

Article

Applying Project-Based Learning in Sustainable Brand Communication Education: Evidence from the RHINOSHIELD Public Relations Case

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Abstract: Background: As sustainability becomes an integral element of strategic brand communication, higher education must equip students with the capacity to integrate Environmental, Social, and Governance (ESG) principles into professional practice. This study implemented a Project-Based Learning (PBL) model in a university-level public relations course, using RHINOSHIELD's "Recycled Shell Program" as a live case. Students engaged in interdisciplinary teamwork, data-driven analysis (e.g., via OpView), and iterative proposal development under the guidance of industry mentors. A mixed-methods approach was employed, including pre- and post-course surveys, portfolio assessments, and expert evaluations. Statistically significant improvements were observed across multiple learning dimensions, including ESG literacy, strategic communication planning, and applied PR proposal writing ($p < 0.001$; Cohen's $d > 1.0$). Industry feedback further validated students' enhanced creativity, feasibility awareness, and alignment with real-world sustainability goals. The findings reinforce the effectiveness of PBL as a pedagogical strategy for cultivating ESG-aligned communication competencies. Through the integration of real-world collaboration and data analytics into the curriculum, the study proposes a replicable instructional framework for advancing sustainability education in branding and public relations.

Keywords: Project-Based learning (PBL), Sustainable brand communication, ESG education, Public relations

1. Introduction

Sustainable development has become a core element in contemporary brand communication. As Environmental, Social, and Governance (ESG) concepts gain traction globally, the demand for professionals equipped with sustainability communication competencies is growing across industries. Higher education institutions are thus actively exploring effective pedagogical strategies to equip students with the knowledge and practical skills necessary to meet the evolving expectations of the professional world.

Among emerging pedagogical approaches, Project-Based Learning (PBL) stands out as a particularly promising method for sustainability-focused brand communication education. PBL emphasizes hands-on experience and problem-solving, enabling students to apply theoretical concepts to real-world scenarios. Through structured projects, learners are guided to collaboratively analyze problems, design strategies, and execute solutions, fostering both technical proficiency and soft skills such as teamwork and communication.

This study investigates the application of PBL in a university-level sustainable brand communication course, using the RHINOSHIELD campus public relations proposal competition as a case study. The study aims to examine how PBL contributes to students' development of public relations (PR) proposal capabilities and sustainability literacy. Specifically, this research has three objectives:

- (1) To assess the effectiveness of PBL in enhancing student learning outcomes within a sustainable brand communication curriculum.
- (2) To explore the role of academia-industry collaboration in facilitating practical performance and professional competence in sustainability communication.
- (3) To construct a pedagogical framework and an assessment model tailored for ESG-oriented communication education in higher education contexts.
- (4) To address these goals, the study poses three research questions:

- (1) How does PBL support students in developing sustainable brand analysis skills, including their understanding of sustainability strategies and competitive positioning?
- (2) In what ways does academia-industry collaboration influence students' planning and execution of communication strategies?
- (3) How can sustainable brand communication education effectively integrate theoretical and practical elements to improve students' problem-solving abilities in real-world contexts?

This research contributes to both theoretical advancement and practical innovation in sustainability-focused communication education. Theoretically, it extends the application of PBL into the domain of sustainable communication education and explores how ESG principles can be integrated into branding and curriculum design. Practically, it provides an innovative instructional model that highlights the value of academia-industry collaboration in enhancing real-world readiness among students. Furthermore, the study proposes a set of evaluative indicators for ESG-based communication teaching, offering concrete references for future curriculum development and assessment in related educational fields.

2. Literature Review

2.1 Project-Based Learning: Theoretical Foundations and Applications

Project-Based Learning (PBL), sometimes referred to as PjBL to distinguish it from Problem-Based Learning, is a learner-centered instructional approach that immerses students in authentic, real-world projects to cultivate problem-solving, critical thinking, and collaboration skills (Hung, 2016).

In higher education, PBL has been widely recognized for its effectiveness in enhancing students' practical competencies and innovative thinking (Hung et al., 2019). By using authentic challenges as learning drivers, PBL fosters interdisciplinary integration and reflective learning, where students are expected to collaboratively complete tasks with clear deliverables—bridging the gap between theory and practice (Hung, 2009; Tweeten and Hung, 2023).

