Water Challenge: Addressing Local Water Issues Through Community-Based Education

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Abstract **- Water scarcity and water safety concerns continue to threaten vulnerable communities worldwide, particularly in upland and geographically isolated areas. This study examined the demographic characteristics and water-related knowledge, attitudes, and practices (KAP) of residents in selected mountain barangays of Cebu City—specifically Sudlon I, Sudlon II, and Babag II. A total of 186 respondents participated, reflecting a balanced age distribution and a female majority. Most respondents had completed elementary or secondary education, underscoring the need for accessible, culturally appropriate, and vernacular communication strategies when delivering water safety information and community programs. Findings revealed that unreliable water access and supply interruptions are the most urgent concerns, with 90.2% reporting water-related problems within the past year. Although many respondents described their water quality as "good," nearly 40% depend on well water for daily use. This indicates a critical gap between perceived water safety and potential health risks associated with untreated or inadequately protected sources. Encouragingly, the community demonstrated strong confidence in community-based education (91.8%) and overwhelming support for stricter water regulations (96.7%). While individual conservation practices were widely observed, participation in organized community initiatives remained limited due to time constraints, insufficient awareness of programs, and inconsistent barangay-level implementation. Respondents preferred short digital materials and face-to-face seminars, suggesting a bimodal educational strategy. Overall, the findings highlight that water safety and reliability—not affordability—are the central issues, requiring practical, community-driven, and governance-supported interventions.**

Keywords: **Cebu, Water, Access, Education**

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I. INTRODUCTION

Freshwater resources are essential to human survival, environmental sustainability, and economic development (United Nations, 2023). However, rapid population growth, urban expansion, and climate change have intensified global water scarcity (World Bank, 2019). Integrated Water Resources Management identifies freshwater as a finite and vulnerable resource critical for sustaining life and ecosystems (Global Water Partnership, 2000). Despite global progress, millions still lack access to safe drinking water, highlighting persistent inequalities in water distribution and infrastructure (World Health Organization & UNICEF, 2023). While water scarcity is a global issue, its impacts are most severe at the local level. Communities in upland and rural areas often experience seasonal shortages, unreliable supply, and limited infrastructure, which disrupt livelihoods, affect sanitation and health, and weaken local economic resilience (World Bank, 2019).

Scholars emphasize that technological solutions alone cannot solve water scarcity; public awareness, education, and community participation are essential components of sustainable water management (United Nations, 2023). Water education enhances environmental literacy, encourages responsible consumption, and empowers communities to adopt conservation practices (Global Water Partnership, 2000). Research shows that community-based education fosters long-term behavioral change. Communities with higher water literacy demonstrate greater willingness to conserve water and adopt innovative solutions (World Health Organization, 2023). In rural contexts, culturally responsive programs have proven particularly effective in strengthening conservation practices and community leadership (UNICEF, 2023). Furthermore, the research also anchored several theoretical perspectives that explain how knowledge, social participation, and behavioral change contribute to sustainable water management. Primarily, the study is grounded in Social Learning Theory developed by Albert Bandura, which emphasizes that individuals learn behaviors through observation, interaction, and shared experiences within their community. In the context of water management, this theory suggests that when community members participate in educational activities, training, and demonstrations about water conservation and sanitation practices, they are more likely to adopt and model responsible water-use behaviors. The framework is further supported by the Theory of Planned Behavior proposed by Icek Ajzen, which explains that a person's behavior is influenced by their

attitudes, subjective norms, and perceived behavioral control. Applied to this study, community members' willingness to engage in water conservation practices depends on their awareness of water issues, their perception of community expectations, and their belief that they can contribute to solving local water problems. Educational programs and community initiatives can therefore shape positive attitudes and strengthen social norms toward responsible water use. In addition, the research draws from Community-Based Environmental Education, which emphasizes participatory learning approaches where local knowledge, cultural practices, and stakeholder collaboration are integrated into environmental problem-solving. This perspective highlights that sustainable **solutions** to water challenges are more effective when communities are actively involved in identifying problems, planning interventions, and implementing water management strategies.

