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Youth-Led Climate Action Through Experiential Sustainability Engagement: A Study of The Green Intervarsity Volunteers Program

(Tindakan Iklim Pimpinan Belia melalui Penglibatan Kelestarian Berasaskan Pengalaman: Satu Kajian Program Sukarelawan Hijau Antara Universiti)

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ABSTRACT

As climate concerns intensify worldwide, universities play an increasingly crucial role in shaping environmentally responsible future leaders. This study examines how experiential learning enhances sustainability awareness and climate-action competencies through the Green Intervarsity Volunteers Engagement Program (GAHIVE), an initiative involving 150 student leaders from Malaysia, Germany, and Indonesia (n=150). Participants engaged in hands-on environmental activities including catch-and-release conservation, on-site nature volunteering, plogging, eco-innovation challenges, and reflective sustainability dialogues. A pre- and post-program assessment measured changes in environmental attitudes, climate-action confidence, and sustainability leadership skills. Statistical analysis using SPSS shown significant improvements across all domains ($p < 0.001$), underscoring the effectiveness of immersive sustainability engagement. Qualitative feedback further highlighted the transformative influence of multicultural collaboration and real-time ecological action. This study affirms the value of experiential sustainability education in empowering youth as climate-conscious global citizens.

Keywords: Climate Action, Sustainability Leadership, Experiential Learning, Youth Volunteers.

ABSTRAK

Seiring dengan semakin meningkatnya kebimbangan terhadap isu iklim di seluruh dunia, universiti memainkan peranan yang semakin penting dalam membentuk pemimpin masa depan yang bertanggungjawab terhadap alam sekitar. Kajian ini meneliti bagaimana pembelajaran berasaskan pengalaman dapat meningkatkan kesedaran kelestarian dan kompetensi tindakan iklim melalui Program Penglibatan Sukarelawan Hijau Antara Universiti, sebuah inisiatif yang melibatkan 150 pemimpin pelajar dari Malaysia, Jerman, dan Indonesia (n=150). Para peserta terlibat dalam aktiviti alam sekitar secara langsung seperti konservasi tangkap dan lepas, sukarelawan lapangan, plogging, cabaran inovasi hijau, serta dialog reflektif mengenai kelestarian. Penilaian pra dan pasca program digunakan untuk mengukur perubahan dalam sikap terhadap alam sekitar, keyakinan melaksanakan tindakan iklim, dan kemahiran kepimpinan kelestarian. Analisis statistik menggunakan SPSS menunjukkan peningkatan yang signifikan dalam semua domain ($p < 0.001$), sekali gus membuktikan keberkesanan penglibatan kelestarian berbentuk imersif. Maklum balas kualitatif turut menonjolkan pengaruh transformasi melalui kerjasama pelbagai budaya dan tindakan ekologi secara langsung. Kajian ini mengesahkan nilai pendidikan kelestarian berasaskan pengalaman dalam memperkasa golongan belia sebagai warga global yang peka terhadap isu iklim.

Kata Kunci: Tindakan Iklim, Kepimpinan Kelestarian, Pembelajaran Berasaskan Pengalaman, Sukarelawan Belia

INTRODUCTION

Climate action has become a critical global priority, particularly as university students are increasingly recognized as key agents of change in environmental sustainability movements (Trott, 2021). Higher education institutions are not only sites of knowledge creation but also platforms for cultivating youth leadership in ecological stewardship (Trott, 2019). In response to this growing demand, the Green Intervarsity Volunteers Engagement Program was developed as an experiential sustainability initiative aimed at strengthening environmental awareness, climate-action readiness, and youth leadership competencies through hands-on ecological engagement (Trott, 2019). The program brought together 150 students from Malaysia, Germany, and Indonesia, engaging them in activities such as catch-and-release conservation, on-site nature volunteering, plogging, eco-innovation challenges, and sustainability reflection sessions (Ali Khan et al., 2021).

The primary objective of this study is to examine how experiential learning within a multicultural context influences students' sustainability competency. Experiential sustainability programs have been shown to increase pro-environmental behaviour, critical thinking, and climate responsibility among youth (Hanafiah, 2024), (Nashorddin et al., 2024). Moreover, the incorporation of real-world ecological tasks enhances emotional connection to nature, reinforcing long-term commitment to environmental citizenship (Nashorddin et al., 2024). However, despite increased interest in sustainability, many students still struggle to translate environmental knowledge into meaningful climate action due to lack of exposure to practical, experiential frameworks (Nashorddin et al., 2024), (Kolenatý et al., 2022). The present study addresses this gap by assessing a program designed explicitly for immersive sustainability engagement across international student groups.

