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ARTICLE

Rethinking Environmental Consciousness: A Multimodal Peer-to-Peer Approach for Sustainable Behavioural Intention Change

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Abstract
Our study aims to (1) understand the impact of student-led knowledge dissemination and (2) examine the effects of multimodal interventions — comprising (i) a video on environmental catastrophes, (ii) pictorial reading materials on environmental issues (iii) lab-based simulated eco-tourism trips. This study involved students enrolled in a subject offered at Universiti Teknologi PETRONAS, Malaysia, attended by undergraduates from three different degree programmes. These interventions were implemented to examine their impact on both student advocates and their peers, particularly in terms of raising environmental awareness, shaping attitudes and fostering sustainable behavioural intentions (SBI). We equip students to become environmental advocates by providing them with environmental knowledge in class and assessing their ability to effectively share this knowledge with their peers. We conducted an experimental study using a multimodality intervention approach to assess changes in SBI. Study 1 measures the initial SBI without treatment, while Study 2 measures the incremental SBI after treatment. In our experiment, we requested 124 students (advocates) to reach out to at least three friends, and from this outreach, we obtained 401 respondents altogether. Our approach uncovers the effectiveness of same-level knowledge transfer (students to peers), facilitating the spread of environmental knowledge within peer groups.

Keywords: Empower students; multimodal interventions; same-level knowledge transfer; student-led knowledge dissemination; sustainable behavioural intention

Introduction

The world is currently grappling with a severe environmental catastrophe. Each country adds to environmental causes at a different rate, exacerbating the global challenge (Reid, Dillon, Ardoin, & Ferreira, 2021; Wang *et al.*, 2025). Though world leaders, policymakers and researchers have been debating and trying to introduce different measures to reduce impending catastrophes, these strategies have yet to see positive outcomes. The intensifying environmental crises require innovative, effective solutions beyond conventional approaches (Bylund, Hellberg, & Knutsson, 2022). While there is a general heightened awareness of environmental issues, mere awareness does not translate into widespread sustainable behavioural intentions (SBI) (Elsamen, Fotiadis, Alalwan, & Huan, 2025).

Although many studies have investigated the cognitive, emotional and social factors influencing SBI (Demirović Bajrami, Đervida, Radosavac, Vuksanović, & Matović, 2025; Sabbir & Taufique, 2022), there is a dearth of research in understanding how participatory, peer-driven learning and advocacy models can dynamically promote SBI. Existing studies have mainly focused on top-down interventions led by governments or institutions (Luo, Jin, & Hu, 2024; Sohre & Schubert, 2022), with little attention given to bottom-up or even student-led efforts that can catalyse social diffusion of environmental values. There are also limited studies that examined the transformative capabilities of empowering students, both as learners and as advocates within their social circles and communities. Hence, our study addresses this gap by investigating how structured student advocacy, embedded through classroom learning and multimodal interventions, can improve the internalisation of environmental values and lead to more sustained SBI.

We believe engaging university students as environmental advocates could create a collaborative knowledge construction and offer a unique solution beyond the classroom walls and into broader society. We argue that this approach can promote a sense of ownership and accountability among young individuals regarding environmental issues. When students are actively participating in advocacy, there are higher chances for them to internalise the values and practices related to SBI, which can lead to lasting behavioural change (Zhou, 2024). Hence, this creates a condition for collective action in combating environmental degradation.

Based on the above, our study aims to (1) understand the impact of student-led knowledge dissemination and (2) examine the effects of multimodal interventions — comprising (i) a video on environmental catastrophes, (ii) pictorial reading materials on environmental issues (iii) lab-based simulated eco-tourism trips. We anticipate establishing a renewed hope in combating environmental catastrophes, hence providing a tactful, diplomatic and immersive experience that transcends the limitations of conventional practices. In our study, students will be mobilised to advocate environmental knowledge to their peers. We will leverage the student's [advocates'] understanding of environmental issues to communicate knowledge to peers with similar standards and intelligence. Our approach uncovers the effectiveness of same-level knowledge transfer (students to peers), facilitating the spread of environmental knowledge within peer groups. This study involved students enrolled in a subject offered at Universiti Teknologi PETRONAS, Malaysia, attended by undergraduates from the Bachelor of Information Technology, Bachelor of Computer Science and Bachelor in Business Management programmes. The students were between 19 and 23 years old, with the majority in their first or second year of undergraduate study.

Our study has several potential contributions. Firstly, we introduced an innovative approach to environmental education where we empower students as advocates for peer-to-peer knowledge dissemination. We believe that this approach could contribute to generating different methods for engaging people to combat environmental issues. We contend that the conventional approach could fall short in capturing the human, emotional and peer-level connection required to promote meaningful engagement. In contrast, students advocating to their peers could offer more relatable perspectives, improving the authenticity and impact of the message. Secondly, our study evaluates the effectiveness of multimodal interventions (video on the environmental catastrophe, pictorial reading materials on environmental catastrophe, lab-based simulated eco-tourism trips) within a single, integrated research design. Our study could provide insights into the different impacts of communication channels on environmental awareness and SBI. We assert that most previous studies were carried out using a single approach, and researchers conclude that their approach is the best without examining whether there are potential changes in intention. Thirdly, we investigate the peer-to-peer approach in the context of environmental knowledge dissemination. We believe it is essential to understand how students can act as advocates and influence their peers, leading to SBI change (Lowan-Trudeau & Fowler, 2022). This could further contribute to the literature on interpersonal dynamics and communication in environmental education. Fourthly, we delve into the Diffusion of Innovations Theory (DOI), where we apply the DOI to

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environmental education. We examine how knowledge can be transferred within a social system. Fifth, we also introduce a two-layer measurement model for assessing the impact of educational interventions. Our approach, which spans from initial exposure (classroom environmental knowledge) to subsequent peer outreach, could add further insights to evaluate the long-term effectiveness of educational programs. We uphold that education is not limited to advancing knowledge but also disseminating knowledge accordingly (Michel & Zwickle, 2021).

Research context

Malaysia belongs to a collectivist society. Though there are many ethnic groups in Malaysia, for example, the Malays, Chinese and Indians form the majority of the Malaysian population, their people still tend to focus on the well-being of a group, prioritising collective goals over individual desires. The Malaysian culture emphasises interpersonal relationships, cooperation and harmony, where the concept of helping each other is deeply ingrained, leading to solid collaborative efforts for the greater good. Group decision carries significant weight, and individuals always seek approval or input from others before making important decisions (Ting, 2023). The collective identity also leads to a sense of belonging and shared responsibility. Though Malaysia is a diverse and multicultural society, the people embrace collectivist values that go beyond mere tradition and foster unity, cooperation and communal well-being.

Shah, Mustaffa, and Yusof (2017) pointed out that natural disasters have consistently been the primary environmental catastrophes in Malaysia. The Malaysian government has initiated many environmental awareness campaigns. However, the effectiveness of the campaigns in terms of positive impact remains undetermined, as no detailed research has been conducted. According to Wi & Chang (2019), an environmental catastrophe is a catastrophic event affecting the natural environment, resulting from natural causes or human activities. While environmental catastrophes affect every part of the world, they tend to inflict the most damage on third-world countries (Hardoy, Mitlin, & Satterthwaite, 2024). This is often attributed to low environmental awareness and insufficient support from governmental efforts in environmental catastrophe prevention. With the advancement of technology and the widespread global use of the internet, the term environmental catastrophe has gained popularity in news and social media. The media and press have played a crucial role in rapidly spreading insights into these environmental catastrophes, leading to a substantial increase in public awareness (Li, 2021).

