

## Bridging Theory and Community: Enhancing Geomatics Education for Civil Engineering through Service-Learning Pedagogy

Jefferson R. Vallente Jr.<sup>1\*</sup>, Paulyn Erica M. Porras<sup>2</sup>, Victoria Melissa C. Pulido<sup>2</sup>,  
Jungie J. Caja<sup>1</sup>, Gem Kevin S. Estimos<sup>1</sup>, Maeray Franzie R. Roa<sup>1</sup>

<sup>1</sup>Civil Engineering Department, College of Engineering, Xavier University, Ateneo de Cagayan, 9000 Cagayan de Oro, Philippines

<sup>2</sup>Social Development - Service Learning Program, Xavier University, Ateneo de Cagayan, 9000 Cagayan de Oro, Philippines

\*Correspondence: [jvallente@xu.edu.ph](mailto:jvallente@xu.edu.ph)

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**Abstract:** Modern engineering education requires pedagogical models that bridge the gap between technical proficiency and social awareness to address complex 21st-century challenges. This paper examines the effectiveness of service-learning in Geomatics education through a case study of the K.A.D.A.I.T.A.N. project in Sitio Kadaitan, Alubijid, Philippines. By integrating 1-metre resolution LiDAR data with participatory geospatial mapping, students conducted high-fidelity flood hazard and risk assessments within a validated topographic range of 135 to 240 metres. The analysis identified critical hydrological “choke points” and assessed land-use impacts through the delineation of 20-metre agricultural and 40-metre forest buffers. To ensure technical rigour and academic credibility, official datasets were triangulated with community-sourced qualitative evidence—an approach that aligns with the UNDRR’s mandate to democratise risk understanding. The results include community-validated flood susceptibility maps and specific, place-based engineering interventions, such as detention ponds, diversion channels, and modular steel bridges. Evaluated against ABET competencies, the project demonstrated significant gains in students’ systems thinking and civic professionalism. This study contributes a replicable framework for participatory GIS and community-based resilience mapping within the Southeast Asian hazard landscape, demonstrating how the technical rigour of Geomatics can be harnessed for inclusive, socially grounded disaster risk reduction.

**Keywords:** Service-Learning; Geomatics; Engineering Education; Flood Hazard Assessment; Civic Engagement

### 1.0 Introduction

Modern engineering education stands at a critical juncture, tasked with preparing graduates for a world of unprecedented complexity. The challenges of the 21st century—from climate change and resource scarcity to rapid urbanisation and social inequality—demand engineers who are not only technically proficient but also ethically grounded, socially aware, and capable of navigating complex socio-technical systems. In response, pedagogical reform has become a central focus for leading academic institutions and accreditation bodies. This section establishes the theoretical and pedagogical framework for service-learning (SL), positioning it as a strategic, high-impact practice that directly addresses this evolving mandate. Service-learning is presented not merely as an alternative to traditional instruction, but as a comprehensive educational strategy that integrates technical rigour with professional and civic development, thereby advancing a new paradigm in engineering education.

Service-learning is a structured pedagogical approach that intentionally integrates academic learning with meaningful community service (Alvarez-Vanegas, Ramani, & Volante, 2024). It is important to distinguish this methodology from other forms of experiential education. Unlike volunteerism, which is often extracurricular and primarily service-oriented, or internships, which are typically pre-professional and career-focused, service-learning is defined by the deliberate and reciprocal integration of service activities with the course curriculum (Piechota & Nambisan, 2005). Furthermore, Piechota and Nambisan (2005) emphasise that the hyphen in “service-learning” signifies the equal importance and symbiotic relationship between the two components.

