

REVIEW ARTICLE

Integration of Green Entrepreneurship in Innovation and Entrepreneurship Courses: A Case Study of Guangdong University of Petrochemical Technology

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Abstract

This study examines the integration of green entrepreneurship principles into the Innovation and Entrepreneurship curriculum at Guangdong University of Petrochemical Technology (GDUPT) and evaluates its impact on student competencies. Using a mixed-methods approach, data were collected from 203 participants (38 faculty members and 162 students) during the 2023-2024 academic year. The findings reveal that green entrepreneurship is integrated to a great extent across five key dimensions: content, teaching strategies, activities, assessment methods, and resources. Students demonstrate high competence in practical skills and exhibit favorable attitudes toward sustainability, though their theoretical knowledge remains at a moderate level.

The study identifies several challenges hindering effective integration, including limited access to updated teaching resources, insufficient administrative support for green projects, and occasional resistance to adopting sustainable practices among both faculty and students. These findings contribute to ongoing discussions about sustainable education management and the role of higher education institutions in fostering environmental entrepreneurship.

Based on the results, the study proposes a comprehensive action plan to strengthen curriculum design, enhance faculty training, and forge industry partnerships. The recommendations emphasize the need for continuous curriculum updates to reflect emerging green technologies, professional development workshops for educators, and institutional policies that incentivize sustainable entrepreneurship initiatives.

Keywords: Green Entrepreneurship, Curriculum Integration, Sustainable Education, Student Competence, Higher Education.

1. Introduction

The growing global emphasis on environmental sustainability has prompted higher education institutions to incorporate green entrepreneurship into their curricula. As a specialized university serving China's petrochemical industry, Guangdong

University of Petrochemical Technology (GDUPT) faces unique opportunities and challenges in preparing students to address environmental concerns while fostering economic growth. This study investigates how GDUPT integrates green entrepreneurship principles into its Innovation and Entrepreneurship

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courses and assesses the resulting impact on student learning outcomes.

The research addresses three primary questions: First, to what extent has green entrepreneurship been incorporated into the curriculum across content, teaching methods, activities, assessment, and resources? Second, what levels of competence do students demonstrate in terms of knowledge, skills, and attitudes toward green entrepreneurship? Third, what challenges do educators and students encounter in implementing these sustainable practices, and how might they be addressed?

By examining these questions, the study contributes to broader discussions about the role of technical universities in promoting sustainable development. The findings offer practical insights for curriculum designers, educators, and policymakers seeking to enhance entrepreneurship education with environmental considerations.

2. Literature Review

The concept of green entrepreneurship has evolved significantly since Elkington's (1997) introduction of the triple bottom line framework, which emphasized balancing economic, social, and environmental considerations. In higher education, this paradigm shift has led to innovative programs like Tsinghua University's Green Innovation and Entrepreneurship Program and Nanjing University's interdisciplinary approach to environmental business education (Mambali et al., 2024).

Current research identifies several critical components for successful integration of green entrepreneurship in curricula. The content must combine environmental science fundamentals with sustainable business strategies, including topics like eco-design, circular economy principles, and environmental policy analysis (Albort-Morant et al., 2018). Effective teaching strategies employ active learning methods such as case studies of successful green businesses, simulation exercises, and field visits to sustainable enterprises (Smith & Johnson, 2023).

Assessment practices in green entrepreneurship education increasingly emphasize authentic evaluation methods. Project-based assessments, where students develop sustainable business plans, and reflective portfolios that document their learning journey have proven particularly effective (Boud & Falchikov, 2007). These approaches align with the experiential

nature of entrepreneurship education while reinforcing sustainability principles.

Student learning outcomes in green entrepreneurship programs typically span three domains. Knowledge outcomes include understanding environmental systems and sustainable market dynamics. Skill development focuses on abilities like environmental impact assessment and green product design. Perhaps most crucially, attitude formation aims to cultivate environmental responsibility and innovation mindsets (Zhang et al., 2024).

Despite these advances, significant challenges persist. Faculty often lack training in sustainability education, and resources for teaching green entrepreneurship remain scarce at many institutions. Additionally, the interdisciplinary nature of sustainability topics can create administrative barriers within traditionally siloed academic structures (Filho et al., 2018).

