

Visual and Narrative Engagements with the “Subak” System: A Thematic Analysis of Sustainability Learning through Creative Interpretation in Bali

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Abstract: *Subak*, Bali’s traditional ecological knowledge (TEK) system rooted in *Tri Hita Karana*, integrates water management, spiritual practice, and communal governance. This study investigates how Singaporean university students engaged with *Subak* during a cross-cultural, place-based learning program. Through immersive field visits to Subak Pulagan, located about 30 kilometers Northeast of Denpasar, students produced drawings and narratives to interpret ecological, cosmological, and social relationships. Using phenomenographic inquiry combined with thematic and factor analysis, six themes were identified: sacred water, spiritual ecology, collective governance, temple networks, sustainability threats, and symbolic meaning. Findings show that students perceived *Subak* as a dynamic socio-ecological system and demonstrated ethical awareness and intercultural understanding. Framed by Critical Pedagogy of Place, their creative expressions revealed processes of reinhabitation and decolonization. The study underscores the value of arts-based, culturally grounded learning for deepening engagement with Indigenous ecological knowledge in Bali.

Keywords: cross-cultural learning; place-based education; *subak*; sustainability ethics; *Tri Hita Karana*

1. Introduction

The rapid environmental deterioration, largely driven by human activity, has weakened planetary systems and placed culturally grounded ecological landscapes at risk (Steffen et al., 2015). Climate instability, biodiversity loss, and socio-ecological disruptions represent urgent global challenges that position

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education as a key driver of systemic change (Homer-Dixon et al., 2021). As a transformative force, education shapes values and fosters agency, positioning it as essential to sustainability transitions (Darder et al., 2017; Lotz-Sisitka et al., 2015).

Sustainability education has grown into a scholarly and pedagogical movement. It emphasizes competencies for engaging with complex environmental problems (Wiek et al., 2011), fosters relational and value-driven learning (Sutherland & Swayze, 2012; Ubertazzi, 2020), and calls for epistemic diversity, including Indigenous ecological perspectives (Boillat et al., 2013; Nesterova, 2020). In this global context, culturally embedded systems such as the Balinese *Subak* offer concrete examples of how ecological stewardship, spirituality, and community governance operate in an integrated manner.

At the same time, understanding how these perspectives are interpreted across cultural boundaries has become increasingly important in globalized education settings, where students often learn about local systems outside their own cultural heritage. This is especially relevant for Singaporean students, whose highly urban and multicultural backgrounds shape how they encounter place-based indigenous knowledge. Cross-cultural frameworks such as intercultural competence (Deardorff, 2006) and cultural humility (Tervalon & Murray-García, 1998) offer important lenses for evaluating how learners respectfully engage with local ecological knowledge. Yet in many curricula, such knowledge remains marginal or symbolic (Souther et al., 2023). There is a continued need to examine how learners from varied cultural contexts relate to traditional ecological systems and how such engagement shapes their environmental understanding (Ma et al., 2019). Creative, place-based learning has emerged as an effective strategy for fostering meaningful connections between learners and local socioecological realities. Visual and narrative modes of expression help students reflect on and interpret complex relationships within environmental systems (Disterheft et al., 2015; Gosselin et al., 2015; Teresa et al., 2022). The Balinese *Subak* system, recognized by UNESCO for its integration of spiritual, ecological, and social values, serves as an instructive example of such a living landscape (Lansing et al., 2017; UNESCO, 2012).

Although previous studies have detailed *Subak*'s institutional and cosmological dimensions (Lansing et al., 2017; Lorenzen & Lorenzen, 2010), less is known about how it is perceived by learners from outside the Balinese context. In particular, there is a gap in understanding how students from highly urban, multicultural, and technologically advanced societies like Singapore relate to place-bound systems such as *Subak*. Immersive learning experiences offer opportunities to investigate how students construct meaning when engaging directly with culturally embedded ecological practices (Ardana et al., 2024;

Papell et al., 2019; Zen et al., 2024ab). Accordingly, this study asks: How do Singaporean students interpret the socio-ecological and spiritual dimensions of *Subak* through visual and narrative expression? Furthermore, what themes emerge from their cross-cultural engagement with this Indigenous knowledge system?

This study examines how university students from Singapore interpreted the *Subak* system during a short-term educational program in Bali. Singapore, with its multicultural setting and strong environmental education agenda, presents a relevant site for such inquiry (Fauzi, 2022; Raihani, 2017). The cultural and epistemic distance between Singaporean students and the Balinese *Subak* system offers a valuable lens for exploring processes of intercultural learning and the development of cross-cultural sustainability literacy. Drawing on phenomenographic inquiry, thematic analysis, and confirmatory factor analysis (Hu & Bentler, 1999; Krippendorff, 2004; Marton, 1988; Watkins, 2018), the study contributes academically by expanding knowledge on cross-cultural and arts-based sustainability education and offers practical insights into how immersive and reflective learning can strengthen intercultural understanding and ethical engagement with Indigenous knowledge systems.

2. Literature Review

2.1 Traditional Ecological Knowledge and Sustainability Learning

Traditional ecological knowledge (TEK) reflects long-standing relationships between communities and their environments. Far from being historical residue, TEK embodies ongoing ecological, spiritual, and social practice (Boillat et al., 2013; Nesterova, 2020). In Bali, *Subak* illustrates this integration through its alignment with Tri Hita Karana, blending water governance, ritual life, and communal agriculture (Lansing et al., 2017; UNESCO, 2012). In cross-cultural learning contexts, such as when international students engage with TEK-based systems, concepts like cultural humility (Tervalon & Murray-García, 1998) and intercultural competence (Deardorff, 2006) become essential to fostering respectful and meaningful interpretation.

Although calls to integrate TEK into sustainability education continue to grow, practical implementation often falls short. It is often symbolic or fragmented, lacking frameworks that support relational and pluralist learning (Disterheft et al., 2015; Sutherland & Swayze, 2012). Immersive, culturally grounded pedagogies offer more promise. They help students cultivate ethical insight and systems thinking, especially when aligned with context-responsive values (Papell et al., 2019; Teresa et al., 2022; Ubertaini, 2020).

2.2 Cultural Landscapes, Local Wisdom, and Global Relevance

As a living cultural landscape, *Subak* exemplifies ecological resilience, sacred governance, and community coordination. It resonates with other Indigenous practices such as Andean terracing or Aboriginal fire regimes (Boillat et al., 2013; Heckenberg, 2016). The global relevance of such systems becomes particularly apparent when learners from highly urban or industrial societies—like Singapore—engage with them through immersive education. Yet, *Subak* faces external threats including tourism, land conversion, and generational shifts (Rusadi et al., 2023).