The definition provided by Bringle and Hatcher, widely adopted in the field, encapsulates this synthesis: service-learning is “a course-based, credit-bearing educational experience in which students (a) participate in an organised service activity that meets identified community needs and (b) reflect on the service activity in such a way as to gain a deeper understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility (Bielefeldt & Pearce, 2012). This definition highlights the core tenets of the pedagogy: it is credit-bearing, addresses authentic community-identified needs, and, most critically, incorporates structured reflection as the mechanism for transforming experience into durable learning (Baylor University, 2023). Reciprocity is another key principle; the partnership is designed to deliver tangible benefits to the community while simultaneously achieving specific learning outcomes for students (ASEE, 2000). The implementation of service-learning is well documented in Asia, particularly in the Philippines, where it contributes significantly to institutional missions and educational outcomes. For example, service-learning initiatives in geriatric education demonstrate how student competencies can be developed in alignment with community needs (Anorico, 2019). Such initiatives also reflect the trifocal functions of faculty—teaching, research, and community engagement—within Philippine higher education institutions, thereby contributing to knowledge generation and societal impact (Elechicon & Paris, 2026). To maintain this balance, institutions such as Xavier University – Ateneo de Cagayan have adopted frameworks inspired by Robert Furco, which emphasise the equal prioritisation of community service and student learning. This approach aligns with broader institutional reforms observed in many Catholic universities in the Philippines, where service-learning is strategically embedded to advance the university’s mission and identity (Adarlo et al., 2024).

The transformative power of service-learning (SL) lies in its ability to bridge the gap between theory and practice through a process of critical reflection. This element is fundamental in distinguishing it from other forms of community engagement. According to Eyler (2002), in the seminal work “Where’s the Learning in Service-Learning?”, reflection serves as the key mechanism through which students interpret their service experiences and connect them to academic content. Such reflection, whether facilitated through journals, discussions, or written assignments, enables students to move beyond surface-level observations towards a deeper understanding of social issues, power dynamics, and their roles as engaged citizens. At Xavier University – Ateneo de Cagayan, reflection constitutes a central component of service-learning programmes, embedded in various forms to support students in engaging sensitively across ethnic and socio-economic boundaries, while also recognising the relevance of their academic studies in addressing development disparities. This process enables students to internalise principles of social justice and ethical responsibility, aligning their academic development with the university’s Ignatian foundation of “faith that does justice.”

In the Southeast Asian context, where rapid and often unregulated urbanisation frequently outpaces official geospatial data collection, participatory approaches are becoming essential for effective disaster risk reduction (DRR) strategies. The United Nations Office for Disaster Risk Reduction (UNDRR) emphasises the urgent need to “democratise risk understanding” by aligning technical risk information with local

realities, particularly in Asian regions where significant gaps in local data and technical capacity persist (United Nations Office for Disaster Risk Reduction, 2022). This shift aligns with broader developments in regional geographical scholarship, which increasingly prioritise community-based, participatory hazard mapping over top-down, purely technical models. By integrating local knowledge with professional-grade geospatial tools, these approaches support the “whole-of-society” principle advocated by the Sendai Framework, ensuring that resilience-building efforts are both technically rigorous and socially inclusive. Furthermore, service-learning pedagogy (SLP) enhances students’ understanding of disasters as complex phenomena arising from the interaction of multiple factors rather than a single cause (Franta et al., 2016). This perspective is particularly relevant in the Philippine context, as demonstrated by events such as Tropical Storm Sendong (Washi) in 2011, which caused severe flooding in Cagayan de Oro and Iligan City due to a combination of hydrometeorological, environmental, and socio-economic factors.

Beyond its service to the community, service-learning (SL) distinguishes itself from other pedagogical approaches through its demonstrated capacity to produce lasting impacts on students’ leadership development. This is achieved through meaning-making processes, which constitute a core principle of transformative leadership (Adarilo et al., 2023).

To ensure that these outcomes are achieved, the implementation of service-learning is typically organised as a cyclical process. A widely recognised model, exemplified by programmes at Xavier University – Ateneo de Cagayan, comprises four distinct stages: Orientation, Engagement, Reflection, and Community Output Presentation.

