



4Ps for fostering social environmental identities: case studies in social entrepreneurship education and education for sustainable development

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Abstract

This study investigates the integration of social entrepreneurship and education for sustainable development courses through a human-centric approach at public universities in Bangkok, Thailand and Tokyo, Japan. It aims to develop design principles for an innovation-driven social entrepreneurship course. Through interviews, questionnaires, and analysis of student projects, the research explores how participation in entrepreneurial activities shapes students' perceptions and social environmental identities. The findings are presented through case studies. At the core of the study is the 4Ps framework—Problems, Projects, Peers, and Purposes. The 4Ps framework highlights how incorporating Problems, Projects, Peers, and Purposes into the learning environment cultivates social environmental identities. Engaging students in project-based, real-world challenges not only deepens their understanding of social and environmental issues but also unites them with a common goal to address these challenges.

Keywords Social entrepreneurship · Education for sustainable development · Environmental identity · Design thinking · Higher education

Introduction

By 2030, the United Nations' Goal 4.7 aims to “ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship, and appreciation of cultural diversity and culture's contribution to

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sustainable development” (UNESCO, 2020). Achieving this ambitious goal necessitates a holistic approach that integrates Education for Sustainable Development (ESD) with entrepreneurship education. This integration is crucial for cultivating an innovative and pro-environmental identity capable of addressing real-world social and environmental challenges through sustainable practices.

Moreover, the United Nations highlights the significance of incorporating entrepreneurship education into broader educational strategies, emphasizing the role of educational and research institutions in promoting science, technology, and innovation, and in developing national systems of innovation (United Nations Conference on Trade and Development, 2010). Embedding entrepreneurship into education should commence as early as elementary level and persist through all educational stages. Curriculum development must be tailored to local contexts, ensuring entrepreneurship is a cross-disciplinary subject to enhance its relevance and impact.

This integrative approach aligns well with research in environmental education, which underscores the importance of critical thinking and active problem-solving in empowering learners to contribute to sustainable societies (Van Poeck & Loones, 2011). Nevertheless, there is a substantial gap in the development of interdisciplinary, hands-on courses that concurrently engage students in ESD and entrepreneurship. These courses should immerse students in practical, community-focused projects, employing participatory teaching and learning methods to foster collaborative decision-making and envisioning sustainable futures (Miura, 2016; UNESCO, 2019).

This study explores the potential of integrating social entrepreneurship (SE) education and education for sustainable development (ESD) to develop design principles for an innovation-driven SE course. Through interviews, questionnaires, and analysis of student projects, the research explores how participation in social entrepreneurial and ESD activities shapes students’ perceptions and social environmental identities.

The research investigates the following questions:

1. In what ways does engagement in innovation-driven social entrepreneurship and ESD activities contribute to students’ social environmental identities formation?
2. How do students’ perceptions of sustainable development evolve through participation in social entrepreneurship and ESD projects?

Literature review

Social entrepreneurship in education

Social entrepreneurship (SE) holds the dual mission of generating both social and economic value (Saebi et al., 2019). It aims to create social value while ensuring financial sustainability. García-González and Ramírez-Montoya (2021) argue that the field of SE can be categorized into two primary schools of thought: the North American and the Europeans. The North American approach emphasizes innovation

in creating social value. This perspective views social entrepreneurs as individuals who introduce new products, services, or processes that address societal challenges in innovative ways. For example, the Grameen Bank provides microfinance services to the poor, thereby creating significant social and economic impacts (Acs et al., 2010).

In contrast, the European approach focuses on collective problem-solving and fostering social change through collaboration. This school of thought emphasizes the role of social enterprises in community development and societal transformation. It highlights the importance of aligning missions with social priorities, often involving various stakeholders to address community needs effectively (Korsgaard & Anderson, 2011).

Education plays a crucial role in involving students in SE. To foster SE education, the curriculum should develop students' abilities to identify and address social problems through innovative and sustainable business solutions (Dobele, 2021). Pedagogical approaches in SE education are diverse and innovative. Hockerts (2018) highlights the importance of experiential learning methods in enhancing students' entrepreneurial intentions and self-efficacy. Schools can significantly improve these outcomes by integrating practical, hands-on activities to students' learning (Hockerts, 2018). García-González and Ramírez-Montoya (2021) underscore the importance of interdisciplinary and transdisciplinary programs that combine technical and soft skills training, preparing students for the multifaceted challenges of SE. Furthermore, collaboration with community partners and industry stakeholders provides real-world learning experiences that are essential for fostering social entrepreneurial activities (Lake et al., 2022).

As innovation is a crucial aspect of SE, it often leverages innovative solutions to address social issues. Kickul and colleagues (2018) advocate for the integration of design thinking into SE education to effectively prepare students for addressing complex social challenges. They emphasize the unique benefits of design thinking—empathy, deep observation, iterative testing, and creative solutions—which are crucial for tackling poorly defined problems inherent in SE. The authors introduce four essential themes for SE education: innovation, impact, sustainability, and scale. They highlight how design thinking fosters innovation by identifying real problems and creating solutions through empathy, enhances impact by promoting deep community engagement, supports sustainability through continuous iteration and feedback. Design thinking complements traditional analytical methods by fostering creativity and human-centered problem-solving, thus enhancing student learning and outcomes across these themes (Kickul et al., 2018).

The impact of SE education on students is profound. A study by Baltador and Grecu (2023) shows that SE education enhances students' entrepreneurial skills, attitudes, and behaviors, equipping them to tackle social and environmental challenges effectively. Moreover, pedagogical contents have a significant influence on students' intentions toward creating social ventures, with attitudes mediating the relationship between social entrepreneurial pedagogy and behavioral outcomes (Adelekan et al., 2018). By integrating SE education and fostering support from stakeholders, schools can significantly enhance the social and economic impact of their students, contributing to sustainable development and social change.

Education for sustainable development

SE education is ideal for incorporating it to Education for Sustainable Development (ESD) practices. SE education is pivotal in developing future leaders capable of addressing complex social challenges as it focuses on addressing long-standing societal needs such as poverty, education, and health through sustainable business models (Certo & Miller, 2008). Moreover, the interplay between social and economic missions often requires social entrepreneurs to carefully balance these social and economic outputs (Muñoz & Kimmitt, 2019).

ESD is emerging as a unifying theme in education, addressing various sustainability aspects such as climate change, disaster risk reduction, and biodiversity (UNESCO, 2012). ESD is founded on the belief that education is a crucial tool for development. Numerous studies indicate that effective ESD classes should empower students to take transformative actions toward sustainability (UNESCO Executive Board, 2019). ESD is not merely about adding sustainability as an additional topic to the curriculum; rather, it enables learners to contribute to sustainable societies through critical thinking and active problem-solving (Lambrechts & Hindson, 2016). The ESD for 2030 framework suggests that learners must first step out of their comfort zones and become critically aware of the world's current problems and conditions. Therefore, cultivating active participants requires teaching methods that extend beyond traditional lecturing. Students should engage in analysis, reflection, and action for both local and global citizenship, actively participating in an interdependent and rapidly changing world (Honan, 2005). Similar to SE education, which emphasizes community involvement, a community-based approach to ESD empowers local communities to address their issues and lay the groundwork for sustainable development. In ESD, knowledge and values about the environment should not operate in isolation (Cutter-Mackenzie & Edwards, 2013). Participation in environmental programs enhances connections with nature, fosters environmental stewardship, and increases interest in learning and discovery (Stern 2008). Engaging with local communities is crucial because community members are the primary stakeholders most affected by local environmental issues, making them experts in contributing to solutions (Sigauke, 2020).

