Sustainable Pedagogy: Integrating Environmental and Social Responsibility in Higher Education Curriculum

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Abstract. There is growing importance of integrating sustainability principles into higher education curricula to address pressing environmental and social challenges. Sustainable pedagogy, which promotes social and environmental responsibility, is seen as a transformative approach to education. While its value in Environmental Education (EE) and Education for Sustainable Development (ESD) is recognized, there is limited empirical research on its effectiveness. This study aims to evaluate sustainable pedagogy through environmental initiatives at universities, examining its impact on students' attitudes and behaviors. The research employs quantitative design, using surveys to assess students' familiarity with sustainability, involvement in environmental projects, and learning outcomes. Experiential learning and interactive teaching methods such as role-playing, simulations, and fieldwork are highlighted as effective in building sustainability skills. The study's findings contribute to the understanding of sustainable pedagogy and guide curriculum integration efforts across various disciplines, ultimately preparing students to address complex global challenges.

Keywords: Sustainable Pedagogy, Higher Education, Sustainable Citizenship Behaviour, Environmental and Social Responsibility, Quantitative.

1 Introduction

The necessity of integrating sustainability principles into higher education curricula to solve urgent environmental and social concerns has come to light more and more in recent years (Leal Filho et al., 2019). A potential approach to involving students in life-changing educational experiences that encourage social responsibility and commitment to the environment is through sustainable pedagogy. Evans and Ferreira (2020) contended that pedagogy for learning for sustainability is highly valued in Environmental Education (EE) and Education for Sustainable Development (ESD); however, the definition, appearance, and effectiveness of such successful techniques are the subject of remarkably little empirical investigation. Through an environmental initiative, this research investigates the efficacy of sustainable pedagogy in a university setting.

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Scholars argue that integrating environmental and social responsibility into higher education curricula can empower students to become change agents capable of addressing complex global challenges. According to Sandri (2022), pedagogy plays a crucial role in determining how sustainability education is delivered and what students learn. When compared to standard teaching approaches, sustainability pedagogies advocate for wide and interactive teaching methods that are seen to be more effective in creating sustainability abilities. Role-playing, simulations, group discussions, debates, stimulus activities, case studies, critical thinking, fieldwork, futures visioning, problem-based learning, worldview and values research, and action research are some of these techniques (Sterling 2012). One of the most effective approaches for sustainability is experiential learning where development around projects and real-world problems, with a focus on local community issues and collaborative learning (Farsari, 2022). The project approach is designed as a complete and competency-based learning model, with roots in Kilpatrick's didactic structure and Dewey's functional learning (Almulla, 2020). It is consistent with three essential elements: student engagement and interaction, solving actual community problems, and a research-based methodology that develops students' instrumental skills and critical, reflective thinking (Fuertes-Camacho et al., 2019; Lambrechts & Van Petegem, 2016).

2 Literature Review

2.1 Community of Inquiry (CoI) Framework

The Community of Inquiry (CoI) framework was introduced as a process framework to assist in the design and facilitation of meaningful learning experiences by combining three presences within the learning environment: cognitive presence, teaching presence, and social presence. Garrison, Anderson, and Archer (1999), who created the CoI framework, believed that a collaborative constructivist approach was required for deep and meaningful learning. Project based learning (PBL) requires students to collaborate to solve real-world problems, which connects nicely with the CoI's focus on developing a cohesive learning community where students actively engage in conversation, critical thinking, and reflection. Research has shown that the integration of the CoI framework in PBL environments can significantly enhance student engagement and learning outcomes (Arbaugh, Bangert, & Cleveland-Innes, (2010); Popescu & Badea, 2020; Kim, & Gurvitch, 2020; Shea, Richardson, & Swan, K., 2022).

