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INTEGRATING SUSTAINABILITY INTO ESP PEDAGOGY: A CASE STUDY WITH ENGINEERING TECHNOLOGY UNDERGRADUATES AT THE UNIVERSITY OF KELANIYA, SRI LANKA

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ABSTRACT: In the context of global environmental concerns and the Sustainable Development Goals (SDGs), engineering education must equip undergraduates not only with technical knowledge but also with the ability to communicate sustainability concepts effectively. English for Specific Purposes (ESP), particularly within STEM education, plays a pivotal role in developing such competence. This study examined how the ESP module, DELT 33212-English for Professional Purposes offered to third-year Engineering Technology undergraduates at the Faculty of Computing and Technology, University of Kelaniya, could be redesigned to integrate sustainability-focused content. The study was conducted over six weeks and involved 35 third-year Engineering Technology undergraduates who had selected specializations and they engaged in targeted ESP tasks, including SDG-aligned technical presentations, green project documentation and reflective writing on eco-conscious engineering. Scaffolded instructional materials, such as guided vocabulary lists and collaborative writing activities, were provided to support learning. Data were collected through pre- and post-intervention questionnaires and focus group interviews. Findings revealed significant improvements in the use of environmental vocabulary, audience-aware communication, ethical framing in technical reports and clarity in sustainability presentations. Qualitative analysis indicated enhanced ethical and environmental awareness, increased confidence in language use and development of reflective and critical thinking skills. While the study was limited by a small sample size, short duration and absence of a control group, it demonstrates the potential of ESP pedagogy to move beyond technical language instruction, promoting responsible communication and ethical engagement with sustainability. The findings have broader implications for ESP curriculum reform, suggesting that sustainability-focused approaches could be adapted across STEM and non-STEM contexts, preparing graduates for the ethical and communicative demands of their professions.

Keywords: engineering technology undergraduates, English for Specific Purposes (ESP), STEM, sustainability

1 INTRODUCTION

Global environmental concerns and the increasing prominence of the Sustainable Development Goals (henceforth SDGs) have highlighted the urgent need for engineering education to equip undergraduates not only with technical expertise but also with the ability to communicate sustainability concepts effectively. English for Specific Purposes (henceforth ESP), particularly within STEM education, plays a pivotal role in developing such linguistic competence (Hyland, 2013; Basturkmen, 2010; Gerasimova, 2025). Despite this, many ESP courses in state universities tend to focus narrowly on occupational or technical language skills, often overlooking the integration of environmental, ethical and social dimensions essential for sustainability-oriented communication (Sanosi et al., 2025). Hence, this study investigates the ESP module, DELT 33212- English for Professional Purposes, offered to third-year Engineering Technology (henceforth ET) undergraduates at the Faculty of Computing and Technology, University of Kelaniya,

to examine how sustainability-focused content can be embedded to enhance students' communicative competence, ethical awareness and reflective capacity. It is not intended to assert superiority over alternative ESP approaches but rather to explore the pedagogical impact of integrating sustainability-oriented tasks within a discipline-specific curriculum. The main objective is to better prepare students to communicate engineering innovations responsibly and ethically, particularly within their chosen specialization pathways.

1.1 Rationale and Objectives

The rationale for this research stems from a clear curricular gap in addressing global sustainability issues within ESP instruction, particularly for ET undergraduates. While current ESP programs typically focus on general academic and professional skills such as paraphrasing, summarizing, technical and business report writing, oral presentations and graph descriptions, they tend to overlook contemporary sustainability topics that are directly relevant to students' disciplinary interests and emerging global priorities. This limitation has been noted in prior research, where ESP has often been critiqued for its narrow focus on linguistic competence at the expense of broader socio-ethical and global concerns (Hyland, 2013; Flowerdew, 2013). By the third year of their degree program, ET undergraduates have selected their specialization pathways, making this a strategically significant stage for introducing sustainability communication aligned with their future careers. In recognition of the increasing demand for engineering technology graduates who are not only technically proficient but also ethically and environmentally cognizant, this study examines how sustainability-related content can be systematically integrated into the selected module to advance students' linguistic proficiency, ethical sensitivity and reflective thinking. It further seeks to evaluate student responses to a series of discipline-linked, sustainability-focused language tasks implemented through the selected module and to assess the extent to which task-based ESP strategies can develop the sustainability communication skills necessary for addressing the linguistic, ethical and professional demands of their future roles.