1. **Orientation:** This initial phase involves preparing students by introducing the community partner, the socio-cultural context of the issue, and the specific learning objectives of the project. It establishes the academic and ethical foundation for engagement.
2. **Engagement:** Students participate in service activities, applying their knowledge and skills to address identified community needs. This stage represents the hands-on, experiential component of the process.
3. **Reflection:** This stage constitutes the cognitive core of service-learning. Through structured activities such as reflective journals, group discussions, and analytical reports, students critically examine their service experiences, connect them to theoretical concepts, and evaluate their broader personal and societal implications (Dewoolkar et al., 2009). As noted in the literature, reflection is the key mechanism through which students interpret their experiences and relate them to academic content, thereby fostering higher-order thinking and deeper disciplinary understanding (ASEE, 2000).
4. **Community Output Presentation:** In the final stage, students synthesise and communicate their learning and project outcomes to peers, faculty, and community partners. This often takes the form of formal presentations or comprehensive reports, serving both as a capstone to the learning cycle and as a tangible deliverable for the community.

## 2.0 Study Area

The study focuses on Sitio Kadaitan, a community located within Barangay Tula in the municipality of Alubijid, Misamis Oriental, on the island of Mindanao in the Philippines.

### 2.1 Geographic and Demographic Profile

Sitio Kadaitan is geographically situated at approximately 8.4049° N latitude and 124.4235° E longitude. The lowest elevation within the settlement is estimated at 136 metres above mean sea level (see Figure 1), while the broader study area spans a topographic range from 135 to 240 metres. The primary settlement is concentrated near the 136-metre contour.

According to the 2020 census, the community has an estimated population of 890 residents, representing approximately 2.77% of the total population of Alubijid municipality. The site is characterised by high flood vulnerability, primarily due to overflow from the Alubijid River, compounded by limited infrastructure such as bridges. As a result, the community is frequently isolated during periods of intense rainfall.

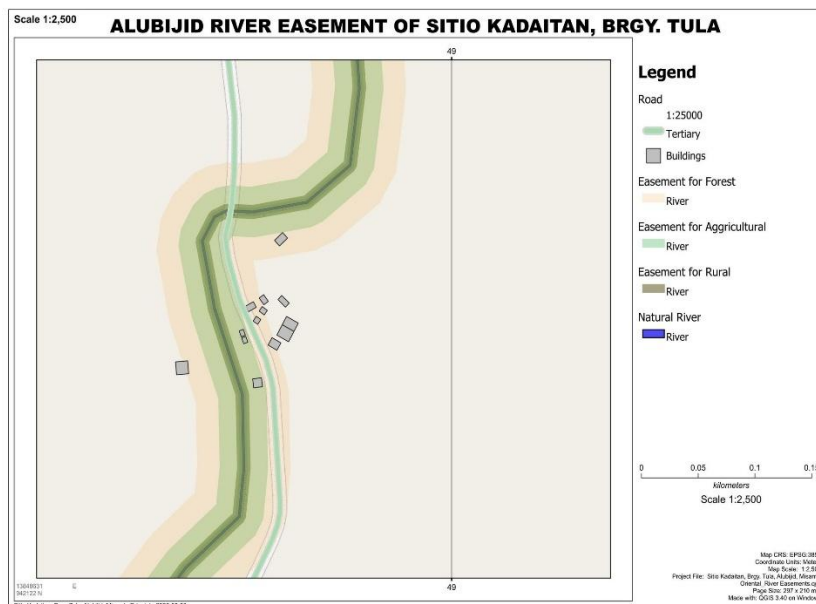


Figure 1: Study area along the River Easement.

## 3.0 Materials and Methodology

### 3.1 Flood Vulnerability and Rationale for Selection

Sitio Kadaitan was selected as the project site due to its significant and well-documented exposure to recurring flood events, as illustrated in Figure 2. The primary cause of flooding is the overflow of the Alubijid River following periods of intense rainfall. This high level of susceptibility is supported by several key factors:

- **Historical and Recent Flooding:** The area has a documented history of flooding, including a significant event on 18 June 2024 that caused severe disruption and rendered the community inaccessible. A subsequent flood event was also recorded in the week preceding 17 May 2025.
- **Corroborating Data:** The community's flood risk is supported by technical evidence, including LiDAR-derived datasets and flood mapping studies of the Alubijid River conducted by the University of the Philippines Diliman (UPD) DREAM Programme.
- **Exacerbating Factors:** Flood risk is further intensified by ongoing road construction in the surrounding area. This development has reduced natural vegetation cover, thereby increasing surface runoff and overall hazard exposure for residents.