While often compared with Problem-Based Learning (also abbreviated as PBL), Project-Based Learning (PjBL) places more emphasis on real-world project execution and iterative development. Unlike abstract problem-solving in PBL, PjBL emphasizes concrete implementation, design, and reflection (Hung, 2011; Budakoğlu et al., 2023). Models such as 3C3R—Content, Context, Connection, along with Reflection, Research, and Resolution—serve as a comprehensive framework for structuring effective PjBL experiences (Hung, 2009; Hung, et al., 2013).

To ensure the effectiveness of PjBL, student motivation is a key consideration. Studies have shown that the incorporation of multimedia elements, real-life cases, and diverse formats (e.g., print, video, face-to-face interaction) enhances learner engagement and interest (Budakoğlu et al., 2018; 2023). Furthermore, instructors should offer multi-layered content and flexible teaching strategies to accommodate diverse learning styles (Pyle and Hung, 2019). Collaborative learning is another crucial characteristic of PjBL, with students often working in small teams. Research indicates that well-designed teaching interventions—such as flipped classrooms—can improve team dynamics and collective problem-solving (Hwang and Chen, 2023). Nevertheless, challenges such as unequal task distribution and communication barriers must be addressed through timely instructor facilitation (Oderinu et al., 2020).

From a methodological standpoint, PjBL effectiveness can be explored through various approaches. Quantitative methods (e.g., path analysis) can identify causal relationships in learning outcomes, while qualitative methods (e.g., ethnographic observation) provide insights into learning processes. Mixed-method approaches, such as design-based research, offer comprehensive analytical perspectives for evaluating instructional effectiveness and pedagogical improvements. (Hung, 2023; Tweeten and Hung, 2023).

In summary, PjBL is an effective pedagogical approach for fostering essential skills in higher education. However, its success depends on thoughtful project design, student engagement, collaborative structures, and appropriate research methodologies tailored to the instructional context (Hung, 2011; Binks et al., 2021).

2.2 Trends in Sustainable Brand Communication

Sustainable brand communication has become increasingly prominent in response to growing global attention on sustainable development and ESG-related issues. Contemporary branding strategies increasingly emphasize interactive communication, transparency, issue-driven narratives, diversified media use, data-driven planning, and the integration of sustainability into brand core values (Lee, et al., 2013; Alipour et al., 2024).

First, the evolution from one-way to two-way communication has become a major trend. Social media has enabled brands to engage in direct dialogue with consumers and stakeholders, fostering mutual understanding and trust (Leonardi and Vaast, 2017;

Ramanadhan et al., 2013). Second, stakeholder expectations for authenticity and transparency continue to rise. Brands are expected to disclose their sustainability goals and performance with credible data and case evidence. Misleading claims—often criticized as "greenwashing"—can severely damage brand credibility (Ellerup and Thomsen, 2018; Cho and Patten, 2007).

Moreover, it is crucial for brands to focus on sustainability issues aligned with their industry. For example, energy companies should prioritize carbon reduction, while fashion brands should focus on labor rights and environmental impacts within the supply chain (Quatrone, 2022). A diversified communication strategy is also critical, involving not only traditional channels but also social media, video platforms, and influencers to deliver compelling narratives (El Alfy et al., 2024).

Data analytics plays an increasingly important role in evaluating the effectiveness of brand communication strategies. Monitoring social media interactions, website metrics, and media coverage allows brands to optimize their communication and engage audiences more precisely (Matakanye and van der Poll, 2021). Ultimately, embedding sustainability into a brand's DNA—from product design and manufacturing to corporate culture—builds internal and external trust, and positions the brand for long-term success (Eccles, Ioannou, and Serafeim, 2014).

In essence, sustainable brand communication relies on authenticity, transparency, and actionable strategies, supported by diverse communication tools and continuous data feedback.

2.3 ESG Education and Public Relations Proposals

University-industry collaboration in ESG and public relations (PR) education offers students valuable real-world exposure while enabling companies to gain fresh perspectives and innovative solutions (Aramayanti et al., 2024). Research suggests that such partnerships inject practical relevance into PR education and help cultivate industry-ready professionals (El Alfy et al., 2020).

Through participation in authentic projects, students can apply theoretical knowledge to practical situations. These collaborative projects may involve communication strategy development, sustainability storytelling, crisis management, or social media analysis—providing holistic training in contemporary PR challenges (Ramanadhan et al., 2013).

