

PROBLEM-BASED LEARNING ON INTEGRATING SUSTAINABILITY PRINCIPLES IN ENTREPRENEURSHIP EDUCATION: STUDENTS' PERCEPTIONS

Ibebuike, URSULA Obiageli; Obilo, Princess Ijeoma & Sangoleye, Solomon A.

Department of Curriculum Studies and Instructional Technology,
Alvan Ikoku University of Education, Owerri, Imo State, Nigeria

Abstract

This study explored Junior Secondary School II (JSS II) students' perceptions of PBL in embedding sustainability principles within entrepreneurship (pre-vocational) education. 2 research questions and 2 hypotheses guided the study. Utilizing a descriptive survey design, the study sampled 88 students (males = 40; females = 48) from three government co-educational secondary schools in Orlu Local Government Area (LGA) of Imo State, Nigeria, using purposive sampling technique. The instrument for data collection was a researcher-designed structured questionnaire titled the Problem-Based Learning on Integrating Sustainability Principles in Entrepreneurship Education Students' Perception Questionnaire (PBLISPEESPQ), comprising 20 items rated on a Four-Point Modified Likert scale with response options of Very High Extent (VHE = 4), High Extent (HE = 3), Low Extent (LE = 2), and Very Low Extent (VLE = 1). The instrument was validated by experts in Measurement and Evaluation, Curriculum Studies, and Entrepreneurship Education, and had a reliability index of 0.78 (Cronbach's Alpha). Data were analyzed using Mean and Standard Deviation for research questions and Paired-Samples t-test for hypothesis testing at the 0.05 significance level. Findings revealed that students perceived PBL as highly effective in integrating sustainability principles into their entrepreneurship education, with both male and female students rating its impact positively. The results indicated no significant gender differences in the perceived effectiveness of PBL, underscoring its inclusivity and universal applicability. It is recommended that educational institutions incorporate PBL into entrepreneurship curricula to deepen students' understanding of sustainability principles and equip them with the skills necessary for ethical and sustainable entrepreneurial ventures.

Keywords: Problem-Based Learning (PBL), sustainability principles, entrepreneurship, pre-vocational education, critical thinking

Introduction

In recent years, there has been growing recognition of the importance of integrating sustainability principles into entrepreneurship education. This shift is driven by global concerns over environmental degradation, social inequality, and economic instability, which underscore the need for businesses to adopt sustainable practices. Problem-Based Learning (PBL) has emerged as a pedagogical approach that not only enhances critical thinking and problem-solving skills but also offers a promising avenue for embedding sustainability principles within entrepreneurship education curricula. Problem-Based Learning, as defined by Savery and Duffy (1995), involves presenting students with complex, real-world problems that require investigation, collaboration, and innovative solutions. This approach encourages students to engage deeply with multifaceted challenges, fostering a holistic understanding of issues that transcend traditional disciplinary boundaries. In the context of entrepreneurship education, PBL has

been increasingly recognised for its potential to cultivate an entrepreneurial mindset that incorporates sustainability considerations. Okere, Ugwoke, and Eze (2020) argue that PBL encourages students to explore sustainable business models, engage in ethical decision-making, and develop innovative solutions that address environmental and social challenges. Similarly, Dorado, Giles, and Welch (2018) asserted that PBL positively influences the integration of sustainability principles in entrepreneurship education, fostering the development of entrepreneurial ventures that consider environmental and social impacts.

Oke, Ajagbe, and Oke (2019) further emphasise that PBL enables students to develop a deep understanding of sustainability issues by immersing them in real-world problems related to sustainable entrepreneurship. This experiential approach not only enhances students' knowledge and skills but also nurtures their awareness of the broader implications of business activities on the environment and society. This paper, therefore, explores how PBL facilitates the integration of sustainability principles in entrepreneurship education and how JSS II students perceive this process, particularly at this formative stage when students are beginning to demonstrate their potentials. By examining how PBL enhances students' ability to apply sustainability principles in entrepreneurial contexts, this study contributes to the ongoing discourse on fostering sustainable entrepreneurship as a means of addressing pressing global challenges.

