1999). The results of both the pre- and post-workshop questionnaires are shown in Figures 4 and 5. Analysis of the results reveals that 'volcanic eruption' and 'earthquake' received the highest frequencies of selection, closely followed by 'landslides' and 'tsunami.'.

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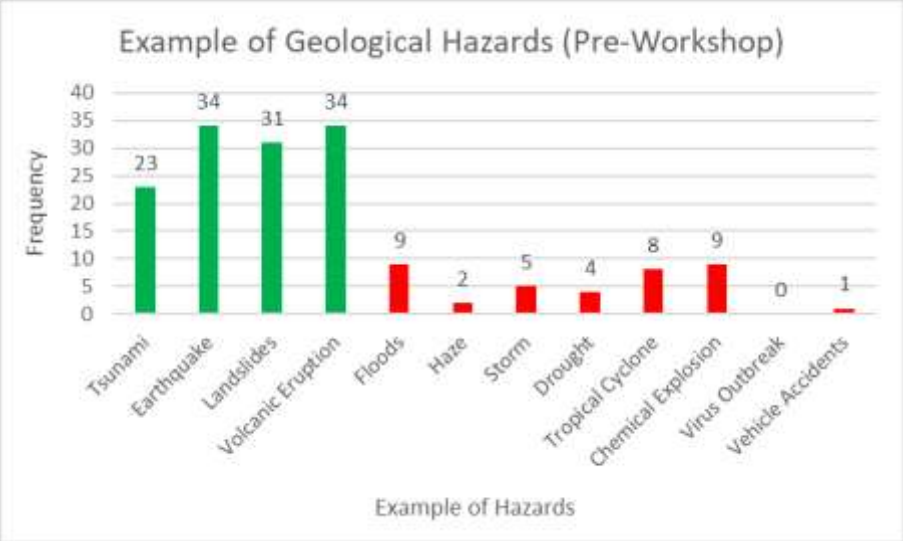

Figure 4: The frequency of answers for geological hazards before the workshop.

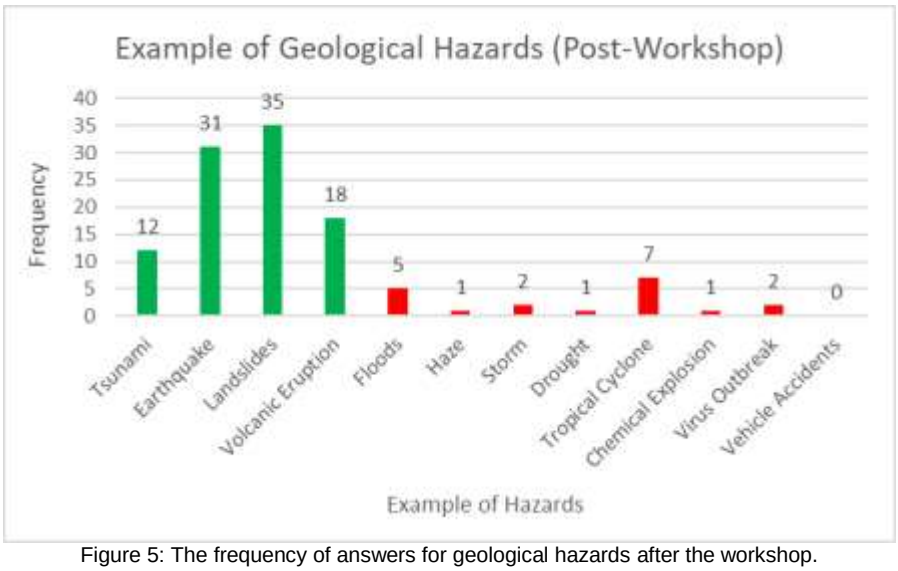

Figure 5: The frequency of answers for geological hazards after the workshop.

In Malaysia, earthquakes are infrequent but plausible occurrences. Participants were prompted to respond to open-ended inquiries regarding appropriate actions to be taken during and after an earthquake. The majority of responses emphasized the importance of seeking refuge outdoors in an open area, protecting one's head, and taking shelter under sturdy objects such as tables during seismic events. Conversely, a notable proportion of participants expressed uncertainty regarding post-earthquake measures in the pre-workshop questionnaire. However, following the workshop, participants demonstrated improved proficiency in providing relevant responses. Additionally, participants were presented with close-ended questions to assess their post-workshop comprehension of geological hazards. The frequencies of responses are shown in Figure 6, revealing favorable outcomes, with a high prevalence of correct responses and minimal instances of incorrect selections. This collective evidence underscores the efficacy of the workshop in enhancing participants' knowledge and preparedness regarding geological hazards, particularly earthquakes.