The involvement of industry mentors is essential. Companies can assign experienced PR professionals to serve as advisors, sharing insights, case studies, and access to real data or tools (Lee et al., 2013). This enhances students' analytical skills and understanding of real-world expectations. Moreover, students often bring creative, outside-the-box thinking that can benefit the corporate partner (Alipour et al., 2024).

This tripartite collaboration benefits all parties: students gain hands-on experience, educators strengthen curriculum relevance, and businesses access innovation. It also fosters mutual learning and advances the development of the public relations profession in the sustainability era.

2.4 Research Gap

Although PjBL and university-industry collaboration have demonstrated pedagogical value in sustainable brand communication education, existing literature is largely descriptive. There is a lack of in-depth analysis of how PjBL integrates ESG frameworks and tools—such as the 3C3R model, data analysis platforms, or social media strategies—to build students' applied competencies.

Additionally, while some research explores how industry collaboration fosters student development, differences across sectors (e.g., tech, energy, fashion) remain underexplored. Little is known about how collaborative models can be optimized based on industry-specific contexts. Importantly, the link between student learning outcomes and corporate value creation is rarely articulated. Questions remain about how to balance educational objectives with industry needs, and how value is co-generated in such partnerships.

Finally, there is a pressing need to develop effective evaluation models—such as performance indicators for ESG communication education or impact measurement tools—to assess how well PjBL and industry collaboration foster integrated learning. This study addresses these gaps by examining the RHINOSHIELD public relations proposal competition as a case of PBL implementation in sustainable brand communication. It also attempts to develop an evaluation framework for ESG-oriented pedagogy, providing insights for future educational design and research.

3. Research Methodology

3.1. Research Design

This study adopts a mixed-method research design, integrating both quantitative and qualitative approaches to examine the effectiveness of Project-Based Learning (PBL) in sustainable brand communication education. The pedagogical intervention was

implemented in a university-level communication strategy course, with RHINOSHIELD serving as the real-world client in a campus public relations proposal competition.

The research process included three main phases:

- (1) Pre- and post-course surveys to measure changes in students' knowledge, attitudes, and skills related to sustainability and brand communication.
- (2) Learning portfolio analysis, including proposal content, teamwork processes, and student reflections.
- (3) Industry-academic collaboration documentation, such as mentor feedback and project presentations.

This triangulated research structure not only evaluates learning outcomes but also captures the experiential and collaborative nature of PBL, thereby ensuring the reliability and validity of the findings.

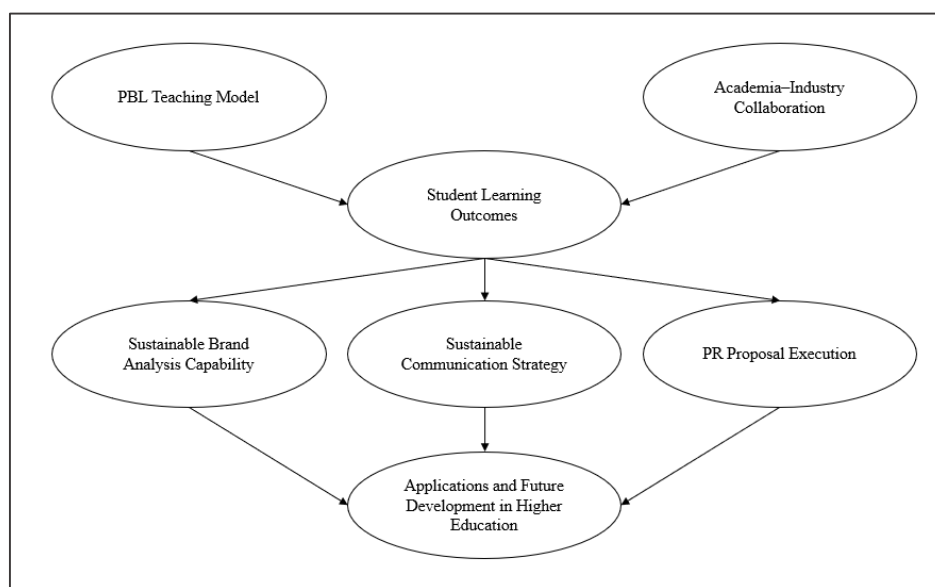


Fig. 1. Conceptual framework of PBL-driven learning outcomes in sustainable brand communication education.