The conceptual foundation of this study draws on Experiential Learning Theory (ELT), which argues that transformative learning occurs when individuals cycle through concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb & Kolb, 2009), (Yen & Sembiring, 2020) (Bentz & O'Brien, 2019). Recent sustainability education research supports ELT as a powerful mechanism for fostering environmental responsibility and leadership among young adults (Rahman et al., 2023), (Yusliza et al., 2020). Additionally, the study is informed by the Sustainable Behaviour Model, which highlights how personal norms, emotional connection to nature, and behavioural intention shape climate-positive actions (Yen & Sembiring, 2020). These theories collectively guide the analysis of how experiential, multicultural activities influence students' sustainability competencies.

The present study contributes theoretically by extending Kolb's Experiential Learning Theory into a multicultural climate-action context, demonstrating that cross-cultural interaction intensifies emotional engagement and reinforces behavioural intention (Kolb & Kolb, 2009)(Savage et al., 2015). The findings also enrich the Sustainable Behaviour Model by illustrating how experiential tasks combined with reflective practices increase personal norms, ecological sensitivity, and pro-environmental motivation among youth (Trott, 2021).

The significance of this study lies in its potential to inform universities, policymakers, and sustainability educators on how to design climate-action programs that effectively build youth leadership and behavioural engagement (Rahman et al., 2023), (Yusliza et al., 2020). As global environmental challenges escalate, developing evidence-based strategies for empowering young climate leaders becomes increasingly urgent.

Despite the growing body of literature on experiential sustainability education, several gaps remain evident. Existing studies primarily focus on single-country contexts and rarely examine multicultural experiential programs that involve cross-national collaboration. Moreover, prior research has emphasised environmental awareness rather than climate-action leadership, leaving limited understanding of how experiential frameworks can strengthen leadership competencies across diverse cultural settings. Research integrating both Experiential Learning Theory and sustainable behaviour models is also scarce, particularly in Southeast Asia (Iqbal et al., 2020). Addressing these gaps, the present study evaluates a multicultural experiential sustainability program conducted across Malaysia, Germany, and Indonesia.

Building upon these identified gaps and the overarching goals of the Green Intervarsity Volunteers Engagement Program, this study is guided by three central research questions. First, it explores the extent to which the program enhances students' environmental awareness and climate-action readiness through immersive ecological activities. Second, it examines how experiential, hands-on sustainability engagement shapes participants' sustainability leadership competencies, including their ability to problem-solve, collaborate, and initiate climate-focused actions. Third, it investigates the influence of multicultural collaboration on students' climate-action perspectives and ecological responsibility,

given the program's diverse international participation. Collectively, these questions provide a comprehensive framework for assessing the program's impact and offer empirical insights into how experiential, multicultural sustainability initiatives can effectively advance youth-led climate action within higher education settings.

BACKGROUND OF STUDY

The Green Intervarsity Volunteers Engagement (GAHIVE) Program was introduced as an experiential sustainability initiative aimed at strengthening youth involvement in climate action by fostering a deeper connection to environmental issues through direct, hands-on participation (Yusliza et al., 2020). Organized by Universiti Teknikal Malaysia Melaka (UTeM) with international partners, the program gathered 150 students from Malaysia, Germany, and Indonesia to engage in a variety of ecological activities. Participants came from diverse academic fields and were placed in a mixed multicultural setting to encourage global perspectives on environmental issues (Nashorddin et al., 2024).

The program took place across several ecological and campus-based locations, allowing students to experience environmental challenges firsthand. Activities such as catch-and-release conservation, nature volunteering, plogging, and eco-innovation challenges were designed to expose participants to real-life issues related to waste management, biodiversity protection, and ecosystem health. These tasks also gave students opportunities to practice teamwork, leadership, and problem-solving in dynamic, real-world contexts.

This program emerged from growing concerns that many university students possess environmental knowledge but lack meaningful, hands-on opportunities to apply it (Rahman et al., 2023). Studies in the region show that experiential learning is more effective than classroom-based approaches in building environmental responsibility and motivating climate action among youth (Yusliza et al., 2020). Additionally, sustainability initiatives often overlook the value of multicultural collaboration, even though climate issues require cross-border understanding and cooperation (Hanafiah, 2024). By integrating experiential learning with international participation, the program served as a platform for students to deepen their environmental awareness, develop leadership skills, and engage directly with sustainability challenges (Nashorddin et al., 2024). Although most university students report concern about climate change, fewer than half engage in sustained environmental volunteering or sustainability initiatives (Rahman et al., 2023).

ISSUE

Provide relevant background information, data, or documentation Universities face a widening gap between students' environmental awareness and their actual participation in climate-action activities. Although most university students report concern about climate change, fewer than half engage in sustained environmental volunteering or sustainability initiatives (Rahman et al., 2023), (Yusliza et al., 2020). This disparity highlights a crucial need for educational interventions that bridge the theoretical understanding of environmental issues with practical, actionable engagement (Cordero et al., 2020).

