DISASTER PREPAREDNESS, AWARENESS, AND PRACTICES OF RESIDENTS WITHIN RIVERINE FLOODING-AFFECTED AREAS IN DAVAO CITY, PHILIPPINES

Brent F. Avelino[1],
Chris John C. Lajos[1],
Adrian P. Lumantas[1],
Exequiel R. Gono Jr.[2][i]
[1]College of Criminal Justice Education,
University of Mindanao,
Davao City, Philippines
[2]College of Teacher Education,
University of Mindanao,
Davao City, Philippines

Abstract:
Awareness and preparedness of residents living in accident-prone areas is imperative to avoid losing lives and properties. This is the case for the people living in riverines frequented by flood; they must be well-informed, prepared, and quick to repair the damages after the incident. It is the main reason the study was conducted, particularly about the levels of disaster preparedness, awareness adaptation, and mitigation practices of residents within riverine flooding-affected areas in Davao City. Four hundred residents along the riverine in Davao City were surveyed, and the data gathered were treated using statistical tools such as Mean, Pearson r, and Multiple Regressions. The result of the study disclosed that the residents of riverine flood-affected areas in Davao City rated their disaster preparedness as very high, as well as their disaster awareness, indicating that they are prepared and well-informed about the effects of floods. They also rated their adapting behavior and mitigation high, showing they knew how to adjust to their situation. Disaster preparedness is correlated to adaptation and mitigation; also, disaster awareness is correlated with adaptation and mitigation. The indicator of disaster awareness, namely flooding risk, strongly influences adaptation and mitigation. The implication of the study concerns the city government's action of relocating the people living in the area to avoid disastrous events.

Keywords: disaster preparedness, awareness, practices, residents, riverine flooding-affected areas, Davao City, Philippines

[i] Correspondence: email exequielgono@gmail.com

1. Introduction

The aftermath of floods caused by heavy rains and typhoons often results in devastating consequences, particularly for those who are already vulnerable and marginalized (Szewranski *et al.*, 2018). These flood disasters, intensified by factors such as social vulnerability, environmental degradation, and climate change, have become increasingly frequent and severe (Bertilsson *et al.*, 2019). Despite efforts to address these issues, communities, especially those living along riverbanks, remain ill-prepared due to a lack of awareness and proactive measures (Gaborit, 2022).

There is a critical need to foster a culture of disaster prevention and management within these communities. This requires comprehensive strategies encompassing early warning systems, evacuation plans, communication infrastructure, and community capacity building (Rosenzweig *et al.*, 2018). To ensure effectiveness, these efforts must be accompanied by localized and participatory risk communication strategies from the government (Cayamanda *et al.*, 2021). Such approaches not only empower communities but also promote inclusivity and collaboration in disaster preparedness and risk reduction initiatives. Urban areas, particularly those undergoing rapid development like Davao City, face unique challenges in managing flood risks (Cayamanda & Lopez, 2022; Echendu, 2021). Understanding community practices and resilience is crucial for mitigating the impacts of flooding, including issues like waste management and unauthorized construction (Aanensen, 2017). Effective emergency preparedness should involve both structural and non-structural measures, considering residents' perceptions and experiences (Ejeta, 2018).

Policymakers must continually assess and update existing policies to address gaps and promote effective community engagement (Cayamanda *et al.*, 2021). While numerous studies have explored the effects of flooding on families in riverine areas, there remains a significant gap in research focusing on community preparedness, awareness, and mitigation practices (Akukwe, 2019; Ibrahim *et al.*, 2020; Jamshed *et al.*, 2020; Masese *et al.*, 2016). This study adopts Icek Ajzen's Theory of Planned Behavior (1991) to examine the determinants of behavior in disaster preparedness and community practices (Najafi *et al.*, 2017). Additionally, it emphasizes the importance of social preparedness for disasters and the need for tailored actions based on the unique characteristics of each community (Merone & Tait, 2018). By understanding these factors, policymakers and stakeholders can effectively promote disaster resilience and mitigate the adverse effects of flooding on vulnerable communities.

The conceptual framework of the study, as depicted in Figure 1, comprises two independent variables and one dependent variable. The first independent variable pertains to the disaster preparedness of residents residing in riverine flooding-affected areas in Davao City. This was assessed through two key indicators: self-preparation, denoting individuals' readiness for any disaster event, and provision preparation, referring to the acquisition and storage of necessary supplies to sustain oneself for a certain period following a disaster. The second independent variable is the disaster

awareness of residents within these areas, evaluated through indicators of flood disaster awareness, which relates to residents' understanding of the effects of floods, and flooding risk awareness, which encompasses residents' awareness of the potential dangers posed by flooding.