Education has a critical role in sustaining these systems. Place-responsive pedagogies connect learners to local knowledge while supporting ethical inquiry. Surata and Vipriyanti (2017) emphasize that ecological literacy must be rooted in cultural understanding. However, educators must proceed carefully. Zen et al. (2019) caution against oversimplifying Indigenous systems, stressing the need for cultural humility.

Critical Pedagogy of Place encourages students to critically explore how landscapes like *Subak* are shaped and challenged over time. Rather than reinforcing dominant narratives, this perspective fosters active engagement with ontological and ethical complexity (UNESCO, 2012).

2.3 Methodological Considerations in Understanding Student Perception

Exploring how students perceive complex ecological systems requires diverse methods. Phenomenography maps variations in learner experience (Marton, 1988), while thematic analysis helps reveal shared interpretive patterns (Krippendorff, 2004; Tight, 2015).

To enhance analytical rigor, these qualitative approaches benefit from quantitative validation. Confirmatory factor analysis, as outlined by Hu and Bentler (1999), helps test the coherence of emergent structures. Watkins (2018) offers guidance on integrating exploratory and confirmatory tools in education research. Such methods are well suited for interpreting multimodal data, including visuals and texts.

Kahu and Nelson (2017) advocate for mixed methods to capture emotional and cognitive aspects of engagement. In line with this, Lansing (2023) underscores the value of methodological pluralism for understanding how environmental knowledge is co-created across cultural and disciplinary boundaries. Yet studies that apply these mixed, multimodal approaches to intercultural or arts-based sustainability learning—particularly in relation to Balinese cultural landscapes—remain limited. This gap provides the rationale for the present study, which employs a combined phenomenographic, thematic, and factor-analytic design to examine how Singaporean students interpret *Subak* through visual and narrative engagement.

3. Methods and Theory

3.1 Methods

3.1.1 Research Design and Context

This study employed a mixed methods design grounded in constructivist and interpretive paradigms. It was conducted as part of a field-based educational program in Bali, Indonesia, where undergraduate students from Singapore explored the *Subak* system as a living expression of traditional ecological knowledge. The immersion program took place in Subak Pulagan, located in Gianyar Regency approximately 30 kilometers northeast of Denpasar. This site was selected for its ecological integrity, accessibility, and contrasting sociocultural dynamics. As part of the UNESCO-designated cultural heritage site labeled “Cultural Landscape of Bali Province: the *Subak* System as a Manifestation of the *Tri Hita Karana* Philosophy,” Subak Pulagan provides a living example of integrated agroecological governance that remains relatively intact yet increasingly vulnerable to land conversion and socio-economic pressures linked to modernization (UNESCO, 2012).

Singapore was chosen due to its multicultural educational context and strong institutional commitment to sustainability education (Fauzi, 2022; Raihani, 2017). The learning experience was structured to enable direct interaction with *Subak* as both a cultural and ecological system. A phenomenographic approach guided the investigation of students’ diverse interpretations (Marton, 1988), while thematic analysis and factor analysis were employed to identify and validate patterns of meaning in their visual and narrative responses (Hu & Bentler, 1999; Krippendorff, 2004; Watkins, 2018).

3.1.2 Participants

The study involved 95 undergraduate students (34 men and 61 women), aged 19 to 25, enrolled in environmental and sustainability-related programs at Singaporean universities. Participation was voluntary, and all students provided informed consent. Students were recruited through course announcements and an open call shared by partnering faculty. Only those who expressed interest and completed consent were included. This voluntary, self-selected sampling ensured participants were genuinely motivated to join the field-based program. Their varied cultural backgrounds and prior exposure to sustainability topics contributed to a rich cross-cultural interpretive context.

3.1.3 Data Collection Procedures

Data for this study were collected during a one-week immersive field program conducted in June 2023, totaling approximately 30 contact hours. The program was designed to expose students to the ecological, spiritual, and social

dimensions of the *Subak* system through a series of thematically structured activities. The experience began with a set of orientation sessions in which participants received introductory briefings about *Subak*’s role as a traditional ecological knowledge system rooted in *Tri Hita Karana*. These briefings provided a conceptual foundation before students entered the field.

The core of the program took place in Subak Pulagan, where students interacted directly with local farmers to gain firsthand insights into *Subak* as both a cultural and agroecological system. Figure 1 captures one such moment, showing a farmer in traditional attire demonstrating water channeling techniques at a diversion structure, while students observe, take notes, and engage in dialogue. Communication throughout the fieldwork was primarily conducted in English, with simultaneous translation into Balinese and Bahasa Indonesia provided by the research team. This bilingual approach ensured that students could access the layered knowledge embedded in *Subak* practices, including the ritualized relationship between people, land, and water.



Figure 1. Student Engagement with Traditional Water Management at *Subak* Pulagan (Photo: Surata, 2023).

Following these field dialogues, each student created a drawing and a handwritten narrative to convey their personal interpretation of the *Subak* system. These visual and textual artifacts, produced on-site, were later digitized for analytical purposes. One such artifact is shown in Figure 2, where Student-93 visually depicts Mount Batur, upstream temples, and the flow of sacred water through rice fields, modern hotels, and out to the sea. The narrative accompanying the drawing reflects on a journey through Bali’s

agrarian landscape and symbolizes the spiritual displacement of Dewi Sri, the revered Balinese goddess of rice who embodies fertility, agricultural prosperity, and the sacred balance between humans and nature. Within this context, the absence of *Dewi Sri* is interpreted as an allegory for the disruption of harmony between humans, nature, and the divine. As a multimodal artifact, the work exemplifies how learners from culturally distinct backgrounds engage with and reframe *Subak* not merely as a traditional irrigation system, but as a living spiritual ecology increasingly challenged by the pressures of modernization.