FLOOD RISK MAP OF ALUBIJID MISAMIS ORIENTAL

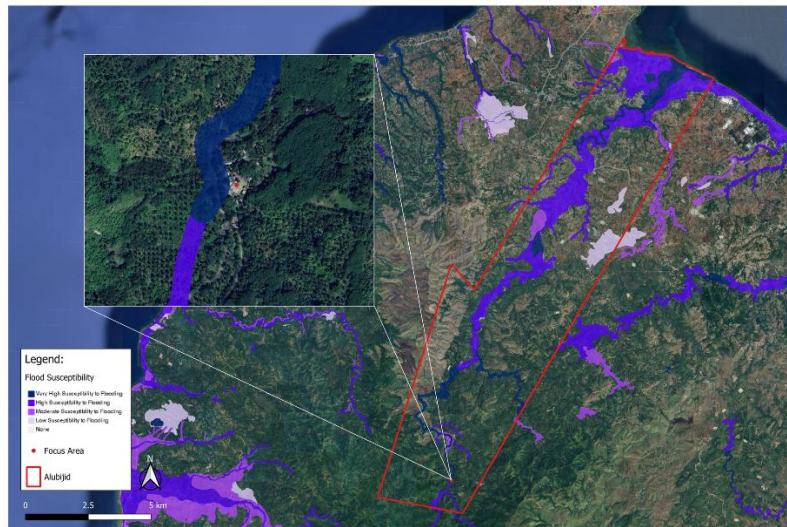


Figure 2: Generated flood hazard map.

The combination of these factors positions Sitio Kadaitan as a critical site for flood hazard and risk assessment, with the aim of providing a robust technical basis for enhancing community preparedness and resilience.

### 3.2 Geospatial Data Acquisition and Technical Workflow

To ensure the technical rigour required for geographical scholarship, the study employed a multi-modal geospatial approach:

- **Primary Data Sources:** High-resolution LiDAR data (1-metre resolution) were sourced from the University of the Philippines Diliman (UPD) DREAM Programme to establish the topographic baseline and delineate the Alubijid River channel.
- **Field Data Collection:** Students utilised mobile GIS tools for geotagging and georeferencing points of interest, including historical high-water marks (observed at 5–6 metres), existing infrastructure, and land-use boundaries.
- **Spatial Analysis:** Flood susceptibility mapping was conducted using a standard Coordinate Reference System (EPSG:4326). The analysis included the delineation of a 40-metre forest buffer and a 20-metre agricultural buffer to assess the protective role of natural ecosystems.
- **Validation and Quality Control:** The student-generated maps were validated through ground-truthing by comparing field-surveyed coordinates with UPD DREAM LiDAR datasets. This participatory mapping approach enabled the correction of base map inaccuracies using local community knowledge, a key practice in community-based disaster risk reduction (CBDRR).
- **Limitations:** While high-resolution LiDAR data provided excellent vertical accuracy, the temporal gap between the 2014 LiDAR acquisition and current site conditions (particularly recent road construction) necessitated field-based updates to account for changes in vegetation cover and drainage patterns.

## 4.0 Results

### 4.1 Geospatial Analysis and Flood Vulnerability

The primary output of the K.A.D.A.I.T.A.N. project was the generation of high-resolution flood susceptibility and hazard maps for Sitio Kadaitan. The technical analysis revealed that the community's vulnerability is primarily driven by its proximity to the Alubijid River and its specific topographic profile.

Topographic analysis using a validated 1-metre LiDAR-derived Digital Elevation Model (DEM) established that the settlement lies within a narrow elevation range of 135 to 240 metres above mean sea level. Initial processing of the raw data revealed localised outliers (ranging from -11 m to 629 m); however, these were identified as digital artefacts resulting from dense canopy interference and sensor noise. Through ground-truthing and manual filtering, the analysis confirmed that the most vulnerable households are concentrated along the 136-metre contour, which corresponds to the river's historical flood stage. To support the analytical component, recent work on the contribution of dike systems to flood mitigation along the Cabulig River was introduced to students, highlighting key hydrological and hydraulic modelling processes. This included the simulation of rainfall-runoff dynamics within the river basin (Ramos Vallente et al., 2024).