2 METHODOLOGY

This study employed a mixed-methods design conducted over a six-week period with 35 third-year ET undergraduates enrolled in the DELT 33212- English for Professional Purposes module at the Faculty of Computing and Technology, University of Kelaniya. Participants had selected specialization pathways, providing a suitable context for discipline-specific sustainability communication tasks. The intervention comprised a series of targeted ESP learning tasks designed to integrate sustainability-oriented communication relevant to students' disciplinary domains. These tasks included SDG-aligned technical presentations, green project documentation and reflective writing on eco-conscious engineering practices. To support students' engagement and ensure consistency, instructional materials such as guided vocabulary lists, structured task templates and exemplar sustainability documents were provided. Data were collected through pre- and post-intervention questionnaires, which included items assessing participants' confidence in employing sustainability-related language, awareness of ethical and environmental considerations and the capacity to adapt communication to different audiences and contexts. Additionally,

focus group interviews were conducted with 12 voluntary participants to obtain qualitative insights into their experiences, engagement and perceptions of the sustainability-focused ESP tasks. This methodological approach enabled the systematic capture of both quantitative and qualitative changes in linguistic proficiency, ethical sensitivity and reflective thinking, while providing sufficient detail to facilitate potential replication of the intervention.

2.1 Data Analysis Method

Quantitative data from the questionnaires were analyzed using descriptive statistics and paired sample t-tests to measure differences in confidence levels of the participants, use of environmental vocabulary and awareness of sustainability-related communication before and after the intervention. Statistical significance was determined at a 95% confidence level (p ¡ 0.05). Qualitative data from focus group interviews were transcribed verbatim and analyzed thematically. This process identified recurrent themes reflecting experiences of the participants, changes in language proficiency, perceptions of sustainability and the relevance of the ESP tasks to their disciplinary and professional development.

3 RESULTS AND DISCUSSION

3.1 Quantitative Results

The analysis of the responses from 35 participants indicated clear improvements in four key sustainability communication competencies before and after intervention. The most notable improvement was in the use of environmental vocabulary, which increased from 38% to 82%. Similarly, audience-aware language use rose from 41% to 86%, ethical framing in technical reports improved from 35% to 78%, and clarity in sustainability presentations increased from 45% to 84%. Paired sample t-tests confirmed these gains as statistically significant ($p < 0.001$) across all domains. Student self-assessment data reflected these improvements, with confidence in engaging in sustainability-oriented communication rising from 42% to 84%.

3.2 Qualitative Findings

A thematic analysis of focus group interview transcripts revealed three major themes reflecting students' evolving engagement with sustainability communication, including the development of critical awareness, integration of ethical and environmental perspectives and challenges and growth in language proficiency.

1. Relevance to Engineering Specializations

Participants expressed that the integration of sustainability into ESP tasks resonated more deeply when contextualized within their engineering specializations. A participant specializing in Materials Science remarked, "when I had to write about sustainable materials, I understood how my knowledge connects with real global issues." Those (4 participants) in Mechatronics and Automation reflected on designing energy-efficient systems, highlighting that their projects "needed to be both innovative and eco-conscious." This indicates that embedding sustainability tasks into ESP instruction can strengthen the transfer of linguistic skills to discipline-specific contexts, a

design principle that could be replicated in other STEM and non-STEM domains.

2. Enhanced Ethical and Environmental Awareness

Several participants (5 participants) acknowledged a newfound appreciation for the ethical responsibilities of engineers. One student shared, “I used to focus only on technical efficiency. Now I think about what that means for the environment and the community.” Another explained, “writing our reflections made me think about how our work can impact the world beyond machines and code.” These insights align with current calls for ESP curricula to cultivate not just workplace communication but also global citizenship competencies, which are increasingly relevant across disciplines.