Before 1974, most environmental awareness programs in Malaysia were conducted by non-governmental organisations, often with support from individual government departments in Malaysia or international bodies such as the World Wildlife Fund (Abd Rahim, Zukni, Ahmad, & Lyndon, 2012). These environmental awareness programs were not centrally organised but carried out by various organisations, each with a specific focus of interest.

In 1974, Malaysia drafted its first framework of environmental legislation, which was approved by parliament in the Environmental Quality Act 1974 policy. The country initiated a dedicated program to manage various industrial pollution issues after implementing Malaysia's inaugural environmental law. This included the regulation of wastewater, which had not been previously overseen, addressing air pollution arising from manufacturing, and tackling challenges related to solid waste. Malaysia took a progressive step by integrating goals for attaining a clean, safe and healthy living environment into its policy framework. This pivotal move occurred with the incorporation of environmental policy as a crucial element in the 3rd Malaysia Plan in 1976, and this commitment has been consistently expanded upon through subsequent plans, including the 12th Malaysia Plan, 2023 to 2025 (Hamzah & Tanwir, 2021). The Malaysian government's visible and acknowledged endeavours to oversee recycling and environmental policies have become apparent. Nevertheless, the general public's awareness of other environmental crises remains uncertain (Izham, Shaari, & Zaman, 2023). It also serves as a reminder to the Malaysian

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government that investing millions of dollars in environmental campaigns should be coupled with a commitment to enhance people's environmental knowledge, making it a top priority.

Research plan

Our study incorporates three pivotal components to understand how environmental knowledge can be disseminated to the community. Firstly, our students (as advocates) will attend their regular classroom sessions (first-layer). In week 7, these students will be divided into three groups, with each exposed to different multimodal interventions. Throughout this period, they continue to receive their regular environmental education until week 12). Following the seventh week, these students will take up the advocate role, propagating insights on environmental factors influencing SBI.

Secondly, to understand a comprehensive dissemination strategy, a multimodal intervention strategy encompasses multiple distinct interventions, for example, video on the environmental catastrophe, pictorial reading materials on the environmental catastrophe and lab-based simulated eco-tourism trips will be implemented. This multimodal intervention will be carried out to understand whether the different interventions will lead to improved SBI outcomes. This forms the second-layer of knowledge dissemination, from advocates to peers). This multimodal intervention approach will add varied sensory experiences (on top of the classroom knowledge), enhancing the effectiveness of our efforts.

Thirdly, we incorporate the key drivers of SBI, representing the evolving important factors influencing environmental behaviour, into our research design. To influence students' understanding and engagement, we introduce awareness, knowledge, motivation, belief, attitude, green mindfulness, environmental identity salience and eco anxiety, leading to SBI. We hope to understand how behavioural intention change can be effectively captured when advocates disseminate the environmental knowledge to their peers (Lowan-Trudeau & Fowler, 2022).

Literature review

Our study is based on the Diffusion of Innovations Theory (DOI). The core of this theory is how new ideas, innovations, or practices can be spread and adopted within a social system (Luke, Powell, & Paniagua-Avila, 2024; Vargo, Akaka, & Wieland, 2020). The theory relies upon the communication channels and social structures influencing adoption. Environmental communication encompasses any form concerning environmental catastrophes, concerns, strategies and issues. Its primary goal is to disseminate information and raise awareness about global environmental issues, including catastrophes, while emphasising human beings' role in environmental care (Bonasia, De Simone, D'Uva, & Napolitano, 2022; Verlie & Flynn, 2022). Examining the effectiveness of environmental communication, research findings indicate that employing diverse interventions to convey environmental messages can significantly impact audience behaviour, subsequently leading to environmental changes. This influence extends across academic, economic, political, regulatoryand policymaking perspectives (Reid *et al.*, 2021).

Multimodal interventions

Lab-based simulated eco-tourism trips

Incorporating a lab-based simulated eco-tourism trip offers participants crucial experiences through a meticulously designed simulated journey. The goal is to provide encounters and experiences that closely emulate real-world scenarios, delivering genuine and immersive experiences to the audience (Taylor, Sundararajan, & Munroe-Lynds, 2022).

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Employing the lab-based simulated eco-tourism trips as an educational instrument has proven effective in shaping, involving and reforming the learning behaviour of the participants. A study conducted by Perez, Gaehle, Sobczak, and Stein (2022) to assess the efficacy of simulated learning unveiled that participants regarded simulation learning as authentic and applicable. The lab-based simulated eco-tourism trips immerse participants in both challenging and exhilarating interactions within a simulated environment. This effectively prepares the participants to adapt and respond to real-life scenarios they may encounter (Björk, Prebensen, Räikkönen, & Sundbo, 2021). Simulated trips provide individuals with a realistic and immersive environment to engage and learn actively. The learner can also experience scenarios that virtually allow for hands-on learning, enhancing knowledge retention and application. Besides this, with the controlled environmental conditions, the simulated trip offers a safe, risk-free and controlled setting for individuals to practice and make mistakes without real-world consequences. This risk-free environment encourages experimentation, exploration and the development of new behaviour for a person who gets in touch with the program.

Pictorial reading materials on environmental catastrophe

Pictorial reading materials continue to serve as one of the primary media strategies for influencing audience behaviour change. This is especially true when the audience has limited time to receive a message because visual stimuli, such as pictorials, play a significant role in effectively conveying information in marketing communication (Kim & Jeong, 2016). The interaction between the poster and the audience acts as a stimulus, evoking a response from the audience and instigating emotional engagement with the marketing message (Zhang, Xu, & Gursoy, 2020).

Video on the environmental catastrophe

Since the 1970s, video has been employed for academic and training purposes across various industries. Today, it continues to be a primary method for delivering information globally. The video serves as a highly effective stimulus, particularly as a flexible training method (Yu & Gao, 2022). The most recent video presentations no longer follow a one-directional information delivery model. Instead, they incorporate unique features that introduce interaction phases. These videos include information and questions within the presentation, encouraging the audience to think and react based on the instructions and guidance provided. This design feature aims to attract a larger audience, making it easier for them to engage with the information being delivered through the video and be influenced more interactively (Smolenskiy & Levshin, 2022).

Sustainable behaviour

The sustainable behaviour proposed by Kollmuss and Agyeman (2002) can be characterised as behaviour consciously aimed at minimising the adverse impact of one's actions on the environment. When individuals conscientiously take actions to reduce the adverse effects of their behaviour on the environment, it indicates their willingness to explore alternative approaches (Fakfare *et al.*, 2025). This might entail additional efforts, time and financial costs compared to their current practices.

Fakfare *et al.*, (2025) concluded that there is a positive association between environmental awareness and sustainable behaviour. additionally, various studies have indicated that the information and messages disseminated through environmental awareness efforts are another crucial factor influencing individuals towards sustainable behaviour. When awareness programs provide dense and detailed information about the connection between humans and the environment, individuals are more likely to gain exposure to understanding environmental challenges, leading to adopting sustainable behaviour.

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Key drivers of SBI

In our study, we measure the incremental change to the mean score using the key drivers of SBI to understand the effectiveness of disseminating environmental knowledge. These drivers, while carefully incorporated into our research design, form a compelling support for the multifaceted approach we designed to foster SBI change:

Awareness: The examination of consumers' awareness regarding environmentally friendly products is a domain where marketers invest their efforts in crafting environmental marketing. Spiteri (2024) reported that the higher the awareness level among individuals regarding environmental catastrophes, the greater the likelihood of them altering their current lifestyle to engage in sustainable behaviour.

