

# Integrating Information Systems to Enhance Academic Community Engagement for Environmental Sustainability: Lessons from Surigao del Sur, Philippines

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## ABSTRACT

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Environmental conservation and preservation play crucial roles amid climate change, urging more community engagement and accountability to reduce the negative environmental impacts. However, despite various programs and regulatory frameworks aiming at increasing community involvement, persistent obstacles remained in the education sector in the Philippines. With the foregoing issues, this study interviewed 596 schools-affiliated individuals across various academic institutions in Surigao del Sur, Philippines, to determine the key determinants (social, psychological, educational, cultural, and emotional aspects) influencing academic community engagement in environmental conservation and preservation; evaluate the level of accountability and assess how these indicators would better predict the sense of community engagement towards improving the community involvement towards achieving a sustainable environment. What drove more socially engaging environmental activities are the key determinants ( $R^2 = 0.79$ ) and the level of accountability ( $R^2 = 0.80$ ), suggesting that individuals, regardless of demographic backgrounds (e.g., age, gender, civil status, educational attainment), are willing to participate, engage and advocate for environmental awareness and join nature-friendly activities towards a more sustainable environment. Our results contribute to how the academic community can foster a more engaging society toward conserving and preserving our threatened and gradually degrading environment.

**Keywords:** conservation; preservation; community engagement

## INTRODUCTION

Environmental conservation and preservation are crucial challenges that necessitate collaborative action from all segments of society. As the effects of climate change, pollution, and biodiversity loss become more visible, the importance of community engagement and accountability in environmental activities has grown significantly. Effective community engagement instills a sense of responsibility in individuals and improves the overall effectiveness of environmental policies and practices.

Researchers and environmentalists emphasize the need of community involvement in supporting sustainable environmental practices. David (2021), Sahai (2019), and Sumardjo et al. (2022) underline the importance of community involvement in building collective responsibility and environmental stewardship. In the Philippines, encouraging community participation has been critical to improving environmental protection efforts and guaranteeing sustainability, as demonstrated by Calinao et al. (2021) and Mamauag and Orencio (2021). Despite legislative support such as Republic Act 9512, issues remain, including a lack of awareness, resources, and institutional efficacy (Kumar, 2022; Taylor et al., 2022). These barriers prevent effective community participation in environmental conservation, contributing to continuous environmental deterioration and biodiversity loss. Addressing these difficulties is critical to improving comprehensive environmental education and promoting sustainable practices in schools and communities (Phan Hoang & Kato, 2019; Throssel, 2023).

In terms of environmental conservation and preservation in the Philippine countryside, the Department of Education in Surigao del Sur, Southern Philippines have recurring local challenges revealing a major setback due to lack of community engagement and accountability in the academic community. Despite a variety of programs and regulatory frameworks aiming at increasing community involvement, persistent obstacles remained in the education sector. For example, while many academic community members participate in environmental conservation programs, fewer are actively involved in policy lobbying efforts. Furthermore, the awareness of environmental policies and sustainable practices is low (Kumar, 2022; Taylor et al., 2022).

We conducted this survey to (1) characterize the respondents based on their demographic profiles; (2) determine the key determinants influencing community engagement in environmental conservation and preservation; (3) evaluate the level of accountability and assess how indicators would better predict the sense of community engagement towards improving the community involvement in achieving a sustainable environment; and (4) develop a modeling framework that would explain the community engagement and level of accountability in the environmental conservation and preservation across various academic institutions in Surigao del Sur, Philippines. We hypothesize that demography will play a crucial role in the academic community's ability to get engaged in various activities related to environmental conservation and that the key determining factors on academic community engagement (e.g., social, emotional, psychological, educational, or cultural) weigh in better than the community's sense of accountability due to some issues relevant to limited environmental programs and lesser attention given to environmental education by the Philippine government.

Our results contribute to the growing demand for more benchmark information that will aid the provincial academic governing bodies, local leaders, and policy-makers towards a better understanding of how the academic community can foster a more engaging society towards conserving and preserving our threatened and gradually degrading environment.