Social Presence refers to learners' ability to project themselves socially and emotionally in a community of inquiry. For example, Kilis and Yildirim (2019) found that implementing CoI concepts in online PBL environments improved students' collaborative and critical thinking abilities. The study found that social presence, as supported by planned group activities and discussions, was critical for fostering a supportive learning community, which is a basic premise of PBL. One of the major variables is student interaction, which entails students connecting with one another and establishing a sense

of cooperation. Students' sense of belonging and trust creates a conducive learning atmosphere in which they feel comfortable expressing ideas and taking intellectual risks.

Cognitive presence refers to learners' ability to generate and confirm meaning through extended thinking and reflection. Cognitive presence is also enhanced in PBL situations, as students are required to examine problems, investigate various solutions, and apply their knowledge in practical circumstances. Wang et als. (2020) discovered that PBL activities that required students to participate in higher-order thinking tasks, such as problem solving and critical analysis, were extremely effective at promoting cognitive presence. Their research found that students who engaged in well-designed PBL situations had higher levels of cognitive engagement and a better comprehension of the subject matter. Student engagement is an important component, and engaged students are more likely to acquire higher cognitive presence by actively participating in learning activities, discussions, and critical thinking processes.

Teaching presence refers to the process of designing, facilitating, and directing cognitive and social processes to achieve meaningful learning outcomes. Effective course design, which includes clear goals, structured problem scenarios, and timely feedback, aids in the maintenance of attention and direction, keeping students engaged and on target. Bolliger and Martin (2018) stressed the importance of an effective teaching presence, which included clear instructional design, active facilitation, and timely feedback, in helping students through the problem-solving process. Their findings revealed that instructors who effectively developed PBL activities not only improved students' social and cognitive presence, but also their overall satisfaction and learning outcomes. Furthermore, Yusoff et al. (2020) discovered that a strong teaching presence contributed to the maintenance of student interest and engagement, both of which are critical for PBL success. Course structure includes the instructor's organization, content, and facilitation, which all have a direct impact on both social and cognitive presence.

Sustainable Citizenship Behaviour (SCB) emphasizes the significance of promoting environmental knowledge, social responsibility, and proactive participation in sustainability projects (Naheen & Elsharnouby, 2024; Tapingkae et al., 2020). Leal Filho et al. (2019) discovered that incorporating sustainability education into the curriculum improves students' environmental understanding and commitment to sustainable behaviours. The study found that students who took part in community-based sustainability projects had a better grasp of environmental issues and a stronger sense of responsibility for their communities. These hands-on experiences not only reinforced academic knowledge, but also enabled students to adopt concrete actions, bridging the gap between awareness and conduct. Overall, the CoI framework provides a strong theoretical and practical foundation for implementing project-based learning, guaranteeing that students develop the skills required for critical thinking, problem solving, and lifelong learning.

2.2 Hypothesis Development

Student interaction is vital for deep learning because it promotes knowledge creation through social collaboration (Wong & Chapman, 2023). Shea et al. (2020) discovered

that students who participated in debates and collaborative activities were more satisfied with their educational experiences. Similarly, Shieh and Hsieh (2021) found that interactive learning activities like group projects and peer comments greatly increased students' perceived pleasure by instilling a sense of community and belonging. Kilis and Yildirim (2019) found that peer interactions in online discussions and group activities led to better knowledge and memory of course materials. Similarly, Cleveland-Innes and Garrison (2020) discovered that students who actively collaborated with their peers improved higher-order thinking skills and a better understanding of the material. Thus, this gives rise to the following hypothesis:

H1: There is a significant relationship between student interaction and student satisfaction.
H2: There is a significant relationship between student interaction and perceived learning.

Student engagement defined as active participation in learning activities and cognitive involvement, has been demonstrated to have a significant impact on student happiness (Gray & DiLoreto, 2016). Wang et al. (2020) discovered that students who participated in engaging and challenging tasks were more satisfied with their courses. Their findings also suggested that students who were more involved in problem-solving and critical analysis assignments performed better academically and learned more deeply. Furthermore, a study by Bolliger and Martin (2018) found that involvement in course materials and activities was positively related to overall happiness, as engaged students felt more connected to the learning process and course goals. Their research also found that engaged students, who actively participated in discussions and applied course topics, had higher levels of comprehension and knowledge application. Thus, this gives rise to the following hypothesis:

H3: There is a significant relationship between student engagement and student satisfaction.
H4: There is a significant relationship between student engagement and perceived learning.