Knowledge: Environmental knowledge is pivotal in fostering environmental awareness and prompting individuals to adopt SBI. A widely acknowledged consensus among researchers is that without sufficient environmental knowledge guiding individuals to engage in the environmental movement and embrace sustainable behaviour, developing effective and sustainable behaviour patterns for continued sustainable behaviour in the future becomes challenging (Ágoston, Balázs, Mónus, & Varga, 2024). Environmental knowledge and environmental concerns share a connection. An elevation in environmental knowledge tends to impact environmental concerns regarding natural issues. Certain aspects of environmental knowledge translate into actionable measures, leading to behavioural consequences and the manifestation of sustainable behaviour.

Motivation: Motivation stands out as a crucial focus within current environmental research. Many researchers have increasingly delved into the study of motivation, driven by the prominence of green marketing as a significant business trend (Sharma, Lim, Kumar, Verma, & Kumra, 2024). Green marketing, in this context, pertains to business activities aimed at producing and facilitating exchanges to meet human needs or desires while minimising adverse impacts on the natural environment.

Belief: Belief constitutes an internal principle ingrained in individuals, grounded in specific knowledge or principles that resist easy alteration under external influences. In the environmental context, environmental belief is defined as an individual's gauge of their attitude toward environmental protection and related issues (Sharma *et al.*, 2024). An alternate interpretation of environmental belief encompasses convictions regarding the endangered environment and the imperative for confronting environmental issues and problems. These specific beliefs encompass notions about the repercussions of environmental catastrophes and the obligation to instigate a lifestyle change.

Attitude: Attitude stands out as a significant contextual factor, reflecting the predispositions that shape the internal desire to transition into action, thereby transforming one's behaviour into sustainable behaviour (Kastner & Matthies, 2023). Based on (Tran, Vu, Pham, Nguyen, & Duong, 2024), attitude influences an individual's intention, and subsequently, the shift in intention shapes the transformation into sustainable behaviour. Elevating environmental attitudes, the entry point to sustainable behaviour, is of paramount importance in safeguarding nature and increasing pro-environmental behaviour among the public.

Green mindfulness: the word green mindfulness typically refers to a form of mindfulness that uniquely emphasises nature and the environment. Based on the clarification Arslan et al., (2021) provided, green mindfulness involves being fully present and attentive to the natural world, fostering a strong correlation between wildlife and nature. Green mindfulness stimulates individuals to engage their senses, observe the beauty of the real world and cultivate an awareness of the interconnectedness between themselves and the natural world. From the previous studies, most of the studies of green mindfulness often emphasise the importance of appreciating and protecting the environment surrounding the world. It can involve activities such as nature walks, prioritising environmental concerns in nearly every action, considering the green thought in a workplace or non-workplace zone, or simply taking time to appreciate the beauty of the outdoors

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and nature consciously. This concept integrates mindfulness principles with ecological awareness, promoting a more sustainable and environmentally conscious way of living and influencing behaviour changes to sustainable behaviour

Eco anxiety: Coffey, Bhullar, Durkin, Islam, and Usher (2021) defined eco-anxiety as a form of anxiety that is rooted in worries and concern about the impact of environmental degradation, climate change, biodiversity loss and other ecological crises on the planet and future generations. A few of the symptoms of eco-anxiety: people tend to have a behaviour change and may feel overwhelmed, fearful, or powerless in the face of environmental problems. Although individuals may come from the same community, their backgrounds can impact different responses to eco-anxiety and its influence on sustainable behaviour (Jarrett, Gauthier, Baden, Ainsworth, & Dorey, 2024). On the one hand, experiencing eco-anxiety may influence individuals to engage in and change to pro-environmental behaviour as a coping mechanism or a way to address the perceived threats to the environment. However, on the other hand, eco-anxiety can also lead to feelings of overwhelm, hopelessness, or a sense of powerlessness, which might hinder individuals from taking positive environmental actions. In extreme cases, individuals may experience environmental paralysis, where the perceived magnitude of the environmental challenges discourages them from engaging in pro-environmental behaviours. Addressing eco-anxiety often involves a combination of psychological support, education and empowering individuals to take meaningful actions to contribute to environmental sustainability (Olsen, Lawson, McClain, & Plummer, 2024)

Environmental identity salience: environmental identity salience refers to the degree to which an individual's environmental identity is prominent in their self-concept. Environmental identity is a significant component of self-recognised principles involving a sense of connection, relationship and environmental identification (Udall, de Groot, de Jong, & Shankar, 2020). The individual with a specific environmental identity tag becomes actively influenced by environmental thoughts. Consequently, environmental identity automatically influences an individual's thoughts, facilitates the adoption of new sustainable behaviour, and leads to decisions prioritising environmental perspectives

Methodology

We employed the DOI as the umbrella theory. Our study involved disseminating environmental knowledge through a peer-to-peer approach (Tattersall, Hinchliffe, & Yajman, 2022), where students advocated their environmental knowledge (first-layer) to their peers (second-layer). New knowledge is transmitted through students' understanding developed during their lectures and tutorials. This foundational knowledge was further strengthened using video on the environmental catastrophe, pictorial reading materials and lab-based simulated eco-tourism trips.

The DOI recognises the significance of interpersonal communication and its influence on the diffusion process. Our study emphasised that students advocate environmental knowledge to their peers, which is part of the interpersonal dynamics in DOI. We acknowledge the importance of time duration, where our study spans 12 weeks with assessments at different points to measure behavioural change.

We employed an experimental study to measure the incremental change in SBI between Study 1 and Study 2. Study 1 measured the initial SBI without treatment, while Study 2 measured the incremental change in SBI after treatment. We evaluated the SBI of both the first- and second-layer respondents before and after the treatment. To assess the changes in SBI, we used the responses from Study 2 minus the responses from Study 1 (Figure 1).

At the beginning of the semester, all students were informed that their class project would focus on the environmental knowledge gained throughout the semester. In every lecture and tutorial session (week 1 to week 7), all students were exposed to examples of environmental issues. A multimodal intervention was introduced in week 7 to assess the effectiveness of different

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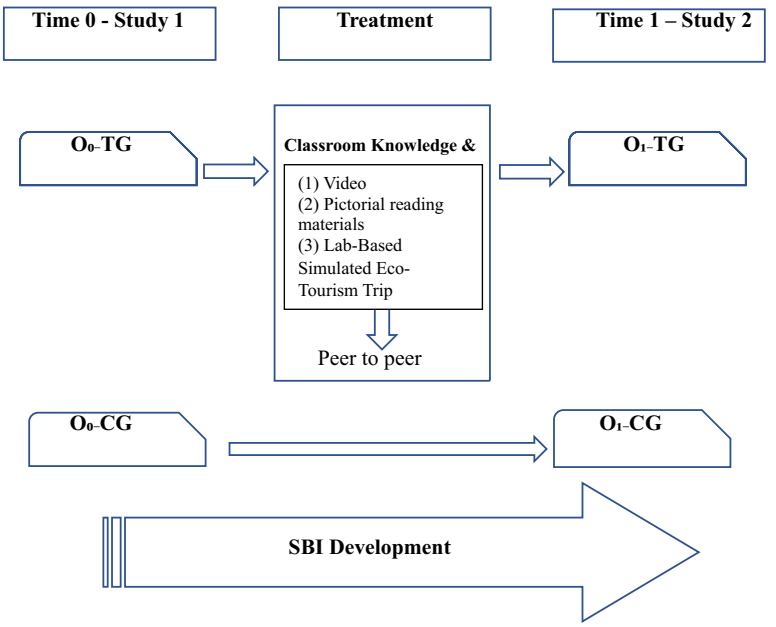

O_0–TG = Treatment Group (Study 1-test)

O_0–CG = Comparison Group (Study 1-test)

O_1–TG = Treatment Group (Study 2-test)

O_1–CG = Comparison Group (Study 2-test)

Figure 1. Experimental study: treatment groups and peer-to-peer knowledge dissemination.

interventions (video on the environmental catastrophe, pictorial reading materials on environmental catastrophe, and lab-based simulated eco-tourism trips) in developing behavioural change. We have employed a professional media agency to produce all three multimodal interventions to ensure high-quality and non-biased media. We input the study requirements and related content for the agency.