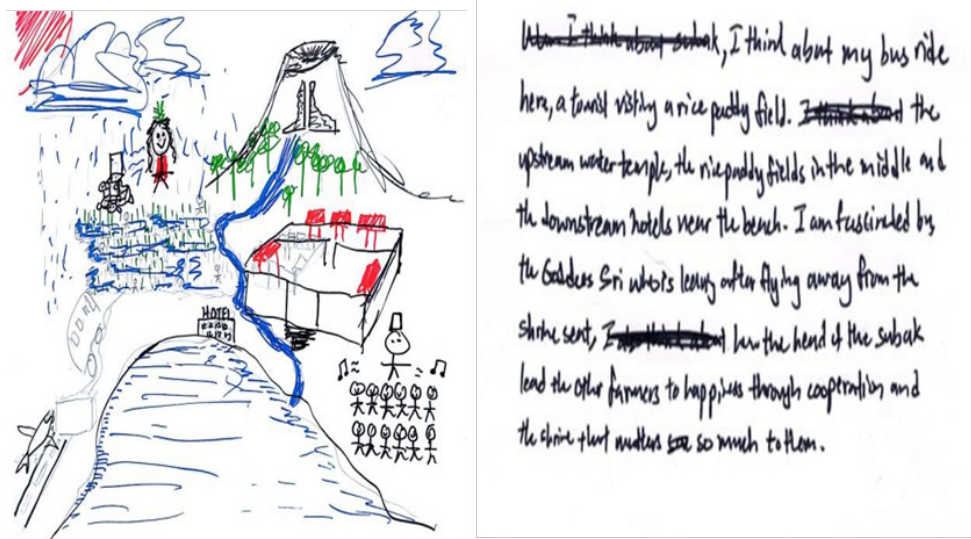


Figure 2. Student-93's Depiction of *Subak* Water Flow and Spiritual Displacement Across Upstream–Downstream Landscapes (Photo: Surata, 2023)

To further explore these interpretations, a selected group of students participated in semi-structured interviews. These interviews were conducted primarily with students whose visual-narrative submissions were initially ambiguous or lacked detailed explanation—such as those associated with Figure 7 and Figure 8—to elicit deeper insights into their intended meanings. Participants were asked to describe the symbolic elements and conceptual logic of their drawings, clarify ambiguities, and articulate the values or messages they hoped to convey. These conversations were audio-recorded and, when necessary, translated to ensure clarity and accuracy.

The program culminated in group presentations, during which students collaboratively shared their reflections and visual narratives. As shown in Figure 3, two student groups are engaged in focused discussions under a *bale banjar* [community hall] pavilion, preparing to present their drawings and interpretations of the *Subak* system to peers and facilitators. The setting provided a culturally grounded space for dialogue, surrounded by elements of Balinese

architecture and communal life. These final presentations were video-recorded and transcribed, providing additional layers of qualitative data that supported the study’s multi-modal thematic analysis. The participatory and dialogical nature of this concluding session enabled students to synthesize their learning experiences while practicing intercultural communication in a reflective and respectful manner.



Figure 3. Group Discussion and Presentation Preparation Under a *Bale Banjar* (Photo: Surata, 2023).

3.1.4 Data Analysis

This study employed a two-tiered analytic approach that combined qualitative and quantitative strategies. On the qualitative side, students’ drawings and narratives were systematically coded using iterative thematic analysis. This process was grounded in principles of trustworthiness and reflexivity, allowing researchers to identify meaningful patterns while remaining attentive to context and interpretation (Krippendorff, 2004).

To complement the qualitative findings, quantitative analysis was conducted through exploratory factor analysis (EFA), which helped reveal latent thematic structures across the dataset. This was followed by confirmatory factor analysis (CFA) to test the internal consistency and overall validity of the emergent model (Hu and Bentler, 1999; Watkins, 2018). The integration of these two methods enabled a rigorous interpretation of both visual and textual data, allowing for the identification of specific student themes as well as broader conceptual groupings that reflected shared perspectives and cross-modal patterns of meaning.

3.1.5 Ethical Considerations

The study followed established ethical protocols for social science research. All participants gave informed consent, and identities were anonymized. Cultural protocols were respected throughout the program, which was developed in consultation with local *Subak* stakeholders. All visual and narrative works were attributed using coded identifiers (e.g., Student-01 to Student-95) to protect anonymity while preserving analytic traceability. The numerical range simply corresponds to the total sample size, with each student assigned a unique code from 1 to 95 for consistent and anonymous referencing throughout the analysis. A final reflection session was conducted to share findings with the community, fostering mutual learning and accountability.

3.2 Theory

Critical Pedagogy of Place (CPP), as introduced by Greenwood (2008, 2013), offers a framework for understanding how education is shaped by and responds to ecological and sociopolitical contexts. This perspective challenges the notion of education as neutral or detached from its surroundings. Instead, CPP emphasizes two interrelated processes. The first, reinhabitation, encourages learners to develop care and responsibility toward the places they engage with. The second, decolonization, invites them to question dominant narratives that often marginalize local or Indigenous knowledge systems (Garzón et al., 2020). In cross-cultural settings, this framework provides a reflective scaffold for learners to negotiate their positionality when encountering unfamiliar cultural ecologies. Arts-based inquiry aligns closely with CPP because both emphasize embodied, situated, and reflective learning. By engaging students in drawing and narrative expression, arts-based methods support the affective, sensory, and experiential dimensions of reinhabitation, while also enabling critical interrogation of dominant assumptions in ways that resonate with CPP's decolonizing aims.

Applied to the *Subak* context, CPP helps students reflect on how traditional ecological knowledge continues to inform contemporary sustainability efforts (Ma, 2021). Alongside this critical lens, arts-based inquiry provides a powerful means for students to explore ecological meaning. Through drawings and narratives, learners express affective, symbolic, and spatial understandings that might not emerge through conventional academic discourse (Gupta et al., 2020). These creative forms of engagement help bridge cultural perspectives and support deeper emotional connection to environmental issues. As Lynch and Mannion (2021) suggest, sensory experiences can foster ecological empathy. Similarly, research by Monroe et al. (2023) and Robles-Piñeros and Tateo (2023) shows that artistic interpretation enables learners to critically engage with social

complexity and cultural nuance. Within the CPP framework, creative expression becomes not only a mode of representation but also a reflective practice that connects personal identity, cultural understanding, and environmental ethics.

4. Results and Discussion

4.1 Results

Thematic and statistical analyses of student drawings and narratives revealed six recurring themes that characterized their interpretations of the *Subak* System. These themes illuminate how students conceptualized the interconnections among environmental, spiritual, and social elements of *Subak*. Each theme was supported by visual representations and written explanations, which were systematically coded using numeric identifiers (e.g., Student-02, Student-76) to trace cross-modal relationships between drawings and narratives. All student narratives were handwritten during the field activity and later digitized for analysis.

4.1.1 Water Management as a Sacred and Practical System

Water management emerged as the most prominent theme, appearing in 30 student submissions. These visual and narrative responses often highlighted the *Subak* system’s dual function—as a technical infrastructure for irrigation and a spiritual framework for ecological stewardship. Students depicted the organized distribution of water as a reflection of equity, ritual value, and collective management rooted in cultural tradition.

In Figure 4, Student-82 portrayed a wide landscape view of rice paddies with evenly distributed irrigation lines, emphasizing *Subak*’s role in ensuring fair and effective water allocation. The accompanying narrative described this arrangement as symbolizing harmony and shared agricultural responsibility.