The dependent variable in the study is the adaptation and mitigation practices of residents within riverine flooding-affected areas in Davao City. This was measured through several indicators, including adaptation and mitigation practices before the flood, which signifies preemptive measures taken to mitigate flood risks, adaptation and mitigation practices during the flood, which encompasses actions undertaken to safeguard life and property during flooding events, and adaptation and mitigation practices after the flood, which involves the recovery and reconstruction efforts following flood-related damages, including rebuilding structures and aiding injured residents.

The study also aimed to analyze the relationship and influence of the independent variables on the dependent variable. By examining the interplay between disaster preparedness, disaster awareness, and adaptation/mitigation practices, the research sought to uncover insights into how these factors contribute to residents' resilience and ability to cope with flooding in Davao City.
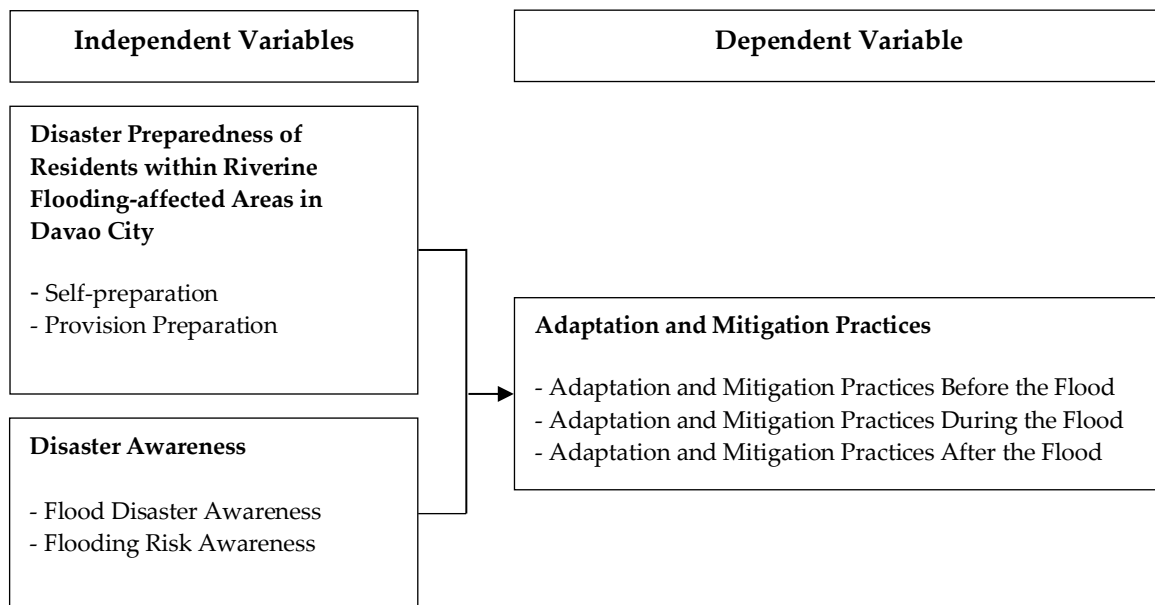

Independent Variables	Dependent Variable
Disaster Preparedness of Residents within Riverine Flooding-affected Areas in Davao City - Self-preparation - Provision Preparation	**Adaptation and Mitigation Practices** - Adaptation and Mitigation Practices Before the Flood - Adaptation and Mitigation Practices During the Flood - Adaptation and Mitigation Practices After the Flood
Disaster Awareness - Flood Disaster Awareness - Flooding Risk Awareness	

Figure 1: The Conceptual Framework of the Study

The study's primary objective was to assess the levels of disaster preparedness, awareness, adaptation, and mitigation practices among residents living in riverine flooding-affected areas in Davao City. Specific objectives included determining the disaster preparedness level using indicators of self-preparation and provision preparation, evaluating disaster awareness through indicators of flood disaster awareness and flooding risk awareness, and describing adaptation and mitigation practices before, during, and after floods. Additionally, the study aimed to establish

significant relationships between disaster preparedness and adaptation/mitigation practices, as well as between disaster awareness and adaptation/mitigation practices. Lastly, it sought to identify which domain of the independent variables significantly influences residents' adaptation and mitigation practices. The formulated null hypothesis was tested at a significance level of 0.05, suggesting that there is no significant relationship between disaster preparedness and adaptation/mitigation practices, nor between disaster awareness and adaptation/mitigation practices. Moreover, it was hypothesized that no domain of independent variables significantly influences adaptation and mitigation practices.