## METHODS

### The Sampled Schools

The research was conducted in public elementary and secondary schools within the Municipality of Barobo, Tagbina, and Hinatuan of the 2nd District of Surigao del Sur. A total of 596 respondents out of 611 were selected to participate in this study through a random sampling technique and full enumeration, guided by Slovin's formula, to ensure a representative and reliable sample of the population. The respondents were strategically distributed across several key positions. To ensure the selection of the most reliable respondents, the researcher employed specific inclusion criteria. These criteria required that the respondents be actively involved in or significantly impacted by environmental conservation efforts within their communities, reside within the targeted areas where environmental initiatives were being implemented, and advocate for environmental issues while participating in community conservation activities. By focusing on respondents who were directly involved in or influential within their communities' environmental efforts, the study ensured that the data collected provided deep and nuanced insights into the factors shaping community engagement and accountability in environmental conservation and preservation.

### Research Instrument and Data Gathering Procedure

The research instruments used in this study were key informant interview guide questions and a self-made survey via a checklist questionnaire, which was constructed through reviewing related literature, studies, and legal bases. The survey questionnaire was carefully crafted to gather quantitative data on various aspects outlined in the research questions. It consisted of different sections to address the diverse components of the study. The gathered data, including demographic profiles, determinants of community engagement, and levels of accountability, were meticulously recorded and tabulated for analysis.

### Data Analysis

To analyze the socio-demographic characteristics of respondents, frequencies and percentages were used, with visualization achieved through ggplot2, reshape, and tidyverse packages for Likert scale results, and ridgelines presented using ggridges for demographic profiles.

## RESULTS

## Demographic profile of the respondents

The socio-demographic characteristics of respondents show that the largest age group is 34-41 years (28.02%), followed by 26-33 years (18.96%), with younger individuals aged 17 and below and 18-25 contributing 13.93% and 11.41%, respectively, while those 58 years and older represent only 2.01%. Females account for 57.05% of participants, highlighting their active role in environmental education, compared to 42.95% males. The majority of respondents are married (68.96%), followed by singles (26.85%), and a smaller proportion who are widowed (4.19%). Educationally, 71.14% are college graduates, and stakeholder involvement is predominantly internal, with 94.30% representing school-affiliated participants, while external stakeholders make up 5.70%. Despite active participation in environmental education, 54.53% of respondents are not affiliated with any formal environmental organization, although 45.47% are involved in such groups, reflecting both strong engagement and opportunities for further organizational alignment.

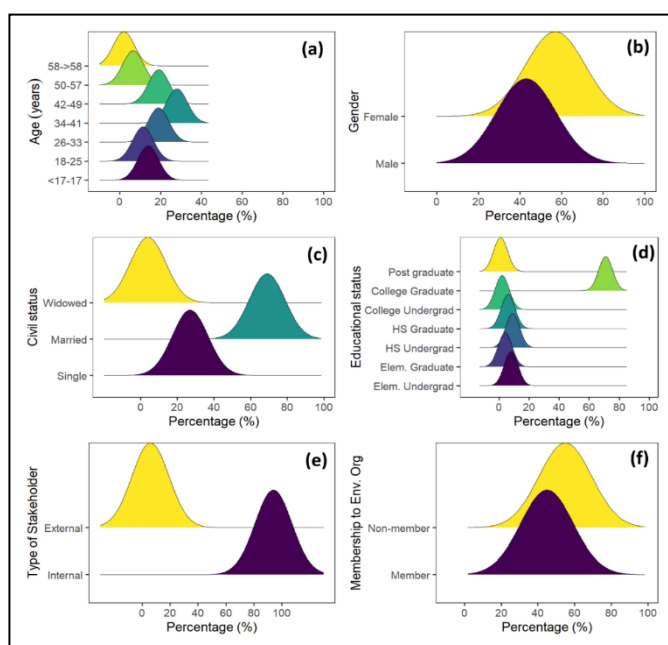


Figure 1. Ridgelines on the demographic profiles of the respondents to the survey conducted in Surigao del Sur, Philippines to determine the key determinants of community engagement and the level of accountability towards the conservation and preservation of the environment