From week seven onwards, students transitioned into student advocates, tasked with approaching at least three other students to disseminate the environmental knowledge acquired in class. Each student was informed that they would need to obtain consent to participate in this study. An explanatory statement, approved by the ethics committee, was provided, detailing the project's risks, the storage of survey documents, participant anonymity, voluntary participation and the right to withdraw. Once their peers had consented, they were given the SBI Google questionnaires to fill out to measure their initial SBI. The reason for choosing at least three other students to advocate for is that we assume each student will have at least three close friends with whom they can share their knowledge. We used this approach to create an additional layer of SBI by leveraging peer-to-peer interactions (Tattersall *et al.*, 2022).

To test the effects on behavioural change, all 124 students in the class (first-layer) were randomly grouped into three groups, comprising 40 (Group A), 42 (Group B) and 42 (Group C) students, respectively. In week seven, Group A students were exposed to a video on the environmental catastrophe, Group B students were exposed to pictorial reading materials on environmental catastrophe, and Group C students were exposed to lab-based simulated eco-tourism trips. To establish neutral peer-to-peer knowledge dissemination and to minimise bias in peer outreach and responses, the first-layer participants (all 124 students in the class) were assured

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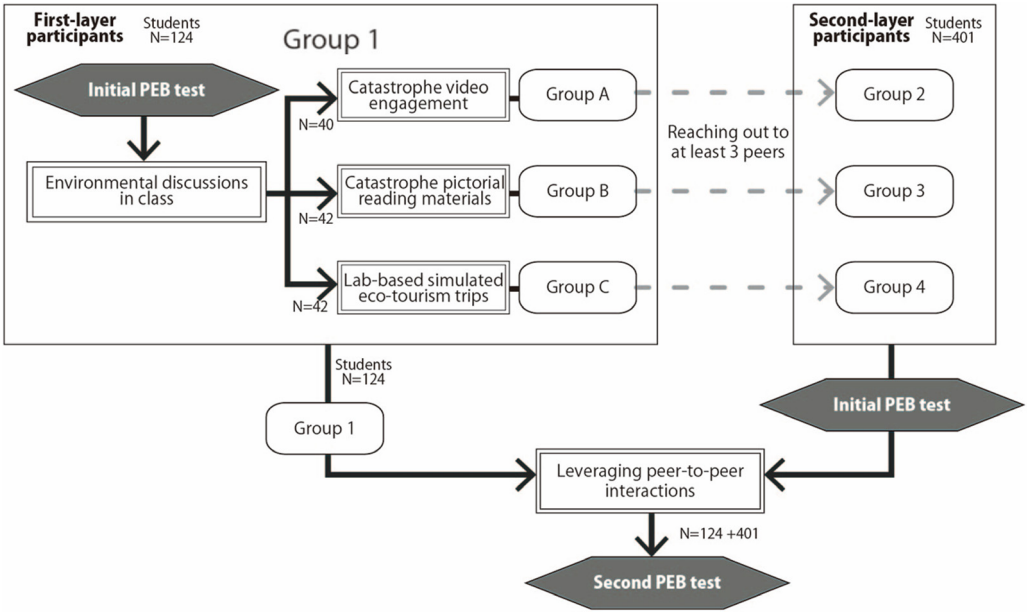

Figure 2. Experimental study methodology flow.

that the end outcome of this study would not impact their grades, minimising bias in peer outreach (Figure 2).

To illustrate further (refer to Figure 2), the entire cohort of 124 students from the class was designated as Group 1 and subsequently divided into three distinct subgroups (Groups A, B and C) to advocate environmental knowledge to their peers (and to compare the effectiveness of various multimodal interventions).

1. Group A was exposed to a catastrophe video. These students were instructed to disseminate their knowledge by engaging at least three peers, forming Group 2 (altogether 129 respondents).
2. Group B engaged with reading materials related to environmental catastrophes. Like Group A, these students were tasked with advocating this knowledge to at least three peers, forming Group 3 (altogether 137 respondents).
3. Group C participated in lab-based eco-tourism trips. Following their experience, these students were encouraged to reach out to at least three peers, forming Group 4 (altogether 135 respondents).

By reaching out to at least three friends, we obtained 401 respondents altogether (some students reached out to four or five friends). At the end of the 12th week, all respondents (124 + 401) were measured again for SBI knowledge. Our approach aims to evaluate the effectiveness of peer-to-peer knowledge dissemination in fostering SBI. We used statistical methods to analyse survey data from both layers to compare outcomes across groups. We captured and analysed the marginal expansion of their SBI (before and after intervention).

Findings

Well-established measurement scales were adapted to measure the various constructs (refer to Table 1 and the appendix for the full measurement items, using a 7-point Likert scale, from

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Table 1. Reliability analysis and source attribution

Dimension	Measurement	Cronbach alpha	Reference
Awareness	Awareness 1	0.86	(Hansla, Gamble, Juliusson, & Gärling, 2008; Schultz, Shriver, Tabanico, & Khazian, 2004)
	Awareness 2		
	Awareness 3		
	Awareness 4		
	Awareness 5		
Knowledge	Knowledge 1	0.84	(Mostafa, 2007; Tamar, Wirawan, Arfah, & Putri, 2021)
	Knowledge 2		
	Knowledge 3		
	Knowledge4		
	Knowledge 5		
Motivation	Motivation 1	0.91	(Cicek-Senturk & Selvi, 2019; Guay, Vallerand, & Blanchard, 2000)
	Motivation 2		
	Motivation 3		
	Motivation 4		
	Motivation 5		
Belief	Belief 1	0.87	(Corral-Verdugo, Bechtel, & Fraijo-Sing, 2003; Huang, 2016)
	Belief 2		
	Belief 3		
	Belief 4		
	Belief 5		
Attitude	Attitude1	0.80	(Naim, Gilbertson, Keles, & Ratinen, 2019)
	Attitude 2		
	Attitude 3		
	Attitude 4		
	Attitude 5		
Green Mindfulness	Green Mindfulness 1	0.82	(Dharmesti, Merrilees, & Winata, 2020)
	Green Mindfulness 2		
	Green Mindfulness 3		
	Green Mindfulness 4		
	Green Mindfulness 5		
Environmental Identity Salience	Identity Salience 1	0.84	(Arnett, German, & Hunt, 2003; Brick, Sherman, & Kim, 2017)
	Identity Salience 2		
	Identity Salience 3		
	Identity Salience 4		

(*Continued*)

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Table 1. (*Continued*)

Dimension	Measurement	Cronbach alpha	Reference
Eco Anxiety	Eco Anxiety 1	0.85	(Hogg, Stanley, O'Brien, Wilson, & Watsford, 2021)
	Eco Anxiety 2		
	Eco Anxiety 3		
	Eco Anxiety 4		
	Eco Anxiety 5		
SBI	SBI 1	0.85	(Wilson & Bellezza, 2022)
	SBI 2		
	SBI 3		
	SBI 4		
	SBI 5		

strongly disagree to strongly agree). We performed the scale reliability and internal consistency, and the Cronbach alpha for all constructs is above .80.