Given Davao City's current flooding challenges, there is a critical need to reassess and reevaluate existing disaster risk reduction plans. The findings of this study hold substantial benefits for various stakeholders. Firstly, for the citizens of Davao City, understanding vulnerability and resilience factors can pinpoint weaker areas requiring attention, facilitating the development of more effective disaster solutions. This is particularly advantageous for residents in flood-prone areas, who can receive better assistance to strengthen preparedness, response, recovery, and mitigation efforts. Secondly, Local Government Units (LGUs) stand to benefit significantly as the study helps identify the specific needs of communities, enabling targeted interventions and the formulation of sustainable solutions. This ensures that resources are allocated effectively, benefiting barangays over the long term. Thirdly, Criminology and Law professionals can utilize the study's findings to inform legislation aimed at environmental protection and responsive disaster risk reduction practices. By considering both structural and non-structural factors, they can contribute to enhancing community resilience. Lastly, this research serves as a valuable reference for future researchers, guiding their investigations into climate adaptation and mitigation strategies. It can be expanded upon to meet the evolving needs of future generations, providing insights into effective climate solutions.

2. Method

2.1 Research Respondents
The study focused on residents living in areas prone to flooding along the alluvial floodplain of the Davao and Talomo Rivers, specifically targeting families from Matina Crossing up to Matina Pangi and the Matina-Bangkerohan riverbank of the Davao River. The target number of respondents was approximately 400 individuals from these identified areas. A simple random sampling technique was employed, ensuring an unbiased selection process where every member of the population had an equal chance of being chosen (Horton, 2023). The study was conducted in July 2023. Inclusions comprised residents residing in the riverine areas of the Davao River, while exclusions encompassed residents not situated in flood-prone zones. Withdrawal was permitted for respondents who initially agreed to participate but later opted out for any reason, respecting their autonomy as volunteers in the study.

2.2 Material and Instruments

The questionnaire utilized in the study was adapted from prior research by Farin, Co, and Farin (2017) for the first independent and dependent variables, while the questionnaire for the second independent variable was adapted from Khan, Johar, and Baba (2017). The preliminary draft underwent refinement by the research adviser and validation by a panel of experts to ensure reliability and validity. Divided into three parts, the questionnaire assessed disaster preparedness, awareness, and adaptation/mitigation practices using indicators specific to each aspect. Responses were rated using a five-level Likert scaling system, ranging from very low to very high levels of agreement, to gauge the respondents' perceptions regarding disaster preparedness, awareness, and adaptation/mitigation practices.

2.3 Design and Procedure

Utilizing a quantitative non-experimental research design with a descriptive-correlational approach, the study aimed to analyze the possible connections between independent variables (disaster preparedness and awareness) and the dependent variable (adaptation/mitigation practices), as well as government disaster risk reduction efforts. This design was deemed appropriate for assessing the levels of disaster preparedness, awareness, and adaptation/mitigation practices among residents in flood-prone areas of Davao City (Creswell, 2012). The researchers obtained approval from local government units in Matina Crossing and Bangkerohan, facilitated by the Dean of the College of Criminal Justice Education. Upon receiving permission, validated questionnaires were distributed to respondents, and the completed surveys were compiled and tabulated using Microsoft Excel. Statistical analysis was conducted by the school statistician, employing mean calculations to determine levels of preparedness, awareness, and adaptation/mitigation practices, Pearson r for relationship assessment, and Multiple Regressions to identify significant domains influencing adaptation/mitigation practices.

3. Results and Discussions

3.1 Level of Disaster Preparedness of Residents Within Riverine Flooding-affected Areas in Davao City

Table 1 illustrates the level of disaster preparedness among residents within riverine flooding-affected areas in Davao City. The overall mean score indicates a very high level of preparedness ($\bar{x}$=4.23), with responses clustered tightly around this value (SD=0.493). Specifically, residents exhibit a high degree of preparedness in terms of self-preparation ($\bar{x}$=4.15), with responses closely grouped (SD=0.552). This indicates a proactive approach among respondents, including participation in disaster risk reduction training, orientation sessions, and posting emergency contact numbers, showcasing their mental and physical readiness and effective communication strategies in times of calamity. These findings align with the government's awareness campaigns aimed at educating Filipinos,

particularly those in flood-prone areas, on flood preparedness strategies (Kurata *et al.*, 2023).