The design and organization of a course are critical for supporting effective learning. Yusoff et al. (2020) discovered that well-structured courses with clear objectives, organized content, and interactive aspects greatly boosted student satisfaction. Their findings also showed that courses with defined goals, structured content, and interactive learning activities improved student learning results. Furthermore, LaDue et al. (2022) found that courses that emphasized active learning and student-cantered approaches resulted in higher levels of satisfaction. Furthermore, their research indicated that courses that used active learning methodologies and student-cantered approaches resulted in greater understanding and knowledge retention. Thus, this gives rise to the following hypothesis:

H5: There is a significant relationship between course structure and student satisfaction.
H6: There is a significant relationship between course structure and perceived learning.

It has been demonstrated that long-term educational outcomes, such as sustainable citizenship behaviour (SCB), are influenced by student satisfaction. According to Leal Filho et al. (2019), satisfied students were more likely to support sustainability and participate in environmentally friendly activities. In a similar vein, Culhane et al. (2018) discovered that higher levels of satisfaction with sustainability education were associated with greater commitment to sustainable activities and community participation. Experiences with deep learning are essential for promoting sustainable citizenship behaviour (SCB). Furthermore, Yusoff et al. (2020) found that deep learning through experiential learning opportunities cultivated proactive and responsible citizens. Thus, this gives rise to the following hypothesis:

H7: There is a significant relationship between student satisfaction and sustainable citizenship behaviour.
H8: There is a significant relationship between perceived learning and sustainable citizenship behaviour.

The research model presented in Figure 1 below is based on the aforementioned hypotheses

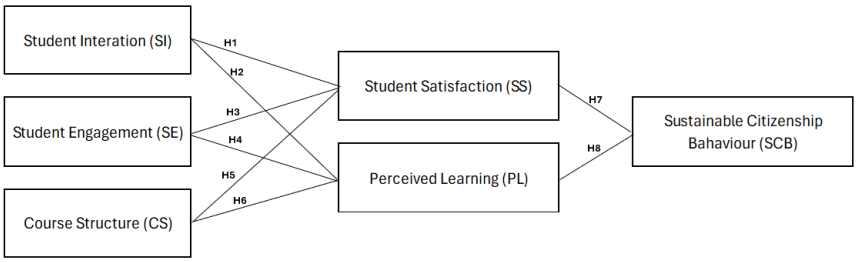

Fig. 1. Research model of the study

3 Methodology

3.1 Questionnaire design and measures

A structured questionnaire was used to gather the data. The seven sections of the questionnaire as follows: demographics, student interaction (SI), student engagement (SE),

course structure (CS), student satisfaction (SS), perceived learning (PL) and sustainable citizenship behaviour (SCB). Each construct's items were evaluated on a Likert scale with a range of 1 (Strongly agree) to 7 (Strongly agree) for each item. Both reliability and validity within questionnaires are based on measurements enhanced by selecting prior items under revision on current studies.

3.2 Sampling and data collection

The respondents were selected from a Malaysia population by employing the purposive sampling technique. The purposive sampling technique was used to choose respondents, who would best answer the questionnaire - students. The sample only comprised of higher education institutions around Klang Valley, this region of the country having the highest amount of higher education institutions compared to other regions (Ministry of Higher Education Malaysia, 2023). Data used in this study was collected from a sample of 450 students across the universities. The size becomes adequate in representing the student population at a 95% level of confidence, according to Krejcie and Morgan (1970) sample table. A total of 28 responses were discarded due to irregular data patterns and large amounts of missing data, the remaining 422 responses usable for further analysis. Based on the results obtain on gender basis, the female participants were 55 percent compare to male participants 45 percent. The leading age category of this study is between 20 to 29 years, amounting to 65 percent.