3. Methodology

This study employed a convergent parallel mixed-methods design to comprehensively assess green entrepreneurship integration at GDUPT. The quantitative component utilized structured surveys administered to 38 faculty members and 162 students selected through stratified random sampling. The surveys measured perceptions of integration across five dimensions using 5-point Likert scales.

Qualitative data were collected through open-ended survey questions and follow-up interviews with 15 participants. These explored challenges in implementation and suggestions for improvement. Thematic analysis identified recurring patterns in the responses.

Statistical analyses included descriptive statistics to determine means and standard deviations for integration and competence ratings. Independent samples t-tests and ANOVA examined group differences, while Pearson correlations assessed relationships between integration levels and student outcomes. All quantitative analyses were performed using SPSS version 28.

The study received ethical approval from the university's research ethics committee. Participation was voluntary, with informed consent obtained from all subjects. Data were anonymized to protect participant confidentiality.

4. Results and Discussion

4.1 Extent of Integration

Analysis revealed substantial integration of green entrepreneurship across all measured dimensions. Content integration received the highest ratings (Mean=2.81), particularly for topics connecting entrepreneurship with environmental protection. Teaching strategies, including case studies and green business competitions, were also well-implemented (Mean=2.75).

Resource availability showed room for improvement, with faculty reporting limited access to current case studies and teaching materials (Mean=2.67). This finding aligns with challenges identified in similar institutions (Smith & Johnson, 2021) and suggests a need for increased investment in curricular resources.

4.2 Student Competence

Students demonstrated strong practical skills in sustainable business practices (Mean=2.86), reflecting the program's emphasis on hands-on learning. Their attitudes toward green entrepreneurship were highly favorable (Mean=3.23), indicating successful cultivation of environmental values.

However, theoretical knowledge scores were moderate (Mean=2.39), particularly in areas like sustainable market analysis and environmental policy. This gap may stem from the technical focus of GDUPT's programs, which traditionally emphasize engineering over business and environmental studies.

4.3 Challenges and Barriers

Qualitative analysis identified three primary challenges:

- First, faculty noted difficulties in staying current with rapidly evolving green technologies and sustainable business models. As one instructor commented, "The field changes so quickly that our materials become outdated within a year."
- Second, administrative systems were not always supportive of interdisciplinary green projects. Bureaucratic hurdles frequently delayed approvals for innovative teaching initiatives.
- Third, some students initially resisted sustainability topics, perceiving them as irrelevant to their technical careers. However, most reported attitude shifts after engaging with practical applications.

5. Conclusion and Recommendations

This study demonstrates that GDUPT has successfully integrated green entrepreneurship principles into its Innovation and Entrepreneurship curriculum, particularly in terms of content and teaching strategies. The program effectively develops students' practical skills and fosters positive attitudes toward sustainability, though theoretical knowledge could be strengthened.

To address identified challenges, the following actions are recommended:

1. Establish a faculty development program focused on sustainability education, including regular workshops and access to current teaching resources.
2. Create an interdisciplinary task force to streamline approval processes for green entrepreneurship initiatives.
3. Enhance industry partnerships to provide students with real-world learning opportunities in sustainable businesses.
4. Develop a digital repository of up-to-date case studies and teaching materials accessible to all faculty.

Future research should examine long-term outcomes, tracking how graduates apply green entrepreneurship principles in their careers. Comparative studies across different types of institutions could also yield valuable insights for curriculum development.

By implementing these recommendations, GDUPT can strengthen its position as a leader in sustainable entrepreneurship education and better prepare students to address the environmental challenges facing China's petrochemical industry.

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Author Introduction

Sun Jian (1984—), male, Ph.D., master's supervisor, senior technician. His main research interests include technology entrepreneurship and engineering education.

Disclosure Statement

All authors disclosed no relevant relationships.