As reported in the initial study (Rahman et al., 2023), pre-intervention data were collected to establish baseline levels of environmental sustainability among Malaysian youth, serving as the reference point for evaluating the effectiveness of the educational intervention. As presented in Table 1, the baseline results indicate relatively high scores for understanding ($M = 0.9209$, $SD = 0.10483$) and attitude ($M = 0.8046$, $SD = 0.09483$), while knowledge ($M = 3.9650$, $SD = 0.58079$) and practice ($M = 3.0706$, $SD = 0.44773$) were moderate. These findings support the earlier issue discussed, where students generally exhibit strong environmental awareness but lower levels of actionable environmental behaviours. Thus, the baseline values shown in TABLE 1 provide essential benchmarks for assessing the magnitude of improvement following the intervention program.

TABLE 1. Pre-Intervention Scores for Environmental Sustainability Domains (n = 200)

Variable	Mean (M)	Standard Deviation (SD)	Scale Type
Understanding	0.9209	0.10483	Likert scale
Knowledge	3.9650	0.58079	Likert scale
Attitude	0.8046	0.09483	Likert scale
Practice	3.0706	0.44773	Likert scale

In Malaysia, this challenge is intensified by ongoing environmental issues, including river pollution, increasing waste generation, and low community participation in conservation efforts (Nashorddin et al., 2024), (Yusliza et al., 2020). National data indicate that over one-third of monitored rivers remain slightly polluted, while plastic waste continues to dominate urban clean-up activities (Department of Environment & Ministry of Natural Resources and Environmental Sustainability, 2023).

TABLE 2 and FIGURE 1 together provide a comprehensive overview of the national river water quality status in Malaysia based on the Environmental Quality Report 2023. The table presents the exact numerical distribution of the 672 monitored rivers, showing that 486 rivers or 72% were classified as clean, 161 rivers or 24% were categorised as slightly polluted, and 25 rivers or 4% fell into the polluted category (Department of Environment & Ministry of Natural Resources and Environmental Sustainability, 2023). The pie chart complements these figures by visually illustrating the proportional distribution of each category, which allows readers to immediately grasp the relative scale of clean, slightly polluted, and polluted rivers. The large section representing clean rivers in the pie chart aligns with the numerical value shown in the table, while the combined slightly polluted and polluted segments highlight that a considerable portion of Malaysian rivers still experience environmental stress. Together, these two forms of data presentation reinforce the interpretation that although most rivers are clean, a meaningful percentage remains affected by pollution. This visual and numerical evidence supports the research issue that freshwater ecosystems continue to face pressure from pollution sources, which in turn underscores the importance of strengthening public environmental engagement, especially among youth.

TABLE 2. National River Water Quality Status (Malaysia, 2023)

Category	Number of Rivers	Percentage
Clean	486	72%
Slightly Polluted	161	24%
Polluted	25	4%
Total Rivers Monitored	672	100%

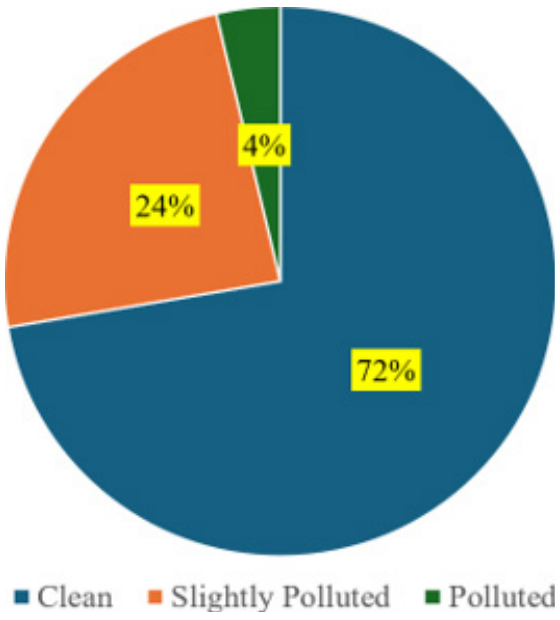

FIGURE 1. National River Water Quality Status (Malaysia, 2023)

At the same time, research highlights that climate action requires cross-cultural collaboration, yet opportunities for multicultural teamwork in sustainability programs remain limited (Trott, 2021), (Jones et al., 2023), (Davis et al., 2025). These gaps in experiential engagement, youth leadership opportunities, and intercultural collaboration underscore the need for structured, hands-on programs such as the Green Intervarsity Volunteers Engagement Program. This study therefore addresses the pressing issue of how experiential and multicultural sustainability activities can strengthen students' environmental awareness, leadership competencies, and readiness for climate action.

METHODOLOGY

A quantitative research design supported by qualitative reflection was employed to evaluate the effectiveness of the Green Intervarsity Volunteers Engagement Program. Data were obtained through a structured, self-administered questionnaire that was distributed to participants before and after the program. A total of 150 students from Malaysia, Germany, and Indonesia were included in the study.