Sustainability principles encompass the fundamental criteria and frameworks designed to ensure that human activities and systems operate in ways that satisfy current needs without compromising the capacity of future generations to meet their own needs. The widely recognized triple bottom line refers to the three interconnected principles of environmental stewardship, social equity, and economic viability. Environmental stewardship involves minimizing detrimental impacts on the environment, conserving natural resources, and promoting biodiversity. Social equity encompasses ensuring fair treatment, inclusivity, and social justice for all individuals and communities. Economic viability focuses on fostering inclusive, efficient, and ecologically sustainable growth (UNEP, 1992). Sustainability aims to integrate these principles into decision-making processes across diverse sectors, including business, education, and governance, with the objective of creating resilient and successful societies capable of withstanding and adapting to global challenges such as climate change, resource depletion, and social inequality. Sterling (2004) and Folke, Hahn, Olsson, and Norberg (2016) emphasize the need to view sustainability challenges as interconnected systems, where actions in one domain (e.g., environment) produce ripple effects across others (e.g., social and economic spheres). This systems-thinking perspective facilitates the design of integrated solutions to complex sustainability problems.

A study by Su, Cheng, and Lin (2017) examined the efficacy of a hybrid PBL approach in incorporating sustainability concepts and found that it had a considerable positive impact on the development of sustainability competencies among entrepreneurship students, enhancing problem-solving abilities and innovative thinking in sustainable business strategies. Borzaga, Depedri, and Tortia (2019) similarly confirmed

that incorporating sustainability principles into PBL improves students' comprehension and practical application of sustainability in entrepreneurship, highlighting collaborative problem-solving, experiential learning, and multidisciplinary methods as effective strategies. Leach, Scoones, and Stirling (2018) maintained that sustainability cannot be achieved without addressing social inequalities and promoting social justice. They argued that sustainable development requires equitable distribution of resources and opportunities, as well as inclusive decision-making processes, to ensure that all segments of society have fair access to resources and benefits.

Entrepreneurship education focuses on cultivating the skills to recognise market deficiencies and create innovative solutions. As stated by Kuratko (2020), it entails fostering the abilities and mindset necessary to identify opportunities in situations that others regard as challenges and to generate innovative solutions that meet market demands. Entrepreneurship education imparts the knowledge and skills required to evaluate and manage risks proficiently, which is crucial for entrepreneurial success. Hatak, Harms, Bierwerth, and Feldmann (2021) emphasise the need to equip aspiring entrepreneurs with skills to anticipate and manage challenges, make well-informed decisions in difficult situations, and recover from failures with resilience. Piperopoulos and Dimov (2020) further note that entrepreneurship education promotes ingenuity and analytical thinking, empowering students to tackle complex challenges by creating original ideas and devising inventive solutions. Neck and Greene (2021) add that entrepreneurship education emphasises practical skills in business planning, fundraising, and scaling ventures, providing aspiring entrepreneurs with the tools to transform ideas into successful enterprises. Renko, Bučar, Tominc, and Auer Antončič (2016) found that PBL successfully incorporates sustainability ideas into entrepreneurial education by cultivating critical thinking and fostering a deeper comprehension of sustainability challenges within entrepreneurial environments, resulting in improved learning outcomes and more favourable student attitudes towards sustainable business practices. In the Nigerian context, Okere, Adeyeye, and Obi (2020) found that PBL serves as a catalyst for integrating sustainability principles into entrepreneurship education, contextualising sustainability within local economic and environmental conditions and preparing students to tackle sustainability challenges and innovate sustainable solutions.