In contrast, Figure 5 presented a more detailed focus on the internal mechanisms of *Subak*. Student-01 chose to illustrate a close-up perspective of the canal infrastructure, interweaving elements of aquatic life and sacred features. In their own words:

“I drew a zoomed in sketch of the Subak system, specifically the split in water channels. I drew fishes and a crab as well as I saw them in the canals. I drew the step in the canal as well. That was used to slow the flow of water and system the mud and sediment in the water. I drew this zoomed-in sketch as I was very intrigued by the small intricacies of the Subak system, like the unit of measurement used. I drew the stone sign when the funding was given [in] 2021.”

This firsthand observation and reflection revealed how students perceived the system beyond its visible function—engaging deeply with the material, biological, and symbolic components of *Subak*. The inclusion of both ecological

elements (such as aquatic biodiversity and sedimentation systems) and cultural references (like stone markers and sacred icons) demonstrate an understanding of water as both a life-sustaining substance and a ritual medium. These multimodal interpretations underscore how students recognized *Subak* as a living expression of sacred water management—where cosmology, community, and sustainability converge (Lansing et al., 2017; Rosilawati et al., 2020).



Figure 4. Student-82's Visual and Narrative of Equitable Water Distribution and Collective Rice Cultivation in The *Subak* System (Photo: Surata, 2023)

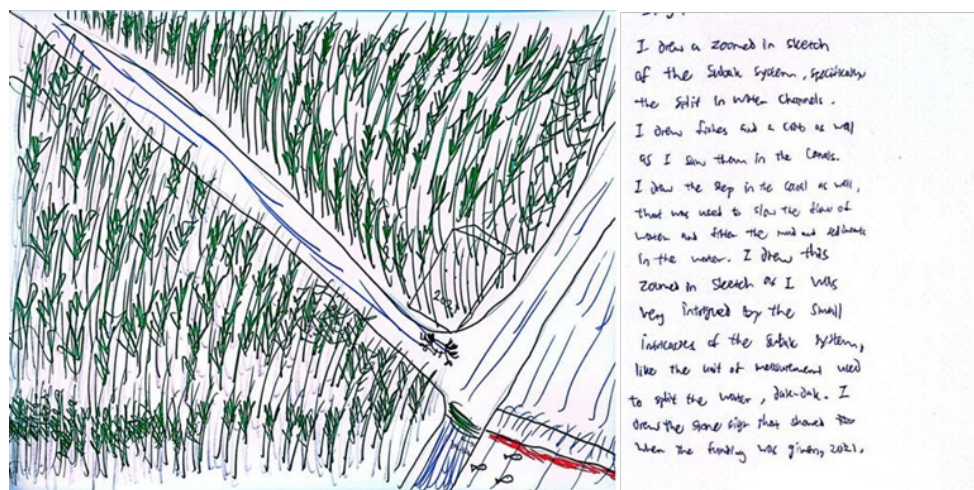


Figure 5. Student-01's Visual and Narrative of Sacred Water Management and Aquatic Life Integration in *Subak* Channels (Photo: Surata, 2023)

4.1.2 *Tri Hita Karana as Spiritual Ecology*

The Balinese philosophy of *Tri Hita Karana*, which promotes harmonious relationships between humans, nature, and the divine, emerged as a prominent interpretive framework across 21 student submissions. These visual and narrative artifacts did not treat *Subak* merely as a technical irrigation structure, but rather as a sacred and integrated system where cosmological, ecological, and communal elements are inseparably linked. Through drawings and accompanying explanations, students depicted the sacred flow of water, religious rituals, and sustainable agricultural practices as interconnected aspects of a living cultural landscape.

In Figure 6, Student-48 presented a visual narrative that traced the journey of water from its source to the sea. As expressed in their own words:

“My drawing shows how water flows in Bali. The water source starts at Batur and first goes to the spiritual place Pura Gunung Kawi. Then it flows into Subak Pulagan before going into the ocean. The drawing reflects Tri Hita Karana philosophy—of man and environment, man and God, man with man.”

This interpretation situates water not only as a physical element sustaining agriculture but also as a spiritual thread that binds sacred mountains, temples, and rice fields. The student’s narrative underscores an integrated cosmology, where the landscape is animated by divine presence and communal responsibility.

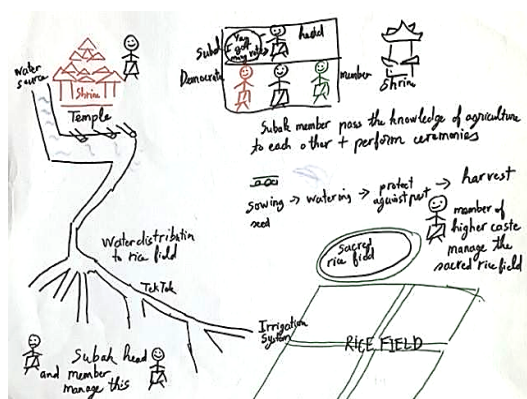
A comparable sensibility is seen in Figure 7 by Student-14, who incorporated imagery of temple offerings, egalitarian decision-making, and cyclical farming practices. In their reflection, the student emphasized *Subak* as a system that is —both spiritual and democratic, where rituals coexist with collaborative governance and intergenerational knowledge-sharing. The drawing captured the idea that sacred stewardship, often upheld by high-caste custodians, prioritizes long-term ecosystem care over short-term monetary interests.

Together, these visual and textual representations reveal how students interpreted *Subak* as an embodiment of spiritual ecology. It is not merely a water distribution system, but a culturally embedded mode of environmental governance where ritual practice, moral obligation, and ecological sustainability are inextricably linked. In this view, *Subak* functions as a dynamic form of Indigenous ecological knowledge, animated by sacred principles and practiced through everyday life (Pungetti, 2018; UNESCO, 2012).

mutual learning within the agrarian landscape. This understanding was further reinforced through their written narratives, which revealed an awareness of *Subak* not merely as an irrigation system but as an adaptive socio-cultural framework rooted in collaboration and tradition.

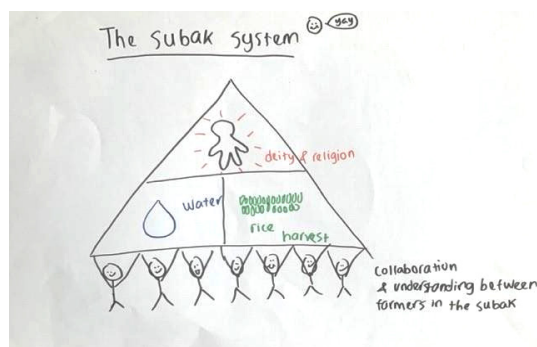
Figure 8, drawn by Student-61, visually illustrates a network of *Subak* members engaged in water management, ritual preparation, and intergenerational knowledge transmission. In their written reflection, the student described *Subak* as a democratic organization in which the head and members collectively oversee water distribution from the temple to the rice fields. The drawing also integrates elements such as shrines and depictions of communal labor, underscoring *Subak*’s integration of religious reverence— particularly the worship of the water goddess—with everyday agricultural routines. For the student, *Subak* represents more than a technical model; it is a living cultural system that interweaves sacred values, environmental management, and the cooperative lifestyle of many farmers.