Effective teaching and learning methods for ESD should be project-based and incorporate three key components: they should be interactive and participative (e.g., group discussions and peer assessments), research-oriented (e.g., problem analysis and values clarification), and action-oriented (e.g., solving real community problems). Additionally, ESD competencies generally require future thinking, an interdisciplinary approach, personal involvement (reflection, empathy, motivating oneself and others), and a focus on values and ethics (Lambrechts et al., 2013). In alignment with progressive pedagogies, Resnick (2017) introduces the four P's of creative learning as a foundational principle for designing playful, project-based learning environments. This framework emphasizes four key elements: Projects, Peers, Passion, and Play. Resnick argues that students learn most effectively when they are playfully involved in projects they are passionate about and find meaningful. These ESD pedagogies are crucial in designing SE classes that incorporate ESD values.

Social environmental identity

Encouraging young learners to engage in critical inquiries about society and environment while empathizing with others helps them develop values and lifestyles aligned with their sense of identity. Kempton and Holland (2003) introduces the concept of “social environmental identity,” which emphasizes social contexts over natural settings. This process fosters an identity that supports environmental stewardship and promotes positive impacts on both the environment and society (Kempton & Holland, 2003). Identity can be further understood through one’s self-definition in relation to the natural world and how this relationship shapes self-concept. Social environmental identity refers to an individual’s self-perception as intrinsically connected to the natural environment and the broader society. The belief that the environment is a crucial part of their identity, influencing their actions in the world (Clayton et al., 2021; Kempton & Holland, 2003). Environmental identity is shaped by both social and environmental factors and can guide behavior across various situations and contexts (Stets & Biga, 2003).

Clayton (2003) proposed several individual-level elements influencing environmental identity, including personal history, emotional attachment, autonomy, relatedness, competence, and pro-environmental motivation. To foster environmental identity, Kempton and Holland (2003) proposed three stages:

1. **Salience Stage:** An individual becomes more aware of environmental issues.
2. **Identification Stage:** An individual begins to see themselves as an environmental actor.
3. **Activism Stage:** An individual becomes more knowledgeable about engaging in environmental action, mentorship, and educating less experienced members, which develops through action.

Applying Kempton and Holland’s foundational work, Stapleton (2015) studied how an ESD program focused on climate change impacts can help develop students’ environmental identities. Stapleton reports that social interactions are crucial in the development and maintenance of environmental identities. Interacting with various people can help shift environmental identity. For example, direct interactions with people affected by climate change make the issue more real and concerning for many youths, generally moving them toward the salience stage. In the identification stage, interactions with peers influence the engagement of many youths in environmental activity. Participants in environmental programs interacting with different groups may experience varying impacts. Involvement in a peer group that discusses and strategizes about environmental issues may help students become environmental actors, which is the third stage of environmental identity development. Moreover, developing an environmental identity requires programs that bring different groups of participants together in a supportive, nonjudgmental, and open community where they can share knowledge and explore methods to carry out environmental action.

In designing SE and ESD courses, one must facilitate experiences that help students develop a deep connection to nature and see themselves as active

contributors to their communities, promoting values of environmental identity. By integrating emotional, cognitive, and behavioral aspects of environmental identity, educational programs can enhance students' long-term commitment to sustainable practices and positive environmental action (Clayton et al., 2021; Stapleton, 2015).

Methods

The study is a two-year research project which engaged undergraduate and graduate students at two public universities in Bangkok, Thailand and Tokyo, Japan. The study is grounded in innovation-driven SE and ESD classes employing qualitative research methods using pre- and post-interview data, post-class questionnaires, and class assignments. Two-year iterative nature of the classes allows the researchers to develop a design principle that emphasizes making relevant environmental and social connections to their learning experience. The iterative nature is also helpful in improving both the course design in different cultural contexts and developing a better understanding of students' learning experiences.

Site and participants

Innovation-driven SE and ESD course comprised 16 sessions (see Table 1). This research is a two-year study conducted at public universities in Bangkok and Tokyo. Both courses were taught online during the COVID-19 lockdown. All names used in the paper are pseudonyms. Table 2 illustrates the participants' demographic information from both implementations (see Table 2).

Bangkok implementation

The Bangkok implementation consisted of weekly 3-h classes over a 3.5-month semester. The course, taught in Thai, was an elective open to all undergraduate students at the university. There were 38 students, including 19 females and 17 males. Most students were freshmen, with approximately 30% being sophomores. The majority of the students came from health sciences disciplines such as Pharmaceutical Sciences, Medicine, and Dentistry (see Table 3). The course was instructed online.

Tokyo implementation

In Tokyo, each class lasted 1 h and 40 min, held twice a week over a 2-month quarter system. The course catered to graduate students in the Transdisciplinary Engineering Program, School of Environment and Society. It was an international program with students from various countries (Table 4). The course was taught in English, and 22 students participated, including 7 females and 15 males.

Table 1 Innovation-driven SE and ESD course structure, *Source* Author

Exploration		Execution	
# of session	Session	# of session	Session
1	Research explanation	1	Brainstorming on the chosen SE project
2	Introduction to the United Nations' Sustainable Development Goals and education for sustainable development	1	Prototyping
1	Introduction to Design Thinking	3	Studio hours (making, group work session) Materials and skills needed Progress report ++ today's goal Group work, office hours
2	Workshop on empathize and interviewing stakeholders	1	Reflecting on stakeholders feedback
3	SE Perspective sessions, exploring different Sustainable Development Goals through the lens of social entrepreneurs	1	SE and ESD Project pitching day

Table 2 Participants' demographic information, *Source* Author

Location	Bangkok	Tokyo	Total
Actual class size	41	27	68
Participants (consensual)	38	22	60
Female students	19	7	27
Male students	17	15	32

Table 3 Bangkok implementation participants by majors and years, *Source* Author

Major	Freshmen	Sophomore	Total
Pharmaceutical Sciences	6	7	13
Medicine	11	0	11
Dentistry	5	0	5
Communication	3	0	3
Economics	0	2	2
Agriculture	2	0	2
Political Sciences	1	0	1
Business	1	0	1
Total	29	9	38

Table 4 Tokyo implementation by nationalities, *Source* Author

Nationalities	Number of participants
Chinese	9
Japanese	4
Thai	4
Indonesian	3
Cypriot	1
Jordanian	1
Total	22

Innovation-driven SE and ESD course design

The learning objective of the innovation-driven SE and ESD course is to empower students to take the role of social entrepreneur in designing projects that address social and environmental challenges while also having business value. Student projects may focus on, but are not limited to, sustainable lifestyles, human rights, gender equality, global citizenship, and the appreciation of cultural contributions to sustainable development.

In the course, students engaged in discussions and explorations of social, economic, and environmental issues both within their localities and beyond. Students shared their proposed solutions with group members, fostering collaborative learning. Each group conducted user experience research to investigate social and

environmental problems of interest, aiming to understand potential customer and market fit.

SE business cases and social entrepreneur guest speakers were incorporated as part of the teaching methods. Guest speakers from various fields related to the Sustainable Development Goals (SDGs) were invited to provide new perspectives and inspire project ideas. The second part of the course emphasized designing and creating innovative solutions for selected local or global sustainability issues using the design thinking process, business design canvas, and fabrication tools. Students followed the design thinking steps by empathizing with target customers' problems, constructing problem statements, and brainstorming to come up for solutions that address their target customers' needs.