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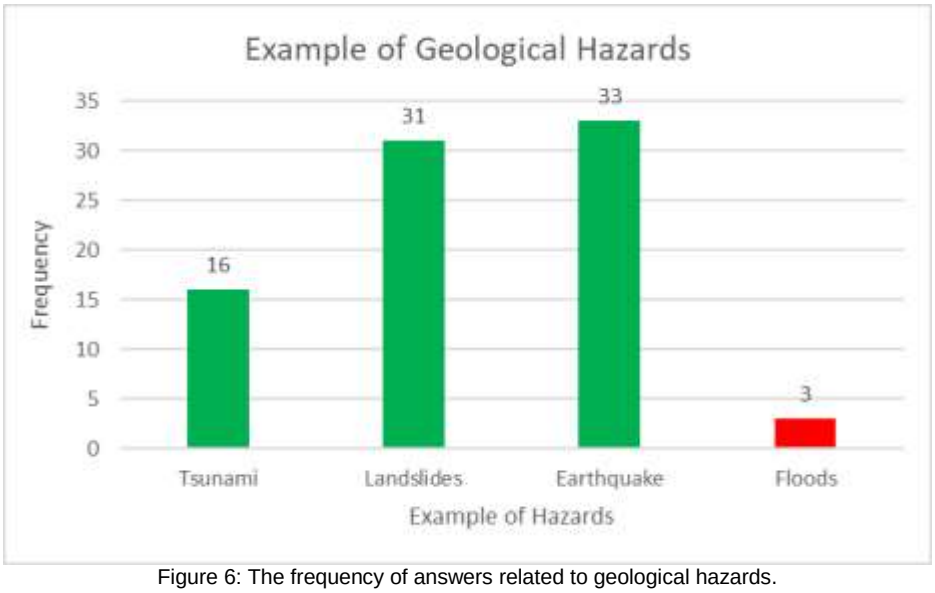

Figure 6: The frequency of answers related to geological hazards.

3.2.3 Technological Hazards

Likewise, participants were presented with a selection of 12 hazard examples to identify those most accurately characterized as technological hazards. According to the United Nations Office for Disaster Risk Reduction (UNDRR, 2018), technological hazards encompass those arising from technological or industrial conditions, hazardous procedures, infrastructure failures, or specific human activities, including chemical, nuclear, and radiological hazards, as well as transport-related hazards. Analysis of the outcomes revealed that 'chemical explosion' garnered the highest frequency of selection, followed by 'vehicle accident' and 'virus outbreak.' Despite limited prior exposure to technological hazards, participants demonstrated a discerning ability to distinguish between examples of technological and geological hazards with precision (refer to Figure 7). While a minority erroneously identified examples of climatic hazards, a notable proportion conflated technological hazards with biological hazards, particularly virus outbreaks.

Conversely, following workshop participation, participants exhibited notable improvements in their ability to identify technological hazards, as evidenced by a significant decrease in the frequency of incorrect responses (refer to Figure 8). This observed enhancement underscores the efficacy of the workshop in clarifying conceptual distinctions and fostering a more nuanced understanding of technological hazard typologies among participants.