## Key Determinants of Community Engagement

Around 93% - 96% of the respondents have moderately or strongly agree to the key determinant indicators (Figure 3). All the key determinants were considered Highly Influential as the scores were  $> 4.21 - 5.00$ . The Emotional determinant has the highest mean of  $4.59 \pm 0.51$  in shaping engagement behaviors. Following closely are the Social and Educational indicators, with means of  $4.57 \pm 0.60$  and  $4.55 \pm 0.61$ , respectively. Both the Psychological ( $4.53 \pm 0.63$ ) and Cultural ( $4.53 \pm 0.59$ ) determinants also indicate strong influence on community engagement as well. The general weighted mean of  $4.55 \pm 0.59$  among all key determinants of community engagement reflects an overall consensus on the critical importance of all the key drivers in motivating community involvement in environmental conservation efforts.

## Level of Accountability

Around 91% - 95% of the respondents moderately or strongly agree to the perceived level of accountability indicators (Figure 4). Each area received a mean score indicative of a Highly Accountable status, with Environmental Operation Management showing the highest mean of  $4.63 \pm 0.59$ , reflecting consistent responses

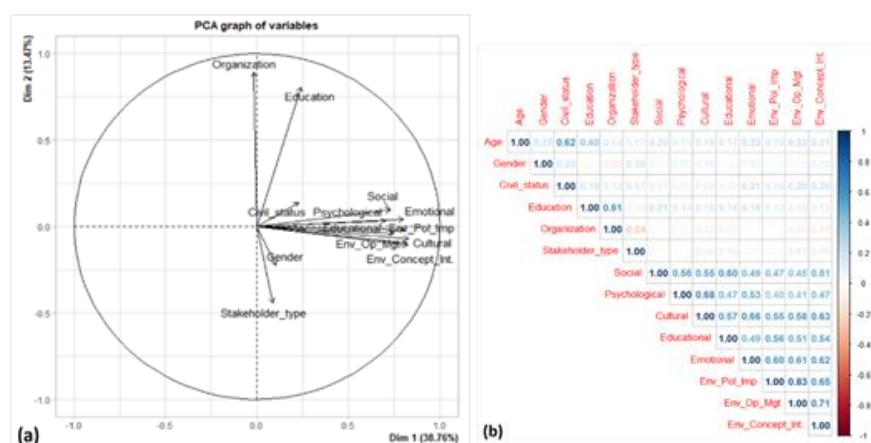
among participants. Environmental Concept Integration closely follows with a mean of  $4.60 \pm 0.60$ , suggesting a strong commitment to embedding environmental principles in daily practices. Environmental Policy Implementation, while slightly lower at  $4.59 \pm 0.64$ , also signifies a robust awareness and adherence to relevant policies. The overall general weighted mean of  $4.61 \pm 0.62$  reinforces the notion that respondents demonstrate a high level of accountability in their roles related to environmental conservation and preservation. This consistent accountability across the areas emphasizes the community's proactive stance in environmental stewardship and sustainable practices.

Table 1. Weighted mean scores and interpretations for the key determinants of community en-gagement and level of accountability indicators. Letters after each number represent statistical differences at  $P < 0.05$ .

Indicators	Weighted mean score $\pm$ SD	Interpretation
<i>Key determinants of community engagement</i>		
Emotional indicators	$4.59 \pm 0.51^a$	Highly influential
Social norms	$4.57 \pm 0.60^b$	Highly influential
Educational aspects	$4.55 \pm 0.61^c$	Highly influential
Cultural appreciation	$4.53 \pm 0.63^d$	Highly influential
Psychological factors	$4.53 \pm 0.59^d$	Highly influential
<b>Weighted mean</b>	<b><math>4.55 \pm 0.59</math></b>	<b>Highly influential</b>
<i>Level of accountability</i>		
Environmental policy implementation	$4.63 \pm 0.59^a$	High accountable
Environmental concept integration	$4.60 \pm 0.64^b$	High accountable
Environmental operation management	$4.59 \pm 0.64^c$	High accountable
<b>Weighted mean</b>	<b><math>4.61 \pm 0.62</math></b>	<b>High accountable</b>