On the question of gender, Lopez and Zhang (2023) found that female students perceived sustainability principles integrated into PBL activities as more relevant to their entrepreneurial aspirations, while male students were more focused on the economic viability of sustainable practices. Chowdhury and Patel (2022) similarly observed that female students exhibited stronger initial interest in sustainability issues and greater enthusiasm for integrating these principles into entrepreneurial ventures, though both male and female students were ultimately influenced by sustainability-focused PBL activities. These findings collectively highlight the effectiveness of PBL in integrating sustainability principles into entrepreneurship education, enhancing students' knowledge, skills, and attitudes towards sustainability, and preparing them to address complex business challenges while promoting environmental and social responsibility.

Statement of the Problem

The increasing recognition of sustainability's importance in addressing global challenges has prompted educational institutions to integrate sustainability principles into various curricula, including entrepreneurship education. As economies grapple with environmental degradation, social inequality, and economic instability, there is a growing consensus that entrepreneurship education must go beyond profit-oriented skills to equip students with the mindset and competencies needed to build ethical, sustainable ventures. Ideally, entrepreneurship education at the junior secondary school level should employ pedagogical approaches, such as Problem-Based Learning (PBL), that immerse students in real-world, complex problems requiring them to critically evaluate environmental, social, and economic considerations. Through this approach, students would be expected to develop a strong grasp of sustainability principles, apply them confidently to entrepreneurial decision-making, and emerge with the critical thinking and problem-solving skills necessary to design ventures that are both innovative and sustainable regardless of gender. In practice, however, entrepreneurship (pre-vocational) education in many Nigerian junior secondary schools continues to rely on traditional, largely theoretical instructional approaches that emphasize content delivery over active engagement with real-world problems. These conventional methods often fail to immerse students meaningfully in authentic sustainability challenges, leaving them with limited opportunities to translate sustainability concepts into practical entrepreneurial reasoning. Consequently, students may complete their entrepreneurship education with an incomplete understanding of how environmental stewardship, social equity, and economic viability intersect with real business decisions.

While a growing body of literature has examined the effectiveness of PBL in higher education and, to a lesser extent, in secondary entrepreneurship education generally, comparatively little empirical attention has been paid to how PBL specifically shapes students' perceptions of sustainability integration at the junior secondary school level, and how these perceptions may vary by gender. This gap is significant because students' perceptions directly influence their engagement, learning outcomes, and future willingness to adopt sustainable practices in entrepreneurial ventures yet the junior secondary school population, a formative stage where entrepreneurial mindsets first take shape, remains under examined in this specific context. It is against this backdrop that the present study investigates Junior Secondary School II (JSS II) students' perceptions of PBL in integrating sustainability principles into entrepreneurship (pre-vocational) education in Orlu Local Government Area, Imo State, Nigeria, and examines whether these perceptions differ significantly by gender. By generating empirical evidence at this level, the study seeks to inform curriculum and pedagogical decisions that can strengthen the integration of sustainability principles into entrepreneurship education from an early stage of students' academic development.

Purpose of the Study

The general purpose of the study is to investigate Junior Secondary School II (JSS II) students' perceptions of Problem-Based Learning (PBL) as a pedagogical approach for integrating sustainability principles into entrepreneurship (pre-vocational) education, including whether these perceptions differ significantly by gender.

1. Determine the extent to which students perceive PBL as effective in integrating sustainability principles into entrepreneurship (pre-vocational) education.

2. Examine the extent to which students perceive their learning outcomes as enhanced by PBL in integrating sustainability principles.

Research Questions

Two research questions guided the study:

1. To what extent do students perceive PBL as effective in integrating sustainability principles into entrepreneurship (pre-vocational) education?
2. To what extent do students perceive their learning outcomes as enhanced by PBL in integrating sustainability principles into entrepreneurship (pre-vocational) education?

Hypotheses

The following null hypotheses were formulated for the study:

- H₀₁:** There is no significant difference in the mean perception of male and female students regarding PBL's effectiveness in integrating sustainability principles into entrepreneurship (pre-vocational) education.
- H₀₂:** There is no significant difference in the mean perception of male and female students regarding learning outcomes based on PBL in integrating sustainability principles into entrepreneurship (pre-vocational) education.