The mapping process further identified critical "choke points" where natural drainage is obstructed by recent agricultural expansion. The delineation of a 20-metre agricultural buffer and a 40-metre forest buffer provided a spatial representation of how land-cover change has intensified surface runoff. These findings indicate that flood risk in Sitio Kadaitan is not solely a function of rainfall intensity, but rather a geographically conditioned phenomenon exacerbated by land-use transitions common in rapidly urbanising Philippine municipalities.

4.2 *Technical Validation and Participatory Data Sourcing*

To ensure the reliability of the hazard maps, a triangulation approach was employed for validation. While official LiDAR data provided the topographic baseline, historical high-water marks were verified through community interviews and qualitative documentation. This included the analysis of community-sourced media and citizen-recorded video footage of the 2011 Tropical Storm Sendong (Washi) and more recent monsoon events.

By treating these community-sourced materials as supplementary qualitative evidence rather than primary hydrological data, the study was able to reconstruct flood levels in areas where official gauging stations were absent. This participatory approach enabled the ground-truthing of the 5–6 metre flood stages reported by residents, effectively bridging the gap between top-down technical models and lived community experience. This method demonstrates how participatory GIS can contribute to “democratising risk understanding,” as advocated by the UNDRR (2022), by transforming experiential and anecdotal evidence into actionable geospatial data.

4.3 *Engineering Interventions and Community Resilience*

Moving beyond hazard identification, the project proposed four specific structural and non-structural interventions: a detention pond, a diversion channel, a modular steel Bailey bridge, and community relocation strategies. The geographical framing of these solutions is critical; for example, the proposed detention pond was sited based on natural topographic depressions identified through GIS analysis, thereby minimising the need for extensive excavation.

The proposed Bailey bridge addresses a key geographical constraint: the isolation of the community during flood events. By providing a resilient connection to the main township, this intervention enhances the place-based resilience of Sitio Kadaitan. These proposals reflect a shift from traditional “hard engineering” approaches towards a more integrated socio-technical paradigm that accounts for both the physical geography and the social fabric of the Philippine rural–urban fringe. By presenting an authentic and multifaceted problem context, service-learning pedagogy fosters the development of systems thinking—a critical competency for 21st-century engineers that is often difficult to cultivate through conventional instruction (Dewoolkar et al., 2009).

4.4 *Pedagogical Outcomes and Professional Development*

The integration of service-learning significantly enhanced student learning outcomes, particularly in relation to ABET competencies. Assessment data indicate that students progressed beyond surface-level GIS application towards a deeper understanding of systems thinking. By engaging with the complexity of real-world data—such as reconciling DEM outliers and verifying community-reported information—students developed the critical thinking skills required for professional Geomatics practice.

The reflection phase enabled students to connect their technical work with the university’s mission of “faith that does justice.” This pedagogical impact is closely linked to the geographical findings; rather than being incidental, it emerges from students’ recognition that their outputs have tangible implications for the safety and well-being of residents in Sitio Kadaitan. This synergy between technical rigour and social responsibility represents a transformative model for engineering education within the Asian context.

5.0 Discussion

Beyond technical proficiency, the project fostered the development of higher-order cognitive skills that are essential for professional engineers. The students’ analysis of proposed flood mitigation solutions is a particularly rich source of evidence for these advanced competencies (Table 1).

**Critical Thinking and Analysis:** The structured evaluation of the advantages and limitations of each proposed intervention demonstrates a high level of critical thinking. For example, in assessing a buffer zone, students identified its benefits in reducing surface runoff and stabilising riverbanks, while also critically acknowledging potential drawbacks, including reduced land availability for agriculture and possible community resistance. This ability to evaluate solutions from multiple, often competing, perspectives and to anticipate unintended consequences reflects a mature engineering mindset.

**Complex Problem-Solving:** The students did not pursue a single “silver bullet” solution to the flooding problem. Instead, they proposed a suite of primary and secondary interventions, ranging from structural measures, such as diversion channels and flood walls, to non-structural strategies, including buffer zones and relocation. This demonstrates a sophisticated understanding that complex, systemic challenges require multi-layered and integrated solutions. The students recognised that a resilient strategy would likely involve a combination of these approaches.