4 Analysis and Results

4.1 Structural Equation Modelling Analysis

To test the hypothesis developed in this study, an adapted version of the Partial Least Squares-Structural Modelling (PLS-SEM) was used. Furthermore, the SmartPLS 4.0 program was specifically applied to evaluate the parameters of the paradigm. (Ringle et al. 2016).

Reliability and Validity. To determine an indicator's stability within the construct's domain, reliability analysis is first conducted (Hair et al., 2021). A construct's internal consistency reliability is considered achieved if the dependability evaluation metrics, such as Cronbach's alpha (α) and Composite Reliability (CR), meet the suggested threshold value of 0.7. Table 1 shows that Cronbach's alpha ($\boldsymbol{\alpha}$) and CR estimates were higher than the 0.7 cutoff. As a result, the scales' internal consistency reliability can be deemed adequate. The validity test was then examined by analysing the convergent discriminant and the constructs' validity. By evaluating the standardized outer loadings and average variances extracted (AVE), convergent validity seeks to confirm the positive connection between the indicators in a series of constructs (Hair et al., 2021). Each paradigm concept had an AVE estimate that was higher than the previously indicated cut-off criterion of 0.5, indicating that convergent validity was reached (Table 1).

Table 1. Reliability and validity results

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CS	0.87	0.875	0.906	0.658
PL	0.779	0.789	0.871	0.693
SCB	0.74	0.746	0.837	0.563
SE	0.723	0.74	0.819	0.578
SI	0.877	0.884	0.905	0.577
SS	0.824	0.855	0.918	0.848

4.2 Hypothesis result

This analysis revealed that all the path coefficients in the model were in the predicted direction and had statistically significant correlations. Student interaction has a significant relationship with perceived learning but not on student satisfaction, supporting H1 and rejecting H2. Student engagement and course structure on the other hand have a significant relationship with student satisfaction and perceived learning, supporting H3, H4, H5 and H6. Lastly, student satisfaction and perceived learning has a significant relationship with sustainable citizenship behaviour, supporting H7 and H8. Table 2 summarizes the findings from this study.

Table 2. Summary of the results

	Hypothesis	P values	Results
H1	*There is a significant relationship between student interaction and student satisfaction. (***SI -> SS)**	0.519	Rejected
H2	*There is a significant relationship between student interaction and perceived learning. (***SI -> PL)**	0.001	Accepted
H3	*There is a significant relationship between student engagement and student satisfaction. (***SE -> SS)**	0	Accepted
H4	*There is a significant relationship between student engagement and perceived learning. (***SE -> PL)**	0.003	Accepted
H5	*There is a significant relationship between course structure and student satisfaction. (***CS -> SS)**	0.024	Accepted
H6	*There is a significant relationship between course structure and perceived learning. (***CS -> PL)**	0	Accepted

H7	*There is a significant relationship between student satisfaction and sustainable citizenship behaviour. (***SS -> SCB)**	0.001	Accepted
H8	*There is a significant relationship between perceived learning and sustainable citizenship behaviour. (***PL -> SCB)**	0	Accepted