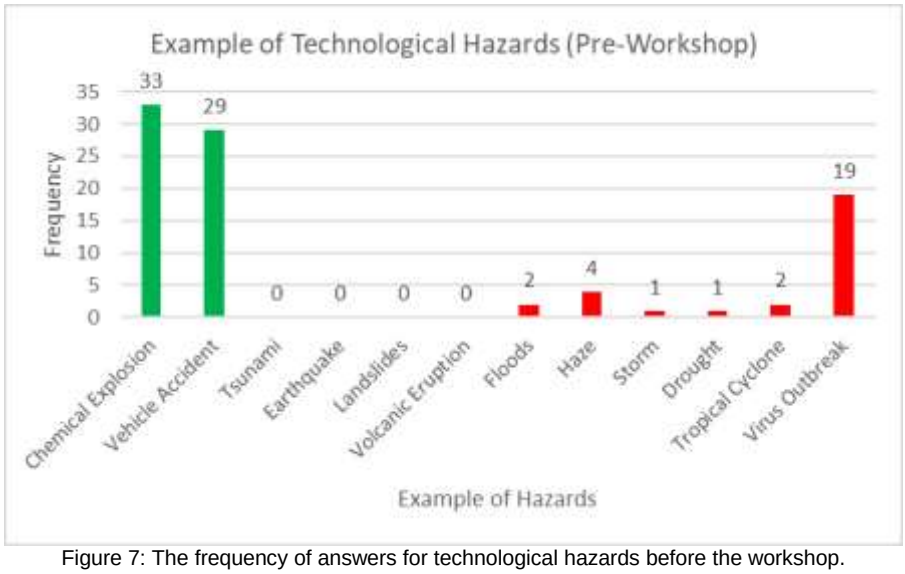

Figure 7: The frequency of answers for technological hazards before the workshop.

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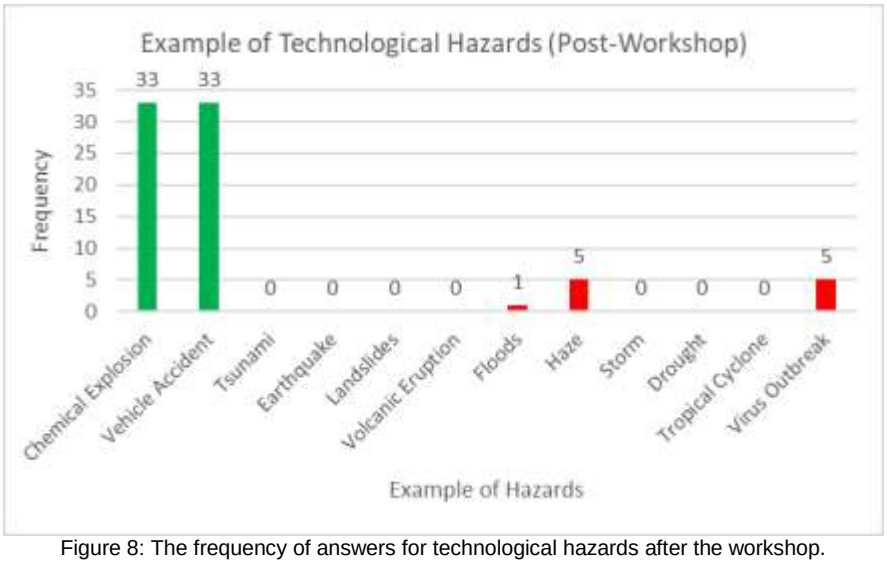

Figure 8: The frequency of answers for technological hazards after the workshop.

To assess participants' knowledge of technological hazard events in Malaysia, a close-ended question was included in the post-workshop questionnaire. Specifically, participants were asked about the cause of toxic pollution in Sungai Kim Kim, with responses from 39 participants available for analysis. The majority of respondents (35) provided correct answers, while only 4 selected incorrect options (see Figure 9). Furthermore, participants were asked separate questions regarding the causes of technological hazards. The findings indicate a strong understanding among participants regarding the causative factors of toxic pollution, with only a minimal proportion failing to accurately identify the cause (refer to Figure 10). These results underscore the effectiveness of the workshop in enhancing participants' comprehension of specific technological hazard events, particularly their ability to identify causal factors related to toxic pollution incidents.