Together, these theoretical foundations explain how **community-based education** can **enhance knowledge, influence attitudes, and promote collective action**, ultimately enabling communities to address local water issues and support sustainable water resource management.

Studies from Africa and Southeast Asia demonstrate that **water literacy** initiatives **and environmental education programs enhance community resilience to drought, promote water conservation behaviors, and increase public support for sustainable water policies** (Maniam et al., 2021; Boon, 2024; Smith & Mayer, 2022), (United Nations, 2023). Research indicates that improving public knowledge about water resources strengthens individuals' willingness to adopt conservation practices and support water management policies. These findings highlight the transformative potential of community-centered education in promoting sustainable water use and environmental stewardship. Water education fosters a culture of conservation, collaboration, and informed decision-making. It strengthens local capacity and empowers citizens to become advocates for sustainable resource management (Global Water Partnership, 2000). Thus, empowering communities through education is essential for long-term water security.

This research aimed to empower upland communities to take ownership of their water resources and actively participate in solving local water challenges. Specifically, it seeked to: describee the socio-demographic profile of residents; identify prevailing water issues; assess knowledge, attitudes, and practices; support targeted educational programs; advocate policy improvements; and strengthen partnerships for sustainable water management.

II. METHODOLOGY

This study used a mixed-method convergent parallel design to examine community water issues, combining quantitative data on knowledge, attitudes, and practices with qualitative insights on community experiences and perceptions. The research was conducted in selected upland barangays facing water scarcity, involving 189 randomly selected survey respondents and additional participants for interviews and focus group discussions. Data were collected using structured questionnaires, semi-structured interviews, focus group discussions, and observation checklists. Surveys gathered demographic information and water-related behaviors, while interviews and FGDs explored experiences, conservation practices, and perceptions of local programs. This study used a mixed-method convergent parallel design to examine community water issues, combining quantitative data on knowledge, attitudes, and practices with qualitative insights on community experiences and perceptions. The research was conducted in selected upland barangays facing water scarcity, involving 189 randomly selected survey respondents and additional participants for interviews and focus group discussions. Data were collected using structured questionnaires, semi-structured interviews, focus group discussions, and observation checklists. Surveys gathered demographic information and water-related behaviors, while interviews and FGDs explored experiences, conservation practices, and perceptions of local programs.

A. Ethical Considerations

The study upheld ethical standards through informed consent, confidentiality, voluntary participation, and secure data storage.

TABLE I
DEMOGRAPHIC PROFILE OF RESPONDENTS
(N = 186)

Variable	Category	Frequency (f)	Percentage (%)
Age Distribution	18–25	49	26.3%
	26–35	40	21.5%
	36–45	48	25.8%
	46 and Above	49	26.3%
	Total	**186**	**100%**
Sex Distribution	Male	85	45.70%
	Female	101	54.30%
	Total	**186**	**100%**
Address Distribution	Sudlon II	25	13.22%
	Sudlon I	30	16.13%
	Babag II	25	13.22%
	Bonbon	30	16.13%
	Sinsin / Buot-Taup	76	40.86%
	Total	**186**	**100%**
Educational Background	Elementary	82	44.09%
	Secondary	62	33.33%
	College	40	21.51%
	No Education	2	1.08%
	Total	**186**	**100%**

The 186 respondents represent a balanced adult population across age groups, with females (54.3%) forming the majority and playing a key role in household water management. Most residents come from upland barangays where elevation-related infrastructure challenges affect water supply. Educational attainment is generally low, with over 80% having only elementary or secondary education, indicating the need for simplified, practical, and accessible communication strategies to ensure effective community engagement.