Their participation was given voluntarily, and full completion of both assessments was achieved, which ensured that all data could be analysed as paired responses.

The instrument was structured using a four-section framework that was designed to capture demographic background, measurable sustainability competencies, and reflective insights as shown Table 3. Section A was used to record demographic information such as age, nationality, academic field, and prior involvement in environmental activities. Section B measured pre-program perceptions through ten five-point Likert items that assessed climate action readiness, ecological sensitivity, sustainability problem solving, teamwork, and multicultural collaboration. Section C was structured to mirror Section B and comprised twelve items that measured post-program changes in these domains, which enabled direct comparison of outcomes. Section D captured qualitative reflections through three open-ended items that encouraged respondents to describe their learning experiences and personal growth. The overall structure was designed to generate both quantitative and qualitative evidence of program impact. Reliability of the quantitative sections was confirmed through Cronbach's alpha values which exceeded 0.82 and demonstrated strong internal consistency.

TABLE 3. Sections of Instruments

Section	Description	No. of Items	Scale
A	Demographic Information	5	Categorical
B	Pre-Program Assessment	10	5-point Likert
C	Post-Program Assessment	12	5-point Likert
D	Open-ended Reflections	3	Qualitative

Data processing was carried out in several stages. All questionnaires were first reviewed manually to ensure completeness and accuracy. The responses were then coded and entered IBM SPSS Version 28. Screening procedures were performed to verify data entry accuracy and to identify possible outliers. Descriptive statistics were generated to summarise demographic characteristics and trends in item responses. Paired sample t tests were conducted to examine differences between pre-program and post-program scores. Linear regression analysis was used to determine whether initial environmental awareness served as a predictor of post-program sustainability competence. Qualitative responses were transcribed and analysed using the thematic method proposed by Braun and Clarke (Braun & Clarke, 2022). This method involved the reading of all responses, creation of initial codes, grouping of these codes, and development of themes that reflected the most prominent aspects of participants reflections.

The analytical workflow for IBM SPSS proceeded according to the sequence shown in the FIGURE 2 below.

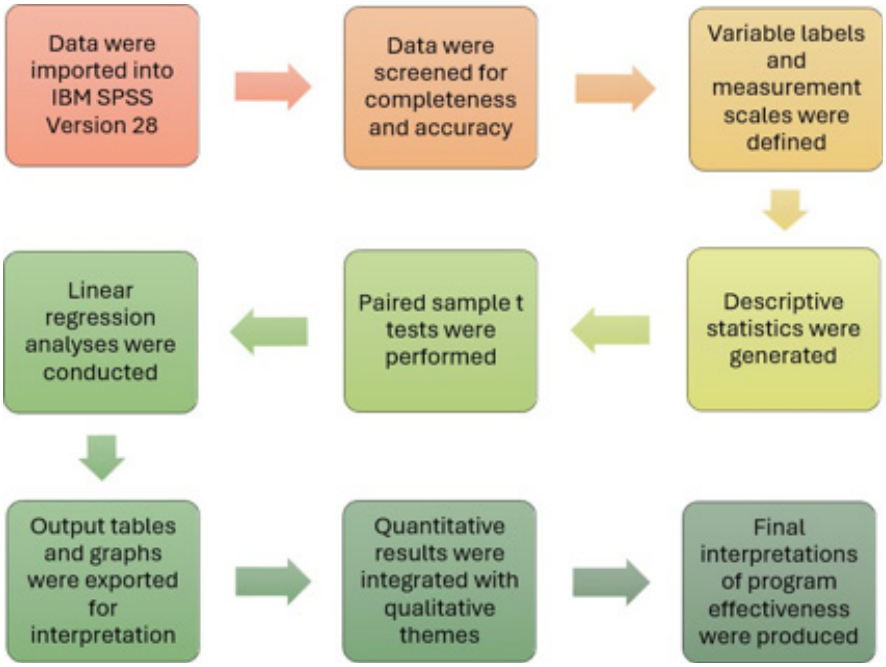

FIGURE 2. Flow Chart of IBM SPSS Usage

RESULT AND DISCUSSION

All 150 responses were confirmed as valid, and diversity in cultural and educational backgrounds was reflected across the participant group, allowing the program to be interpreted as a multicultural sustainability learning environment. Upward shifts across all measured domains were observed in the post program scores.

Pre and Post Program Comparison

A paired sample analysis was conducted to evaluate the effectiveness of the sustainability program. Descriptive results indicated a clear upward shift in competency levels from pre-program to post program. As illustrated in FIGURE 3, the mean score increased from 3.4695 (SD = 0.40844) before the program to 4.0642 (SD = 0.35379) after participation. The height of the bars visually demonstrates the substantial improvement in sustainability-related competencies.