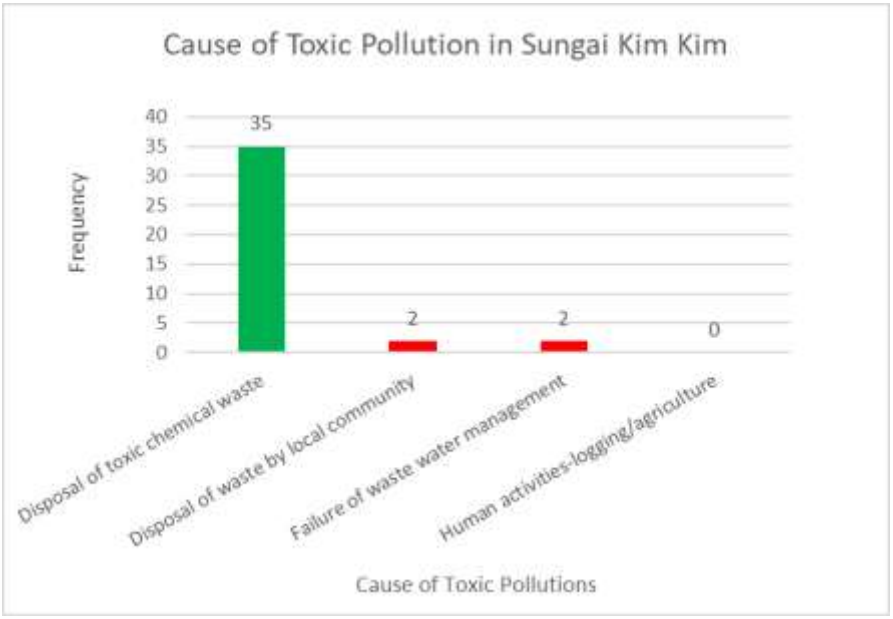

Figure 9: The frequency of answers for the cause of toxic pollution in Sungai Kim Kim.

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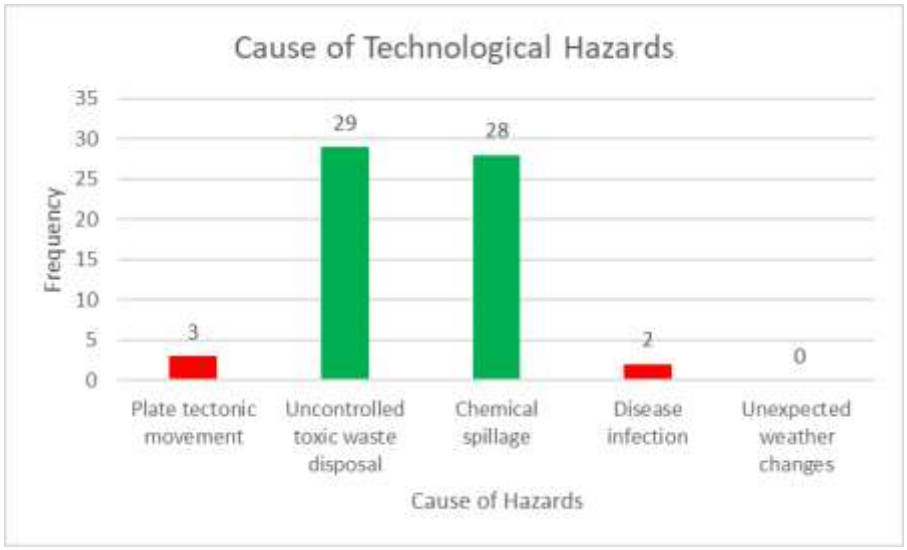

Figure 10: The frequency of answers for the cause of technological hazards.

3.2.4 Biological Hazards

Biological hazards encompass entities of organic origin or those transmitted through biological vectors, including pathogenic microorganisms, toxins, and bioactive substances such as bacteria, viruses, or parasites, along with venomous wildlife, insects, poisonous plants, and mosquitoes carrying disease-causing agents (UNDRR). Prior to the workshop, the predominant response frequency was related to 'virus outbreak' compared to other categories (Figure 11). This suggests that participants had some familiarity with biological hazards; however, the prevalence of responses related to 'chemical explosion' and 'tropical cyclone' indicates a more nuanced understanding.

Post-workshop, the frequency of 'virus outbreak' responses increased significantly, accompanied by a notable decrease in incorrect responses (Figure 12). The majority of trainee teachers demonstrated proficiency in distinguishing biological hazards from other types of hazards. To assess their comprehension further, participants were asked to identify examples of biological hazards occurring in Malaysia, either currently or in the past. Only 39 respondents addressed this question. Figure 13 illustrates a marked prevalence of responses concerning the 'Covid-19 Outbreak' and 'Nipah Virus Outbreak,' contrasted with negligible frequencies of responses related to 'Drought' and 'Coastal Erosion'.