3.2. Participants and Context

The study employed a variety of data sources to ensure comprehensiveness, reliability, and validity. A questionnaire survey was administered using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) to assess changes in students' public relations (PR) knowledge, skills, and attitudes before and after the course.

The questionnaire covered three primary dimensions:

- (1) Foundational PR Knowledge – e.g., “I know what public relations is,” used to assess students' understanding of basic PR concepts.
- (2) Practical PR Experience – e.g., “I can name at least one real-world PR case,” used to evaluate students' familiarity with and exposure to PR practices.
- (3) Learning Interest and Career Planning – e.g., “I am interested in the field of PR and actively follow trends in the industry,” used to understand students' motivation for learning and career development intentions.

Surveys were administered anonymously before and after the course to capture changes in learning outcomes, while minimizing potential social desirability bias and ensuring authentic feedback. To ensure measurement quality, Cronbach's alpha was calculated, yielding a value greater than 0.80, indicating high internal consistency and meeting the reliability standards of academic research. Content validity was also assessed through expert review. Academics and industry professionals in the field of public relations were invited to evaluate the questionnaire to ensure that each item accurately captured changes in students' knowledge, skills, and attitudes.

In addition to the survey, the study collected a range of student learning artifacts, including midterm proposals, interim reports, and final project submissions. Classroom interactions and student feedback were documented throughout the course. To enhance the credibility and trustworthiness of the findings, triangulation was applied by integrating data from classroom observations and student interviews.

For example, one student wrote in a reflective journal: “Through this proposal project, I gained a deeper understanding of how to align brand values with sustainability goals. It was a completely new learning experience for me” (Student D07). These firsthand reflections provided rich material for the study’s thematic analysis.

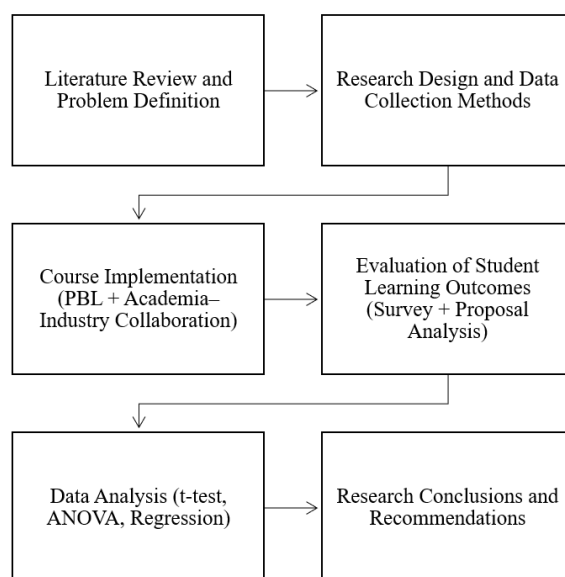


Fig. 2. Research procedure of the PBL-based sustainability communication study.

3.3. Instruments and Data Analysis

To ensure robust evaluation, this study utilized the following research instruments:

Learning Outcome Questionnaire: A pre- and post-test instrument used to assess students’ progress in understanding ESG principles, communication strategy design, PR planning, and data-driven execution. The instrument included 20 items on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Items were categorized into four domains: (1) sustainability knowledge (5 items), (2) brand communication strategy (5 items), (3) public relations proposal planning (5 items), and (4) data analysis and media execution skills (5 items). Sample items include: “I understand the core principles of ESG and sustainable development,” “I am confident in developing a communication strategy aligned with brand positioning,” and “I can evaluate target audience insights using data tools.”

(1) **Team Proposal Evaluation Rubric:** Developed based on professional PR assessment criteria, including strategic insight, ESG integration, creativity, feasibility, and data application.

(2) **Student Reflection Reports:** Qualitative data drawn from weekly journals, capturing individual learning experiences and team dynamics.

(3) **Industry Feedback Forms:** Collected from RHINOSHIELD and external PR consultants who served as judges during the final proposal presentations.

In addition to the instruments, this study adopted a mixed-methods approach combining both quantitative and qualitative analysis to comprehensively evaluate the impact of Project-Based Learning (PBL) in a sustainable brand communication course. Data sources included pre- and post-course surveys, student learning portfolios, team proposal documents, and industry feedback.