Table 2 shows that, generally, there is an incremental change to the mean score from Study 1 to Study 2 – increased from a minimum of 3.43 to a maximum of 6.43. This upward change indicates greater student engagement and responsiveness to the intervention over time. The interventions have improved their knowledge of the environment and SBI, with the increased mean value. This indicates that the knowledge disseminated can be transmitted effectively through the students to their peers. The percentage changes range from 42% (in the attitude variable) to 81% (in the SBI variable) at $p < .00$. Such variations in percentage change show that there are positive improvements in all variables between study 1 and study 2. The improved change indicates that effective environmental knowledge dissemination is taking place. On the other hand, the correlation between the variables (Study 1 and Study 2) ranges from 0.18 to 0.58 at $p < .00$. These correlation values show positive correlations among the studied variables to the SBI in Study 1 and Study 2. The mean values of SBI in Study 2 have increased significantly from 3.43 (Study 1). The increased mean values indicate that the correlation of variables with SBI in Study 2 continues to exhibit an "upward trend," as the denominator (mean value) in Study 2 is higher, reflecting the interconnected influence of the paired relationships and the effectiveness of the intervention. Only the awareness variable showed an insignificant relationship. In other words, the meta-analysis underscores the significant positive incremental change in the mean score and correlations of all variables (except awareness) towards SBI. The shift towards higher mean scores in Study 2 suggests the likelihood of a positive impact increases after advocates engage with their peers. This reinforces the role of student-led advocacy in improving environmental knowledge and shaping environmental behaviours, showcasing the importance of interpersonal influence in sustainability education. This result holds implications for educational interventions, peer-to-peer knowledge dissemination and potential avenues for future research.

Figure 3 gives the 95% confidence interval that the mean of the key drivers to SBI ranges from 1.75 to 2.75. Like the boxplot, the mean differences and significance level in SBI show a mean range of the different multimodal interventions (refer to Table 3 for detailed and accurate statistical information for precise mean values and significance). The mean differences were obtained when we measured their behavioural changes based on Study 1 and Study 2. (Note: Table 3 is different from Table 2. Table 2 presents the mean for the entire respondent group, providing an overall perspective. In contrast, Table 3 breaks down the mean scores to highlight variations across respondent subgroups).

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Table 2. Meta-analysis of relationships among sustainable behavioural intention (SBI) (Study 1 and Study 2)

		Mean	% Δ	SD	Sig (2-tailed)	Correlation with SBI S1	Correlation with SBI S2
Pair 1	Awareness S1	3.52	77	1.13	0.00	−0.025	−0.042
	Awareness S2	6.24		0.93		.20**	.18**
Pair 2	Knowledge S1	4.36	45	0.83	0.00	.27**	.24**
	Knowledge S2	6.31		0.89		.32**	.27**
Pair 3	Motivation S1	4.32	49	0.91	0.00	.29**	.20**
	Motivation S2	6.43		0.84		.30**	.19**
Pair 4	Belief S1	4.00	57	1.09	0.00	.23**	.18**
	Belief S2	6.26		0.96		.38**	.30**
Pair 5	Attitude S1	4.38	42	0.88	0.00	.44**	.34**
	Attitude S2	6.20		0.94		.42**	.35**
Pair 6	Green Mind S1	4.33	48	0.90	0.00	.47**	.35**
	Green Mind S2	6.42		0.83		.49**	.40**
Pair 7	Identity S1	4.03	58	1.07	0.00	.31**	.33**
	Identity S2	6.35		0.85		.46**	.38**
Pair 8	Anxiety S1	4.19	51	1.00	0.00	.45**	.30**
	Anxiety S2	6.33		0.92		.58**	.45**
Pair 9	SBI S1	3.43	81	0.95	0.00	1	.54**
	SBI S2	6.21		0.93		.54**	1

In Table 3, the percentage change in mean scores (SBI change) for each group is as follows: Group 1 exhibited a percentage change ranging from 1.97% to 3.02%. Group 2's percentage change varied from 1.74% to 2.70%. Group 3 demonstrated a range from 1.77% to 2.85%, while Group 4 showed a percentage change ranging from 1.81% to 2.74%. Despite some differences in the degree of SBI change, all groups exhibited a positive change, suggesting that the interventions have contributed to visible improvements in SBI across different conditions. These results indicate distinct levels of change across the different groups, highlighting the varying impacts of the interventions implemented. The differences in percentage changes may imply the various degrees in participants' baseline awareness, engagement levels and responsiveness to the interventions. All these changes are significant at $P < 0.00$. With the different treatments provided, the positive mean changes and the SBI changes highlight the potency of the multimodal interventions. Specifically, the mean changes from Study 1 to Study 2 have improved significantly, suggesting that the drivers of SBI can be enhanced through the students' peer knowledge dissemination.

All the SBI measures between Study 1 and Study 2 significantly differ at $p < .00$. This shows that the changes or differences observed between Study 1 and Study 2 are significant. Please refer to Figure 4 for the graphical marginal expansion. In general, the overall mean is highest for Group 1 (treatment group classroom knowledge + respective intervention) with an overall mean of 5.30 and an average percentage change of 58.29%, followed by Group 3 (pictorial reading materials on environmental catastrophe) with an overall mean of 5.26 and an average percentage change of 54.31%, Group 2 (video on the environmental catastrophe) with an overall mean of 5.09 and an average percentage change of 57.71%, and Group 4 (lab-based simulated eco-tourism trips) with an overall mean of 5.09 and an average percentage change of 55.72%. Although no statistically significant differences were observed among the groups, the highest percentage change in positive

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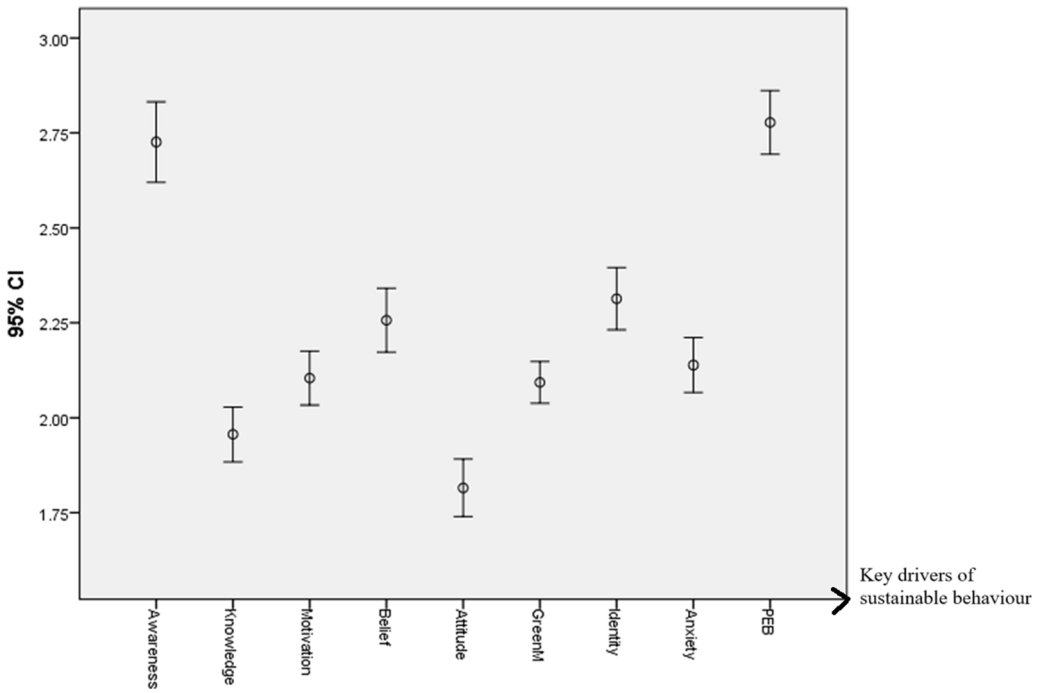

Figure 3. A boxplot sustainable behavioural intention distribution.

behaviour was noted among students who attended class. Furthermore, while advocacy efforts contributed to increased positive behaviour, the strength of this change was not as pronounced as that observed in students who participated in classroom activities.