Similarly, Figure 9, by Student-64, presents a tiered triangular composition marked by three interrelated levels—deity and religion at the top, followed by water and rice harvest below—held aloft by a group of collaborative farmers. This metaphorical structure depicts *Subak* governance as a participatory and layered system, grounded in shared values and responsibilities (Lansing & Kremer, 1993; Zen et al., 2019). The drawing emphasizes that the strength of *Subak* lies not only in its institutional design but also in its reliance on communal trust and understanding.



“In my drawing, I try to show how Subak works as a democratic organization. The Subak head and its members manage the distribution of water from the temple to the rice fields. They also pass agricultural knowledge to each other and perform ceremonies together. I included the temple and the shrine to show the religious role of Subak, especially worship of the water goddess. There is also the part about lifestyle—many farmers working together. For me, Subak is a cultural system that connects religion, water resource sharing, and daily life.”
(explanation by Student-61, as recorded on June 21, 2023).

Figure 8. Visual and Narrative Explanation of *Subak*’s Democratic Organization, Ritual Practice, and Water Governance by Student-61 (Photo: Surata, 2023)



"I drew a triangle to represent the Subak system. On the top is the spiritual part—deity and religion—because I learned that rituals and prayers are really important in Balinese farming. Below that, I placed water, rice, and harvest, which are the practical outcomes of Subak. And at the bottom, holding everything up, are the farmers. They work together with understanding and collaboration. Without them, the whole system wouldn't stand (Based on Student-64's explanation during the recorded session on 17 June 2023).

Figure 9. Visual and Narrative Representation of *Subak*'s Triadic Harmony and Communal Foundation by Student-64 (Photo: Surata, 2023)

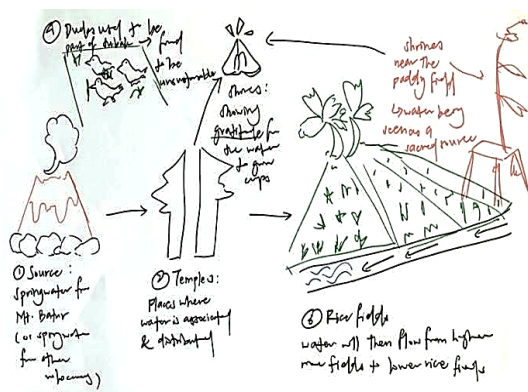
4.1.4 Water Temple Networks as Spiritual Infrastructure

Eleven illustrations centered on the water temple network, which students interpreted as eleven student submissions focused on the role of water temple networks, highlighting their dual significance as both hydrological control points and spiritual sites within the *Subak* system. These illustrations and narratives emphasized that temples do more than bless water; they function as nodal points where ecological management and sacred rituals converge. Students' narratives and visuals consistently described the temples as the guiding infrastructure that governs water distribution and symbolizes cosmological order.

As seen in Figure 10 (by Student-26) and Figure 11 (by Student-60), water is represented as flowing from the spring at Mount Batur through a series of temples and eventually into the layered rice terraces. Student-26's drawing emphasized how this flow is structured spiritually and practically, showing the temple as the site where water is associated with ritual before being distributed across *Subak* lands. The student noted that water descends from higher to lower rice fields and included shrines near the paddies to illustrate how water is revered. Additionally, they depicted ducks as an integral part of the historical *Subak* system—once essential for pest control and nutrient cycling—underscoring how *Subak* used to integrate nature and spirituality as a complete system.

This sense of integrated governance was echoed by Student-60, who articulated that "*Subak is the water distribution system, the cultural belief, and the practice of a peaceful and democratic management system. It's not just physical but a cultural landscape.*" Their narrative, paired with the depiction of sacred water

pathways and shared agricultural responsibility, reflects a nuanced recognition of *Subak* as an Indigenous governance model. These interpretations reinforce that the *Subak* system is not merely a hydraulic engineering feat, but a sacred geography that links temples, ecosystems, and community rituals (Heckenberg, 2016; Geria et al., 2023; Huang & Rockwell, 2023).



"I showed how *Subak* starts from spring water at Mount Batur, which flows to temples where it is blessed and distributed. From there, water moves through the rice fields, from higher to lower terraces. I included shrines near the paddies to show how water is seen as sacred. I also drew ducks because they used to be part of the *Subak* system, helping with pest control and soil fertility. Now they are less used, but I wanted to show that *Subak* once included both nature and ritual in a complete system." (Student-26, recorded on June 17, 2023).

Figure 10. Student-26's Visual and Narrative Depiction of Sacred and Hydrological Flow from Mountain Temples to Rice Terraces (Photo: Surata, 2023)

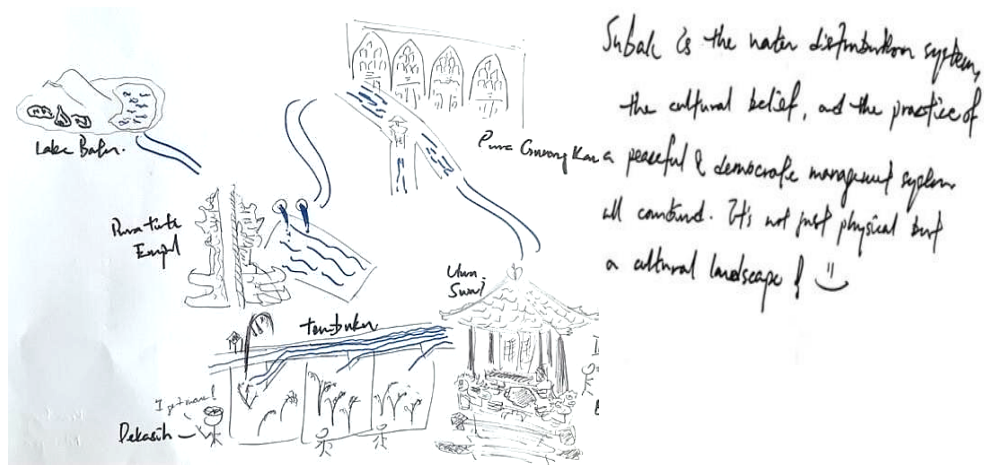


Figure 11. Student-60's Visual and Narrative Depiction of The Interconnected Roles of Water Temples in Resource Management and Ritual Practice (Photo: Surata, 2023)

4.1.5 Sustainability and Emerging Threats

Ten illustrations revealed student awareness of the *Subak* system's vulnerability in the face of environmental and socio-economic change. The students conveyed this tension through visual and written modalities, illustrating *Subak's* dual status as both a resilient, value-based system and one under threat from modernization, land conversion, and generational disengagement.