Moreover, residents demonstrate a very high level of preparedness in provision preparation ($\bar{x}$=4.30), with responses tightly clustered (SD=0.566). This encompasses measures such as installing electrical outlets at higher wall levels to avoid flood damage and developing flood management plans, indicating a clear course of action and financial readiness to cope with flooding emergencies. These findings support the notion that effective emergency preparedness requires disseminating information about flood risks and residents' perceptions of previous flood experiences, as highlighted in previous research (Ejeta, 2018; Barnes, Dunn, & Wilkinson, 2019). Overall, understanding the potential effects of disasters and being prepared to respond effectively are crucial aspects of disaster preparedness, as evidenced by the residents' proactive measures in Davao City.

Table 1: Level of Disaster Preparedness of Residents
within Riverine Flooding-affected Areas in Davao City

Indicators	Mean	Standard Deviation	Descriptive Level
Self-preparation	4.15	0.552	High
Provision Preparation	4.30	0.566	Very High
Overall	**4.23**	**0.493**	**Very High**

3.2 Level of Disaster Awareness of Residents within Riverine Flooding-affected Areas in Davao City

Table 2 presents the level of disaster awareness among residents within riverine flooding-affected areas in Davao City. Overall, the mean score indicates a very high level of awareness ($\bar{x}$=4.22), with responses clustered closely around this value (SD=0.560). Specifically, residents demonstrate a high level of awareness regarding flood disasters ($\bar{x}$=4.22), with responses tightly grouped (SD=0.560). This indicates that residents possess knowledge on safety measures during disasters and understand the importance of staying in evacuation areas until it is safe to return home. They are also highly aware of how to prevent disasters in their area. These findings align with previous research emphasizing the crucial role of awareness in prompting proactive actions and reducing risks associated with disasters (Cayamanda *et al.*, 2021).

Moreover, residents exhibit a very high level of awareness regarding flooding risk ($\bar{x}$=4.27), with responses closely clustered (SD=0.614). They prioritize ensuring the safety of their families by maintaining ready kits and planning evacuation routes before disasters strike. They also prepare provisions such as money, water, first aid, and food in anticipation of disaster events. This underscores residents' full awareness of the risks posed by flooding in Davao City. The findings highlight the urgent need to empower communities and enhance their capacity to adopt flood and disaster prevention measures, particularly in the context of climate change impacts (Kuang & Lao, 2020). Additionally, the significance of effective risk communication practices, beyond mere

provision of information, is emphasized in promoting household flood preparedness (Arapostathis, 2021).

Table 2: Level of Disaster Awareness of Residents
within Riverine Flooding-affected Areas in Davao City

Indicators	Mean	Standard Deviation	Descriptive Level
Flood Disaster	4.22	0.560	Very High
Flooding Risk	4.27	0.614	Very High
Overall	**4.24**	**0.549**	**Very High**

3.3 Level of Adaptation and Mitigation of Residents within Riverine Flooding-affected Areas in Davao City

Table 3 illustrates the level of adaptation and mitigation among residents within riverine flooding-affected areas in Davao City. The overall mean score indicates a high level of adaptation and mitigation ($\bar{x}$=4.10), with responses clustered closely around this value (SD=0.180). Specifically, residents exhibit a high level of adaptation and mitigation before the flood ($\bar{x}$=4.16), indicating proactive measures such as securing important items and orienting family members on evacuation procedures. This suggests that residents are well-prepared to minimize the impact of flooding events by taking preventive actions beforehand. These findings support the notion that community practices reflect flood resilience, enabling swift recovery and functional restoration post-disaster (Aanensen, 2017).

Moreover, residents demonstrate a very high level of adaptation and mitigation during flooding ($\bar{x}$=4.24), with responses tightly clustered (SD=0.262). They exhibit proactive behavior by promptly evacuating to designated centers, maintaining calmness, and ensuring food safety. This indicates residents' familiarity with flood situations and their ability to respond effectively to mitigate risks. The findings align with previous research highlighting the unpredictability and complexity of flooding events, emphasizing the importance of relying on trusted sources for decision-making during emergencies (Attems *et al.*, 2019).