**Synthesis:** The project required students to synthesise diverse sources of information to develop a coherent assessment and a set of actionable recommendations. These included quantitative data from LiDAR surveys conducted by the UP DREAM Programme, qualitative evidence from historical flood accounts (including supplementary materials such as publicly available video recordings), field-collected geospatial data, and established principles of engineering and spatial planning. This capacity to integrate disparate forms of evidence into a cohesive analytical framework is a critical competency for addressing complex real-world challenges.

Table 1: Relationship between student project evidence and the achievement of ABET student outcomes (Criterion 3) within the K.A.D.A.I.T.A.N. service-learning framework

Project Evidence (Activity/Output from K.A.D.A.I.T.A.N. Report)	Corresponding ABET Student Outcome (Criterion 3)
1. Generation of topographic and flood susceptibility maps using geospatial data to analyze flood risk in Sitio Kadaitan.	1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Proposal of a suite of mitigation solutions (e.g., Detention Pond, Flood Wall) with detailed analysis of advantages and disadvantages.	2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Production of a comprehensive technical report and delivery of presentations to community stakeholders (LGU, Barangay officials).	3. An ability to communicate effectively with a range of audiences.
4. Analysis of the social impacts of proposed solutions, such as the potential for “loss of livelihood” and “psychological trauma” from relocation.	4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Explicit acknowledgement of the “collaborative spirit” and “collective pursuit of knowledge” of the CE 23 student team.	5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Collection and analysis of field data (geotagging) and synthesis with external data sources (LiDAR surveys from UP DREAM program).	6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Finally, the project's impact extended into the affective domain of learning, cultivating in students a deeper sense of civic identity and social responsibility. This outcome is evident not only in the project outputs but also in the language and framing adopted throughout the report. The students were not merely detached technicians; rather, they functioned as engaged partners in a community development initiative.

Direct collaboration with the Local Government Unit of Alubijid and the Barangay officials of Tula provided a practical foundation for civic engagement. Students learned to navigate the complexities of working with community stakeholders, to value local knowledge, and to adapt their technical solutions to real-world contexts and needs. This experience extends learning beyond the classroom and positions students as active citizens capable of applying their specialised skills for the common good, thereby fulfilling a core objective of service-learning pedagogy (Baylor University, 2023). Furthermore, as demonstrated in their applied outputs, students were able to design an Early Warning System aligned with the four components outlined by the World Meteorological Organization (WMO), as illustrated in Figures 3 and 4.

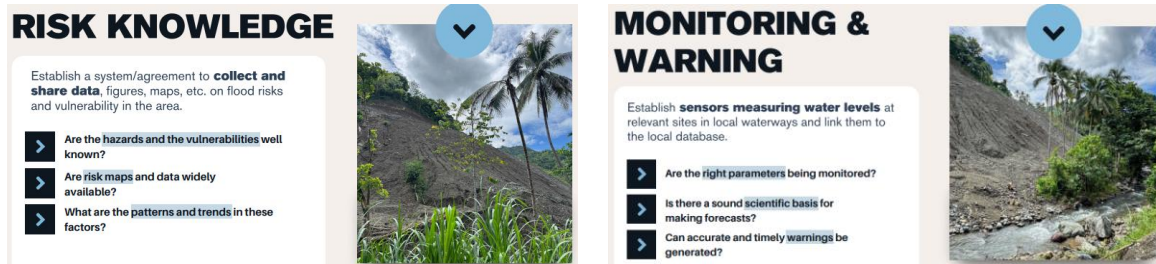


Figure 3: Risk Knowledge and Monitoring & Warning recommendations by the students