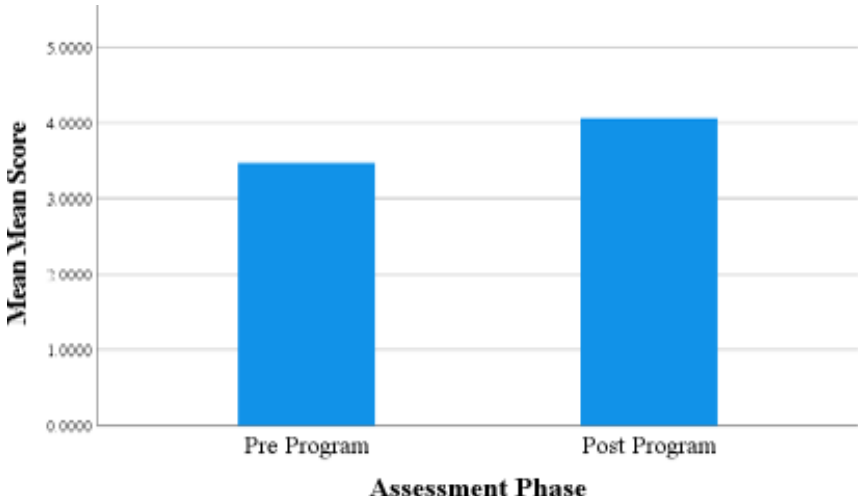

FIGURE 3. Mean Scores for Pre-Program and Post-Program Assessments

Further examination of score distributions confirmed that both pre-program and post program data were approximately normally distributed. FIGURE 2 displays the pre-program score distribution, which is centred around the mean value with no extreme skewness, indicating stable initial variability among participants. Similarly, FIGURE 3 shows the post program distribution, demonstrating a tighter clustering of scores around the higher mean value, suggesting greater consistency in competency after program completion.

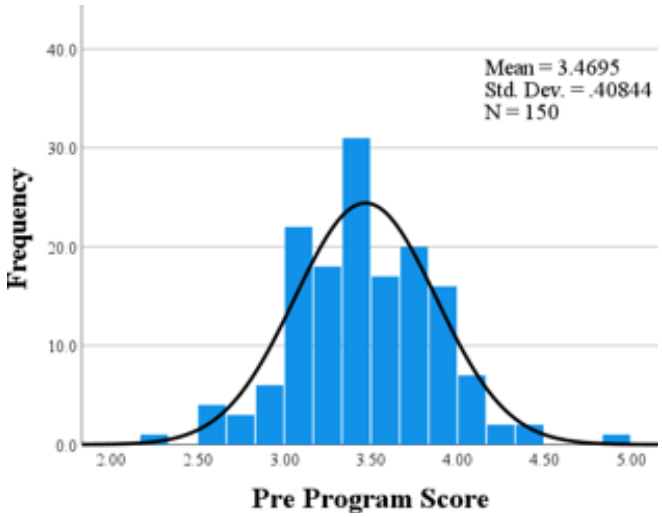

FIGURE 2. Distribution of Pre-Program Scores with Normal Curve Overlay

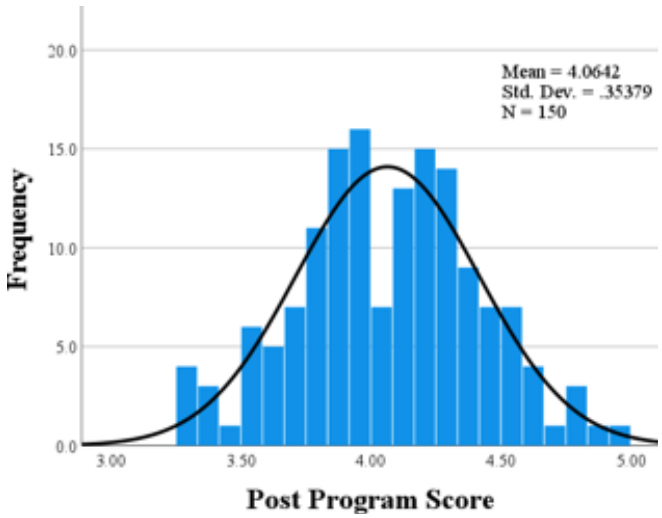

FIGURE 3. Distribution of Post-Program Scores with Normal Curve Overlay

A paired sample t test was performed to determine whether the observed changes were statistically significant. Results are summarised in TABLE 4. The test revealed a significant difference between pre-program and post program means, $t(149) = -23.519$, $p < 0.001$. The effect size, illustrated in FIGURE 4, shows Cohen's $d = 1.920$, which represents a very large practical effect, indicating that the program had a strong impact on participants' sustainability competencies.

TABLE 4. Paired Sample t-Test Comparing Pre-Program and Post-Program Competency Scores.

