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Teacher-Mediated AI-Supported Task-Based ESP: Engagement and Perceived Sustainability Awareness among Engineering Students

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ABSTRACT

Teaching English for Specific Purposes (ESP) requires teachers to address learners' disciplinary needs, design authentic tasks, and sustain engagement. This exploratory study examines how artificial intelligence (AI) can serve as a teacher-facing pedagogical resource for exploring professional situations relevant to civil engineering and designing contextualized, meaningful task-based learning activities. The study involved 48 fourth-year civil engineering students in an 11-week ESP course that incorporated both textbook-based activities and teacher-mediated, AI-supported task-based activities. Using an exploratory, retrospective comparative design, the study examined students' reported engagement across behavioral, cognitive, emotional, and social dimensions, as well as their perceptions of sustainability awareness and professional responsibility in sustainable practice. Data were collected through a study-specific questionnaire, classroom observations, focus-group discussions, and student artifacts. The questionnaire elicited students' retrospective perceptions of both activity types at the end of the course. Descriptive findings showed higher reported engagement for AI-supported task-based activities in the behavioral, emotional, and social dimensions, while cognitive engagement received similar ratings across both instructional approaches. Qualitative findings highlighted different forms of cognitive engagement across the activities. Sustainability-related findings were mixed, with higher ratings for most items in the AI-supported activities. The largest difference concerned perceived responsibility for sustainability in professional practice, which focus-group accounts did not directly link to the activities. The findings do not establish causal effects or isolate AI's contribution from other instructional design features. Nevertheless, the study illustrates a practical approach to integrating AI into teacher-mediated task-based ESP design and contributes to emerging research on AI-supported pedagogy in ESP.

KEYWORDS

AI-Supported Teaching

English for Specific Purposes (ESP)

Task-Based Language Teaching (TBLT)

Learner Engagement

Engineering Education

Sustainability

Introduction

Meaningful and engaging learning is a central goal of effective language teaching. Designing such learning experiences is challenging in changing English as a Foreign Language (EFL)

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contexts and can be particularly demanding in English for Specific Purposes (ESP), where instruction must respond to linguistic, disciplinary, and professional needs simultaneously.

ESP teachers are expected to conduct informed needs analyses and design activities that reflect learners' specialized fields, which are often highly technical, as well as their academic and professional communication needs. This can be particularly challenging when teachers have limited familiarity with learners' disciplinary domains or when available teaching materials provide contexts that are not sufficiently specific to their fields.

The present study is situated in English instruction for civil engineering students at a Moroccan engineering school, where instruction was guided by a textbook covering multiple engineering disciplines. While such materials provided useful linguistic input, the textbook offered limited contextual specificity and few opportunities for task-based activities closely related to civil engineering practice. This created a need for complementary activities that could connect language learning more closely with students' disciplinary and professional contexts.

At the same time, increasing attention is being given to the potential uses of artificial intelligence (AI) in education. Although concerns remain about students' uncritical or inappropriate use of AI tools, emerging research has also examined how generative AI (GenAI) can help teachers develop and adapt learning materials. In ESP, these tools may help teachers explore professional scenarios, draft instructions for classroom tasks, and adapt activities to specialized disciplinary contexts. This potential is particularly relevant when teachers need to supplement general-purpose materials with activities more closely aligned with learners' fields.

Recent studies have examined the use of generative AI in ESP across a range of contexts. Synekop et al. investigated students' and teachers' views of ChatGPT in English for Engineering classes, while Jmaiel et al. examined its use in ESP writing. Lytovchenko et al. explored ChatGPT-supported task-based ESP learning, and Christoforou examined the use of GenAI in student-created multimodal compositions in an English for Chemical Engineering course. These studies illustrate the growing interest in learners' use of GenAI for writing, task completion, and multimodal meaning-making. However, relatively less is known about how teachers use GenAI to design and adapt task-based ESP activities and how students engage with the resulting activities.