3. Language Empowerment and Confidence

Participants initially expressed a degree of apprehension regarding the use of sustainability-specific terminology, describing it as “technical but unfamiliar.” However, as they engaged in repeated practice and task-based learning, they reported notable improvements in both language confidence and competence. One student specializing in Embedded Systems stated, “we presented ideas like green robotics and it was tough at first, but practicing with peers helped.” This progression was largely facilitated by scaffolded instructional strategies, including guided vocabulary lists and collaborative writing activities, which enabled learners to internalize complex terminology and contextualize it effectively within engineering-related discourse. These findings suggest that targeted ESP interventions can successfully bridge gaps in content-specific vocabulary and support learner autonomy and self-efficacy in disciplinary communication. By providing transparent instructional scaffolding, such as vocabulary guides and model texts, this intervention offers a replicable framework for ESP educators seeking to incorporate sustainability in diverse academic settings.

4. Development of Critical and Reflective Thinking

The use of reflective journals and peer feedback mechanisms played a vital role in improving the higher-order thinking skills of the students. Many participants demonstrated an ability to move beyond descriptive language tasks and engage in evaluative and reflective thinking. For instance, one student wrote, “our presentation on solar-powered manufacturing made me realize how design choices have long-term consequences.” This response illustrates how learners began to critically assess the broader ethical and environmental implications of their engineering work. Such reflective practices, embedded in ESP instruction, promoted not only deeper conceptual understanding but also the transferability of critical thinking skills to other academic and professional contexts. This highlights the broader potential of ESP interventions to encourage reflective practices that are equally valuable in other disciplines, thereby demonstrating the wider applicability of this approach beyond STEM.

4 DISCUSSION

The findings underscore the transformative potential of ESP instruction when integrated with sustainability-oriented content that aligns with the disciplinary specializations of the undergraduates. The integration of sustainability themes into the selected module demonstrated that third-year ET undergraduates could significantly enhance their linguistic proficiency, ethical sensitivity and reflective thinking when engaged in authentic, discipline-specific language tasks aligned with their specializations. These results are consistent with Hyland's (2013) critical ESP framework, which emphasizes the need for ESP instruction to go beyond functional language teaching and cultivate broader awareness of global issues. Moreover, the marked improvement in the abilities of the undergraduates to apply sustainability language within technical and ethical contexts demonstrates the effectiveness of interdisciplinary, ethics-informed ESP curricula. In particular, for institutions in developing country contexts, such curricular innovations may contribute to bridging the gap between global sustainability imperatives and localized professional communication needs. However, the transferability of these approaches must be approached cautiously and tested across different institutional, disciplinary and cultural environments before broader generalizations can be made. At a broader level, these findings offer preliminary implications for ESP curriculum reform, providing a practical model that could inspire efforts to embed sustainability in higher education language instruction across disciplines. Ultimately, integrating sustainability discourse into ESP empowers undergraduates to be not only skilled communicators but also ethically aware learners who are better prepared to engage with pressing global challenges.

5 CONCLUSION

This study provides evidence that integrating sustainability-focused content within ESP instruction can enhance linguistic proficiency, ethical awareness and critical-reflective thinking among third-year ET undergraduates. The implementation of SDG-aligned tasks in the selected module facilitated authentic, discipline-specific engagement, allowing students to link technical learning with sustainability considerations while developing professional communicative competence. Notwithstanding these positive outcomes, the study is constrained by a limited sample size, short intervention duration and focus on a single institution, which restricts the generalizability of the findings. Further research with larger cohorts, extended interventions and comparative designs is required to validate the efficacy and transferability of such pedagogical approaches. Nonetheless, the findings indicate that task-based strategies such as scaffolded vocabulary, reflective writing and authentic projects can be adapted beyond STEM disciplines, offering a framework for embedding sustainability into ESP curricula and fostering ethically and environmentally informed graduates.

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