TABLE II
SUMMARY OF COMMUNITY KNOWLEDGE, ATTITUDES, AND PRACTICES (KAP) ON WATER MANAGEMENT
(N = 186)

Dimension	Indicator/Question	Key results (f/%) or Top Responses
A. Knowledge of Water Issues	Experienced water-related issues in the past year	Yes: 166 (90.2%)
	Believe community-based education can address water issues	Yes: 169 (91.8%)
	Aware of existing water education programs	Yes: 152 (83.1%)
	Enough resources for public education	Yes: 163 (89.1%)
	Support stricter water usage regulations	Yes: 177 (96.7%)
B. Attitudes Toward Water Issues	Overall water quality rating	Good (89), Fair (52), Excellent (31)
	Concern about local water issues	Very Concerned (95), Somewhat Concerned (62) – 87.2% combined
	Biggest water-related challenges (Top 3)	1. Lack of clean water (74) 2. Unreliable supply (70) 3. Climate change (68)
	Primary drinking water source (Top 3)	1. Well water (89) 2. Tap water (69) 3. Bottled water (37)
	Perceived frequency of water quality testing	Always (89), Sometimes (34), Often (24)
	Frequency of water conservation at home	Always (114), Often (27)
	Level of being informed on water-saving practices	Well Informed (60), Slightly Informed (54), Very Well Informed (34)
	Motivation for water conservation (Top 3)	1. Environmental concerns (106) 2. Financial savings (96) 3. Community responsibility (84)
C. Conservation Practices and Barriers	Most common conservation practices	1. Fixing leaks (114) 2. Turning off tap (99) 3. Collecting rainwater (93)
	Involvement in community initiatives	Generally low; limited to personal efforts or occasional assemblies
	Main barriers to engagement (Top 3 themes)	1. Lack of time 2. Lack of information 3. Lack of organized programs
	Most helpful information needed	1. Practical conservation tips 2. Water quality testing 3. Proper water management
	Preferred educational format	1. Social media/videos 2. Face-to-face seminars 3. Infographics/posters

A. Knowledge of Water Issues

Findings show high awareness of water-related problems, with 90.2% of respondents experiencing water issues in the past year. Most believe community education (91.8%) and stricter regulations (96.7%) can help address these challenges. Although awareness of water education programs and resources is relatively high, limited outreach effectiveness and participation indicate that awareness does not always translate into collective action.

B. Attitudes Toward Water Issues

Respondents expressed high concern regarding. Attitudinal findings reveal strong concern about local water issues, with 87.2% expressing that they are either very concerned or somewhat concerned. The most pressing challenges identified include lack of clean water, unreliable water supply, and the impacts of climate change. While many respondents rated water quality as "good" or "excellent," this perception contrasts with the high incidence of reported water problems, indicating possible misconceptions about actual water safety standards. The primary source of drinking water for most households is well water, followed by tap water and bottled water. Heavy reliance on well water presents potential health risks due to contamination and inconsistent or informal testing procedures. Although many respondents believe water quality testing occurs regularly, this perception may reflect limited understanding of formal and standardized water testing systems. Perceptions that water testing occurs regularly may indicate misunderstanding of formal testing procedures

C. Conservation Practices and Barriers

Regarding conservation practices, the community demonstrates positive individual behaviors. Common practices include fixing leaks (114 respondents), turning off taps when not in use (99), and collecting rainwater (93). Conservation is primarily motivated by environmental concern, financial savings, and a sense of community responsibility. Most respondents reported that they "always" or "often" practice water conservation at home, suggesting strong personal commitment. However, involvement in organized community initiatives remains generally low and is mostly limited to occasional assemblies or individual efforts. The main barriers to broader engagement include lack of time, insufficient information dissemination, and absence of structured programs. Respondents expressed the need for practical conservation tips, clearer guidance on water quality testing, and proper water management strategies. Preferred educational formats include social media videos, face-to-face seminars, and

infographics, indicating that hybrid communication approaches would likely be most effective.