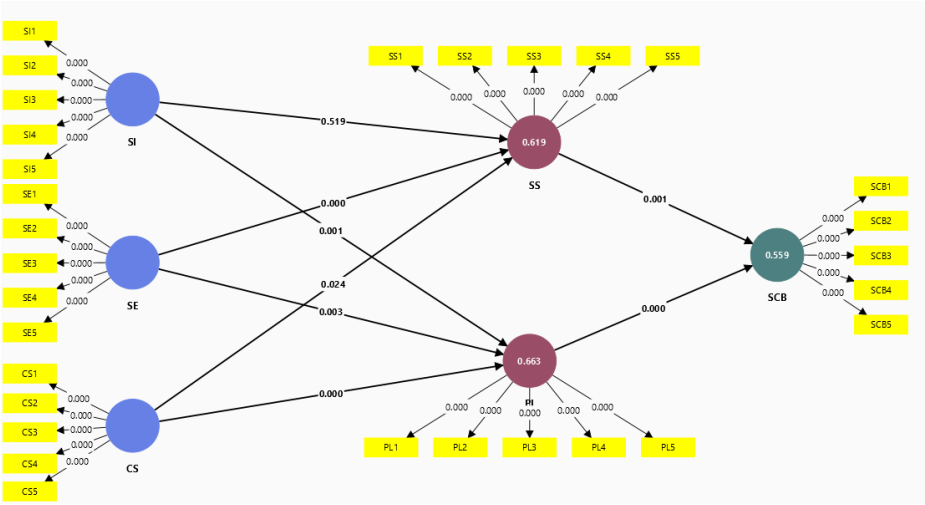

Fig. 2. Structural Model of the study.

5 Discussion

The study demonstrated that student interactions important to perceived learning, consistent with Cleveland-Innes and Garrison (2020) who observed that students who engaged in peer interaction gained stronger understanding of the material and higher-order thinking abilities. The results show that students' satisfaction is not always increased by simple interaction among themselves, which is contrary to expectations. This aligns with research by Shieh and Hsieh (2021), who discovered that although student interaction might promote a feeling of community, overall pleasure is not always a result of it. This shows that interactions' context and quality—rather than their quantity—may have a greater impact on students' pleasure.

Engaged students, who actively participate in learning activities, reported greater satisfaction with their courses and showed better academic performance. This aligns with the findings of Wang et al. (2020) study, which demonstrated that students' satisfaction levels increased along with their cognitive presence and knowledge application when they were assigned more involved and complex activities. In a similar vein, Bol-

liger and Martin (2018) discovered a favourable relationship between student satisfaction and engagement, emphasizing that engagement strengthens students' bonds with the curriculum and the learning process.

Well-designed courses with precise goals and well-organized content greatly increased student satisfaction and encouraged better learning outcomes. This result is consistent with the work of Yusoff et al. (2020), who showed that well considered course design, including interactive components and active learning techniques, raises student satisfaction and promotes deeper comprehension. This viewpoint was further reinforced by LaDue et al. (2021) research, which demonstrated how designing courses with a student-cantered approach raised satisfaction levels, which in turn enhanced learning results.

Students who felt satisfied were more likely to support sustainability and act in ways that were less harmful to the environment. This result is consistent with that of Leal Filho et al. (2019), who found that students who were satisfied with their education on sustainability showed a stronger commitment to sustainable activities. Students were more inclined to participate in SCB if they demonstrated greater levels of comprehension and application of sustainability ideas. Deep learning experiences in sustainability education encouraged proactive and responsible citizenship behaviours. Additionally, Yusoff et al. (2020) also reported that experiential learning opportunities, which facilitated deep learning, were effective in nurturing sustainable citizenship.

6 Conclusion

This study makes a significant theoretical contribution to Community of Inquiry (CoI) framework within project-based learning (PBL) sustainable paedology. The study extends the CoI framework beyond traditional learning outcomes to include long-term behavioural impacts, Sustainable Citizenship Behaviour (SCB). From a practical standpoint, this study provides insightful information to educators and curriculum designers who want to use education to encourage sustainable citizenship. The study highlights the importance of interactive and student-cantered course designs and offers practical suggestions for developing more stimulating and productive learning environments. By putting these results into practice, educational initiatives that serve both wider societal aims and academic ones can be developed.

Overall, this research contributed to the growing body of knowledge on effective pedagogical strategies for fostering sustainability education and promoting active citizenship among students. This project aims to expand our knowledge of sustainable pedagogy and its implementation in a university setting by using a case study approach. Ultimately, this research contributes to the broader goal of preparing students to address the complex environmental and social challenges facing society. By integrating the CoI framework with sustainability education, this study provides a robust theoretical foundation and practical guidelines for educators and institutions aiming to cultivate responsible and proactive citizens through effective educational practices.

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