### Correlation Matrices among surveyed variables

The PCA results showed that variables that are correlated within Dimension 1 explained 38.76% of the variations while Dimension 2 could explain 13.4% (Figure 2a). Together, the PCA can explain 52.16% of the variability of demographic profiles, key determinants of environmental conservation and preservation, and the accountability indicators within the PCA sphere. Obviously, positively correlated variables (e.g., key determinants and accountability indicators) were almost lumped together in the positive value quadrats. However, demographic profiles (e.g., age, gender, civil status, educational attainment, etc.) were scattered and weakly correlated with the key determinants and accountability indicators.



**Figure 2.** (a) Principal Component Analysis using the demographic profiles and the measured and latent factors in determining the respondents' willingness to engage and be accountable in environmental conservation and

preservation, and (b) Correlation matrix among the demographic profiles, key determinants in community engagement, and the accountability in the conservation and preservation of the environment

## **DISCUSSION**

### **Demographic factors**

The total number of respondents is 596, highlighting a broad spectrum of participation across different age groups. This diversity can enhance community engagement strategies and educational programs by incorporating a range of perspectives and expertise, ultimately promoting more effective environmental conservation and awareness efforts. The environmental education aims to enhance knowledge and attitudes among individuals of all ages, indicating that the involvement of younger demographics can lead to greater awareness and active participation (Narwal 2021; Shutaleva et al., 2022). However, challenges in fostering genuine environmental consciousness among youth are pointed out by Tarubal (2021), suggesting a potential gap between awareness and active participation.

Our results showed more active female respondents than male counterparts. De Andrade Correa (2022) emphasizes the significance of gender equality in environmental decision-making, suggesting that female involvement is crucial for promoting sustainable practices and environmental justice. Eslit (2023) also notes that community-led environmental initiatives benefit significantly from the active participation of women, pointing to their effectiveness in driving local environmental protection efforts.

Lasco et al. (2019) emphasize that family dynamics significantly influence community participation in environmental initiatives, suggesting that married individuals often take on roles as primary caregivers and active participants in promoting environmental awareness and sustainability. Additionally, the small percentage of widowed individuals among the respondents reflects the broader demographic challenges many communities face, particularly in areas affected by environmental degradation and socio-economic issues.

Roka (2019) underscores the pivotal role that higher educational attainment plays in understanding and addressing environmental issues. Moreover, the literature suggests that educational interventions enhance community engagement and accountability. For instance, Ardoin et al. (2020) found that accessible and relevant environmental education significantly raises community awareness and responsibility toward environmental conservation which resulted in direct benefits to the environment and address conservation issues concretely. This suggests that the predominance of college graduates among the respondents in our study may lead to a greater understanding and commitment to environmental issues.

Around 54.53% of our respondents were non-members of any environmental organization. Tarubal (2021) highlights the challenges in fostering genuine environmental consciousness, noting that despite educational efforts, there remains a significant gap in active participation within environmental initiatives. Moreover, McCarthy (2020) emphasizes integrated approaches to environmental management, suggesting that while formal organizational membership is beneficial, grassroots efforts and individual actions can also play significant roles in fostering environmental responsibility.