In Figure 12, Student-67 depicted a peaceful and balanced *Subak* landscape, highlighting core values such as harmony, justice, and spiritual-environmental interconnectedness. As the student elaborated,

"On the left, picture the subaks to be cohesive organizations which celebrate balance—spiritual, environmental, and humanelements. I also see core themes of peace, sharing, justice, equity between the people of the subaks."

However, the drawing also conveyed a critical concern:

"It seems as though money and capitalism are the largest threats to the Subaks, with farmers mostly seeking more profit. The tribute to the building and other things to replace Subak—such as villas— and the fact that people no longer want to be farmers. Boo capitalism."

By contrast, Figure 13, drawn by Student-92, utilized a snow globe to frame the *Subak* as a fragile yet enduring cultural system preserved within external forces of development. In the accompanying narrative, the student explained,

"Snow globe represents the preservation of the unique Subak system from external developments: despite modernization of agricultural practices elsewhere, the Subak system is still well- maintained and preserved, working within the constraints of the natural environment."

This resilience was attributed to the philosophical grounding of *Tri Hita Karana*, which the student noted promotes "God, human-human interaction, and human-environmental interaction, resulting in greater profit, societal harmony, and harmony with nature." Still, the narrative acknowledged critical threats: "Younger generations are not interested, there is growing mechanization, tourism, and global climate change." Together, these contrasting yet complementary visual-narrative submissions reflect an emergent critical literacy. Students not only identified the spiritual and ecological strengths of *Subak* but also recognized its contested future amid evolving economic and environmental dynamics (Kamakaula, 2024).

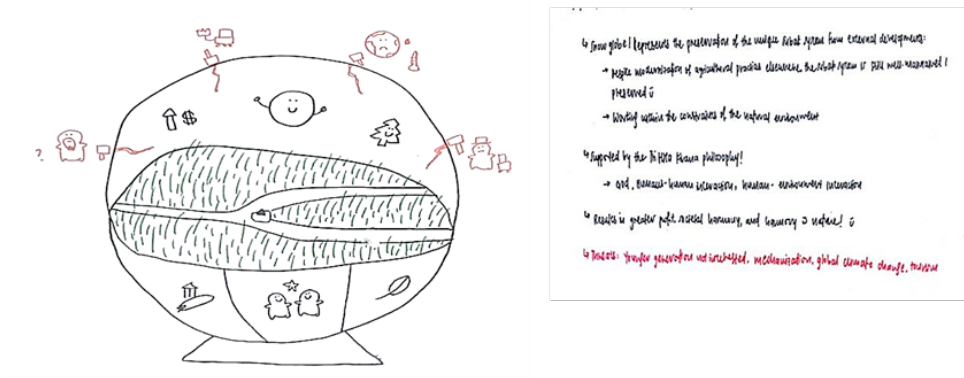


Figure 12. Visual and Narrative Representation by Student-67 on *Subak*'s Internal Harmony and External Threats (Photo: Surata, 2023)

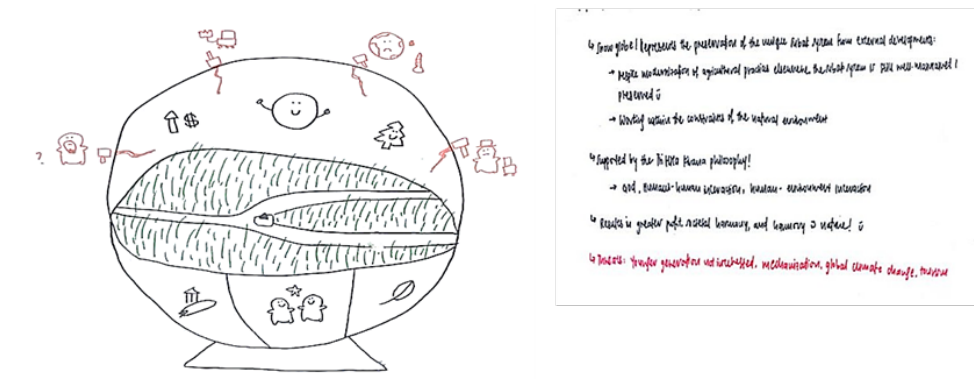


Figure 13. Depiction by Student-92 of *Subak* Preservation Amid Modernization and Ecological Tensions (Photo: Surata, 2023)

4.1.6 Temples as Organizational and Symbolic Centers

Eight student illustrations positioned temples at the core of *Subak*'s spiritual and communal framework. Rather than being depicted solely as religious sites, temples were visualized as central hubs for ecological coordination, collective identity, and agricultural order. This dual significance—both symbolic and functional—emerged strongly across visual and narrative data.

In Figure 14, the drawing by Student-35 places the temple at the center of farming activities and ceremonial life. The student shared, “*What I felt—the deepest impression on me—was how the gods were at the centre of all aspects of farming and everything was brought for them. The temple ties together the community.*” This quote reinforces the understanding of the temple not just as a sacred place but as the spiritual anchor of *Subak*'s cooperative ethos.

Figure 15, created by Student-39, shows the sacred water's journey from Mount Batur to Pura Ulundanu, then into the *Subak*-managed rice fields. In the student's words, "The drawing shows that the *Subak* system in Bali is all part of one big ecosystem, with the Pura Ulundanu at Batur being the core. It supplies water to all the *Subaks*, and people work together with each other and with the environment farming this ecosystem. It's supposed to look like Earth." This visual and narrative depiction suggests a cosmological integration where temple-based rituals, ecological stewardship, and social collaboration are inseparable.