Assessment Phase	Mean Score	Standard Deviation	t value	p value
Pre Program	3.4695	0.40844		
Post Program	4.0642	0.35379	−23.519	< 0.001

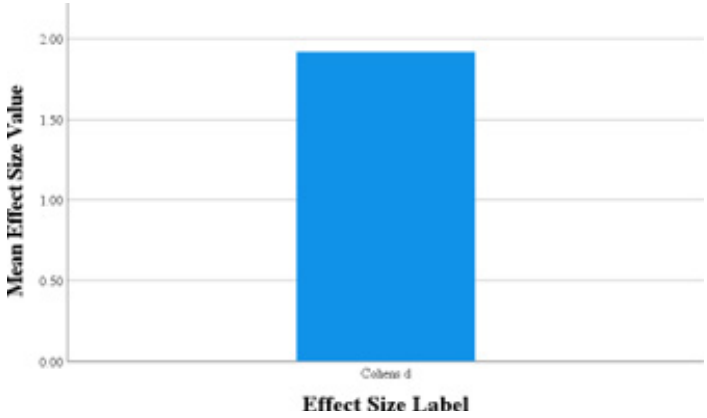

FIGURE 4. Cohen's d Effect Size for Pre-Program to Post-Program Score Change

This supports findings from recent studies showing that experiential and action-based environmental programs effectively enhance pro-environmental attitudes and leadership capabilities among university students (Douglas et al., 2024), (Zammitti et al., 2024). The program's hands-on activities, such as catch-and-release conservation and plogging, likely provided concrete experiences that facilitated behavioural and attitudinal change, aligning strongly with Experiential Learning Theory (Yusliza et al., 2020), (Savage et al., 2015).

Regression Analysis Predicting Post Program Competency

To assess whether initial awareness predicted post program performance, a simple linear regression was conducted. Results indicated that pre-program competency significantly predicted post program competency ($B = 0.588$, $\beta = 0.678$, $p < 0.001$). The regression model explained 46% of the variance in post program scores ($R^2 = 0.460$), as shown in TABLE 5, indicating a moderate predictive relationship. This suggests that participants who entered the program with higher baseline awareness tended to show somewhat stronger gains.

TABLE 5. Regression Analysis Predicting Post-Program Competency Scores

Predictor	B Coefficient	Beta	t value	p value	R^2
Constant	2.025		11.084	< 0.001	
Pre Program Score	0.588	0.678	11.235	< 0.001	0.460

The regression line and data scatter are presented in FIGURE 5. Although a positive relationship is visible, the spread of data points around the regression line visually confirms that the relationship is moderate rather than strong. This supports the statistical conclusion that while prior awareness influences post program competency, a substantial portion of improvement is attributable to the program itself rather than only to initial differences.

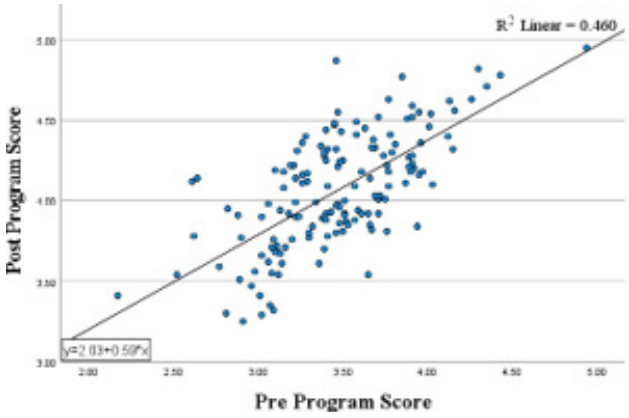

FIGURE 5. Scatterplot of Pre-Program and Post-Program Scores with Regression Line

This finding is consistent with studies suggesting that students who exhibit early environmental interest are more likely to benefit from experiential sustainability interventions (Rahman et al., 2023), (Pauw et al., 2015). Nevertheless, the moderate R^2 value also reflects the strength of program design, which provided structured, reflective, and culturally diverse learning opportunities that supported competency growth across participants with varying baseline awareness levels (Kolenatý et al., 2022), (Pauw et al., 2015).

Thematic Analysis

Open ended responses were analysed using Braun and Clarke's thematic method, and five overarching themes were identified from participants' reflections (Braun & Clarke, 2022). A heightened sense of ecological awareness was described, as deeper understanding of environmental degradation was reported to have been gained through hands on exposure to polluted river sites and accumulated waste. Activities such as plogging were noted to have created emotional connection to local environmental issues, allowing the severity of ecological problems to be perceived more clearly. Growth in sustainability leadership was also indicated, as leadership skills were described as having developed through coordination of group tasks, collective decision making, and problem solving during eco innovation challenges.