In this study, GenAI's potential relevance to student engagement lies in how it supports teachers in designing learning activities, rather than in students' direct interaction with the technology. Task-based language teaching creates opportunities for meaningful communication and interaction, but these opportunities depend partly on how teachers design tasks and how closely the tasks reflect learners' disciplinary and professional contexts. GenAI may support this design process by enabling teachers to explore and develop a wider range of professionally contextualized scenarios and task formats. Teachers can then evaluate, select, adapt, and contextualize the resulting materials through their expertise. The resulting tasks can create opportunities for purposeful language use, interaction, problem-solving, and decision-making, features relevant to task engagement and its relationship with task design (Philp and Duchesne 51; Hiver et al. 2-3). Thus, AI is not assumed to produce engagement directly; its possible contribution lies in supporting teachers' capacity to design the task conditions through which engagement may occur. The first link in this pathway, from AI use to task design, is the least evidenced and is not tested here. The study examines only students' reported engagement with the resulting activities, which differ from the textbook-based activities in several of these features at once.

Drawing on this framework, the present study examines students' reported engagement with textbook-based activities and teacher-mediated, AI-supported task-based activities across behavioral, cognitive, emotional, and social dimensions. Qualitative data provide further insight

into how students experienced the activities, including their professional relevance, interaction, problem-solving, perspective-taking, and engagement with sustainability-related issues. The study examines a teacher-mediated pedagogical configuration in which GenAI was used to support the development of contextualized ESP tasks. It addresses the following research questions:

RQ1. How do students report their behavioral, cognitive, emotional, and social engagement across textbook-based activities and teacher-mediated AI-supported task-based activities?

RQ2. How do students describe their engagement in teacher-mediated, AI-supported task-based activities, particularly regarding professional contextualization, peer interaction, problem-solving, perspective-taking, and sustainability-related content?

Literature Review

Student Engagement

Student engagement was conceptualized as a multidimensional construct including learners' behavioral, cognitive, and emotional involvement in learning (Fredricks et al. 60). In a systematic review of 72 empirical studies on ChatGPT-supported learning, Lo et al. identified social interaction as an under-explored aspect of engagement (1). Kahu's framework emphasizes the importance of distinguishing engagement itself from the structural and psychosocial factors that influence it and from its potential outcomes (759-62). This distinction is relevant to the present study because task design may shape opportunities for engagement without being equivalent to engagement itself. For the language-classroom context, Philp and Duchesne's framework is particularly relevant because it conceptualizes engagement through behavioral, cognitive, emotional, and social dimensions, with particular attention to task-based interaction. Drawing on this framework, the present study examines students' reported engagement across these four dimensions in textbook-based and teacher-mediated AI-supported task-based activities.

Behavioral engagement refers to learners' participation and involvement in academic activities, including effort, persistence, concentration, and attention (Fredricks et al. 62). In task-based instruction, meaningful goals and concrete outcomes can provide a focus for participation as learners work toward completing a task. The extent to which learners sustain their involvement may also depend on how tasks are structured and how relevant and manageable they perceive them to be.

Cognitive engagement concerns learners' investment in understanding, reasoning, problem-solving, and processing learning content (Fredricks et al. 63-64). Tasks that require learners to interpret situations, consider alternatives, make decisions, or formulate solutions can create opportunities for reasoning and problem-solving alongside language use. Cognitive engagement may therefore vary with the content, structure, and cognitive demands of an activity. Given the inconclusive evidence concerning cognitive engagement in ChatGPT-supported learning (Lo et al. 12), examining students' accounts alongside their overall ratings may help illuminate the forms of cognitive involvement they experienced.

Emotional engagement relates to learners' affective reactions to learning, including interest, enjoyment, boredom, and anxiety (Fredricks et al. 63). In ESP, this dimension may be particularly relevant when activities connect with learners' disciplinary contexts, academic needs, and anticipated professional situations. Such relevance may contribute to students' perceptions of the value of learning, although its relationship with engagement depends on how learners experience the activities.