Methods

The study adopted a descriptive survey design, which is appropriate for investigating individuals' perceptions, attitudes, and opinions within a defined population. The study was conducted in Orlu Local Government Area (LGA) of Imo State, Nigeria. Population comprised all JSS II students in the 17 government-owned co-educational secondary schools in Orlu LGA, totaling 1,453 students. A purposive sample of 88 students (males = 40; females = 48) was drawn from three schools. Purposive sampling was employed because the researchers targeted specific schools with JSS II students engaged in entrepreneurship (pre-vocational) education. The instrument for data collection was a researchers designed structured questionnaire titled the Problem-Based Learning on Integrating Sustainability Principles in Entrepreneurship Education Students' Perception Questionnaire (PBLISPEESPQ). The instrument comprised 20 items rated on a Four-Point Modified Likert scale with response options of Very High Extent (VHE = 4), High Extent (HE = 3), Low Extent (LE = 2), and Very Low Extent (VLE = 1). The instrument was validated by experts in Measurement and Evaluation, Curriculum Studies, and Entrepreneurship Education. The reliability of the instrument was established using Cronbach's Alpha method, yielding a reliability coefficient of 0.78, which is acceptable for research purposes. Data collected were analyzed using Mean and Standard Deviation for research questions. A mean score of 2.50 and above was taken as indicating a high extent of agreement, while any mean below 2.50 was taken as indicating a low extent. The Paired-Samples t-test was used to test the hypotheses at the 0.05 level of significance.

Results

Research Question 1: What is the extent to which students perceive Problem-Based Learning (PBL) as effective in integrating sustainability principles into entrepreneurship (pre-vocational) education?

Table 1: Students' Perceptions of PBL in Integrating Sustainability Principles into Entrepreneurship Education

S/N	ITEMS	Mean Male	SD	Mean Female	SD	Decision
1	How effectively has Problem-Based Learning (PBL) helped you understand the importance of sustainability principles in entrepreneurship?	2.78	0.69	2.59	0.50	High Extent
2	To what extent has PBL encouraged you to consider environmental and social impacts in entrepreneurial decision-making?	2.87	0.75	2.75	0.62	High Extent
3	How effective was PBL in fostering your ability to develop innovative solutions that address sustainability challenges in business?	2.89	0.71	2.78	0.67	High Extent
4	How much has PBL increased your awareness of the triple bottom line (environmental, social, and economic aspects) in entrepreneurial contexts?	2.80	0.72	2.69	0.65	High Extent
5	To what extent do you feel PBL has prepared you to incorporate sustainability principles into your future entrepreneurial ventures?	2.80	0.74	2.74	0.63	High Extent
6	How would you rate the relevance of sustainability concepts learned through PBL to real-world entrepreneurial challenges?	2.77	0.68	2.63	0.57	High Extent
7	Has PBL enhanced your understanding of how sustainable business practices can contribute to long-term success in entrepreneurship?	2.74	0.65	2.66	0.53	High Extent
8	Do you believe PBL has improved your critical thinking skills in relation to sustainability issues in business?	2.78	0.67	2.65	0.54	High Extent
9	How likely are you to apply the sustainability principles learned through PBL in your future entrepreneurial activities?	2.90	0.81	2.85	0.71	High Extent
10	How effective do you think PBL has been in integrating sustainability principles into your entrepreneurship education?	2.76	0.64	2.69	0.57	High Extent
	Grand Mean	2.81	0.71	2.70	0.60	High

Extent

The results in Table 1 reveal that students perceived PBL as highly effective in integrating sustainability principles into entrepreneurship education. Both male and female students rated the effectiveness of this integration highly across all items, with a grand mean of 2.81 (SD = 0.71) for males and 2.70 (SD = 0.60) for females, both indicating a high extent. These scores demonstrate that students recognize the value of PBL in understanding and applying sustainability principles in entrepreneurial contexts. The consistency of high mean ratings across all items suggests that PBL is effective in fostering students' comprehension and practical application of sustainability principles across the various dimensions of entrepreneurship education.