Appreciation for multicultural collaboration

FIGURE 6. Thematic Map of Sustainability Learning Outcomes

was further reflected, as interactions with peers from Germany and Indonesia were reported to have broadened global perspectives and revealed cultural variations in environmental practices. Increased personal responsibility toward climate action was also expressed, as greater motivation to adopt sustainable behaviours was described following guided reflection and structured debriefing processes. Finally, emotional connection to nature was strengthened, as close interaction with natural ecosystems during conservation activities was said to have encouraged a sense of stewardship and long-term environmental commitment.

These themes are visually represented in FIGURE 6, in which the five thematic domains are mapped to illustrate their collective contribution to sustainability learning outcomes (Braun & Clarke, 2022).

The overall findings were found to be strongly aligned with Experiential Learning Theory (ELT) (Kolb & Kolb, 2009). Measurable improvements in sustainability awareness, leadership capability, and motivation for climate action were observed following participation in the program, suggesting that the experiential learning cycle was effectively engaged. According to ELT, learning is facilitated when individuals undergo a sequence comprising concrete experience, reflective observation, abstract conceptualisation, and active experimentation (Kolb & Kolb, 2009). Evidence of this sequence was reflected in participants' accounts, in which hands-on ecological activities, reflective sessions, conceptual linkage to sustainability principles, and subsequent application of insights in group problem solving were consistently reported.

Concrete Experience was provided through activities such as plogging, river conservation work, and eco innovation tasks. Reflective Observation was facilitated through structured reflection and group debriefings. Abstract Conceptualisation was indicated when participants described linking their experiences to broader sustainability principles. Active Experimentation was demonstrated as participants applied their insights during collaborative tasks and environmental problem-solving exercises.

The alignment between program structure and ELT processes is illustrated in FIGURE 7, which depicts how each program component corresponded to a specific stage within the experiential learning cycle.

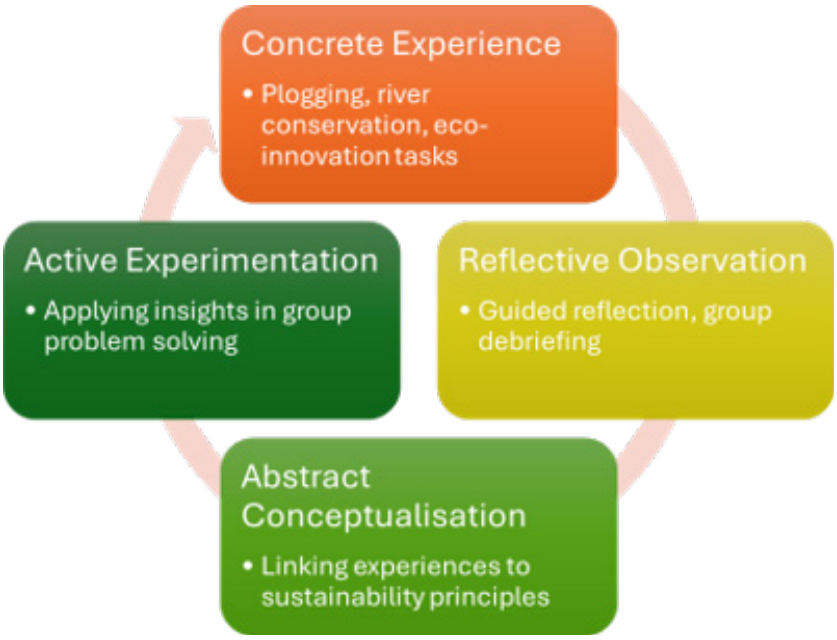

FIGURE 7. Experiential Learning Cycle Applied in the Program

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RESEARCH IMPLICATIONS AND RECOMMENDATIONS

The findings of this study are interpreted as providing convincing evidence that experiential sustainability programs can be used effectively to cultivate environmental awareness, leadership capability, and readiness for climate action among university students. The significant improvement in mean scores from pre-program to post program, the exceptionally large effect size, and the moderate predictive role of pre-program competency suggest that meaningful learning occurred when students were engaged directly with ecological tasks and structured reflection. These outcomes support earlier work which has proposed that experiential learning and authentic environmental engagement are central to the development of climate conscious youth leaders (Rahman et al., 2023), (Yusliza et al., 2020), (Douglas et al., 2024).

This study also demonstrates strong alignment with several United Nations Sustainable Development Goals (SDGs). First, the program contributes directly to SDG 4.7, which emphasises the importance of Education for Sustainable Development by equipping students with the knowledge, competencies, and values necessary to act for environmental sustainability. The experiential and reflective components of the program support transformative learning processes that empower youth as responsible global citizens. Second, the observed improvements in climate-action readiness and ecological responsibility align with SDG 13, as the program strengthens youth capacity to contribute to climate mitigation and adaptation efforts through increased awareness, leadership, and pro-environmental behaviours. Third, the program's multicultural design involving students from Malaysia, Germany, and Indonesia supports SDG 17, which highlights the importance of international partnerships in addressing global challenges. The collaborative learning environment fostered cross-border understanding and demonstrated how intercultural engagement can enhance collective climate responsibility. These SDG linkages reinforce the broader societal relevance of the program and underscore its potential as a scalable model for sustainability education within higher education institutions.