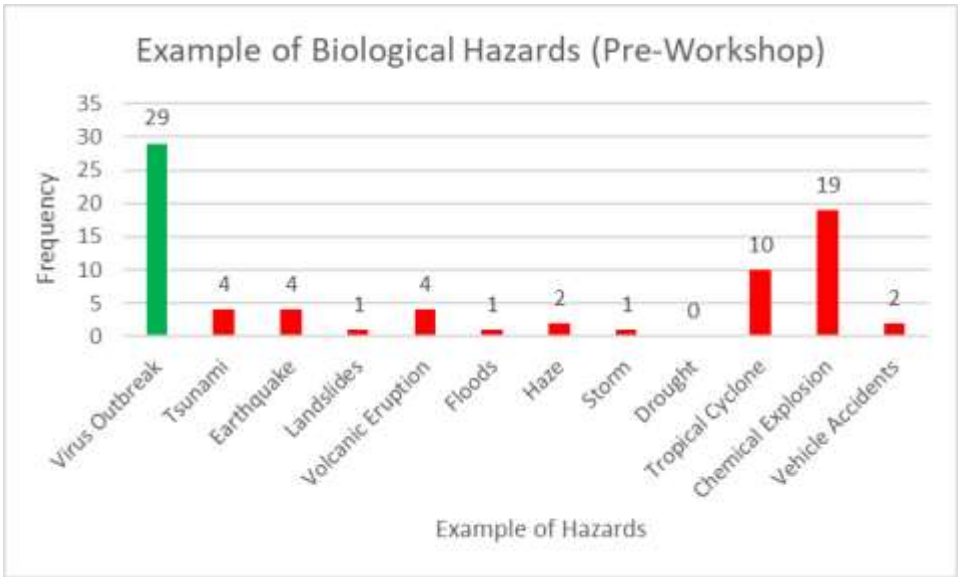

Figure 11: The frequency of answers for biological hazards before the workshop.

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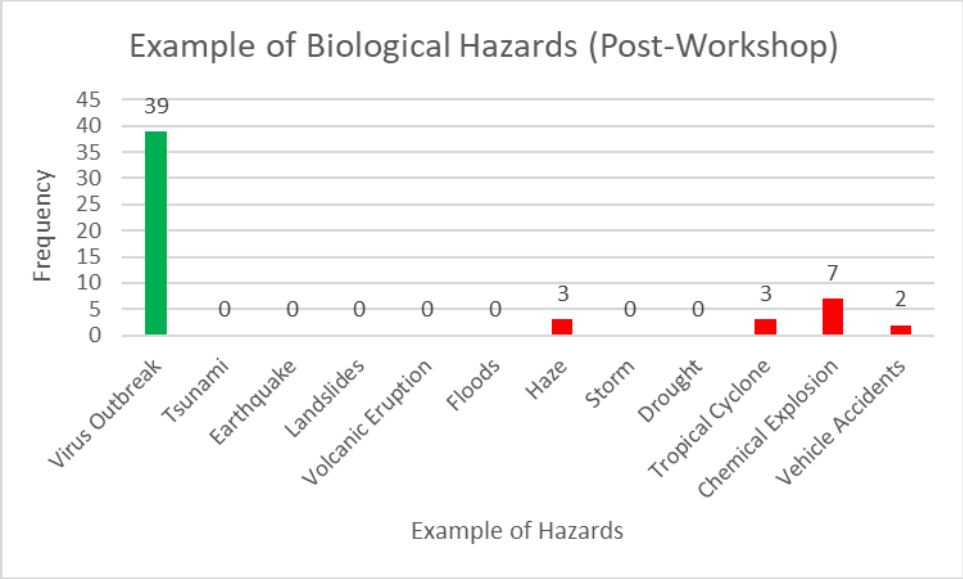

Figure 12: The frequency of answers for biological hazards after the workshop.