To assess learning gains, paired-samples t-tests were conducted to compare students’ pre- and post-test performance in brand analysis, sustainability communication strategy, and PR proposal execution. The sample size was $n = 24$ for all statistical analyses. Data distribution was examined using the Shapiro–Wilk test, and the results met the assumption of normality ($p > .05$), supporting the use of parametric tests. Cohen’s d was calculated to determine the effect size of learning improvements. In addition, a one-way ANOVA was performed to confirm the significance of score changes, and linear regression analysis was used to examine the predictive impact of PBL on student performance, evaluating its effectiveness as a pedagogical model.

The study also analyzed students’ proposal development over time, group discussions, and final presentations to explore how PBL influenced their learning experience. Thematic and content analyses were conducted on student reflection journals and post-course feedback to extract recurring themes, learning challenges, and perceived gains from the PBL process. Thematic analysis was used to code and categorize qualitative data, with two independent researchers conducting the analysis to enhance inter-coder

reliability. Additionally, professional feedback from industry mentors was analyzed to assess students’ applied competencies and professional readiness.

Together, the integration of quantitative statistics and qualitative insights provided a comprehensive assessment of how PBL supports learning in sustainable brand communication, offering both theoretical contributions and practical implications for future educational design.

Table 1. Evaluation Rubric for PR Proposal Projects.

Evaluation Dimension	Description	Weight (%)
Strategic Insight	Clarity of brand positioning, communication goals, and target segmentation.	20%
ESG Integration	Effectiveness in embedding sustainability and ESG values into proposal.	20%
Creativity and Innovation	Originality of campaign ideas, concept execution, and storytelling.	20%
Data and Media Application	Use of data analysis, media selection rationale, and planning logic.	20%
Feasibility and Professionalism	Realism, budget awareness, presentation quality, and professional polish.	20%
Total		100%

Note. Each dimension was assigned an equal weight of 20% in evaluating student proposals. This rubric was used by both faculty and industry mentors to assess the strategic clarity, ESG integration, creativity, data application, and professionalism of PR projects.

3.4. Data Analysis

The course was structured using a phased progression model that integrated theoretical instruction, hands-on practice, and industry collaboration. This step-by-step approach was designed to gradually cultivate students’ analytical and proposal-writing competencies in the field of sustainable brand communication. The core objective was to help students understand the connection between ESG (Environmental, Social, and Governance) principles and brand communication, and to apply this understanding in real-world scenarios through project-based work.

To achieve this, the course was divided into three major stages, encompassing the full learning journey—from foundational theory building and practical simulation to final project execution.

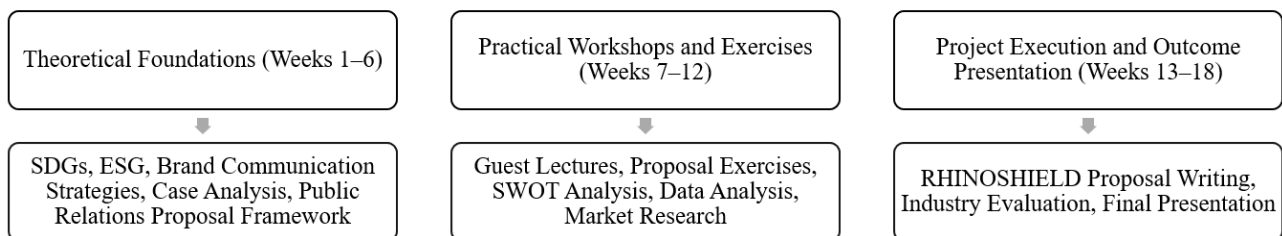


Fig. 3. Course structure and timeline of the sustainable brand communication project.

Phase 1 (Weeks 1–6): Theoretical Foundation.

This phase focused on building a foundational understanding of sustainability and ESG. Through structured lectures and case analyses, students explored topics such as the UN Sustainable Development Goals (SDGs), corporate social responsibility (CSR), and ESG applications in brand strategy. Selected case studies showcased how different companies embedded sustainability into branding. To contextualize theory, students reviewed award-winning PR campaign videos from past campus competitions. Practical assignments included brand needs assessment and message house exercises to help students internalize the fundamentals of brand communication and prepare for subsequent proposal work.