From a theoretical perspective, the results are found to reinforce the applicability of Experiential Learning Theory and sustainability competency models in the context of climate action education (Kolb & Kolb, 2009), (Yen & Sembiring, 2020), (Rahman et al., 2023). The thematic findings and quantitative gains collectively suggest that the four stages of experiential learning, namely concrete experience, reflective observation, abstract conceptualisation, and active experimentation, were activated in a coherent manner through the program activities. Emotional connection to nature, personal responsibility, and collaborative leadership were shown to be strengthened, which aligns with frameworks that emphasise the interaction between cognitive, affective, and behavioural elements in sustainable behaviour (Yen & Sembiring, 2020), (Pauw et al., 2015). The study therefore contributes empirical support to the argument that well designed experiential and multicultural programs can serve as effective vehicles for operationalising these theoretical models in higher education settings.

Several practical recommendations for universities and program designers are implied by

the findings. It is recommended that sustainability curricula incorporate structured field-based activities such as river conservation, nature volunteering, and community focused waste reduction projects, as these activities were shown to enhance awareness and encourage meaningful participation. Regular reflective practices, including guided debriefing sessions and written reflections, are suggested to be embedded in program design to consolidate learning and support the development of leadership and problem-solving skills. Multicultural collaboration should be intentionally facilitated through international partnerships and blended teams, since interaction among students from different countries in this program was associated with broader perspectives on climate issues and stronger appreciation of shared global responsibility. Institutions are further encouraged to establish continuing platforms for environmental volunteering so that students may sustain the behaviours and competencies acquired during short term interventions.

Implications are also noted for institutional and policy level planning. Universities may consider recognising experiential sustainability participation through credit bearing modules or micro credential systems, thereby signalling the value of climate action competencies within graduate attributes. Collaboration with local authorities, non-governmental organisations, and industry partners is recommended so that students can contribute to real environmental projects while learning from practitioners. At a broader policy level, integration of experiential sustainability education into national higher education frameworks may be considered, particularly in countries where environmental degradation and climate vulnerability are already evident (Nashorddin et al., 2024), (Yusliza et al., 2020), (Department of Environment & Ministry of Natural Resources and Environmental Sustainability, 2023).

Several limitations should be acknowledged in interpreting the findings of this study. First, the program was conducted within a single institutional and program context, which may limit the generalisability of the results to broader populations or different university settings. Second, the study utilised a short-term pre- and post-intervention design, and thus it was not possible to determine whether the observed improvements in awareness, leadership competencies, and climate-action readiness were sustained over time. Third, the assessment relied on self-reported measures, which may be influenced by social desirability effects or participants' subjective interpretation of items. Fourth, the study did not include behavioural tracking beyond the program duration. Therefore, actual long-term sustainability behaviours could not be evaluated. Finally, although the multicultural composition of the participants was a strength, cultural differences in environmental norms and communication styles may have introduced variability in responses that was not fully captured in the analysis.

Future research is recommended in several directions. Longitudinal studies may be carried out to determine whether gains in awareness, leadership, and responsibility are maintained over extended periods after program completion. Comparative investigations of different experiential program designs, including digital and hybrid formats, may be conducted to identify which combinations of activities and pedagogical strategies yield the strongest climate action outcomes. Studies involving larger and more diverse institutional samples would also be valuable to test the generalisability of the present findings. Through such continued inquiry, a stronger evidence base can be established to guide universities and policymakers in designing experiential and multicultural sustainability initiatives that effectively prepare youth to respond to current and emerging climate challenges.

CONCLUSION

The results of this study show that the Green Intervarsity Volunteers Engagement Program strengthens students' environmental awareness, sustainability leadership, and readiness for climate action through experiential and multicultural learning approaches. All measured competencies increased significantly, and the regression analysis confirms that students with higher initial awareness tend to achieve stronger development throughout the program. The qualitative findings reveal deeper ecological sensitivity, a stronger emotional connection to nature, and a richer appreciation for collaboration across cultures. These experiences demonstrate how experiential immersion supports both cognitive and affective dimensions of sustainability learning. The outcomes also align with the core principles of Experiential Learning Theory, where real ecological engagement, structured reflection, and collaborative problem solving continually reinforce meaningful transformation among participants.

Overall, this study offers clear evidence that experiential sustainability education effectively bridges the persistent gap between environmental knowledge and climate-responsible behaviour among university students. The multicultural composition of the program enriches this process by encouraging global perspectives on environmental challenges and

strengthening students' sense of collective ecological responsibility. The findings highlight the potential of experiential and internationally collaborative programs to advance climate-action competencies in higher education while preparing youth to play an active role in environmental stewardship within their communities and the wider global context.

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