Research Question 2: What is the extent to which students perceive their learning outcomes as enhanced by PBL in integrating sustainability principles into entrepreneurship (pre-vocational) education?

Table 2: Students' Perceived Learning Outcomes Based on PBL in Integrating Sustainability Principles

S/N	ITEMS	Mean Male	SD	Mean Female	SD	Decision
1	Before participating in PBL activities, how familiar were you with sustainability principles in entrepreneurship?	2.56	0.46	2.53	0.50	High Extent
2	To what extent have you gained new knowledge about sustainability principles through PBL?	2.84	0.73	2.75	0.62	High Extent
3	To what extent has PBL improved your understanding of the environmental aspects of sustainability in entrepreneurship?	2.74	0.61	2.65	0.51	High Extent
4	How well do you think PBL has taught you about the social dimensions of sustainability relevant to entrepreneurship?	2.87	0.76	2.78	0.70	High Extent
5	Has PBL increased your knowledge of the economic considerations related to sustainable business practices?	2.75	0.66	2.66	0.51	High Extent
6	To what extent are you confident in applying sustainability principles learned through PBL to solve real-world entrepreneurial problems?	2.87	0.77	2.73	0.67	High Extent
7	To what extent do you believe PBL has deepened your understanding of the interconnectedness of environmental, social, and economic sustainability issues?	2.83	0.76	2.75	0.66	High Extent
8	How much has PBL expanded your	2.82	0.79	2.72	0.61	High

	awareness of sustainable business models and their benefits?					Extent
9	How effective do you think PBL has been in preparing you to incorporate sustainability principles into your entrepreneurial thinking and actions?	2.85	0.91	2.74	0.62	High Extent
10	What is your rating of the overall impact of PBL on your knowledge of sustainability principles in the context of entrepreneurship?	2.91	0.80	2.82	0.75	High Extent
	Grand Mean	2.80	0.73	2.71	0.62	High Extent

The findings in Table 2 indicate that students perceived their learning outcomes based on PBL as highly enhanced with respect to the integration of sustainability principles. Both male and female students rated the extent of their learning outcomes highly across all items, with a grand mean of 2.80 (SD = 0.73) for males and 2.71 (SD = 0.62) for females, both indicating a high extent. These values indicate that PBL has significantly enhanced students' knowledge and understanding of sustainability principles in the context of entrepreneurship education.

Hypothesis

Table 3: t-test Results for Gender Differences in Students' Perceptions of PBL in Integrating Sustainability Principles (Hypothesis 1)

Gender	N	Mean	SD	t_{nal}	df	t_{tah}	Decision
Male	40	2.81	0.73	0.791	86	1.987	Accept H_{01}
Female	48	2.70	0.62				

As shown in Table 3, the calculated t-value ($t_{\text{nal}} = 0.791$) is less than the critical t-value ($t_{\text{tah}} = 1.987$) at $df = 86$ and $p > 0.05$. Therefore, the null hypothesis H_{01} is accepted. This indicates that there is no significant difference in the mean perceptions of male and female students regarding PBL's effectiveness in integrating sustainability principles into entrepreneurship (pre-vocational) education.

Table 4: t-test Results for Gender Differences in Students' Perceived Learning Outcomes Based on PBL (Hypothesis 2)

Gender	N	Mean	SD	t_{nal}	df	t_{tah}	Decision
Male	40	2.79	0.73	0.548	86	1.987	Accept H_{02}
Female	48	2.71	0.64				

As shown in Table 4, the calculated t-value ($t_{\text{nal}} = 0.548$) is less than the critical t-value ($t_{\text{tah}} = 1.987$) at $df = 86$ and $p > 0.05$. Therefore, the null hypothesis H_{02} is accepted. This indicates that there is no significant difference in the mean perceptions of male and female students regarding their learning outcomes based on PBL in integrating sustainability principles into entrepreneurship (pre-vocational) education.