Phase 2 (Weeks 7–12): Practical Application and Workshops.

In this stage, students transitioned to hands-on learning through workshops led by industry professionals. Sessions covered proposal writing, sustainability issue framing, and stakeholder communication strategies. RHINOSHIELD provided detailed brand profiles and market positioning insights. Students drafted proposal outlines based on target market research and strategic objectives. Activities included social listening using tools like OpView to examine consumer perceptions of the brand and ESG issues.

Emphasis was placed on interdisciplinary teamwork, iterative improvement, and expert feedback to refine the proposal in line with actual brand demands.

Phase 3 (Weeks 13–18): Project Execution and Final Presentation.

Students completed a comprehensive ESG-oriented PR proposal tailored to RHINOSHIELD's branding objectives. Guided by industry mentors, students polished their content through strategic consultations. Final deliverables included written proposals, data analysis reports, and presentation decks. These were presented at a final showcase judged by a panel of faculty and PR professionals. Evaluation criteria included innovation, feasibility, and sustainability impact. Students also submitted supporting documents demonstrating analytical rigor, such as SWOT analyses and value proposition canvases, ensuring the assessment emphasized both process and performance.

The course was grounded in university–industry collaboration, which served as a foundational element throughout project design and execution. RHINOSHIELD actively contributed branding cases, datasets, and expert mentorship. During Weeks 7–12, the company hosted briefing sessions and proposal clinics, offering students real-time feedback on sustainability goals and branding challenges. Direct engagement with industry professionals significantly enhanced the depth, relevance, and feasibility of student proposals, while fostering practical insight into ESG-driven branding challenges.

To ensure objective and comprehensive assessment, the proposal competition adopted a multidimensional rubric encompassing innovation, practicality, and ESG impact. Students were required to communicate their brand strategies and design thinking using structured visual frameworks and data-informed tools, aligning with professional standards in strategic communication.

RHINOSHIELD's branding position—CHANGEMAKER—and campaign theme, "Sustainable Planet: I'm IN," grounded the entire course in practical relevance. Students were tasked with promoting the "Recycled Shell Program," aiming for a 15% year-over-year increase in participation. Supported by materials on single-material engineering and the RHINOLOOP circular ecosystem, students were encouraged to align campaign strategies with Gen Z behavior research and ESG storytelling.

By engaging directly with industry experts and real brand challenges, students translated theoretical insights into actionable strategies. The course not only enhanced students' communication and analytical skills but also fostered the development of sustainability-minded professionals capable of meeting evolving industry demands. Rather than passive recipients, students became active learners immersed in authentic problem-solving, bridging classroom learning with real-world practice.

4. Discussion

4.1 Statistical Analysis of Learning Outcomes

This study employed paired-samples t-tests to examine whether the differences between pre-test and post-test scores were statistically significant. Cohen's *d* was calculated to assess the effect size for each item. The results demonstrated both statistically significant improvements ($p < .001$) and meaningful practical significance, with all effect sizes exceeding $d = 1.0$.

Among all measured items, the greatest improvement was observed in the item "Understanding ESG concepts and applying them to brand analysis" with a Cohen's *d* of 1.25, indicating notable progress in students' ability to integrate ESG principles with brand strategy. Similarly, the item "Integrating data to optimize PR proposals" had a Cohen's *d* of 1.24, reflecting enhanced data-driven communication planning skills. In summary, all learning outcomes achieved Cohen's *d* values above 1.0, demonstrating substantial real-world impact and confirming the effectiveness of the course in enhancing students' capabilities in sustainable brand communication and public relations (Table 1).

In addition to the paired-samples t-test, one-way ANOVA and linear regression analyses were also conducted to explore the effects of Project-Based Learning (PBL) on student performance. Although a one-way ANOVA yielded statistically significant results, $F(1, 10) = 82.99$, $p < .001$, this method is generally less appropriate when comparing only two conditions (pre- and post-test). Therefore, the paired-samples t-test provides a more suitable and interpretable analysis for assessing within-subject changes in this context.

Table 1. Comparison of Pre-Test and Post-Test Scores in Sustainable Brand Communication Course.