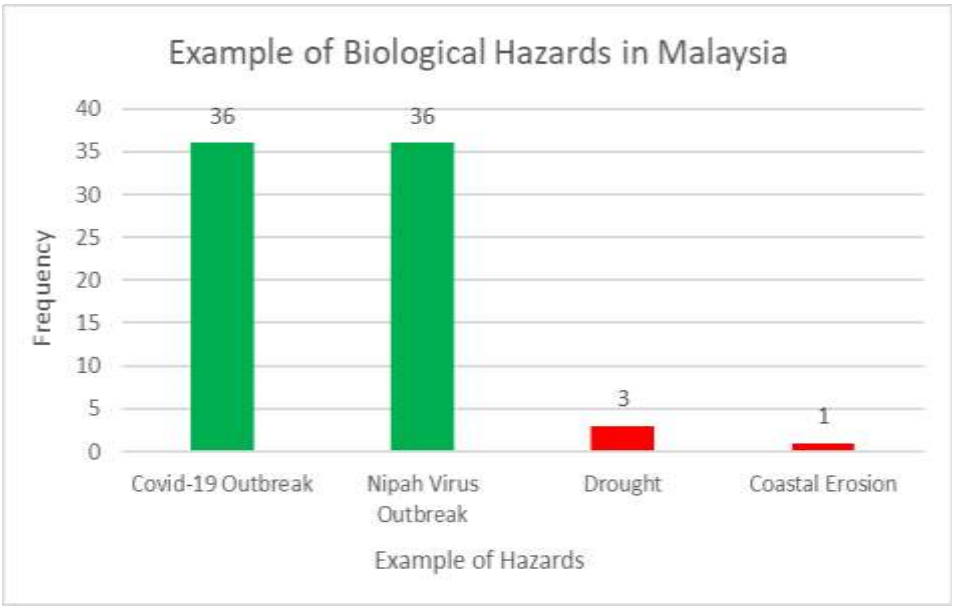

Figure 13: The frequency of answers for example of biological hazards in Malaysia.

3.3 Perspectives of Trainee Teachers Towards DRR education in Malaysia

In this section, we analyzed responses to specific questions from both the pre- and post-workshop questionnaires, namely Q11, Q12, and Q17 pre-workshop, and Q10 and Q20 post-workshop. The findings reveal that the majority of participating trainee teachers strongly agreed on the significance of incorporating hazard education into school curricula. However, one respondent expressed uncertainty about the necessity of integrating disaster education for schoolchildren (refer to Table 3). Regarding perceptions of Malaysia's potential to become a hazard-resilient nation within the next five years, 22 participants remained undecided, while 13 respondents expressed optimism, and five respondents held pessimistic views (see Figure 14). Notably, analysis of Q17 responses from the pre-workshop questionnaire indicated a predominantly positive inclination among trainee teachers toward engaging in disaster education. Additionally, only one respondent exhibited ambivalence. Following the workshop, a noticeable shift was observed, with most participants demonstrating enhanced abilities to articulate informed perspectives and assimilate values pertinent to disaster education.

Table 3: Level of importance for disaster education towards school children in Malaysia.

No.	Level of Importance	No. of participants
1.	Very Unimportant	0
2.	Unimportant	0
3.	Not Sure	1
4.	Important	5
5.	Very Important	34

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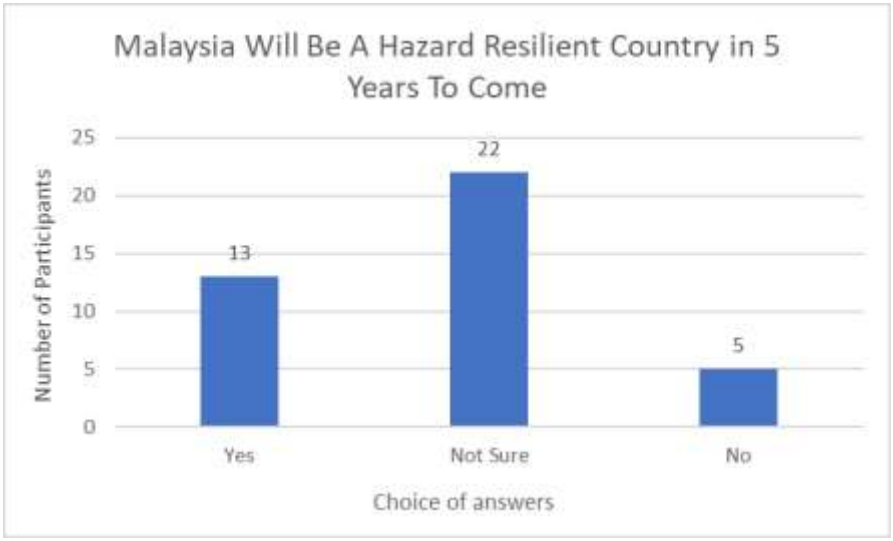

Figure 14: The frequency of answers for 'Can Malaysia be a hazard resilient country in the next 5 years?'