IV. ANALYSIS

The findings of the study carry significant implications for program development, policy formulation, community engagement, and sustainable water resource management. The socio-demographic profile indicates that more than 80% of respondents have only elementary or secondary education, suggesting that water education programs must adopt simplified and accessible learning approaches. Educational strategies should therefore use clear language, culturally relevant examples, visual materials, and practical demonstrations rather than technical explanations. Water literacy initiatives emphasize that learning materials should be contextualized to the community's everyday experiences in order to improve understanding and retention (UC ANR Water Literacy for ESL Learners, 2025; Project WET, 2026). In addition, since women represent the majority of respondents and are often responsible for managing household water use, involving women as key participants and advocates in water education programs can strengthen the effectiveness of community-based water management initiatives (Plan International Philippines, 2025).

The geographic distribution of respondents further reveals that many residents live in upland barangays such as Sudlon II, Sudlon I, and Babag II, where elevation and terrain affect water access and supply reliability. This highlights the importance of infrastructure investments that are specifically designed for highland communities. Water management strategies such as gravity-fed distribution systems, rainwater harvesting facilities, and improved water storage structures can help address the challenges posed by topography. Incorporating terrain considerations into water infrastructure planning is critical to achieving equitable water service delivery in remote or upland communities (APN Science Bulletin, 2022; Wateroam Southeast Asia Gravity-Fed Systems, 2024).

The strong support for stricter water usage regulations, expressed by 96.7% of respondents, also suggests that the community is receptive to policy reform. This provides an opportunity for local government units to strengthen ordinances related to water conservation, groundwater protection, and water quality monitoring. Community concern about water-related issues indicates a favorable environment for implementing stronger regulatory frameworks that promote sustainable water governance (ABS-CBN UPLB Study, 2025; NAST Philippines, 2012).

Despite many respondents rating their water quality positively, the majority reported experiencing water-related problems and relying heavily on well water sources. Studies have shown that well water in many rural communities may contain microbial contaminants such as *E. coli*, which pose health risks if not properly monitored or treated (UPLB E. coli Study, 2025; Water Potability Study – Isabela, 2025). Strengthening public understanding of water testing procedures and contamination risks is therefore essential. Transparent reporting systems and community-based monitoring initiatives can improve both water safety and governance of communal water resources (Journal of Nature Studies – Polillo Island, 2014).

Community perceptions of water safety are often influenced by psychological and contextual factors. Research indicates that individuals frequently judge water quality based on sensory cues such as taste, smell, and clarity rather than scientific testing (Doria, 2010; Grupper et al., 2021). When water appears clean and has been used for many years without visible problems, residents may assume it is safe even if contamination is present (Doria, 2010; Lasco & Hardon, 2024). A sense of personal control over water sources, such as relying on one's own well or household filtration system, may also reduce perceived risk and lead individuals to rationalize that their water supply is safe despite potential hazards (Caputo et al., 2022).

Although households reported practicing water conservation behaviors—such as repairing leaks and collecting rainwater—participation in organized community initiatives remains limited. Studies suggest that barriers to participation often arise from limited time, lack of information, and insufficiently structured community programs rather than unwillingness to participate (Barriers in Participative Water Governance, 2022; IWA Participation Barriers Study, 2024). Considering that respondents prefer communication channels such as social media, face-to-face seminars, and visual materials, adopting hybrid engagement approaches that combine digital information dissemination with community meetings may help increase participation in water-related programs.

The identification of climate change as a major water-related concern also emphasizes the need for climate-resilient water management strategies. Measures such as watershed rehabilitation, drought preparedness planning, and soil and water conservation practices can strengthen water security in vulnerable upland communities. Integrating climate adaptation strategies into local water management plans is essential to ensure the long-term sustainability of water resources (Forest Foundation Sierra Madre Risk Assessment, 2026; BSWM Water Management Division, 2026).