The studies conducted by Roka (2019) and Eslit (2023) highlight the effectiveness of community-based approaches, where collaboration between internal stakeholders and external entities can enhance environmental outcomes. Additionally, Ardoin et al. (2018) that effective environmental education goes beyond just transferring information; it develops environmental attitudes, values, and knowledge, and builds skills that prepare individuals and communities to collaboratively undertake positive environmental action. The works of Schmitz and & Herrero-Jáuregui (2021) that cultural landscapes, which are the result of social-ecological processes, can be preserved through the integration of cultural and ecological conservation efforts and highlights the importance of considering both internal and external stakeholders to effectively address environmental challenges

### **The key determinants of community engagement**

Emotional engagement is one of the most critical determinants of community engagement in our study. Surigao del Sur is a province with closely-knitted small school communities where everyone knows everybody and where



people are emotionally attached to their surroundings. Infield et al. (2017) highlights the cultural values and emotional attachments can enhance conservation efforts by fostering deeper connections between communities and their natural environments. Furthermore, Garcia and Lee (2019) assert that educational interventions can significantly increase community awareness and responsibility toward environmental conservation, emphasizing that emotional connections fostered through these interventions can enhance accountability and action.

In social norms, the academic community believes that social bonds contribute to a sense of responsibility for environmental stewardship. It has been a social belief that community leaders shape the social dynamics of environmental engagement. Miao and Nduneseokwu (2025) emphasized that public organizations, as stewards of public resources and policy enforcers, are uniquely positioned to lead by example in environmental protection and conservation. They added that the significant impact of community leaders and environmental awareness on promoting sustainable practices and policies.

In environmental literacy is crucial in a developing country such as the Philippines. Environmental education has been embedded in the school programs, knowing that integrating environmental topics into the curriculum impacts understanding of conservation issues. Akinsemolu and Onyeaka (2025) emphasize that green education, through its innovative and holistic approach, is essential for building a sustainable and desirable future. Munna and Kalam (2021) note that integrating environmental topics into formal school curricula positively impacts community understanding of conservation issues. This study suggest that such programs significantly motivate community involvement in conservation efforts.

For cultural appreciation, the province of Surigao del Sur is rich in cultural traditions and heritage. The school curriculum includes cultural awareness and preservation, believing traditional ecological knowledge influences understanding sustainable practices. Cultural belief systems shape individuals' perceptions and responses to environmental changes. The cross-cultural data, indicating that an overwhelming majority of the world's population supports environmental protection, and identifies with the value of looking after the environment (Milfont and Schultz 2016). This study reveals that communities with a strong cultural tradition of stewardship demonstrate high levels of accountability in conservation efforts, indicating that cultural narratives play a critical role in influencing individual perceptions and behaviors toward the environment.

Around 93% of our respondents agree with our psychological indicators. The academic community feels that environmental threats and their consequences impact psychological commitment to conservation, while psychological rewards influence environmental conservation engagement. The significance of psychological rewards is supported by Catuday (2023) who emphasize the role of achievement and intrinsic motivation in fostering sustained participation. A personal connection to nature aligns with Sicat (2023), who argues that emotional attachment enhances engagement, while Marpa (2020) highlights that a sense of responsibility significantly affects commitment levels. The importance of psychological factors in community engagement is further emphasized by the frameworks (Calinao et al. 2021).

### **Level of Accountability**

The results revealed that 99% of the respondents knew the environmental policies and understood their role in implementing these programs. The respondents believe they can be held responsible for their actions towards the environment and share a personal responsibility to implement environmental policies. Tarubal (2021) asserts that environmental education (EE) in the Philippines, while facing challenges, remains critical in fostering genuine environmental consciousness and accountability. The high mean scores in respondents' awareness of environmental policies and their roles in implementing them reflect educational programs' significance in cultivating a strong sense of responsibility toward environmental issues. The strong agreement among respondents on the necessity of personal responsibility in adhering to environmental policies aligns with findings from Catuday (2023), indicating a positive correlation between stakeholders' environmental awareness and their accountability.

Around 97% of the respondents have been actively incorporating environmental awareness into their decision-making process, and they educate themselves about the environmental impacts of their various activities. This echoes the respondents' commitment to integrating eco-friendly alternatives and disseminating environmental knowledge within their communities, as reflected in the high mean scores for statements related to active

contribution and advocacy for education on environmental concepts. Conversely, challenges in the implementation of environmental education high-lighted by Tarubal (2021) suggest that while awareness is high, substantial gaps in genuine environmental consciousness remain. This aligns with the lower mean score, regarding the advocacy for including environmental concepts in educational curricula, indicating that despite high accountability levels, there may still be obstacles to fully realizing the potential of education in promoting sustainability practices.