Item	Pre-Test Mean	Post-Test Mean	Pre-Test SD	Post-Test SD	t-value	p-value	Cohen's d
Analyzing sustainable brand strategies	3.45	4.21	0.67	0.71	-5.23	< 0.001	1.10
Understanding ESG concepts and applying them	3.12	4.02	0.71	0.73	-4.89	< 0.001	1.25
Designing impactful brand communication	3.38	4.26	0.75	0.69	-6.02	< 0.001	1.22
Adjusting communication via data analysis	3.19	4.05	0.69	0.70	-4.92	< 0.001	1.24
Integrating data to optimize PR proposals	3.44	4.31	0.72	0.68	-5.84	< 0.001	1.24
Writing professional PR press releases	2.91	4.10	0.65	0.66	-6.15	< 0.001	1.20

Note: All scores are based on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). t-values are from paired-samples t-tests. Cohen's d > 0.8 indicates a large effect size.

4.2 Sustainable Brand Analysis Skills

The findings indicate a significant improvement in students' ability to analyze sustainable brands, especially in understanding industry trends, interpreting ESG values, and conducting stakeholder analysis. For instance, one student reflected, "After analyzing RHINOSHIELD's market positioning, I better understood how ESG strategies enhance brand competitiveness" (Student A03). Another student noted, "We designed an interactive campaign targeting Gen Z to strike a balance between brand goals and consumer expectations" (Student E08). These observations reflect students' capacity to translate theory into practice and to interpret brand sustainability from multidimensional perspectives.

Further analysis confirmed significant gains in sustainable brand cognition. For example, scores for "I can analyze sustainable brand strategies" improved from a pre-test mean of 3.45 (SD = 0.67) to 4.21 (SD = 0.71), with $t = -5.23$ ($p < 0.001$). Likewise, scores for "I can understand ESG concepts and apply them to brand analysis" rose from 3.12 to 4.02, showing substantial improvement ($t = -4.89$, $p < 0.001$) (Table 2).

Table 2. Results of Sustainable Brand Analysis.

Item	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	t-value	p-value	Cohen's d
Analyzing sustainable brand strategies	3.45	0.67	4.21	0.71	-5.23	<0.001	1.10
Understanding ESG concepts and applying them	3.12	0.71	4.02	0.73	-4.89	<0.001	1.25

Note: Items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). t-values are based on paired-samples t-tests. Cohen's d represents effect size; values above 0.8 indicate a large effect.

4.3 Sustainable Communication Strategies

Students demonstrated clear improvement in planning sustainable communication strategies, especially in the areas of creative concept development and execution. One student shared, "The course challenged us to develop a proposal from scratch, which required us to align brand positioning with sustainability values and ultimately deliver an innovative campaign" (Student D03). Another remarked, "Using SWOT analysis, we assessed feasibility and created contingency plans to manage risks" (Student E01).

Statistical data supports this progress. For the item "I can design impactful brand communication strategies," scores increased from 3.38 (SD = 0.75) to 4.26 (SD = 0.69), with $t = -6.02$ ($p < 0.001$). Similarly, "I can adjust communication strategies through data analysis" scores improved from 3.19 to 4.05 ($t = -4.92$, $p < 0.001$) (Table 3).

Table 3. Analysis of Sustainable Communication Strategy.

Item	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	t-value	p-value	Cohen's d
Designing impactful brand communication	3.38	0.75	4.26	0.69	-6.02	< 0.001	1.22
Adjusting communication via data analysis	3.19	0.69	4.05	0.70	-4.92	< 0.001	1.24

Note: Scores were measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). t-values are from paired-samples t-tests. Cohen's d values above 0.8 indicate a large effect size, reflecting substantial improvement in students' strategic communication skills.

Students also learned to integrate quantitative and qualitative indicators for campaign evaluation. One student commented, "Designing KPIs helped us link data to projected outcomes clearly and persuasively" (Student F07).

4.4 PR Proposal Execution

Throughout the PR proposal execution process, students showcased the ability to synthesize theory and practice. Many cited the role of industry mentors in refining their work. One student shared, "The mentor emphasized the importance of data support, so we revisited our market analysis and used OpView to strengthen our case" (Student G04). Another noted, "In our crisis simulation, we found gaps in our original plan. With team discussion and mentor feedback, we revised the strategy to make it more feasible" (Student H06).