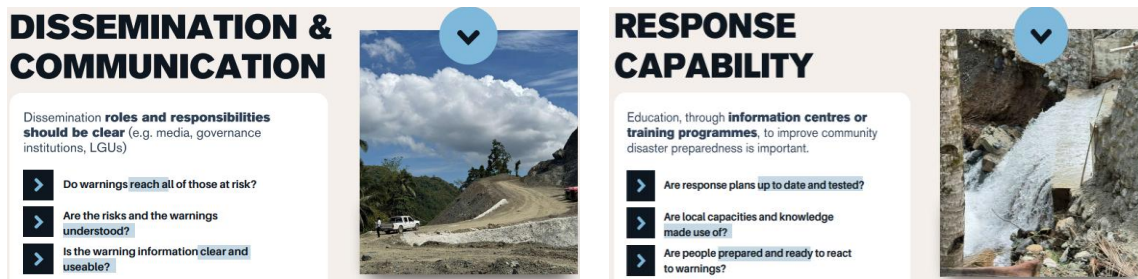


Figure 4: Dissemination & Communication and Response Capability recommendations by the students

The analysis of the K.A.D.A.I.T.A.N. project provides not only compelling validation of the service-learning model but also a rich source of insights for its broader implementation. This concluding section synthesises the findings from the case study and supporting literature into a forward-looking and actionable framework. It is intended as a blueprint for educators, curriculum committees, and academic leaders seeking to adopt, enhance, or institutionalise service-learning within Geomatics and Civil Engineering programmes. The framework addresses key success factors, models for curricular integration, and strategies for robust assessment, culminating in a vision of engineering education as a public good.

The successful integration of service-learning is not automatic; it requires careful planning and adherence to established best practices. The K.A.D.A.I.T.A.N. case, supported by a broad body of research, highlights several critical elements essential for creating a high-impact learning experience while delivering tangible value to the community. Outcomes derived from community engagement, consultation, and group discussions informed the development of both nature-based and engineering solutions, which were subsequently presented to stakeholders, as illustrated in Figure 5. The following table 2 outlines a phased implementation framework that incorporates these best practices, serving as a practical guide for course design.

Table 2: Phased implementation framework incorporating best practices for service-learning course design.

Phase	Key Activities for Instructors & Students	Primary Learning Objectives	Suggested Methods	Assessment
1. Orientation	<b>Instructor:</b> Identify and establish a reciprocal partnership with a community organization. Co-develop a project scope that meets a genuine community-identified need and aligns with course learning objectives. <b>Students:</b> Conduct background research on the community partner, the social and historical context of the problem, and relevant technical precedents. Participate in orientation sessions on ethical community engagement.	Understand the social, cultural, and ethical context of the engineering problem. Develop initial project goals and a work plan.	Project proposal or charter. Initial reflection paper on community context and personal learning goals.	
2. Engagement	<b>Instructor:</b> Act as a mentor and facilitator ("guide on the side"). Provide just-in-time technical workshops, facilitate access to resources, and conduct regular team check-ins to monitor progress and address challenges. <b>Students:</b> Conduct fieldwork, data collection (e.g., surveying, geotagging), and geospatial analysis. Engage in regular communication with the community partner.	Apply Geomatics and engineering principles to a real-world problem. Develop technical skills in data acquisition, processing, and analysis. Practice effective teamwork and project management.	Field notes and data logs. Interim progress reports. Peer evaluations.	
3. Reflection	<b>Instructor:</b> Design and facilitate structured reflection activities (e.g., guided discussions, journaling prompts). Provide critical feedback on students' analysis and interpretation of data. <b>Students:</b> Analyze collected data in the context of community needs. Evaluate multiple potential solutions, considering their technical, social, economic, and	Synthesize technical data with community needs to evaluate the viability and impact of potential solutions. Develop critical thinking and complex problem-solving skills. Deepen understanding of course content.	Analytical memos or reports (e.g., pros-and-cons analysis of solutions). Structured journal entries. In-class discussions.	

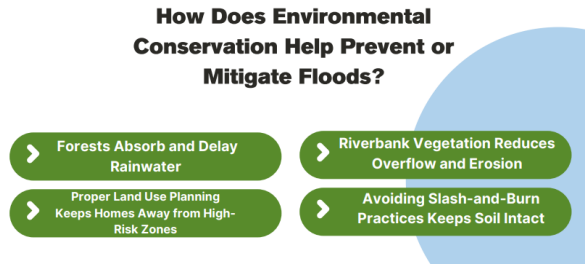
**4. Community Output Presentation**

environmental implications. Connect the service experience to academic course concepts.