The students then created prototypes to facilitate thinking, learning, and obtaining feedback from the community, iterating on their designs accordingly. Students were encouraged to utilize digital tools and fabrication equipment, such as 3D printers and microcontrollers, in their innovations.

Toward the end of each class, students pitched their SE and ESD projects and shared knowledge about target customers' feedback. This hands-on, project-based course, situated in a maker-centered learning environment, provided opportunities for students to design and create. The final project aimed to develop the skills, knowledge, awareness, and attitudes necessary for students to address identified issues and contribute to building a sustainable future.

Data collection

Interviews

To prevent coercion or undue influence on students joining the research, the researcher was not involved in the interview data collection process. For research activities such as recruitment, consent processes, interviews, and questionnaires, independent research assistants collected, managed, transcribed, and anonymized the data under Institutional Review Board from both institutions. The researcher remained blinded to the identity of participants until after grades were posted. The recruitment and consent process did not unduly disrupt typical classroom learning. The research explanation, consent forms, and interviews were conducted by the research assistants, who were independent of the class.

Of the 60 students in both implementations, 20 were randomly selected for interviews prior to the implementation. An additional eight students were interviewed post-implementation, totaling 28 interviews. The interviews followed a semi-structured format. Students were interviewed at the beginning of the class to determine their experience with the SDGs, SE, and their knowledge of relevant making and technology concepts or skills. In the post-implementation interviews, students were asked about their experiences of making SE and ESD projects alongside their peers. The goal was to understand how making projects for social and environmental betterment influenced the students social environmental identities and may have developed an interest in SE and sustainable development.

Students' exit questionnaire

All students who participated in the research completed an open-ended exit questionnaire. The questionnaire included questions such as: "After taking the class, what do you think sustainable development is?" "How would you describe this class to other students who haven't taken it?" and "How would you apply the knowledge and skills gained from this class to daily life or other classes in the future?" Additionally, there was a Likert scale question assessing students' satisfaction with the class and their perceived usefulness of the content.

Class assignments

Throughout the course, students produced a variety of class assignments and artifacts, including in-class worksheets, photographs of their projects during the construction process, prototypes, and final projects.

Data analysis

This study employs a qualitative research approach grounded in the principles of case study methodology (Creswell et al., 2007). The case studies helped the researcher answer the first research question: In what ways does engagement in innovation-driven SE and ESD activities contribute to the formation of students' social environmental identities?

Case study research involves exploring an issue through one or more cases within a bounded system, such as a specific setting or context (Creswell & Poth, 2007). This approach examines the bounded system over time, utilizing detailed data collection from multiple sources of information, including observations, interviews, and artifacts such as reports, final projects, and assignments. In a case study (Stake, 1995), the researcher focuses on an issue or concern and then selects a bounded case to illustrate this issue.

Data collection in case study research is typically extensive, utilizing multiple sources of information (Creswell & Poth, 2007). Early in the data collection process, the researcher ensured that the data were well organized, creating a digital folder for each student. The researcher reviewed artifacts, selecting those relevant to the chosen students. Data were organized chronologically to investigate students' progression in social environmental identity and their handling of challenges throughout the social entrepreneurship project process. In selecting cases, the researcher established a rationale for a purposeful sampling strategy, focusing on student group with compelling narratives that could support or challenge existing beliefs (Creswell & Poth, 2007).

In constructing comprehensive case studies, the researcher employed several methods of data analysis to address the second research question: How do students' perceptions of sustainable development evolve through participation in social entrepreneurship projects? The initial approach involved analyzing preinterview,

post-interviews, and post-class questionnaires. A coding scheme was developed to quantify instances where students discussed their experiences.

Using Dedoose software, the researcher examined segments of the transcripts related to the students' experiences with (1) environmental identity, (2) empathizing with community needs (target customers), (3) direct interaction with problems, and (4) social learning. Data were coded using a "bottom-up" approach, allowing themes and coding categories to emerge from data patterns (Miles et al., 2014). For instance, one code captured students' reflections on their experiences in the identification stage of identity development, with phrases such as: "I have already known that there are various issues that need to be managed. If one day I have a chance to be a part of solving one of these problems, I know how to solve it and know whether a problem connects to other issues."

Limitations when studying identity

Studying identity presents inherent challenges due to its complexity and context-specific nature. Moreover, identity is dynamic and continuously evolving. An individual's identity comprises multiple facets, not all of which are expressed simultaneously (Wenger, 1998; Wortham, 2006). Although the researchers conducted interviews with the students 1–4 months before and after their experience, it is not possible to determine the lasting effects on their identities.

The analysis in this study focuses on the changes observed at the time of the implementation. It is important to note that the reported changes are based on students' self-assessments. The open-ended nature of the interview and questionnaires questions encouraged honest and reflective responses, providing meaningful insights into their identity shifts.

Findings

Case Study from the innovation-driven SE and ESD courses

This section describes two case studies from implementations in Bangkok and Tokyo, highlighting the narratives of how students collaboratively developed projects of interest and reflected on their SE and ESD initiatives. These case studies provide insights into the processes and outcomes of engaging students in SE and ESD classes. By exploring the projects, readers can understand how students applied their interests and technical skills to address critical social and environmental issues, developed a deeper awareness of these challenges, and transformed their perspectives to see themselves as active contributors to sustainable solutions. These cases are particularly useful in demonstrating the importance of understanding the problems of target customers, working on projects, having a purpose, and collaborating with peers in fostering a sense of environmental identity and activism among students.

Case 1: the butterfly effect: student activism in gender equality

The first case investigates how engagement in innovation-driven SE and ESD activities contribute to the formation of students' social environmental identities, focusing on gender equality during the Bangkok implementation.

The class structure was student-driven, allowing them to choose their classmates and topics of interest by SDGs. The team consisted of seven freshmen from the Faculty of Dentistry and the Faculty of Communication, including six female members and one male member.

While exploring the SDGs, all members identified Goal 4: Quality Education as a priority. Nin from the Faculty of Dentistry described education as a "door" for average individuals to ascend the social ladder. Another team member Koranat, identifying as bisexual and growing up in conservative southern Thailand, added that gender inequality is deeply rooted in schools. She shared experiences of gender discrimination, such as classmates being prohibited from wearing hijabs in school. Other members noted that gender issues impact identity and that Thai society is still opening up to gender diversity.

Inspired by a guest speaker on LGBTQ+ rights, the team shifted their project to SDG Goal 5: Achieving Gender Equality. They recognized that gender inequality affects not only women but also men and diverse gender groups. They named their team "Butterfly," based on the Butterfly Effect theory, suggesting that small actions can lead to significant impacts. They hoped their SE and ESD project could contribute to positive change.

Through research, the team found that LGBTQ+ individuals globally face discrimination in schools, communities, and workplaces. They believed everyone deserves equal rights and opportunities for physical and mental health. Targeting Thai schoolchildren, the team aimed to instill values of gender equality early, as diverse school environments can sometimes lead to ridicule, affecting children's mental health. They aspired to use tangible outputs as soft power to influence societal attitudes without imposing a uniform mindset.