Statistically, the item "I can integrate data to optimize PR proposals" increased from a pre-test mean of 3.44 to 4.31 ($t = -5.84, p < 0.001$). Likewise, "I can write professional PR press releases" scores improved from 2.91 to 4.10 ($t = -6.15, p < 0.001$) (Table 4).

Table 4. Analysis of PR Proposal Execution.

Item	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	t-value	p-value	Cohen's d
Integrating data to optimize PR proposals	3.44	0.72	4.31	0.68	-5.84	< 0.001	1.24
Writing professional PR press releases	2.91	0.65	4.10	0.66	-6.15	< 0.001	1.20

Note: Responses were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). t-values are derived from paired-samples t-tests. Cohen's d indicates effect size; values above 0.8 represent large effects, highlighting significant improvement in PR execution competencies.

In the RHINOSHIELD campus PR competition, the "Recycling Shells" initiative became a central theme in student proposals. The brand's ESG information—such as its use of 85% recycled materials and plastic reduction efforts—provided a clear structure for students. Their campaigns incorporated ideas like "single-material technology" and the "RHINOLOOP sustainable ecosystem" to align brand values with ESG messaging. One group member wrote, "We analyzed engagement data and designed an interactive campaign targeting Gen Z audiences" (Student F08). This highlights both students' integrative thinking and the course's role in fostering innovative, sustainability-oriented solutions.

This study's results confirmed significant improvements in sustainable brand analysis, communication strategies, and PR execution, with all p-values < 0.001. Most Cohen's d values exceeded 0.80, confirming both statistical and practical significance.

5. Conclusions and Recommendations

This study explored the implementation of Project-Based Learning (PBL) within the context of sustainable brand communication education, using the RHINOSHIELD campus public relations proposal competition as a pedagogical model. The findings demonstrated significant enhancements in students' competencies across brand sustainability analysis, ESG-integrated strategy formulation, and applied public relations execution. The course design successfully bridged theory and practice through phased instruction, industry mentorship, and multidimensional assessment mechanisms. Students not only acquired practical skills but also developed a nuanced understanding of ESG-brand alignment and data-informed decision-making.

This research contributes to the growing body of literature on sustainability education by addressing a notable gap in the application of ESG concepts to brand communication pedagogy. It advances a replicable PBL framework that emphasizes industry

engagement, interdisciplinary learning, and real-world relevance. Furthermore, the study highlights the value of integrating data analytics and design thinking into communication curricula to foster innovation and strategic literacy.

To amplify the practical impact of sustainability education, several recommendations are proposed. Institutions should foster sustained partnerships with industry to provide students with authentic, applied learning opportunities. Assessment strategies should be diversified to include both quantitative metrics and reflective evaluations, yielding a more holistic picture of student development. Additionally, cultivating data literacy through the use of media monitoring and market analysis tools is essential for preparing students for evidence-based practice. Finally, creativity and problem-solving skills can be enhanced by incorporating experiential methods such as design thinking workshops and simulation-based exercises.

Despite its contributions, the study presents several limitations. It was confined to a single institution and focused on a specific case study, potentially limiting the generalizability of its findings. Future research should include a broader range of academic disciplines to evaluate the interdisciplinary potential of PBL in ESG education. Moreover, the absence of confidence intervals for effect sizes constrains the precision of the statistical analysis; subsequent studies should incorporate interval estimates to enhance methodological rigor. A longitudinal approach would also provide valuable insights into the sustained impact of PBL on students' professional development and post-graduation application of ESG communication skills.

Additionally, comparative studies examining PBL alongside other instructional models—such as flipped classrooms, experiential learning, or blended learning—could help determine the most effective pedagogies for sustainability-oriented communication. Given the rapid evolution of ESG discourse, future research should also consider the integration of emerging technologies, including artificial intelligence, big data analytics, and immersive media (e.g., AR/VR), to support students' strategic planning and real-time problem-solving capabilities.

In sum, this study affirms the efficacy of PBL in sustainability communication education and underscores the importance of technologically enriched, interdisciplinary, and practice-oriented curricula. Preparing students to navigate the complexities of ESG communication requires not only conceptual understanding but also adaptive, data-driven, and innovative skillsets for future leadership in real-world contexts.

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Data Availability Statement: The data generated and analyzed during this study, including student survey responses, learning portfolios, and expert evaluations, are not publicly available due to privacy and institutional restrictions, but are available from the corresponding author upon reasonable request.

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