Table 4 shows the Tukey Honestly Significant Difference (HSD) test. The Tukey HSD test compares the mean differences among the groups under study. We compared each group to understand the dynamics of the different interventions. The Tukey HSD test offers a robust method for assessing whether the differences in mean scores between multiple groups are statistically significant. The test is specifically useful in showing whether the observed differences between groups could result from genuine effects rather than random variation. The test assesses pairwise differences between groups (Groups 1, 2, 3 and 4). Table 4 shows that the p-value is insignificant at $p > 0.05$ (except for awareness between Groups 1 and 4, Groups 3 and 4). All the SBI drivers, except awareness, indicate an insignificant mean difference among the pairwise means of the three other groups of multimodal interventions. This finding suggests that the influence of the interventions on these SBI drivers is relatively consistent across different groups. In other words, no substantial variations were observed. This shows that while the interventions can influence SBI outcomes, their impacts are not significantly different between the compared groups, except in the case of awareness. The findings imply that no strong evidence suggests significant differences among the groups' means. These findings indicate that, although different interventions have been implemented, the groups share higher similarities than differences in outcomes. In other words, the groups are more alike than different for all the different treatments and peer-to-peer knowledge dissemination, highlighting the possibility of uniformity in their impact.

The regression analysis (Table 5) indicates a statistically significant relationship between all the independent variables and SBI at $p < 0.05$, except for belief, with an R^2 of .56. All regression coefficients exhibit positive values, except for motivation, which shows a negative effect.

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Table 3. Mean differences and significance level in sustainable behavioural intention (SBI) knowledge dissemination

	Group 1 - Treatment Group				Group 2 - Peer Group				Group 3 - Peer Group				Group 4 – Peer Group			
	Classroom Knowledge + Respective Intervention				Video on the environmental catastrophe				Pictorial reading materials on environmental catastrophe				Lab-based simulated eco-tourism trips			
	Mean	% Δ	SBI Δ	Sig. (2-tailed)	Mean	% Δ	SBI Δ	Sig. (2-tailed)	Mean	% Δ	SBI Δ	Sig. (2-tailed)	Mean	% Δ	SBI Δ	Sig. (2-tailed)
Awareness S1	3.49	86.53	3.02	0	3.42	77.78	2.66	0	3.47	82.13	2.85	0	3.64	66.76	2.43	0
Awareness S2	6.51				6.08				6.32				6.07			
Knowledge S1	4.42	47.51	2.1	0	4.38	43.61	1.9	0	4.38	42.01	1.85	0	4.25	46.59	1.98	0
Knowledge S2	6.52				6.29				6.22				6.23			
Motivation S1	4.39	48.75	2.15	0	4.29	49.42	2.11	0	4.4	47.27	2.08	0	4.22	49.29	2.09	0
Motivation S2	6.53				6.41				6.48				6.3			
Belief S1	4.13	54.96	2.27	0	3.77	63.66	2.39	0	4.32	49.77	2.15	0	3.81	58.27	2.22	0
Belief S2	6.4				6.17				6.47				6.03			
Attitude S1	4.44	44.14	1.97	0	4.43	39.28	1.74	0	4.48	39.51	1.77	0	4.2	43.10	1.81	0
Attitude S2	6.4				6.17				6.25				6.01			
Green Mind S1	4.41	48.07	2.12	0	4.23	48.70	2.06	0	4.38	49.09	2.15	0	4.27	48.24	2.06	0
Green Mind S2	6.53				6.29				6.53				6.33			
Identity S1	4.2	53.33	2.24	0	3.83	63.19	2.41	0	4.19	53.70	2.25	0	3.92	59.95	2.35	0
Identity S2	6.44				6.25				6.44				6.27			
Anxiety S1	4.24	52.83	2.24	0	4.01	53.37	2.14	0	4.28	48.83	2.09	0	4.23	49.41	2.09	0
Anxiety S2	6.48				6.15				6.37				6.32			
SBI S1	3.39	88.50	3	0	3.36	80.36	2.7	0	3.53	76.49	2.7	0	3.43	79.88	2.74	0
SBI S2	6.39				6.06				6.23				6.17			
Overall mean	5.30	58.29			5.09	57.71			5.26	54.31			5.09	55.72		

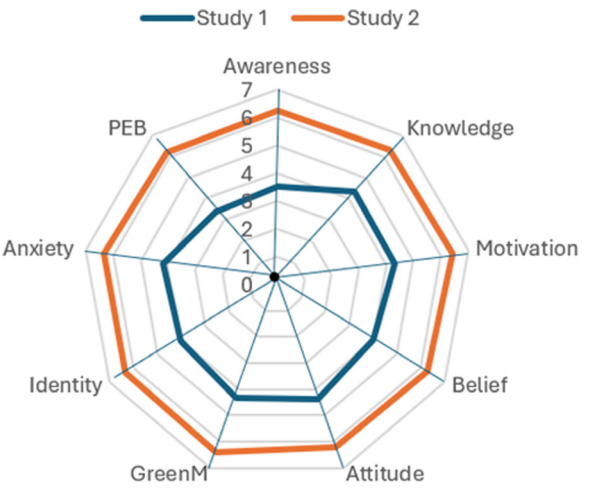

Figure 4. The marginal expansion of sustainable behavioural intention.

Discussions and implications

Our study is the first to employ a different approach to measuring SBI and marginal change. Respondents were divided into four groups with different treatments or approaches. The findings showed that when respondents are exposed to environmental knowledge, there are significant behavioural changes between the before-treatment and after-treatment. Our study contributes to an innovative approach to environmental education. We have introduced a novel peer-to-peer approach to environmental education, where we have empowered students as advocates for disseminating environmental knowledge. Our approach has proven to be successful through increased SBI. This approach deviates from traditional approaches, as we explored the effectiveness of same-level knowledge transfer. We believe that this approach could be a paradigm shift as the same-level knowledge transfer has been evidenced in many studies, such as study groups (students form study groups and share their understanding and learn together (El Said, 2021; Young & Lewis, 2022)), peer tutoring (a classic example of peer-to-peer knowledge dissemination where they help each other, (Arco-Tirado, Fernandez-Martin, & Hervas-Torres, 2020; Dixon *et al.*, 2023)), discussion groups (forming groups that allow students to ask questions, share resources and discuss academic topics, (Goode, Roche, Wilson, & McKenzie, 2023; Verbree, Hornstra, Maas, & Wijngaards-de Meij, 2023)), peer mentoring programs (more experienced students mentor poorer ones) etc. This decentralised knowledge dissemination and exchange has improved students' knowledge and academic performances (Goode *et al.*, 2023).