Furthermore, residents assess the level of adaptation and mitigation after flooding as high ($\bar{x}$=3.89), with responses clustered closely (SD=0.283). They prioritize safety by using alternative light sources and ensuring the provision of basic needs such as food and shelter. This suggests that residents are equipped with knowledge and experience from previous flooding incidents, enabling them to take appropriate actions to secure their well-being post-disaster. The importance of effective disaster risk communication in disseminating mitigation strategies is underscored by these findings (Ong *et al.*, 2021). Overall, residents' high level of adaptation and mitigation practices reflect their resilience and ability to cope with flooding challenges in Davao City.

Table 3: Level of Adaptation and Mitigation of
Residents within Riverine Flooding-affected Areas in Davao City

Indicators	Mean	Standard Deviation	Descriptive Level
Before the Flood	4.16	0.306	High
During the Flood	4.24	0.262	Very High
After the Flood	3.89	0.283	High
Overall	**4.10**	**0.180**	**High**

3.4 Correlation between Disaster Preparedness and Adaptation and Mitigation of Residents within Riverine Flooding-affected Areas in Davao City

Table 4 illustrates the correlation between disaster preparedness, and adaptation and mitigation among residents within riverine flooding-affected areas in Davao City. While some indicators of adaptation and mitigation showed no significant relationship with certain indicators of disaster preparedness, such as provision preparation during the flood and self-preparation after the flood, the overall result indicates a significant correlation between the independent and dependent variables (p-value<0.001). This signifies the rejection of the null hypothesis and suggests that disaster preparedness is correlated with adaptation and mitigation among residents.

These findings align with prior research by Nugraheni, Suyatna, and Agus Setiawan (2022), which highlights the high correlation between flooding preparedness and mitigation efforts. Such correlations are valuable for national and local governments in formulating policies and programs aimed at sustainable flood mitigation, emphasizing both structural and non-structural measures to minimize flood events. Similarly, the results resonate with the study by Lee, Tung, and Lin (2018), emphasizing the importance municipalities place on disaster preparedness through the development of emergency plans and allocation of resources to address potential challenges.

Moreover, the outcomes support the provisions outlined in Republic Act 10121 (2010), which underscores disaster preparedness as the proactive avoidance of adverse impacts through advance actions and mitigation as the reduction of adverse impacts through environmental policies and public awareness initiatives. Overall, these results underscore the significance of integrating disaster preparedness and mitigation efforts to enhance resilience and minimize the impact of flooding in riverine areas of Davao City.

Table 4: Correlation between Disaster Preparedness and Adaptation and
Mitigation of Residents Within Riverine Flooding-affected Areas in Davao City

Adaptation and Mitigation	Disaster Preparedness		
	Self-Preparation	Provision Preparation	Overall
Before the Flood	0.269*	0.282*	0.313*
	0.001	0.001	0.001
During the Flood	0.151*	0.094	0.138*
	0.002	0.061	0.006
After the Flood	-0.006	-0.012	-0.010
	0.899	0.811	0.835
Overall	**0.222***	**0.198***	**0.238***
	0.001	**0.001**	**0.001**

3.5 Correlation between Disaster Awareness and Adaptation and Mitigation of Residents Within Riverine Flooding-affected Areas in Davao City

Table 5 presents the analysis of the correlation between disaster awareness and adaptation and mitigation among residents within riverine flooding-affected areas in Davao City. While one indicator of adaptation and mitigation showed no significant relationship with all indicators of disaster awareness, specifically after the flood disaster and flooding risk, the overall result indicates a significant relationship (p-value<0.001), leading to the rejection of the null hypothesis. This suggests a notable correlation between disaster awareness and adaptation and mitigation among residents.

These findings align with Kertawidana's (2019) emphasis on the importance of awareness activities in disaster preparedness, particularly in developing local warning systems and community evacuation plans. Similarly, Lee, Tung, and Lin (2018) highlight the capacity-building potential of raising awareness among individuals and communities to cope with disasters effectively. Moreover, Boonyaratkalin, Partiprajak, and Piaseu (2020) underscore the critical role of disaster awareness in mitigating the impact of disasters, especially in disaster-prone regions.