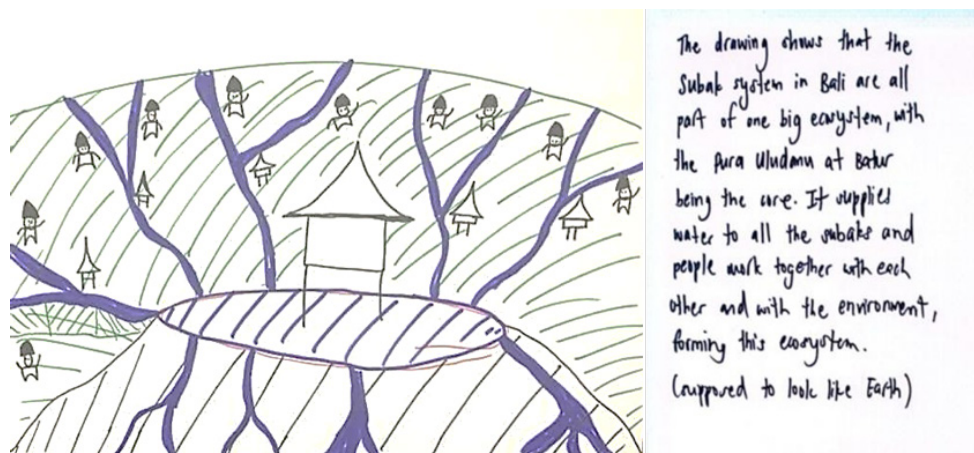


Figure 14. Spiritual Center and Community Cohesion Framed Through Temple Practices, by Student-35 (Photo: Surata, 2023)

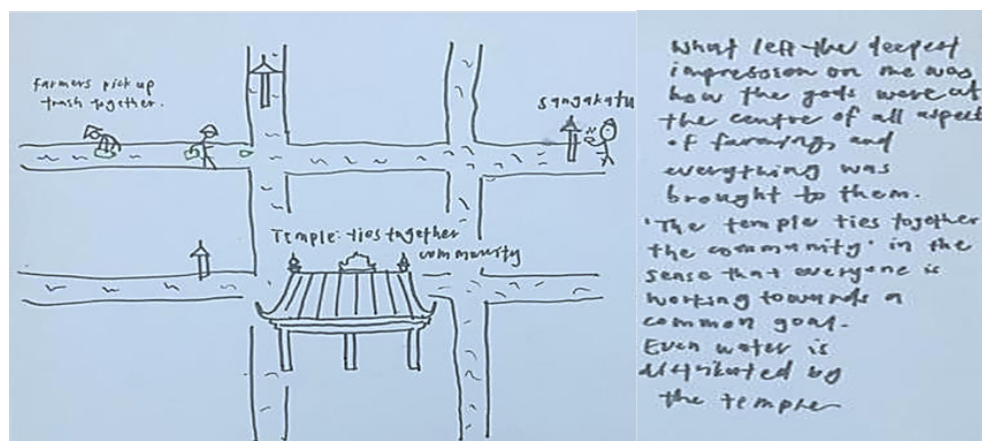


Figure 15. Temple as A Unifying Element of *Subak*'s Ecological and Ritual Flows, by Student-39 (Photo: Surata, 2023)

4.1.7 Factor Analysis of Thematic Structure

To complement the qualitative analysis, Exploratory Factor Analysis (EFA) was conducted to identify latent thematic structures from the students' visual

and narrative data. As presented in Table 1, three primary factors emerged:

- 1) Factor 1 linked “Temple as Organizational and Symbolic System” and “Water Management as Sacred and Practical System,”
- 2) Factor 2 grouped “Water Temple Networks as Spiritual Infrastructure” and “Tri Hita Karana as Spiritual Ecology,”
- 3) Factor 3 combined “Community Collaboration and Governance” and “Sustainability as Emerging Threats.”

Table 1. Exploratory Factor Analysis of Thematic Dimensions in Student Visual-Narrative Representations of the *Subak* System

No	Theme	Factor 1	Factor 2	Factor 3
1	Temple as A Centrepiece	0.8475	-0.1082	-0.0123
2	Water Irrigation and Management	0.7289	-0.2014	0.0256
3	Water Temple Networks	0.0417	0.5031	-0.0328
4	<i>Tri Hita Karana</i>	0.0568	0.2041	0.0345
5	Community Cooperation	-0.0214	0.0678	0.4215
6	Sustainability in Threats	0.0396	-0.0435	0.4213

Note: Factor loadings for each thematic category derived from students’ drawings and narratives. Source: SPSS Processed Results, 2024.

Confirmatory factor analysis (CFA) was then performed to validate these thematic groupings. As shown in Table 2, fit indices indicated a strong model: CFI = 0.962, TLI = 0.950, and RMSEA = 0.042 (Hu & Bentler, 1999; Watkins, 2018). These results confirm that students’ conceptualizations of the *Subak* system formed coherent and interrelated thematic clusters, reflecting both conceptual understanding and emotional engagement that spanned across narrative and visual modalities.

Table 2. Confirmatory Factor Analysis Model Fit Indices for Student Interpretations of the *Subak* System

No	Fit Index	Value	Acceptable Threshold
1	Chi-Square (χ^2)	48.76	-
2	Degrees of Freedom (df)	24	-
3	p-value	0.0023	> 0.05
4	Root Mean Square Error of Approximation (RMSEA)	0.042	< 0.06
5	Comparative Fit Index (CFI)	0.962	> 0.90
6	Tucker-Lewis Index (TLI)	0.950	> 0.90
7	Standardized Root Mean Square Residual (SRMR)	0.035	< 0.08

Source: AMOS Processed Results, 2024.

However, the overlap between themes of community collaboration and emerging threats suggests that students interpreted *Subak* as a dynamic socio-ecological system rather than a static cultural relic. This interpretation is evident in students' drawings and narratives that juxtaposed images of harmonious water sharing and temple rituals with symbols of urban encroachment and capitalist pressures. For instance, some illustrated communal ceremonies alongside villas and dollar signs, signalling their recognition that sustainability requires both preserving core values and adapting collectively to contemporary challenges. These hybrid representations exemplify students' ability to engage critically with complexity, as shaped by intercultural experience and participatory observation. Together, the six themes point to a holistic view of *Subak* as a unified cultural landscape. The EFA and CFA results support this interpretation by demonstrating that the thematic relationships students expressed form a consistent and statistically validated structure.

4.2 Discussion

This study provides insight into how Singaporean university students interpreted the Balinese *Subak* system through visual and narrative engagement. Instead of seeing *Subak* as a static tradition, participants described it as a dynamic social and ecological landscape in which spirituality, ecology, and community are intertwined. Their creative expressions, consisting of drawings and written narratives, revealed an understanding of sustainability as an ethical and relational practice that is grounded in local ecological knowledge and not confined to technical frameworks. These findings affirm the significance of place based and cross-cultural learning in cultivating emotional connection, ethical humility, and critical reflection across different epistemological domains (Darder et al., 2017; Homer-Dixon et al., 2021 Lotz-Sisitka et al., 2015; Steffen et al., 2015).