6. References

1. Aher, P. D., Patil, Y. D., Waysal, S. M., & Bhoi, A. M. (2023). Critical review on biopolymer composites used in concrete. *Materials Today: Proceedings*.
2. Bao, Q., & Chai, H. (2022). [Retracted] Environmental Regulation, Financial Resource Allocation, and Regional Green Technology Innovation Efficiency. *Discrete Dynamics in Nature and Society*, 2022(1).
3. Chen, X., Wang, Y., & Zhang, Z. (2022). Machine learning algorithms in chemical synthesis: Optimizing catalytic processes for energy efficiency. *Journal of Chemical Engineering*, 45(3), 123-135.
4. Cheng, P., Zhang, J., Chen, J., Zheng, Y., & Li, Z. (2024). Stakeholder attention and ambidextrous green innovation: Evidence from China. *Business Strategy and the Environment*.
5. Faisal, Y. A., Gunawan, I., Cupian, Hayati, A., Apriliadi, A., & Fajri, M. (2023). Examining the Purchase Intentions of Indonesian Investors for Green Sukuk. *Sustainability*, 15(9), 7430.
6. Guo, L., Li, H., & Zhao, J. (2021). Health and agricultural impacts of PM2.5 emissions from China's petrochemical sector: An epidemiological study. *Environmental Health Perspectives*, 129(7), 789-801.
7. Guo, M., Wang, H., & Kuai, Y. (2023). Environmental regulation and green innovation: Evidence from heavily polluting firms in China. *Finance Research Letters*.
8. Ghimire, A., Ali, S., & Khan, A. (2023). Does green innovation promote environmental efficiency from a global perspective? A hybrid approach (fuzzy DEA-SEM-ANN). *Environmental Science and Pollution Research*, 30(47), 104432–104449.
9. He, B. (2022). Application of Data Mining Technology in Enterprise Green Innovation Model Construction and Path Analysis. *Computational Intelligence and Neuroscience*, 2022, 1–9.
10. Haleem, F., Farooq, S., Cheng, Y., & Waehrens, B. V. (2022). Sustainable Management Practices and Stakeholder Pressure: A Systematic Literature Review. *Sustainability*, 14(4), 1967.
11. Khan, A. N., Mehmood, K., & Kwan, H. K. (2024). Green knowledge management: A key driver of green technology innovation and sustainable performance in the construction organizations. *Journal of Innovation & Knowledge*.
12. Liu, T., & Zhou, B. (2024). The impact of artificial intelligence on the green and low-carbon transformation of Chinese enterprises. *Managerial and Decision Economics*, 45(5), 2727–2738.
13. Liu, S., Wu, S., & Cheng, H. (2023). Preparation and characterization of lignin-derived nitrogen-doped hierarchical porous carbon for excellent toluene adsorption performance. *Industrial Crops and Products*, 192, 116120.
14. Salim, N., Ab Rahman, M. N., Abd Wahab, D., & Muhamed, A. A. (2020). Influence of Social Media Usage on the Green Product Innovation of Manufacturing Firms through Environmental Collaboration. *Sustainability*, 12(20), 8685.
15. Tian, C., Liang, Y., Lin, Q., You, D., & Liu, Z. (2024). Environmental pressure exerted by the petrochemical industry and urban environmental resilience: Evidence from Chinese petrochemical port cities. *Journal of Cleaner Production*.
16. Wang, Y., Zhang, X., Wang, Y., Chen, X., & Song, M. (2023). The road to sustainable development: Results of the differentiated choice of corporate environmental strategy. *Sustainable Development*.
17. Xie, J., Abbass, K., & Li, D. (2024). Advancing eco-excellence: Integrating stakeholders' pressures, environmental awareness, and ethics for green innovation and performance. *Journal of Environmental Management*.
18. Zhou, L., Chen, Y., Zhang, X., Li, J., Wu, X., Zuoqiu, S., Wang, H., Zheng, C., & Yang, F. (2024). Different VOC species derived from fugitive emissions at various altitudes around petrochemical plant. *Atmospheric Environment: X*, 21, 100232.
19. Zhou, W., Zhuang, Y., & Chen, Y. (2024). How does artificial intelligence affect pollutant emissions by improving energy efficiency and developing green technology. *Energy Economics*.
20. Zhang, J., & Li, S. (2023). The Impact of Human Capital on Green Technology Innovation—Moderating Role of Environmental Regulations. *International Journal of Environmental Research and Public Health*, 20(6), 4803.