**Instructor:** Coordinate a final presentation event involving the community partner and other stakeholders. Guide students in preparing professional-quality deliverables.  
**Students:** Prepare and deliver a comprehensive final technical report. Create and present a summary of findings and recommendations to the community partner. Articulate the project's outcomes and their personal learning journey.

Develop effective written and oral communication skills for diverse audiences. Demonstrate mastery of project content and its broader implications. Solidify personal and professional learning from the experience.

Final technical report graded with a comprehensive rubric. Oral presentation evaluated by instructor and community partner. Final individual reflection paper.



**CONTOUR FARMING**

- The practice of tillage, planting, and other farming operations performed on or near the contour of the field slope.
- Tiling sloped land along lines of consistent elevation in order to conserve rainwater and to reduce soil losses from surface erosion



**FLOODPLAIN RETENTION PONDS**

- Basins or hollows designed to temporarily store excess stormwater or floodwater during heavy rainfall or river overflow events.
- Typically constructed within or near floodplains—the low-lying areas adjacent to rivers or streams that are prone to flooding.



**FLOOD MITIGATION MEASURES**

- **Flood-tolerant crops:** use of resilient varieties of crops to manage risks effectively
- **Land Management:** practice contour planting to contour runoff
- **Flood Control Areas:** natural or artificial wetlands prone to flooding to reduce overflow
- **Watershed Management:** reforest upland areas to minimize runoff and erosions

**REFORESTATION TREE-PLANTING**

- The process of restoring forest ecosystems by planting trees in areas where they have been removed or where the forest has been degraded.
- This helps to reduce soil erosion and helps in water absorption.



**FLWSAFE Tula**

FLWSAFE Tula is a nonstructural flood mitigation campaign aimed at enhancing household-level disaster preparedness and community-based resilience in Barangay Tula, Alubid.

**TARGET AUDIENCE:**  
 Residents in flood-prone and low-lying areas of Barangay Tula. (Primary)  
 Barangay leaders, youth groups, and the local DRRM committee. (Secondary)

**OBJECTIVES:**

- Assign one trained Flood Safety Coordinator per purok by June 2026.
- Facilitate two community-based flood workshops with at least 80% household engagement.
- Distribute flood awareness kits and hazard maps to all households within one month of campaign initiation.
- Baseline and endline surveys to assess knowledge improvement.
- Attendance monitoring and training assessment.
- Validation of mapped hazard zones and kit utilization.
- Focus group discussions for campaign refinement.

**MONITORING & EVALUATION**

**CAMPAIGN ACTIVITIES**

- Community Launch & Orientation
- Community Feedback Forum
- Localized Flood Mapping
- Distribution of Flood Safety Kits
- Emergency Prep Checklists
- Preparedness Training Sessions

**EXPECTED OUTPUT**

The campaign will institutionalize grassroots flood preparedness in Barangay Tula through informed participation, local knowledge sharing, and the use of nonstructural mitigation tools.

Figure 5: Nature-based and Engineering Solutions formulated by the students

**6.0 Conclusions**

The K.A.D.A.I.T.A.N. project demonstrates that service-learning is a transformative pedagogy for Geomatics education, effectively bridging the gap between technical engineering competencies and social responsibility. By directly addressing the recurring flood vulnerabilities of Sitio Kadaitan, students not only met ABET professional standards but also produced high-resolution, community-validated hazard maps that provide a robust technical foundation for local disaster risk reduction and resilience planning.

Beyond its pedagogical value, this study makes a distinct contribution to Asian geographical scholarship by presenting a robust framework for participatory hazard mapping in the Southeast Asian context. The integration of official LiDAR datasets with community-sourced qualitative evidence offers a replicable methodology for “democratising risk understanding” in regions where geospatial data are often limited or inaccessible. These findings underscore the importance of place-based resilience and illustrate how the technical rigour of Geomatics can empower marginalised communities to better respond to climate-related hazards.

Ultimately, the integration of technical proficiency with the Ignatian principle of “faith that does justice” offers a sustainable model for engineering education in Asia. It prepares a new generation of graduates to address complex socio-technical challenges through inclusive geospatial practices, ensuring that engineering solutions are both technically robust and socially grounded.

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