Many studies worldwide have examined the necessity of Disaster Risk Reduction (DRR) education for schoolchildren, highlighting a recognized and documented need to educate students about the various phases of the disaster cycle. While educating schoolchildren from a young age is acknowledged as crucial, ensuring that teachers are adequately trained and knowledgeable about DRR is equally important but has received less attention in research. Teachers play a pivotal role in implementing educational initiatives effectively, including DRR education. Addressing this gap could lead to more effective DRR education programs in schools and enhance overall disaster resilience in communities. Teachers are integral in shaping the school community and influencing children's learning experiences. Their understanding of DRR is essential, as it enables them to integrate preparedness measures into daily lessons, ensuring that children receive a comprehensive education on safety and resilience. By empowering teachers with DRR knowledge, schools can improve their preparedness and contribute to safer, more resilient communities. Therefore, in addition to building the resilience of schoolchildren, it is crucial to strengthen the capacity of teachers from the outset of their training, fostering a culture of disaster awareness early on—especially since disasters have become a shared concern for everyone.

While this study provides valuable insights into the effectiveness of the intervention through a capacity-building workshop, several limitations should be acknowledged. The study uses a short-term assessment, relying on pre- and post-workshop questionnaires to measure changes in knowledge and understanding. This approach captures immediate effects but does not assess long-term retention or the practical application of the knowledge gained. Future research could include follow-up assessments over an extended period, with a larger sample size and statistical validation for broader generalizability, to evaluate sustained learning outcomes. Additionally, the study relies on self-reported data, which introduces the potential for response bias. Participants may have provided socially desirable answers or overestimated their understanding due to the nature of self-assessment. To address this, future studies could incorporate objective knowledge assessments or observational methods to validate self-reported findings. The study focuses on a single cohort of indigenous trainee teachers from one Teacher Training Institute. While this allows for an in-depth exploration of this specific group, it limits the generalizability of the findings to other trainee teachers or institutions. Future research could expand the sample to include multiple training institutes or compare findings across different regions to enhance the external validity of the results. Despite these limitations, the findings offer valuable preliminary insights that can inform the development of more comprehensive training programs and future research in capacity-building for disaster risk reduction education.

4.0 Conclusions

DRR education for schoolchildren in Malaysia is still in its emerging phase, requiring focused attention. Ensuring that teachers participate in training programs or facilitating trainer workshops is crucial for the effective dissemination of DRR education to students. Recognizing the important role of schoolchildren as potential agents of change, efforts to instill awareness about the importance of disaster education among them can extend beyond the household to influence the local community. These findings highlight the significant improvement in participants' understanding, comprehension, and articulation of disaster-related concepts after the workshop. These results reflect the workshop's effectiveness in equipping trainee teachers with enhanced knowledge and skills related to DRR education, marking a constructive step forward in its introduction and refinement in the educational context.

While this study highlights the perspectives of indigenous trainee teachers on DRR, it is essential to explore further how indigenous knowledge systems interact with DRR education. Indigenous communities have long relied on traditional environmental knowledge to anticipate and respond to natural hazards, using environmental cues such as changes in animal behavior, water levels, and wind patterns. However, formal DRR education often overlooks these culturally embedded practices. For example, during the capacity-building workshop, one respondent shared insights into how their communities recognize warning signs of floods and landslides based on generational wisdom. By incorporating indigenous knowledge into DRR education, training programs can become more contextually relevant and culturally responsive. Future research should explore ways to co-develop DRR strategies with indigenous communities, ensuring that traditional wisdom is acknowledged alongside scientific models. Additionally, a qualitative study could further investigate how indigenous trainee teachers perceive the integration of their cultural knowledge into formal DRR training.

In conclusion, the study highlights the crucial foundation needed to advance DRR education in Malaysian schools, emphasizing the important role of teacher capacity building and student empowerment as catalysts for community awareness. The positive impact observed among trainee teachers after the workshop demonstrates the effectiveness of the targeted intervention in enhancing their efficiency and confidence in delivering DRR education. Going forward, policymakers and education stakeholders must prioritize ongoing efforts to institutionalize DRR education in the national curriculum. This requires continuous professional development initiatives for educators, coupled with the integration of innovative pedagogical approaches tailored to engage students effectively. Additionally, fostering partnerships between

educational institutions, government agencies, and civil society organizations can strengthen resources and expertise, facilitating the successful implementation of DRR initiatives across multiple school settings. Based on the findings of this study, future research may explore longitudinal evaluations to measure the long-term effects of DRR educational interventions on students' knowledge, attitudes, and behaviors. Comparative studies across different regions or countries can also offer valuable insights into best practices and contextual factors that influence the effectiveness of DRR education programs.

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