Social engagement refers to the social dimension of learners' interaction with others (Philp and Duchesne 58). Collaborative tasks can require learners to exchange ideas, negotiate responses, provide feedback, and work toward shared outcomes. These forms of interaction are particularly relevant to task-based ESP activities involving professional communication and collaborative problem-solving. Because research on ChatGPT-supported learning has under-examined social interaction (Lo et al. 12), this dimension warrants particular attention in studies of teacher-mediated AI-supported tasks that involve peer interaction.

Task-Based Language Teaching: Theoretical Foundations

Task-Based Language Teaching (TBLT) is grounded in approaches to language teaching that emphasize meaningful communication and purposeful language use rather than the isolated practice of linguistic forms (Ellis; Long). Tasks give learners opportunities to use language to achieve communicative or problem-solving goals, connecting language use with specific purposes, contexts, and outcomes. These principles are particularly relevant to English for Specific Purposes (ESP), where language instruction is expected to reflect learners' academic, disciplinary, and professional needs.

In ESP contexts, task-based activities can provide opportunities for learners to use English while engaging with situations relevant to their fields of study and anticipated professional contexts. Rather than treating specialized vocabulary and language forms as ends in themselves, tasks can situate language use within activities such as discussing technical problems, negotiating solutions, communicating project information, or participating in professional interactions. Such activities can provide meaningful contexts for language learning, consistent with the ESP emphasis on selecting content that serves learners' needs and specific language-learning objectives (Dudley-Evans and St John). However, the extent to which these opportunities translate into sustained learner engagement depends partly on how tasks are designed and implemented.

The relevance of TBLT to engagement therefore lies not simply in using tasks, but in how they are designed and implemented. Recent work on L2 task engagement emphasizes the importance of examining task design and implementation, including task demands, task sequencing, and variations between individual and collaborative engagement (Hiver et al. 2-3, 13). In ESP, task relevance to learners' disciplinary and professional contexts, as well as the opportunities they provide for communication, problem-solving, and decision-making, may also shape learner engagement. These features are particularly pertinent to the present study, in which textbook-based activities differed from the teacher-mediated task-based activities in professional contextualization, cognitive demands, and opportunities for peer interaction.

The increasing integration of digital technologies into task-based language teaching further complicates the relationship between task design and learner engagement. Research on technology-mediated TBLT has examined diverse approaches to integrating technology into task-based language learning, but gaps remain in research on task design, implementation, and outcome evaluation (Kim and Namkung 57-59). These considerations make it important to examine how technology is used within particular instructional designs rather than assume that its integration necessarily improves learning. In this context, generative AI offers teachers opportunities to develop and adapt learning materials and tasks, while effective integration requires teachers to evaluate and refine AI-generated suggestions in light of pedagogical goals and learners' needs (Zhao et al.; Xin).

Artificial Intelligence in Language Education and ESP

Artificial intelligence (AI) has become an increasingly prominent area of research in language education because of its potential to support language-skill development, provide feedback, personalize learning, and assist teachers with pedagogical tasks (Crompton et al. 2505-07; Kohnke et al.). Within this broader field, GenAI has attracted particular attention because of its ability to generate and adapt instructional content, creating possibilities for materials development and pedagogical design while also raising concerns about accuracy, overreliance, authorship, and the need for human oversight. The pedagogical value of these affordances therefore depends partly on how AI-generated content is evaluated and incorporated into instructional practice.