Sustainable water management also requires strong partnerships and multi-sectoral collaboration. Effective water governance depends on cooperation among local government units, barangay officials, educational institutions, and community organizations. Evidence from water resilience initiatives in the Philippines shows that collaborative models integrating education, research, and community participation contribute to stronger and more sustainable water management systems (Plan International Philippines Water Resilience Project, 2025). Schools and universities can play a critical role by providing research support, training programs, and technical expertise to local communities.

Overall, the findings reveal a community with high awareness of water-related concerns and positive conservation practices, but one that remains constrained by gaps in infrastructure, knowledge dissemination, and institutional coordination. Similar patterns have been observed in broader studies on groundwater governance in the Philippines, which identify technical limitations and fragmented management systems as key barriers to sustainable water resource

management (UP Diliman Groundwater Crisis Study, 2025). Addressing these systemic gaps can help transform individual conservation behaviors into coordinated community action.

The findings also reinforce the theoretical frameworks guiding the study. Consistent with the Theory of Planned Behavior proposed by Icek Ajzen, respondents demonstrate strong attitudes toward water conservation, as reflected in their high support for stricter regulations, yet participation in organized initiatives remains limited due to structural barriers such as lack of time and information. The results also align with community-based environmental education models promoted by organizations such as the Global Water Partnership, which emphasize localized and participatory learning approaches for improving environmental behavior. In addition, the gap between perceived and actual water safety reflects principles of Social Learning Theory developed by Albert Bandura, suggesting that community perceptions are shaped largely by shared experiences and sensory cues rather than scientific evidence. Without targeted interventions that address these social norms and perceptions, misconceptions about water safety may persist within communities.

V. DISCUSSION

The findings highlight important implications for program development, policy formulation, community engagement, and long-term water resource sustainability. Although residents show awareness of water issues and willingness to support conservation, structural, informational, and organizational barriers limit collective action. These results emphasize the need for integrated and participatory water governance aligned with Integrated Water Resources Management and Sustainable Development Goal 6 frameworks (Global Water Partnership [GWP], 2000; United Nations [UN], 2015).

The socio-demographic profile indicates that over 80% of respondents have only elementary or secondary education. This suggests that water education programs should prioritize simplified language, practical demonstrations, and culturally relevant examples rather than technical messaging. Community-based WASH education supported by visual materials such as infographics and short videos has been shown to improve understanding and behavioral outcomes (World Health Organization [WHO], 2017; UNICEF, 2021).

Women represent the majority of respondents and play a central role in household water management. Gender-responsive water governance therefore requires involving women as community leaders and peer educators in water advocacy initiatives (UNESCO, 2019). Additionally, because many residents live in upland barangays with limited access to centralized water systems, education and outreach programs should be decentralized and community-based to reach geographically isolated populations (Asian Development Bank [ADB], 2020).

Infrastructure challenges are also influenced by terrain and elevation. Highland communities often experience weak water pressure, intermittent supply, and higher infrastructure costs. Context-appropriate solutions such as gravity-fed systems, rainwater harvesting, spring protection, and local storage facilities can improve water access and sustainability (ADB, 2020; UNICEF, 2021).

Strong public support for stricter water regulations suggests readiness for policy reform. Effective water governance requires regulatory frameworks that promote conservation, groundwater protection, and regular water quality monitoring. Policy implementation is more effective when accompanied by transparent communication and participatory decision-making (GWP, 2000; United Nations Development Programme [UNDP], 2016).

Another key finding is the gap between perceived water quality and potential contamination risks. Although many respondents believe their water is safe, reliance on untreated well water without consistent testing may expose households to microbial or chemical contamination. Communities often overestimate water safety when monitoring and reporting systems are limited (WHO, 2017). Improving public understanding of water quality standards and transparently sharing test results can strengthen informed decision-making and public trust (UNESCO, 2019).

While households practice individual conservation behaviors, organized community participation remains limited. Effective environmental governance requires accessible information, supportive institutional structures, and consistent engagement opportunities. Hybrid approaches that combine digital communication with in-person activities may help increase participation (United Nations Environment Programme [UNEP], 2018; UNICEF, 2021).