Through the framework of CPP, the analysis demonstrates that students participated in acts of reinhabitation by building affective and cognitive relationships with the landscape. Simultaneously, their interpretations reflected decolonial sensibilities through critique of dominant narratives surrounding development. These processes were shaped by the students' intercultural status as visitors engaging with a local knowledge system, which required attentiveness, reflexivity, and humility. The six thematic dimensions identified in the analysis—namely water governance, spiritual ecology, community cooperation, temple networks, environmental threats, and symbolic meaning—indicate that learners negotiated the complexity of *Subak* through symbolic reasoning expressed across both visual and narrative forms.

4.2.1 *Integrating Indigenous Perspectives*

Students’ attention to *Tri Hita Karana* reflected an alignment with foundational principles of Indigenous ecological knowledge. The visual and written responses emphasized *Subak* as a moral system that unites spiritual practice with ecological balance and social harmony (Lansing & Kremer, 1993; UNESCO, 2012). One student, identified as Student-28, stated that —*Subak* is the water distribution system, the cultural belief, and the practice of a peaceful and democratic management system. || Such interpretations suggest that when learning processes are anchored in cultural meaning and emotional relevance, particularly in intercultural contexts, students are able to engage more deeply with unfamiliar knowledge systems and suspend prevailing assumptions.

These findings correspond with current efforts to incorporate indigenous perspectives into sustainability education (Nesterova, 2020; Sutherland & Swayze, 2012). Furthermore, they respond to growing critiques concerning superficial engagement or tokenism in cross cultural learning settings (Ono, 2023). The integration of field immersion with creative interpretation allowed students to approach traditional knowledge with ethical sensitivity and analytical depth (Felege et al., 2019; Ochoa, 2023).

4.2.2 *Creative Expression and Environmental Literacy*

Activities involving drawing and narrative writing enabled students to express layered and multidimensional understandings of the *Subak* system. Many of the visual artifacts included images of rice terraces, temples, and interconnected water flows that represented both sacred interdependence and spatial logic within Balinese agroecology (Ison & Bramwell-Lalor, 2023; Zhongbin, 2024). By coding and linking these images to students’ accompanying texts, the research highlighted the development of ecological, emotional, and cultural literacies that extended beyond conventional forms of academic expression.

This observation aligns with existing research demonstrating the potential of artistic and expressive approaches to enhance sustainability education through affective and reflective engagement (Gupta et al., 2020; Robles-Piñeros & Tateo, 2023). Through this multimodal process, students were not merely observers but became participants in the ethical and ecological dynamics of place.

4.2.3 *Responding to Socioecological Change through Relational Learning*

Students engaged critically with the contemporary challenges confronting the *Subak* system. Their reflections, found in both drawings and narratives, frequently mentioned economic pressures, environmental degradation, and

reduced interest among younger generations. One participant commented that —Money and capitalism seem like the largest threats to *Subak*, indicating awareness of the broader social and economic systems that shape ecological sustainability. Such interpretations reflect an emerging critical environmental literacy that is consistent with Freire’s (1970) notion of education as a practice of liberation and consciousness building.

Importantly, students did not merely critique the system but also proposed constructive strategies. Suggestions included youth focused education initiatives, local capacity building, and more ethical approaches to tourism. These recommendations are consistent with frameworks for collaborative and future oriented sustainability education (Laksmi et al., 2023; Wiek et al., 2011).

Furthermore, a strong sense of relational responsibility emerged. Students described sustainability not only in terms of managing natural resources but also as a set of relationships that connect people, beliefs, and landscapes. One student observed, “Sustainability is not just about resources, but about relationships.” This view aligns with pedagogical frameworks that emphasize the integration of cognitive, emotional, and sociopolitical dimensions in learning (Stapleton, 2020; Zen et al., 2024b). Through immersive learning, participants began to see themselves as part of interconnected ecological and cultural systems and expressed both empathy and agency in facing environmental complexity.

4.2.4 Contributions and Future Directions

This study contributes to the growing body of literature on the integration of Indigenous knowledge and expressive learning methods within the field of sustainability education. It shows that even short-term, cross-cultural learning engagements can nurture ethical awareness, intercultural humility, and systems thinking. These findings reinforce the significance of decolonial, place responsive, and arts-based pedagogies.

Nonetheless, the study is limited by the relatively small and culturally specific group of participants (Zen et al., 2024a) and by its reliance on self-reported materials. Although the confirmatory factor analysis established internal thematic coherence, broader generalizations remain tentative. Future research is encouraged to include diverse cultural contexts, explore intergroup comparisons, and investigate long term learning trajectories (Carnes & Nix, 2023). The use of hybrid and digital learning platforms may help to widen access and increase inclusivity (Coudray, 2020; Hoffmann & Lutz, 2019). It is also vital that subsequent research centers the voices and epistemologies of Indigenous communities in the development and evaluation of educational programs, ensuring respectful and meaningful integration (Masenya, 2022; Wu et al., 2022).

5. Conclusion

This study focused on the ways in which university students from Singapore interpreted the Balinese *Subak* system through visual and narrative engagement during an educational experience rooted in cultural immersion. Rather than treating *Subak* as a static or inherited tradition, students described it as a dynamic socioecological system that integrates water governance, spiritual cosmology, and communal responsibility. Through their drawings and written narratives, students expressed sustainability as an ethical and relational understanding grounded in traditional ecological knowledge and shaped through intercultural awareness.

The research employed a combination of phenomenographic inquiry, thematic analysis, and factor analysis to uncover six core thematic areas that reflected student perspectives. These included sacred water, spiritual ecology, collective governance, temple structure, threats to sustainability, and symbolic meaning. Framing the analysis within the Critical Pedagogy of Place allowed the research to identify student experiences as involving emotional and ethical reconnection to landscape through reinhabitation, alongside critical interrogation of dominant development narratives as part of decolonization. The students’ position as external learners required a respectful and thoughtful interpretive process rooted in cultural humility.

The findings emphasize the importance of embedding reflective, context-sensitive, and culturally grounded strategies in environmental education. Creative forms of expression such as drawing and storytelling supported students in forming meaningful connections with the local landscape, while also encouraging empathetic engagement and critical reflection. These insights may be applied in *Subak* community education programs by incorporating arts-based activities, participatory storytelling, and youth-focused workshops that foreground the spiritual and ecological values of *Subak*. Such approaches can help strengthen intergenerational knowledge transfer and community engagement.

The capacity of indigenous ecological systems such as *Subak* to inspire ethical and ecological insight within cross-cultural education reveals the continuing relevance of inclusive and culturally responsive sustainability learning that respects the integrity of place-based knowledge. Future longitudinal research could examine how students’ understandings and attitudes evolve over time after the immersion experience, offering deeper insight into the lasting impacts of cross-cultural and arts-based sustainability learning.

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