Theoretical contributions

We have also conducted a multimodal intervention, including class knowledge dissemination, video on the environmental catastrophes, pictorial reading materials on environmental catastrophes, and lab-based simulated eco-tourism trips. This study contributes to a different perspective on how different multimodal interventions can be carried out in one study. We provide insights into the combined impact of various communication channels (direct classroom knowledge and peer-to-peer knowledge dissemination on environmental awareness and attitudes, and the multimodal interventions on SBI. The multimodal interventions in our study show that environmental education can be significantly enhanced through sensory engagement and varied stimuli. When students experience a mixture of visual, auditory and interactive elements, they can heighten their environmental awareness and intention. The multiple senses and experiences can

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Table 4. Comparing means with Tukey HSD: variations and pairwise

	Mean Difference (I-J)							
	(I) Group	(J) Group	(I) Group	(J) Group	(I) Group	(J) Group	(I) Group	(J) Group
		2		1		1		1
		3		3		2		2
	1	4	2	4	3	4	4	3
Awareness (J) Group	0.36		−0.36		−0.16		−.59*	
	0.16		−0.20		0.20		−0.23	
	.59*		0.23		.43*		−.43*	
Knowledge (J) Group	0.20		−0.20		−0.26		−0.13	
	0.26		0.06		−0.06		0.08	
	0.13		−0.08		−0.13		0.13	
Motivation (J) Group	0.03		−0.03		−0.07		−0.06	
	0.07		0.04		−0.04		−0.03	
	0.06		0.03		−0.01		0.01	
Belief (J) Group	−0.12		0.12		−0.12		−0.05	
	0.12		0.24		−0.24		−0.17	
	0.05		0.17		−0.07		0.07	
Attitude (J) Group	0.23		−0.23		−0.20		−0.16	
	0.20		−0.03		0.03		0.07	
	0.16		−0.07		−0.04		0.04	
GreenM (J) Group	0.06		−0.06		0.03		−0.06	
	−0.03		−0.09		0.09		0.00	
	0.06		0.00		0.10		−0.10	
Identity (J) Group	−0.17		0.17		0.00		0.11	
	0.00		0.17		−0.17		−0.07	
	−0.11		0.07		−0.10		0.10	
Anxiety (J) Group	0.10		−0.10		−0.15		−0.15	
	0.15		0.05		−0.05		−0.06	
	0.15		0.06		0.01		−0.01	
SBI (J) Group	0.30		−0.30		−0.30		−0.26	
	0.30		0.00		0.00		0.04	
	0.26		−0.04		−0.04		0.04	

*The mean difference is significant at the 0.05 level.

evoke a deeper emotional connection to environmental issues, as they can feel the connection more vividly, promoting a heightened sense of concern and understanding.

In our study, we have also employed the peer-to-peer approach to knowledge dissemination. We focused on how students acting as advocates can influence their peers and increase their SBI. Our study added to the literature on interpersonal dynamics and communication in environmental education. This is important as we explored the feasibility and practicality of how peer-to-peer

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Table 5. Regression analysis and sustainable behavioural intention (SBI)

Model		Unstandardised Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	Sig.	R^2
1	(Constant)	0.89	0.30		0.00	0.56
	Awareness	0.05	0.03	0.07	0.04	
	Knowledge	0.09	0.03	0.11	0.00	
	Motivation	−0.13	0.04	−0.14	0.00	
	Belief	0.01	0.03	0.01	0.71	
	Attitude	0.07	0.03	0.08	0.04	
	GreenM	0.28	0.04	0.30	0.00	
	Identity	0.16	0.04	0.17	0.00	
	Anxiety	0.33	0.03	0.39	0.00	

a. Dependent Variable: SBI

knowledge dissemination can foster SBI through peer influence. Our findings showed the effectiveness of same-level knowledge dissemination, where they can share knowledge accordingly and engage in meaningful discussions (Hinsz & Bui, 2023). Power structures and hierarchy are minimised or nearly eliminated at the peer level. This creates an environment conducive to open discussion, fostering clearer shared goals and mutual understanding of information.

We have employed the DOI for environmental education. We explored how environmental knowledge can be transferred within a social system. We have enhanced the understanding of the effectiveness of the diffusion process through the same-level peer-to-peer knowledge dissemination and adoption of environmental knowledge within a collective context. This approach is more sustainable than the conventional teaching approach, as knowledge dissemination and behavioural change can be initiated at the university level to instil higher SBI. Instead of investing considerable resources in knowledge dissemination strategies, our study showed a more straightforward and effective avenue — to leverage students as conduits for knowledge dissemination. Tapping into the student population can be a readily available and influential channel where we can foster the transfer of knowledge within communities.

We significantly contribute to understanding a two-layer channel approach towards educational impact, examining how initial exposure in the classroom can lead to significant SBI changes among peers. Our study investigated the long-term effectiveness of educational programs in going beyond knowledge advancement. The two-layer channel approach indicates minimal information loss, effectively achieving the primary objective of communicating SBI. Interactive discussions and feedback within this approach increase participants' comprehension and intentions, highlighting that structured peer communications and responsive feedback systems can significantly strengthen message retention and impact. This insight underscores the important role of reciprocal communication in strengthening environmental understanding and motivation, suggesting a powerful avenue for advancing sustainable behaviour education.

We have also amplified the importance of leveraging social norms as an effective policy tool to address environmental concerns. Using a peer-to-peer knowledge dissemination approach, our study examines how social norm participation and involvement can provide a distinctive perspective on fostering SBI. Peer-to-peer knowledge dissemination extends the discourse on how social influence can create collective accountability and reinforce positive behaviours within a community. When social norms are involved, individuals tend to conform to others to maintain belonging within the system, avoiding feeling outcast in a collectivist community.

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We have successfully engaged and mobilised communities by providing a tactful, diplomatic and immersive experience that transcends the limitations of conventional practices. Our study supports the interpersonal dynamics and communication in environmental education, where there can be a ripple effect in transferring environmental knowledge to the bigger society. Creating a well-informed, engaged and proactive community is important, as it can lead to more cooperative collective action, behavioural change, policy advocacy and long-term sustainability. Our study provides evidence that the community can be mobilised to contribute to a positive impact on environmental issues.

Empowering students as environmental advocates helps students to take ownership of environmental issues, promoting personal responsibility and accountability. In daily life, it is rare to witness students engaging in discussions about environmental issues. Our study has successfully challenged this norm, promoting an avenue where students are willing and motivated to advocate for environmental knowledge among their peers. While they were indeed tasked with advocacy, this experience may serve as a foundation for developing ongoing, intrinsic advocacy behaviours, potentially encouraging a more substantial commitment to sustainability in their immediate communities and beyond.

Practical implications

The implications of our study are profound and can be used to pave the way for transformative environmental education strategies and behavioural transformation. We believe practitioners and decision-makers can tailor educational interventions and capitalise on the effectiveness of classroom knowledge advocacy, videos on environmental catastrophes, pictorial reading materials on environmental catastrophes, and lab-based simulated eco-tourism trips. Creating a dedicated university compound that caters to hands-on environmental components, such as community gardens, recycling stations and eco-innovation labs, can operate as a dynamic learning hub. This conducive environment will encourage students to be more enthusiastic in applying environmental concepts, working together on sustainable projects and experiencing real-time impacts, strengthening their lessons and pledge to lasting behavioural change.

Our study supports the idea that empowering students as environmental advocates for peer-to-peer knowledge dissemination can be a potent strategy. Policymakers and decision-makers can incorporate peer-led environmental activities and discussion sessions into the co-curricular activities, allowing students to manage workshops, participate in group environmental activities, and continuously share sustainability practices campus-wide. We believe the peer-to-peer strategy is relevant, as students are more open to discussions when they are approached by their peers instead of by an authority. They gain ownership and greater engagement, promoting stronger, lasting behavioural change. This is because they feel personally devoted in sustainability goals and peer-driven initiatives.