Climate change was also identified as a major concern affecting water availability. Climate variability significantly impacts water resources, particularly in upland communities. Integrating watershed rehabilitation, groundwater protection, and drought preparedness into local planning can strengthen long-term resilience (IPCC, 2022).

Sustainable water management further requires strong collaboration among local governments, academic institutions, health agencies, and environmental organizations. Multi-sector partnerships improve technical capacity, resource efficiency, and program sustainability (UN, 2015; UNDP, 2016; WHO, 2017).

Overall, the community demonstrates awareness and willingness to conserve water, but infrastructure limitations, knowledge gaps, and weak program coordination hinder collective action. Addressing these issues through simplified education, climate-resilient infrastructure, stronger regulation, improved water safety awareness, structured community engagement, and multi-sector collaboration can strengthen long-term water security and environmental sustainability (GWP, 2000; UN, 2015; IPCC, 2022).

This study also has several limitations. First, it relied on self-reported perceptions and practices, which may be affected by social desirability bias (Brace, 2018; Vesely & Klöckner, 2020). Second, the focus on the upland barangays of Sudlon I, Sudlon II, and Babag II limits generalizability to other contexts (Bryman, 2016). Third, the study did not include laboratory-based water testing, so conclusions about contamination risks are based on perceptions rather than empirical measurements (Doria, 2010). Finally, the cross-sectional design captures attitudes at a single point in

time and cannot assess long-term behavioral changes (Creswell & Creswell, 2023).

VI .CONCLUSION

The highland barangays of Cebu City face a significant water crisis characterized by unreliable supply and potential water safety risks. Although the community demonstrates strong awareness and willingness to act, it remains institutionally underserved. Heavy reliance on well water raises health concerns, while structural barriers limit organized community participation.

Addressing these issues requires public health education on water safety, improved infrastructure for reliable supply, community-based educational programs, and stronger local governance support. The community is not resistant to change but requires accessible, organized, and sustained institutional support.

Based on the study findings, local government units, barangay officials, and partner institutions should implement a comprehensive community-based water management program that prioritizes water safety, supply reliability, and public health education. Educational campaigns should focus on proper water treatment, safe storage, and regular well-water testing to address misconceptions and reduce health risks.

Considering the community's educational background, materials should be simple, visual, culturally appropriate, and translated into the local language. A hybrid approach combining face-to-face seminars and short digital content can further improve accessibility and engagement.

Infrastructure improvements, including reliable water systems, rainwater harvesting, and protected communal water sources, should be developed through multi-sector partnerships. Establishing barangay-level water committees can strengthen community participation, monitor water conditions, and coordinate conservation initiatives.

Regular information dissemination, scheduled activities, and visible programs are also necessary to overcome participation barriers such as limited time and limited awareness.

Strengthening policy implementation and enforcing existing water regulations will further support sustainable water use. By integrating education, infrastructure development, community participation, and governance support, upland communities can improve water security and build long-term resilience to water scarcity and climate-related challenges.

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BIOGRAPHY

Nancy G. Largado, is a Filipino educator and academic leader born on December 26, 1979, in Valencia, Alegria, Cebu, Philippines. She earned her Bachelor of Secondary Education from the University of San Jose–Recoletos in 2002. She completed multiple graduate degrees at Cebu Technological University, including Master of Arts in Education (Teaching Chemistry, 2015), Master of Arts in Education (Teaching Science, 2019), and Doctor of Development Education (2025). She also obtained a Master of Arts in Pastoral Ministry from Seminario Mayor de San Carlos in 2015.

Currently serving as Dean of the Student Affairs and Services Office at Cebu Technological University–Cebu City Mountain Satellite Campus, Dr. Largado is recognized for her commitment to student welfare and science education in upland Cebu communities. Her research focuses on science teaching strategies, flipped classroom approaches, and improving learning outcomes in rural and resource-limited settings.