To better understand the issue, the team interviewed two 18-year-old LGBTQ+ individuals in Thailand, who reported increased acceptance but persistent discrimination, such as discomfort in gender-binary restrooms and the lack of gender-neutral titles in official documents. The users emphasized the importance of fostering gender sensitivity from a young age. They also interviewed moms of young children to better understand the prospect of their target customer, in developing products targeting children. Patara reflected that interviewing these users enhanced his understanding, helping him see real issues beyond his initial perceptions. Patara, the only male member, noted that while women and LGBTQ+ individuals often face inequality, some men also experience it, stressing the need for gender equality based on mutual comfort. He admitted later the post-interview that he initially felt uncomfortable in the all-girl group but learned to engage in discussions.

The team defined their problem statement: "How might we raise awareness for younger generations on gender equality so that people in the LGBTQ communities and other marginalized groups feel they belong and can freely express themselves?"

As the class was 100% online with members based in different regions of Thailand, Google Jam board and Zoom were used to collaboratively create a mood board for the project. Nin described this process as her favorite, appreciating the collaboration and the fusion of diverse perspectives from students in different disciplines. She said, “I loved that everyone is posting their ideas on Google Jam board (Fig. 1). It makes me want to come up with cool ideas so that my teammates know that I can also come up with good ones. I also loved how we ended up combining a lot of ideas together.” She appreciated working with students from other disciplines, saying, “Our team comes from the Faculty of Dentistry and Communication. We’re totally different species. Their perspectives wowed me, and it was clear that our different perspectives could contribute to the project.”

The team decided to create gender-diverse dolls, addressing the gendered nature of existing market options. Nin reflected, “We hope to educate the new generation without forcing too much.” Although the idea of gender-neutral dolls is not entirely novel (Mattel launched its first gender-neutral Barbie dolls in 2019 (Yuhas, 2019)), each member contributed to the concept design of the dolls. They explored gender-neutral dolls and other gender-related issues, such as same-sex marriage dolls, a doll with a hijab, a doll advocating for free sanitary napkins, a Thai feminist icon doll, Paralympics athletes, and a unisex doll. Creating minimum viable product (MVP), the team focused on two dolls: a unisex doll with the theme “fashion has no gender” and “La-ia-d Pibulsongkram,” a Thai feminist icon from World War II. They chose a local icon to resonate with their primary audience, Thai children. Nin expressed a desire to teach kids that gender equality is essential and to avoid judging others for their differences. Despite being fully online, team members collaborated effectively using Google Jam board and Zoom, each contributing to the design of the dolls and their packaging, which included engaging educational content. They came up with business plan and

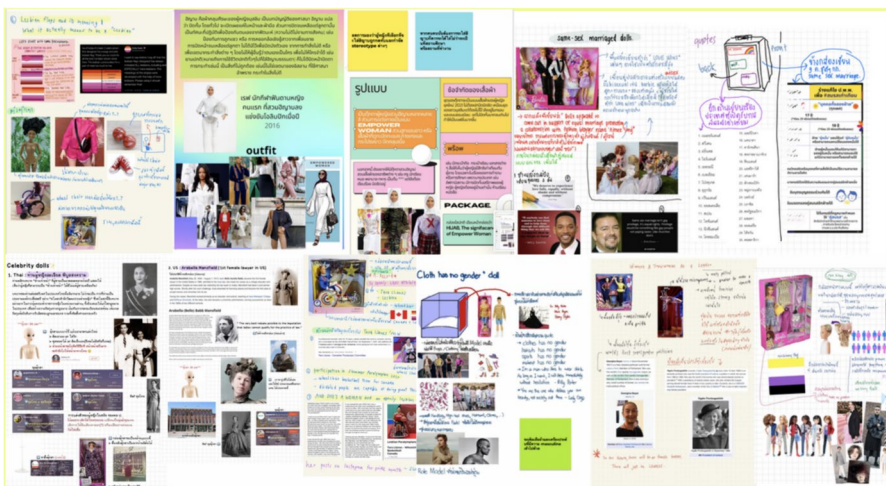


Fig. 1 Butterfly’s Concept Design on Google Jam Board, Source Butterfly

pitched their SE and ESD ideas at the end of the course and reflected upon their SE and ESD journey.

Korانات reflected that the dolls served as “soft power” to instill gender equality values in children, noting that while change takes time and is hard to measure, awareness at a young age can help address societal gender inequality. Moreover, Patara initially felt distant from being a changemaker, expressing doubts in the pre-interview. However, by the post-interview, he realized that “being a changemaker isn’t about creating inventions that change the world, but solving everyday problems in society.” He highlighted the importance of “attention to detail, such as communication techniques,” and the value of sentimental connections, which are often overlooked but essential. Similarly, Nin shared that while she’s “not a full changemaker yet,” brainstorming with her peers made her feel like one, prompting her to think more deeply and consider multiple perspectives, which inspired their project ideas.

Case Summary: This case study explores how engaging in innovation-driven SE and ESD activities helped students develop a deeper understanding of gender equality while forming their identities as contributors to society and the environment. The students progressed through Kempton and Holland’s (2003) three stages of environmental identity development: salience, identification, and activism. Initially, they became aware of gender equality issues through direct interactions with guest speakers and real-life stories. Collaborating in a diverse team, the “Butterfly” team decided to create gender-diverse dolls to educate the new generation. Their work fostered positive social interactions, enhancing their commitment to the cause. Personal histories further influenced their engagement, motivating them to design educational toys that promote gender equality. Throughout the project, they mentored each other, sharing knowledge and skills, which exemplified their progression to the activism stage. This journey highlighted their growth from awareness to active advocacy, showcasing their role as changemakers in promoting gender equality.

Case 2 RinSE: from awareness to action

The RinSE project was developed by six graduate engineering students from the Tokyo implementation, motivated by SDG 6: Clean Water and Sanitation. With members from four different nationalities, the team aimed to address water scarcity challenges in Cyprus by guiding independent farmers toward environmentally conscious and drought-resistant agricultural methods. The project focused on creating a comprehensive platform that educates farmers about drought precautions and supports sustainable agricultural practices.

Initially, the team debated which SDG to address, considering health and well-being before shifting to water scarcity, due to Aaron’s connection with the Water Development Department of Cyprus, as the issue aligned with his research interests. The team was also inspired by a guest speaker who is a social entrepreneur from the “Ricult” application, which uses machine learning to predict and increase farmers’ production. Lin, a student from China, shared, “[The guest speaker] showed me that if we use it in the correct way, the application can solve a lot of problems that I never thought it could help with. I found that innovation is

about how we could understand user's problems and come up with solutions that address their needs while having business values."

The team then conducted interviews with an expert at the Water Development Department of Cyprus. From the interview with the expert, the students learned that climate variation began to change considerably in the 1990s, rendering the government's dam-building calculations insufficient to supply the population's water needs due to altered water balances. This necessitated the addition of water recycling and desalination. The expert highlighted concerns about prolonged droughts and their potential damage to agriculture, noting that the industry remains highly vulnerable to such events.

Shahem, member from Jordan, emphasized the importance of focusing on individual users, advocating for a customer-centric approach. He explained, "We had a lot of debate because Aaron had a different point of view, focusing on city-wide or governmental solutions. But for me, it should be focused on people who are directly impacted by the drought." This approach allowed the team to bridge governmental goals and farmers' needs, identifying gaps and creating solutions that addressed both perspectives. Thus, they interviewed additional user to further understand the impact of water scarcity.

The team interviewed George, a small restaurant owner in Nicosia. George runs a small taverna with narrow profit margins and is highly sensitive to fluctuating commodity prices. During a five-year drought starting in 2008, the government imposed 36-h weekly water supply cuts, forcing George to close his restaurant on certain days. The drought also caused fresh produce prices to skyrocket, further squeezing his margins. Although potable water availability has improved since 2008, small businesses like George's still struggle during droughts due to insufficient water for agriculture and industry.