We also believe that encouraging student-led initiatives could be an important strategy for promoting environmental awareness and SBI within communities. When leading environmental events, students garner a sense of ownership and responsibility. Most of the student-led activities will inspire peer-to-peer engagement. This will create a ripple effect beyond the regular classroom sessions while cultivating a collective commitment to sustainable community behaviours. Our study supports the notion that when students are responsible for advocating, they are more sincere to oblige. They feel a direct stake in advocating and fostering environmental awareness. This behaviour could stem from a sense of ownership aligned with their values, which will subsequently foster a sincere commitment to environmental advocacy.

The application of the DOI to environmental education can catalyse change. We believe that social dynamics and the unprecedented environmental catastrophe could add to students' advocacy and motivation to spread environmental knowledge if there is a proper platform for them to do so. Initiating student-led platforms such as campus clubs or digital networks can

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enhance social influence and peer engagement. This will make environmental education more available, relevant, and action-driven among students. The university or college environment is conducive as students spend much time with their peers for discussions and casual chats. Hence, the DOI and the two-layer measurement model could facilitate the organic diffusion of environmental awareness within communities.

As part of the curricular design, our study suggests that academics can leverage their teaching materials, building upon the videos, pictorial reading materials and lab-based simulated eco-tourism trips. These approaches could garner higher knowledge absorption than textbook materials. When students are watching, reading or going through the videos, pictorial reading materials and lab-based simulated eco-tourism trips, their sensory experiences are active. These teaching materials capture students' attention and also optimise learning outcomes. This multisensory engagement encourages memory retention, deepens understanding, encourages real-world experiences, stimulates curiosity and creates an emotional connection to the subject matter, contributing to a more effective and immersive learning experience. Institutions and policymakers can use these insights to design comprehensive environmental education curricula that engage students through diverse learning approaches and experiences.

Using videos depicting environmental catastrophes can potentially promote SBI by promoting urgency and awareness. Such impactful visuals can cut through indifference and evoke emotional responses, which may lead to behavioural change, particularly when paired with clear, actionable solutions. However, these videos can also provoke eco-anxiety. Excessive exposure to negative content without a sense of agency may result in psychological withdrawal, emotional numbness, or disengagement. Therefore, when students are presented with such content, it is essential to reinforce the purpose of the exposure — answering the question, *"Why should I change my behaviour?"*, with a compelling emotional appeal. We recommend combining emotionally charged content with empowering, solution-oriented strategies to maximise effectiveness and minimise adverse effects.

Limitations

Though our study has important contributions, we do not deny our limitations. We do not measure how much knowledge is missing or how much new knowledge is being added through peer-to-peer knowledge dissemination. It is important to measure the differences to ensure insights into the efficacy of classroom education in shaping advocacy. Proper monitoring of the knowledge dissemination process can help refine educational strategies and improve the impact and reach of students as advocates for shared knowledge. Another limitation of our study is that we do not measure the students' actual behaviour. Recognising the potential discrepancy between perceptions and actions, we proposed that in the future, researchers validate the translation of acquired knowledge into practical application to ensure tangible outcomes between understanding and implementation. We also did not map the intrinsic SBI tendencies to multimodal interventions. This is important, as the outcome can provide a tailored strategy to equip individuals with SBI actions.

Conclusion

Through our study setting, we have used the innovative aspect of this research — to engage students as advocates to promote deeper environmental awareness among their peers and higher SBI. This approach bridges traditional educational gaps by providing a different approach to achieving long-term, meaningful change in SBI and advocacy. Combining a video on environmental catastrophes, pictorial reading materials on environmental issues and lab-based simulated eco-tourism trips can offer a holistic approach to promote SBI by engaging emotions, enhancing awareness and providing simulated learning that inspires individuals to reflect and take

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meaningful action toward environmental responsibility. In conclusion, our study has opened the door for researchers to consider peer-to-peer knowledge transfer and to inquire whether this impacts actual behaviour, offering a deeper and more meaningful avenue for environmental education and behavioural transformation. Another important consideration from our study is that videos depicting environmental catastrophes can be powerful tools to foster SBI. However, such content may also induce eco-anxiety. Therefore, it is crucial to use these videos with care and balance. We recommend that future studies examine how such videos can be combined with emotional engagement and empowerment — presenting the severity of environmental issues alongside actionable steps individuals can take to be part of the solution.

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Ethical standard. The authors affirm that all procedures involving human participants were conducted in accordance with the ethical standards of Universiti Teknologi PETRONAS and Kyushu Institute of Technology. Informed consent was obtained from all student participants involved in the study. To ensure privacy, all data have been anonymized.

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Appendix

Awareness

1. I am aware that global warming poses a significant challenge to society.
2. I understand that conserving energy and resources is crucial for mitigating the impacts of global warming.
3. I recognise that we can enhance environmental quality by reducing our energy consumption and resource usage.
4. Numerous species will face extinction in the coming decades due to human-induced environmental catastrophes.
5. Assertions that the present pollution levels are altering the environment are accurate.

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Knowledge

1. I know how to select products and packages that reduce the amount of waste in landfills.
2. I understand the environmental phrases and symbols on the product packaging.
3. The pollutants generated by various consumer products pose a potential hazard to human health.
4. Overusing chemical fertilisers and pesticides can result in environmental harm.
5. The rise in carbon dioxide levels will contribute to climate warming.

Motivation

1. I see the pleasure in improving the quality of the environment.
2. I see the pleasure in mastering new ways to protect the environment.
3. I like the feeling of doing things for the environment.
4. I want to learn how to protect the earth from human-made disasters.
5. I enjoy reading information about global environmental issues.

Belief

1. Humans must live in harmony with nature.
2. Humankind is severely abusing the environment and causing environmental catastrophes.
3. We are approaching the maximum number of people the earth can support.
4. Natural resources will soon be exhausted if we do not preserve them.
5. A way of preventing natural resource exhaustion is using it when necessary.

Attitude

1. I view documentaries focusing on environmental issues.
2. I promptly caution individuals who are harming the environment.
3. My friends perceive me as someone who is environmentally conscious.
4. I impart my environmental knowledge to my friends.
5. When making a purchase, I prioritise buying recyclable products.

Green mindfulness

1. When removing my waste, I consider the impact on the environment.
2. I contemplated the environmental impact of removing non-degradable materials.
3. I conscientiously consider the environment in my choices of products and purchases.
4. I am mindful not to leave any harmful materials behind.
5. I am conscientious about choosing an appropriate location for disposing of my waste.

Environmental identity salience

1. Practicing pro-environmental behaviour . . . is integral to who I am.

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2. Being a person practising pro-environmental behaviour . . . is something I clearly feel about.
3. Practising pro-environmental behaviour . . . means more to me than having a reputable social status.
4. Being a person practising pro-environmental behaviour . . . is something I always think about.

Eco anxiety

1. I feel anxious/nervous when thinking about climate change.
2. I feel anxious/nervous when thinking about global warming.
3. I feel anxious/nervous when thinking about environmental degradation.
4. I feel anxious/nervous when thinking about resource depletion.
5. I always think about environmental losses due to human-made environmental catastrophes.

Sustainable behaviour

1. Looked up for ways to reuse things.
2. Recycled cans or bottles.
3. Encouraged friends and family to recycle.
4. Purchased products in reusable containers.
5. Picked up litter that was not your own.

Author Biographies

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