Respondents (98%) are well aware that lifestyle choices align with environmentally sustainable practices and are willing to participate in any training programs on environmental operation management. Lasco et al. (2019) emphasize that a strong commitment to sustainable practices among individuals can lead to significant environmental benefits. The high level of awareness regarding the environmental impact of workplace operations (mean of 4.69) resonates with Arpornsilp (2019) assertion that awareness is crucial for effective engagement in sustainable practices. However, the variability noted which indicates some divergence in opinions about the accountability of individuals in environmental operations (mean of 4.56), suggests a need for further exploration of barriers to accountability. Tarubal (2021) points out the lack of substantial progress in fostering genuine environmental consciousness in the Philippines, which could contribute to differing perceptions among respondents about their roles in environmental management.

### **The impact of demography to commit towards environmental conservation**

The study explored further by determining the correlations among all the variables within the PCA to evaluate the strengths of their relationships. It was confirmed that the demographic profiles were not significantly correlated with the key determinants and accountability indicators as shown in the correlation matrix (Fig2b). Our result did not support our hypothesis that social demography will play a more significant role towards this environmental preservation.

Furthermore, Garcia and Lee (2019) emphasize that educational interventions empower individuals across age groups, reinforcing the observation in our result that community are engaged irrespective of age classes. While diverse age representation in environmental initiatives is beneficial, it is essential to address the nuances and challenges behind environmental efforts to enhance the effectiveness of community engagement in environmental education.

The predominance of female respondents in this study highlights the importance of female leadership in environmental efforts while also acknowledging the complexities surrounding male participation in environmental education. It must be for this reason that gender demography weakly explained variance in demographic contribution to community engagement ( $R^2 = 0.05$ ) since the role of men and women in implementing environmental activities are closely-linked and tangled. This suggests that while females are more prominent in environmental education roles, it is essential to recognize and address the barriers that may limit male involvement. Nevertheless, gender is not the most limiting factor in engaging the academic communities as depicted in our SEM result.

De Andrade Correa (2022) advocates for an inclusive approach to environmental decision-making, stressing the importance of incorporating diverse family structures and social contexts to enhance the effectiveness of environmental initiatives. Our study are confined within the perspectives of married, single individuals, and widowed. The absence of representation from divorced or separated individuals might suggest a gap in understanding the varied perspectives and contributions that could enrich community engagement efforts. Eslit (2023) notes the necessity of recognizing the diverse backgrounds and circumstances of community members when designing environmental programs. A lack of representation from different civil statuses may hinder the effectiveness of initiatives aimed at addressing environmental challenges comprehensively, emphasizing the need for inclusive strategies that engage all community segments.

Despite the majority of respondents being college graduates, there remains a notable percentage of individuals with lower educational attainment, such as high school and elementary undergraduates, who may lack the same level of environmental understanding. The disparity resulted to weaker link of educational attainment and to the collective demographic profile as a whole. Calinao et al. (2021) highlighted the need for targeted outreach and engagement to

ensure that all community members, regardless of educational background, are equipped to participate in environmental initiatives effectively.

This study demonstrates a careful understanding of what constitutes to engage the academic community in the conservation and preservation of the environment. It showed that anybody, irrespective of age, gender, civil status, educational attainment, and others, can participate in environmentally-driven activities and foster advocacy to encourage more participation from school-affiliated individuals and beyond. The determinants of community engagement (social, psychological, cultural, educational, and emotional) collectively play a significant role in keeping the academic society environmentally engaged, and the level of accountability equally drove this environmental policy-driven entity towards a more vibrant and sustainable environment. This study is geared toward providing a more profound understanding of where to focus to stir active community involvement in conserving and preserving the environment towards a sustainable society

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