When the team were discussing about SE and ESD project ideas, Aaron realized that an application focused solely on drought would not engage users until it was too late. He noted, "You need to create an application that people can use before there's a drought. It should guide users on what crops to plant and suggest drought-resistant options." This insight led to the development of a proactive platform that supports farmers year-round, integrating soil recognition, water calculators, and government resources.

As a result, the RinSE project aimed to develop a robust and comprehensive platform to address the diverse challenges faced by farmers in Cyprus and globally, particularly focusing on drought resilience. The platform includes several key components: soil recognition technology, which allows farmers to identify soil types through smartphone photographs, a water calculator that helps determine precise water requirements, an intelligent chatbot offering real-time support, and an information hub providing expert articles, case studies, and best practices for sustainable agriculture (Fig. 2). Lin who was responsible for the chatbot, reflected on the importance of understanding user needs. He noted, "From this course, I learned what SDGs and SE are. This thought may affect every project I make in the future. More importantly, for the first time in this class, I completed a project with a high degree of completion through teamwork."

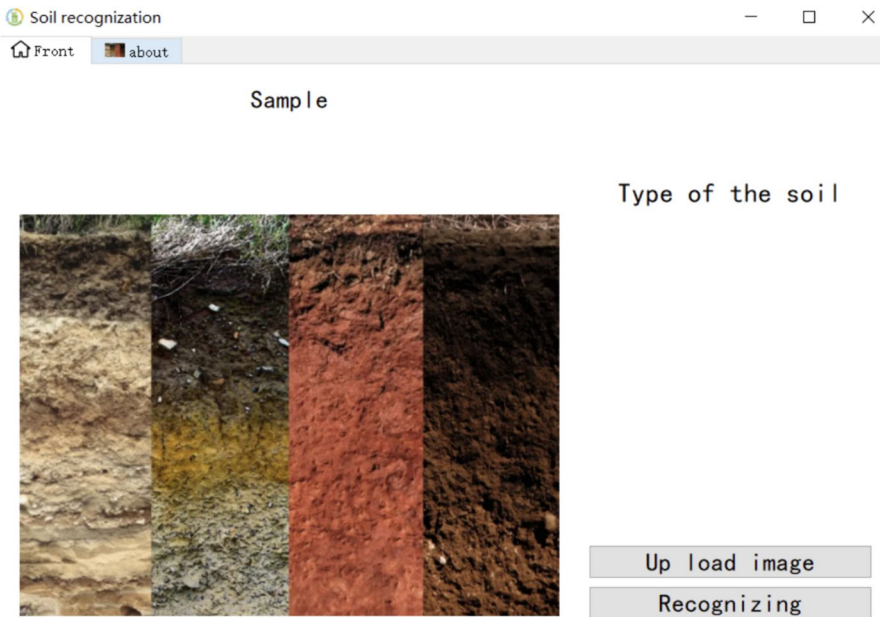


Fig. 2 Screenshot of RinSE Soil Recognition Interface, *Source* RinSE

Shahem emphasized the importance of continuous learning, design thinking, and collaboration. Reflecting on the class experience, he highlighted that the project involved issues he had never deeply explored before, such as agricultural problems from a governmental perspective involving weather mapping, forecasting stations, water calculations, and soil recognitions. He stated, “Probably the most important of all, is to have a positive attitude toward each given challenge; when we were told to make a project that utilizes technology and we would require to learn some application design, some programming, chatbot integration and so on. We treated the task as an opportunity to research and test what can be done in these areas.” Shahem also underscored the importance of narrowing focus to specific contexts and emphasizing that a strong team dynamic and willingness to learn and contribute were essential to their success. “Luckily, we had a great team dynamic and each of us were competent to deliver and learn for the sake of not letting others down. And I believe this mindset is the most important takeaway and the most important that I would keep up in future work and classes.”

By integrating these features, the RinSE platform empowers farmers to combat drought, optimize water usage, and access government resources, ultimately supporting sustainable agricultural practices and fostering resilience in water-scarce regions.

Case Summary: This case study examines how six graduate engineering students from a public university in Japan developed the RinSE project to address water scarcity in Cyprus. Driven by SDG 6: Clean Water and Sanitation, the team created a comprehensive platform to guide farmers in sustainable agricultural practices.

Initially, they faced challenges working as a team. However, throughout the project, the students learned about the situation in Cyprus through Aaron's advocacy and connections with experts. They leveraged each other's engineering expertise to develop various aspects of the platform, such as coding skills and technical knowledge in water management.

At the project's inception, they identified potential customers and consulted with experts. As they worked together, they identified George, a restaurant owner directly affected by the drought, as a key stakeholder. Through this project, the students not only applied their technical skills to address a critical environmental issue but also developed a deeper understanding of how their expertise can be used for social and environmental good. This transformative experience highlighted the impact of engineering solutions on real-world problems and reinforced their roles as changemakers in promoting sustainable agriculture.

The shift in students' perceptions of sustainable development: data overview

Zooming out from the case study, this section provides a data overview of the rest of the students involved in both Bangkok and Tokyo implementations.

Before and after the class, students were asked, "What is sustainable development to you?" Interviews and post-class questionnaires reveal a significant shift in their understanding. This section highlights three emerging themes from the data.

Initially, in both Bangkok and Tokyo implementations, awareness of sustainable development varied, with 20% of students viewing it primarily as an environmental issue. However, through participation in hands-on entrepreneurship projects, their perceptions evolved to embrace a more holistic, global, and social understanding of sustainable development.

In the pre-class interviews, students often saw the SDGs as an abstract international framework, distant from their immediate concerns. As the class progressed, they recognized how their actions, particularly in problem-solving, could contribute significantly to sustainable development while considering future generations. This shift underscores the impact of practical engagement on students' understanding and commitment to sustainable development.

Theme 1: From Solely Environmental Issue to a Holistic View

The preinterview data revealed varying levels of understanding about sustainable development among undergraduate students. Notably, 20% of the students interviewed initially identified sustainable development solely as an environmental issue. For instance, Bandit from the Faculty of Pharmacy stated, "Environment is one of the controlled factors to develop sustainably. So, sustainable development is to use resources or what you have to make continuous development." Similarly, Patara, emphasized the efficient use of natural resources and added, "Sustainable development is to use alternative energy like recycling things." This perspective was echoed in Tokyo's implementation. For example, Budi from Indonesia remarked, "How we

can develop something without neglecting the impact on the environment. So in the end, the environment will be sustained for our future generations.”

In contrast, from the post-interview data in Bangkok’s implementation, eleven of fifteen students interviewed perceived sustainable development not just as an environmental issue but from a more holistic perspective that included social dimensions. For example, a student explained, “It’s not just economic development. It develops every aspect, including the economy, society, and people. The development must balance everything at the same time. Each aspect supports each other and it will develop sustainably.” Similarly, Patara stated, “It is a development that everyone sees that we are facing the same problems both within the country and internationally. And we must help each other to eliminate those problems so that everyone can live happily and peacefully in this world, both human society and nature.”

Exit questionnaire data further support this shift in perspective, showing that eleven students from Tokyo’s implementation and eight students from Bangkok recognized that sustainable development could be interpreted in many different ways, and it needs to fully consider and balance the wider or future impact we face as a society in terms of environmental, social, and economic limitations. As one student put it, “sustainable development is not only about the environment but also ensuring a healthy and just society, meeting the diverse needs of all people.”