Table 5: Correlation between Disaster Awareness and Adaptation and
Mitigation of Residents Within Riverine Flooding-affected Areas in Davao City

Adaptation and Mitigation	Disaster Awareness		
	Flood Disaster	**Flooding Risk**	**Overall**
Before the Flood	0.346*	0.371*	0.384*
	0.001	0.001	0.001
During the Flood	0.207*	0.211	0.223*
	0.001	0.001	0.001
After the Flood	-0.079	-0.033	-0.059
	0.116	0.511	0.243
Overall	**0.255***	**0.295***	**0.295***
	0.001	**0.001**	**0.001**

3.6 The Extent of Influence of Independent Variables on Adaptation and Mitigation

Table 6 presents the results of the regression analysis, indicating a linear causality between the independent variables and the dependent variable, adaptation, and mitigation. The analysis reveals a significant influence between one indicator of disaster, specifically flooding risk, and adaptation and mitigation (t = 2.957 with P-value = 0.002, which is less than the significance level of 0.05). This suggests that flooding risk significantly influences adaptation and mitigation practices among residents within riverine flooding-affected areas in Davao City.

The coefficient of determination (R^2) indicates that 9.89% of the variance in adaptation and mitigation practices is attributed to the linear combination influenced by the flooding risk indicator. Thus, flooding risk emerges as a significant contributor to adaptation and mitigation efforts, as confirmed by Collins (2018), who underscores the influence of community and national preparedness on creating resilient systems, particularly in mitigating foreseeable catastrophes like flooding.

Furthermore, Altarawneh, Mackee, and Gajendran (2018) emphasize the importance of preparedness and mitigation strategies focusing on risk identification, which aligns with the significant impact of flooding risk identified in this study. Additionally, Sado-Inamura and Fukushi (2019) stress the primary objective of preparedness in reducing risks through appropriate actions and enhancing the capacity of vulnerable populations. Effective disaster management policies should integrate suitable mitigation measures based on identified risks within the community.

Table 6: The Extent of Influence of Independent Variables on Adaptation and Mitigation

Adaptation and Mitigation (Dependent Variable)				
Independent Variables	**β (Standardized Coefficients)**	**B (Unstandardized Coefficients)**	**t**	**Sig.**
Constant	0.0800	3.61418	45.169	0.001
Self-Preparation	0.0197	0.03077	1.561	0.119
Provision Preparation	0.0192	0.00997	0.519	0.604
Flood Disaster	0.0244	0.00987	0.404	0.686
Flooding Risk	0.0215	0.06345	2.957	0.003
R	0.315			
R²	0.0989			
F	11.636			
p	0.029			

4. Conclusions and Recommendations

Based on the conclusions drawn from the study's findings, it is evident that residents of riverine flood-affected areas in Davao City have rated their disaster preparedness and awareness as very high, indicating a strong level of readiness and knowledge about the impacts of floods. Moreover, their high ratings in adapting behavior and mitigation practices suggest a proactive approach to addressing their circumstances. The study further reveals a correlation between disaster preparedness and adaptation/mitigation, as well as between disaster awareness and adaptation/mitigation, with flooding risk being a significant influencer.

In response to the study's conclusions, several recommendations can enhance flood preparedness and safety. Residents should regularly listen to PAG-ASA weather radio broadcasts for updates and warnings. Moving valuables to safer ground, establishing escape plans, and avoiding risky behavior like crossing floodwaters are key precautions. The local government should secure relocation sites for those in flood-prone areas. Additionally, assembling emergency kits with essentials for at least three days is advised. Residents must stay vigilant during heavy rainfall, prepared to evacuate if needed. Future research should assess the effectiveness of government-provided resources for flood-prone areas to inform better disaster management strategies.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author

Exequiel R. Gono Jr. is a graduate school faculty member at the Professional Schools of University of Mindanao, Matina Campus. He is a member of the Philippine Statistical Association, the Philippine Association of Researchers and Statistical Software Users, The Philippine Association for Teacher Education, Mathematics Teacher Education, and the Philippine eLearning Society (Member). His research interests are Mathematics Education, Assessment of Learning, Mathematical Modeling, and Applied Statistics. Dr. Gono has authored and co-authored research publications such as Probabilistic Estimation of Passing the Pharmacist Licensure Examination, Redefinition of the Parameters of Meaningful Mathematics Learning, Obstacles in Pursuing Business among Entrepreneurship Students, Status of Mangroves and Faunistic Components in Vanishing Island, Island Garden City of Samal, and Estimating Technical Efficiency of Academic Departments of a Philippine Higher Education Institution.

Brent F. Avelino, Chris John C. Lajos, and Adrian P. Lumantas are criminology students of the University of Mindanao, Philippines.

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