Discussion

The findings of this study reveal that PBL is perceived as an effective approach for integrating sustainability principles into entrepreneurship (pre-vocational) education among JSS II students in Orlu LGA. The results demonstrate significant enhancement in students' understanding and application of sustainability concepts attributable to PBL, aligning with previous research highlighting the efficacy of PBL in fostering critical thinking and problem-solving skills. The high mean scores for both male students (grand mean = 2.81) and female students (grand mean = 2.70) in Research Question 1 suggest that PBL's impact is consistent across gender lines, emphasizing its universal applicability. These findings are consistent with those of Okere, et al (2020), who found that PBL encourages students to consider environmental, social, and economic impacts in entrepreneurial decision-making and fosters the development of innovative solutions to sustainability challenges.

With respect to learning outcomes (Research Question 2), grand mean scores of 2.80 for males and 2.71 for females indicate that PBL has significantly enhanced students' knowledge of sustainability principles, deepened their understanding of the interconnectedness of environmental, social, and economic issues, and expanded their awareness of sustainable business models. These findings align with Su, et al (2017), who found that PBL positively impacts the development of sustainability competencies and problem-solving abilities among entrepreneurship students. The t-test results for both hypotheses indicate no significant gender differences in mean perceptions of PBL's effectiveness ($t = 0.791$, $p > 0.05$) or learning outcomes ($t = 0.548$, $p > 0.05$). This finding underscores the inclusivity of PBL in providing equitable educational benefits to all students, regardless of gender. While Lopez and Zhang (2023) identified potential gender differences in perceptions of sustainability education, the present study suggests that PBL can bridge such differences by providing a balanced and effective learning experience for both male and female students.

These findings support the integration of PBL into entrepreneurship (pre-vocational) education as a means of fostering sustainable business practices. PBL's focus on real-world problems and experiential learning helps students develop a practical understanding of sustainability, equipping them to address complex business challenges responsibly. This aligns with the arguments of Oke, et al (2019), who stressed PBL's role in nurturing students' awareness of the broader implications of business activities on the environment and society. Furthermore, the incorporation of PBL in entrepreneurship education enhances students' readiness for future entrepreneurial endeavours by equipping them with the skills and knowledge needed to implement sustainable practices, as emphasised by Kuratko (2020) and Hatak et al. (2021).

Conclusion

The findings of this study indicate that PBL is highly effective in integrating sustainability principles into entrepreneurship (pre-vocational) education among JSS II students in Orlu LGA. Both male and female students perceived PBL as significantly

enhancing their understanding and application of sustainability concepts in entrepreneurial contexts. The grand mean scores of 2.81 for males and 2.70 for females demonstrate a high extent of perceived effectiveness, and the consistent findings across all items suggest that PBL fosters critical thinking, problem-solving skills, and innovative approaches to sustainability challenges. Furthermore, the t-test results reveal no significant gender differences in the perception of PBL's effectiveness or learning outcomes, underscoring its universal applicability and inclusivity. The study concludes that PBL is a valuable pedagogical approach for integrating sustainability principles into entrepreneurship education, preparing students to adopt sustainable business practices and ethical decision-making in their future entrepreneurial ventures.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Since students perceived PBL as highly effective in integrating sustainability principles into entrepreneurship education, educational institutions and curriculum planners should formally adopt and scale up PBL as a core instructional strategy in entrepreneurship (pre-vocational) education, rather than treating it as a supplementary activity.
2. Teachers should be supported through targeted professional development to strengthen their capacity to design and facilitate PBL activities, ensuring these self-reported gains are consistently achieved in practice, since students perceived PBL as significantly enhancing their learning outcomes, including their knowledge of sustainability principles and their confidence in applying them to real-world entrepreneurial problems,
3. Schools should maintain co-educational, non-gender-differentiated PBL implementation, as the findings show the approach already benefits male and female students equitably without requiring gender-specific adaptation.
4. Schools and researchers should complement PBL implementation with objective assessment tools (e.g., performance-based tasks or knowledge tests) to verify whether the high perceived learning outcomes correspond to actual gains in sustainability-related entrepreneurial competencies

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