Theme 2: From Abstract Principle to My Own Action

In the Bangkok implementation, six out of ten students identify sustainable development as a principle that they have heard vaguely. For example, Thanadej from the Faculty of Medicine said, “I knew that there are 17 topics but don’t know what they are.” Rujipat from the Faculty of Political Science recalled briefly hearing about it in high school but without much detail. Natnaree from the Faculty of Pharmacy, one of the few familiar with the concept, described it as “methods or principles that can cause development and produce good results that benefit society.”

Four out of ten students in Tokyo’s implementation identify sustainable development by articulating the United Nations’ SDGs principle. Zack explained, “Development that does not hinder future developments—something that will progress without falling backward.” Lin noted that he took many classes at the university on SDG, “I studied SDGs for many classes. But most of the classes is taught in a very same way, like to talk about how important of it, how we should decide project.” This finding shows that the students perceive sustainable development as a distant concept or principle rather than a relatable practice.

In exit questionnaires, 9 out of 22 students from Tokyo recognized sustainable development as a more tangible concept and viewed themselves as active contributors by addressing social and environmental issues. One student remarked, “The SDGs are clear goals that promote global efforts to tackle various issues. By incorporating design thinking and prototyping, I feel I am getting closer to achieving these goals.” Another student wrote on the questionnaire that for him sustainable development is “innovating to help those facing problems or solving existing issues effectively and practically, allowing those helped to utilize solutions sustainably for future progress. In class, developing various skills for learning, such as thinking,

designing, collaborating, problem-solving, and planning, encourages unrestricted idea proposals and promotes substantial learning, applicable in daily and future life for sustainability.”

Similarly, in the Bangkok exit questionnaire, 15 out of 38 students emphasized the importance of “problem-solving” in their understanding of sustainable development. One student highlighted, “It’s about deeply considering the causes of problems, having a clear problem statement, and finding efficient, long-term solutions.” Another added, “Solving problems accurately by addressing core issues leads to sustainable development.” Interviews further reinforced this relatable shift, with eleven of fifteen Bangkok students recognizing sustainable development as a practical approach to problem-solving. Worawit stated, “It’s about addressing current issues and finding long-term solutions for continuous improvement.”

Theme 3: Care for Future Generations

The exit questionnaire responses, totaling 60 from both implementations, revealed that 30 students mentioned sustainable development in the context of future implications. They highlighted the importance of considering future generations, emphasizing the need to “solve problems by using resources most effectively, maximizing positive outcomes without troubling future generations.” One student expressed the goal of “finding solutions that ensure stability and happiness in our lives while improving the future for subsequent generations.”

This focus on future generations underscores a growing awareness among students that sustainable development requires a balance between present needs and long-term impact, fostering a commitment to responsible solutions. They also see themselves as problem solvers and innovators, ready to contribute to sustainable change.

Discussion: 4Ps for fostering social environmental identities

The focus of sustainable development on collective problem-solving and fostering social change through collaboration underscores the role of social enterprises in environment and societal transformation (Korsgaard & Anderson, 2011). Cultivating social environmental identities (Kempton & Holland, 2003) in students within SE and ESD courses is crucial. This study argues that learning environments should promote project-based learning through collaborative engagement with real-world problems. This will allow students to not only deepen their understanding of social environmental issues but are also motivated by a shared purpose to address these challenges. Employing the design framework of 4Ps: Problems, Projects, Purposes, and Peers—adapted from Resnick’s (2017) framework for creative learning—the study examines how learning environments can be structured to support the development of social and environmental identity across three stages: Saliency, Identification, and Activism (Fig. 3).

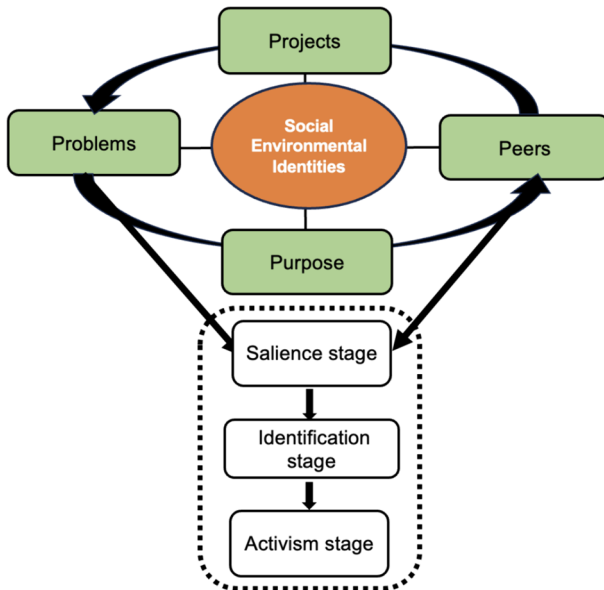


Fig. 3 Diagram of 4Ps for Fostering Social Environmental Identities, *Source* Author

Problems

By initiating project inquiries with concrete “Problems,” students are deeply connected to real-world issues that go beyond theoretical learning (Van Poeck & Loones, 2011). This approach empowers students to directly confront sustainability challenges, encouraging them to engage in thorough investigations that explore diverse solutions and prompt actionable responses to environmental and social issues.

A key component of this approach involves the class instructions that allow students to better understanding the problem through methods such as desk research, interviews, observations with target audiences, and engagement with field experts. These processes enable students to uncover the underlying causes of social and environmental challenges, enhancing their ability not only to comprehend complex issues but also to actively contribute as effective problem solvers. According to Kempton and Holland (2003)’s social environmental identities, “Salience stage” is critical as it prompts individuals to become aware of and responsive to environmental challenges. The findings support the role of instructional strategies like guest speakers, problem-based learning, experiential learning, and fieldwork interviews in facilitating this salience stage.

For instance, students such as Nin from the Butterfly group explored issues like gender inequality, leading to personal reflections on biases and societal perceptions:

“From learning about the 17 SDGs, I discovered numerous issues that were previously unknown to me. Moreover, I observed that some countries face

more severe issues than ours, particularly concerning gender equality. People often underestimate women’s capabilities, a bias I once held until our group project enlightened me on the seriousness of gender inequality”.

Nin’s experience in grappling with gender inequality issues resonates with Kempton and Holland’s (2003) concept of heightened awareness or a “waking up” moment, often triggered by direct experiences such as environmental degradation in their local communities or threats of displacement from familiar environments.

In the Tokyo implementation, the RinSE team conducted multiple interviews with water experts in Cyprus as well as with people directly impacted by the drought problem. This helped them better cultivate an interest in the problem and explore solutions more deeply. Moreover, students like Lin from RinSE, who had prior exposure to SDG-related coursework, reflected on their learning experiences. Lin mentioned in his post-interview how insights from the CEO of Ricult, a social enterprise specializing in agricultural technology, inspired his team’s project approach:

“Learning about Ricult’s efforts to predict crop yields and improve farmer productivity opened my eyes to the challenges faced by farmers. This understanding motivated my team to tackle the drought issue in Cyprus, empathizing with local restaurant owners directly impacted by water scarcity”.

Lin and his RinSE teammates’ proactive response exemplifies the practical application of SDGs in addressing real-world challenges, marking their transition toward the salience stage of awareness and action.

Projects

The concept of “Project” within this 4Ps design framework emphasizes active engagement in meaningful, hands-on endeavors where students generate ideas, design prototypes, and iterate toward solutions (Resnick, 2017). This section explores how working on SE projects contribute to their understanding of sustainable development and their overall engagement in the class. Working on SE projects underscores the student-centered nature of the learning process, where small groups collaboratively tackle real-world challenges (Chiang & Lee, 2016; Teff-Seker et al., 2019). These projects are designed to tease out solutions to problems identified through guided master questions or brainstormed by students.

By focusing class outputs on SE projects that address real-world issues through project-based learning students move into the “Identification Stage.” This stage marks their transition from passive learners to active participants in environmental action (Kempton & Holland, 2003). It involves recognizing their role as agents capable of effecting change, rather than relying solely on governmental or external interventions.

From the first case study, students begin to perceive themselves as empowered changemakers, applying their knowledge to tangible challenges. For instance, the Butterfly team’s SE project on gender equity through soft toys exemplifies this agency:

“I’m inspired by how my peers perceive gender inequality, their desires for change, and strategies for enacting it”, remarked Pichapon from the Faculty of Communication Arts. Pichapon reflected on how her team aspired to work on the diverse doll project. She elaborated, “To address real societal issues, I propose using toys to educate children about bullying and LGBTQ+ acceptance. Many children face bullying and discrimination due to lack of education on diversity. By introducing dolls that normalize LGBTQ+ identities, we aim to foster inclusivity from a young age”.

Condliffe et al. (2017) mention that PBL has roots in the progressive education movement that called for more student-centered and experiential approaches to education and the need for the promotion of deeper learning through active exploration of problems facing the world. This project not only demonstrates students’ agency in addressing pressing real-world social issues but also reflects their commitment to societal transformation through using doll as educational tools.

Purposes

The concept of “Purposes” in this framework underscores the intrinsic motivation that drives meaningful learning experiences. Learning processes are intentionally designed to align with students’ needs, concerns, and interests, empowering them to engage in projects that resonate personally and contribute to broader societal goals such as the SDGs. When learners undertake projects that hold personal significance and genuine care, the potential for impactful learning becomes limitless (Eisenberg, 2012).

Resnick (2017) argues that passion sustains effort and persistence in learning. Similarly, having a clear purpose provides students with a goal, meaning, and reason to achieve their project objectives (author, 2016). For instance, the RinSE group initiated a project aimed at addressing drought challenges in Aaron’s home country, Cyprus. Their purpose was to support communities impacted by severe droughts, leading them to develop the RinSE platform—a chatbot-driven tool to educate about soil erosion and conservation practices. Through such projects, students not only deepen their understanding of environmental practices but also transition into the Activism stage (Kempton & Holland, 2003), gaining knowledge on how to effectively engage in environmental action and educate others through their acquired skills.

Similarly, the Butterfly team pursued their purpose of promoting gender equality through educational toys for children. Acknowledging the nature of societal change, they highlighted the critical role of early education in combating gender biases. As Koranat noted,

“While change takes time and is challenging to measure, raising awareness from a young age can significantly impact societal views on gender equality”.

This dedication to purpose-driven projects not only equips students with practical skills but also nurtures their ability to lead and mentor others in environmental and social activism.

Peers

“Peers” highlights the role of collaborative learning in fostering social and environmental identity. Learning thrives as a social activity where individuals share ideas, collaborate on projects, and build upon each other’s contributions (Resnick, 2017). In the context of the Innovation-driven SE and ESD class, which emphasizes group projects, students are required to collaborate closely to foster innovation. Thus, teamwork and collaboration skills become essential for achieving collective goals.

Moreover, collaborative learning environments, characterized by group interactions and cooperative teamwork, offer students opportunities to learn from diverse perspectives and skill sets. As Nin articulated, “My group members came from two different faculties—Dentistry and Communication Arts. This diversity allowed me to see various aspects that I had not previously considered.”

Engaging with peers from different academic backgrounds enriches the learning experience by facilitating a dynamic exchange of ideas and insights. Research by Laal and Ghodsi (2012) supports this, noting that collaborative settings promote deeper understanding of subject matter through peer interaction. Friend and Barron (2022) further emphasize that such environments enable students to leverage individual strengths to achieve common objectives.

Additionally, Kempton and Holland (2003) emphasize “empowerment”—acquiring a sense of agency, either individually or as a group member, through active participation. This empowerment is crucial as it enhances students’ confidence in their ability to effect change and contribute meaningfully within the class. Reflecting on their experiences, students highlighted significant gains in social and teamwork skills. For example, Koranat noted, “I learned the importance of brainstorming with team members and collaborating with classmates from different faculties, some familiar and some new.” Facilitating innovative collaboration, students could creatively tackle complex issues.

When facing challenges with unfamiliar tasks, Shahem credited his teammates for their collective success. As he said, “Luckily, we had a great team dynamic, and each of us was competent to deliver and learn for the sake of not letting others down.” Together, they were able to push through the task and complete it successfully.

By working closely with peers from varied backgrounds, students develop a deeper appreciation for teamwork, empathy, and the value of diverse perspectives in fostering social and environmental identities.

Conclusion

The ESD for 2030 framework emphasizes the importance of cultivating active global citizens who are critically aware of current global challenges. In alignment with this framework, entrepreneurial learning seeks to foster creativity, innovation, and an entrepreneurial mindset, empowering youth to succeed in the workforce and aiding their personal development (UNESCO-UNEVOC, n.d.). Traditional lecturing alone is insufficient; instead, learners must engage in analysis, reflection, and action to foster local and global citizenship in an interdependent world (Honan, 2005). This

research explores the 4Ps framework—Problems, Projects, Purposes, and Peers—as a structured approach to enhancing environmental identity development across stages of Salience, Identification, and Activism.

The 4Ps framework highlights the roles of Problems, Projects, Purposes, and Peers in advancing both SE and ESD. By integrating this framework, educators and researchers can design and implement effective educational programs that enhance student engagement, skill development, and readiness to tackle real-world challenges. This approach not only provides educators with innovative pedagogical strategies but also offers researchers opportunities to contribute to the evidence base supporting these educational innovations.

By integrating the 4Ps into educational practices, educators can empower future generations to take proactive roles as agents of positive change, fostering a sustainable and equitable world.

Declarations

Conflict of interest There is no conflict of interest.

Ethical approval This study has received approval from the Research Ethics Review System for Research Involving Human Participants (CU-REC) at Chulalongkorn University (Ref No: 152/64) and the Human Subject Research Ethics Review Committee at Tokyo Institute of Technology (Ref No: 19208).

References

- Acc, Z. J., Boardman, M., & McNeely, C. (2010). The social value of productive entrepreneurship. *Journal of Business Venturing*, 25(1), 1–12. <https://doi.org/10.1016/j.jbusvent.2009.07.003>
- Adelekan, A. O., Adeniyi, M. A., & Adeyemo, A. A. (2018). Enhancing social entrepreneurial intentions: The role of innovativeness and emotional intelligence. *Journal of Social Entrepreneurship*, 9(3), 207–222. <https://doi.org/10.1080/19420676.2018.1452285>
- Baltador, L. A., & Grecu, V. (2023). Social entrepreneurship education and its impact on entrepreneurial attitudes. *Social Enterprise Journal*, 19(2), 129–148. <https://doi.org/10.1108/SEJ-10-2022-0099>
- Certo, S. T., & Miller, T. (2008). Social entrepreneurship: Key issues and concepts. *Business Horizons*, 51(4), 267–271. <https://doi.org/10.1016/j.bushor.2008.02.009>
- Chiang, C. L., & Lee, H. (2016). The effect of project-based learning on learning motivation and problem-solving ability of vocational high school students. *International Journal of Information and Education Technology*, 6(9), 709–712.
- Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In S. Clayton & S. Opatow (Eds.), *Identity and the natural environment* (pp. 45–66). MIT Press.
- Clayton, S., Czellar, S., Nartova-Bochaver, S., Skibins, J. C., Salazar, G., Tseng, Y.-C., Irkhin, B., & Monge-Rodriguez, F. S. (2021). Cross-cultural validation of a revised environmental identity scale. *Sustainability*, 13(4), 2387. <https://doi.org/10.3390/su13042387>
- Condliffe, B., Quint, J., Visher, M. G., Bangser, M. R., Drohojowska, S., Saco, L., & Nelson, E. (2017). Project-Based Learning: A Literature Review. MDRC. Retrieved from https://www.mdrc.org/sites/default/files/Project-Based_Learning-Literature_Review.pdf
- Creswell, J. W., Hanson, W. E., Clark Plano, V. L., & Morales, A. (2007). Qualitative research designs: Selection and implementation. *The Counseling Psychologist*, 35(2), 236–264. <https://doi.org/10.1177/0011000006287390>
- Cutter-Mackenzie, A., & Edwards, S. (2013). Toward a model for early childhood environmental education: Foregrounding, developing, and connecting knowledge through play-based learning. *The Journal of Environmental Education*, 44(3), 195–213. <https://doi.org/10.1080/00958964.2012.751892>

- Dobele, A. R. (2021). Embedding social entrepreneurship in higher education: From concept to action. *Journal of Higher Education Policy and Management*, 43(3), 263–279. <https://doi.org/10.1080/1360080X.2021.1905265>
- Eisenberg, M. (2012). Constructionism: Changes in technology, changes in purpose. *Proceedings of Constructionism*.
- Friend, M., & Barron, T. (2022). Collaborating with colleagues to increase student success. In *High leverage practices for inclusive classrooms*, Routledge, pp 11–23.
- García-González, A., & Ramírez-Montoya, M. S. (2021). Social entrepreneurship education: Developing students' capacity for innovation and social change. *Journal of Social Entrepreneurship*, 12(3), 1–18. <https://doi.org/10.1080/19420676.2020.1839496>
- Hockerts, K. (2018). The effect of experiential learning on the formation of environmental identity. *Journal of Business Ethics*, 151(4), 839–857. <https://doi.org/10.1007/s10551-016-3252-6>
- Honan, A. (2005). Opportunities for development education within formal education in the Republic of Ireland. *Policy & Practice-A Development Education Review*, 1.
- Kempton, W., & Holland, D. C. (2003). Identity and sustained environmental practice.
- Kickul, J. R., Gundry, L. K., Mitra, P., & Berçot, L. (2018). Designing with purpose: Exploring the social and sustainable implications of design thinking in social entrepreneurship education. *Journal of Social Entrepreneurship*, 9(1), 114–127. <https://doi.org/10.1080/19420676.2018.1429577>
- Korsgaard, S., & Anderson, A. R. (2011). Enacting entrepreneurship as social value creation. *International Small Business Journal*, 29(1), 36–53. <https://doi.org/10.1177/0266242610364424>
- Laal, M., & Ghodsi, S. M. (2012). Benefits of collaborative learning. *Procedia-Social and Behavioral Sciences*, 31, 486–490. <https://doi.org/10.1016/j.sbspro.2011.12.091>
- Lake, D., Motley, P. M., & Moner, W. (2022). Completing the CiCLE: Long-term assessment of community-involved collaborative learning ecosystems for social innovation in higher education. *Social Enterprise Journal*, 18(1), 28–50.
- Lambrechts, W., & Hindson, J. (2016). Research and innovation in education for sustainable development. *Exploring Collaborative Networks, Critical Characteristics and Evaluation Practices*, 130–136.
- Lambrechts, W., Mulà, I., Ceulemans, K., Molderez, I., & Gaeremynck, V. (2013). The integration of competences for sustainable development in higher education. *Journal of Cleaner Production*, 48, 65–73. <https://doi.org/10.1016/j.jclepro.2011.12.034>
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook*. 3rd.
- Miura, U. (2016). Education for sustainable development (ESD). UNESCO Bangkok. Retrieved from <https://silo.tips/download/education-for-sustainable-development-esd-ushio-miura-unesco-bangkok>
- Muñoz, P., & Kimmitt, J. (2019). Social entrepreneurship as boundary work. *Entrepreneurship Theory and Practice*, 43(3), 390–416. <https://doi.org/10.1177/1042258719837563>
- Van Poeck, K., & Loones, J. (2011). Education for sustainable development: Flag and cargo. Retrieved from <https://www.ensi.org/global/downloads/Publications/318/ESD%20Flag%20and%20Cargo.pdf>
- Resnick, M. (2017). *Lifelong kindergarten: Cultivating creativity through projects, passion, peers, and play*. MIT Press.
- Saebi, T., Foss, N. J., & Linder, S. (2019). Social entrepreneurship research: Past achievements and future promises. *Journal of Management*, 45(1), 70–95.
- Sigauke, E. (2020). Connecting urban agriculture with design thinking: A case study from Zimbabwe. *The Journal of Environmental Education*, 52(1), 53–68. <https://doi.org/10.1080/00958964.2020.1820214>
- Stake, R. (1995). *Case study research*. Sage.
- Stapleton, S. R. (2015). Environmental identity development through social interactions, action, and recognition. *The Journal of Environmental Education*, 46(2), 94–113. <https://doi.org/10.1080/00958964.2014.1000813>
- Stern, N. (2008). The economics of climate change. *American Economic Review*, 98(2), 1–37.
- Stets, J. E., & Biga, C. F. (2003). Bringing identity theory into environmental sociology. *Sociological Theory*, 21(4), 398–423. <https://doi.org/10.1046/j.1467-9558.2003.00196.x>
- Teff-Seker, Y., Portman, M. E., & Kaplan-Mintz, K. (2019). Project-based learning in education for sustainable development: A case study of graduate planning students. *Case Studies in the Environment*.
- UNESCO. (2012). Shaping the education of tomorrow. Retrieved from <https://sustainabledevelopment.un.org/content/documents/919unesco1.pdf>

- UNESCO Executive Board. (2019). SDG 4 - Education 2030: Part II Education for sustainable development beyond 2019. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000366797>
- UNESCO. (2020). Multi-stakeholder approaches to education for sustainable development in local communities. Retrieved from <https://www.rcnetwork.org/portal/sites/default/files/Multi-stakeholder%20approaches%20to%20ESD.pdf>
- UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training. (n.d.). BILT – Entrepreneurship in TVET. Retrieved from <https://unevoc.unesco.org/bilt/BILT+-+Entrepreneurship+in+TVET>
- United Nations Conference on Trade and Development. (2010). Enterprise development policies and capacity-building in science, technology and innovation: Entrepreneurship education, innovation, and capacity-building in developing countries (TD/B/C.II/MEM.1/9). Retrieved from <https://digitallibrary.un.org/record/702707>
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press.
- Wortham, S. (2006). *Learning identity: The joint emergence of social identification and academic learning*. Cambridge University Press.
- Yuhas, A. (2019, September 25). Mattel's gender-neutral dolls are here. *The New York Times*. Retrieved from <https://www.nytimes.com/2019/09/25/arts/mattel-gender-neutral-dolls.html>

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