Research in language education and ESP has examined a broadening range of GenAI applications, including learner support, writing, task-based learning, and students' use of GenAI to create multimodal compositions, such as videos. Studies have examined GenAI across engineering English and other ESP contexts. Synekop et al. investigated students' and teachers' views of ChatGPT in engineering English classes, while Jmaiel et al. examined its impact on ESP writing skills. Cho and Choe explored a ChatGPT-supported ESP course for airline cabin services, combining classroom activities with AI-assisted assignments and individualized coaching. In a related task-based approach, Lytovchenko et al. compared students' writing performance with and without ChatGPT. More recent work has extended these applications to specialized disciplinary contexts, including GenAI-assisted multimodal meaning design in an English for Chemical Engineering course (Christoforou). These studies illustrate the diversity of GenAI applications in language education, but they do not establish that integrating GenAI necessarily improves learning. For instance, Lytovchenko et al. found that students using ChatGPT performed comparably in idea generation and initial-draft structuring but struggled with deeper aspects of writing, including communicative achievement and creativity (4). These findings caution against assuming that student-facing GenAI use necessarily enhances learning and highlight the importance of examining how AI is incorporated into particular instructional designs. However, the extent to which findings from student-facing GenAI applications can be extended to teacher-mediated uses, where AI supports the design of learning activities rather than students' direct production, remains insufficiently examined.

Research has also examined teacher-mediated uses of GenAI in curriculum and activity design, highlighting the importance of teachers' critical evaluation and adaptation of AI-generated suggestions and the preservation of their pedagogical agency (Zhao et al.; Sha et al.; Xin). In ESP, ChatGPT-supported needs analysis has also been explored as a way to identify specialized and profession-specific language needs (Assassi). This work highlights the role of teacher judgment in aligning AI-generated material with instructional objectives and learners' disciplinary contexts. However, teachers' use of GenAI to develop instructional materials and students' engagement with the resulting activities remain distinct areas of inquiry. The latter is particularly relevant to ESP, where task design must respond to learners' academic and anticipated professional needs. This study contributes by examining students' reported behavioral, cognitive, emotional, and social engagement across textbook-based activities and teacher-mediated, AI-supported task-based activities.

Sustainability and Professional Relevance in ESP

Engineering education increasingly addresses environmental and sustainability-related challenges, but their inclusion in curricula does not necessarily translate into meaningful or professionally relevant learning experiences. Reviews of sustainability in engineering

education show growing curricular attention while also highlighting challenges in translating sustainability principles into meaningful learning outcomes (Gutierrez-Bucheli et al.). Research has therefore emphasized the importance of connecting sustainability with realistic engineering decisions, professional responsibilities, and real-world contexts (El-Zein et al.; García-Segura et al.; Kleine et al.). Recent research in Moroccan engineering education similarly highlights the need for practical and interdisciplinary approaches to sustainability learning (El Youssfi et al. 2). Taken together, these works suggest that the presence of sustainability in the curriculum is not sufficient on its own; its educational value also depends on how it is integrated into disciplinary learning activities.

This issue is particularly relevant to English for Specific Purposes (ESP), where learning activities are expected to reflect the communicative purposes and professional contexts of the disciplines served (Dudley-Evans and St John 10). Situating sustainability within engineering contexts can help connect sustainability concepts with professional practices and future occupational responsibilities (Sandri et al. 451). Research in engineering ESP has identified gaps in students' understanding of sustainability and highlighted the potential of ESP instruction to promote learners' awareness of issues relevant to their studies and future professional practice (Santiago López and Roldán Riejos 236). Sustainability-related scenarios can thus provide contexts for using English to discuss environmental impacts, evaluate alternatives, negotiate trade-offs, and communicate professional decisions. Their relevance to ESP lies not simply in the topic itself, but in the opportunities created for purposeful language use within disciplinary situations.

In the present study, sustainability is incorporated into task-based ESP activities as a topic relevant to civil engineering, providing context for purposeful language use and professional problem-solving. Teacher-mediated AI use supported the development of engineering-related scenarios involving environmental impacts, professional responsibilities, trade-offs, and alternative solutions. The questionnaire examined students' perceived sustainability-related learning and awareness, while qualitative data provided contextual information about their experiences of the activities. Accordingly, the sustainability dimension of the study concerns students' perceptions of learning and awareness in relation to sustainability-related content, rather than objectively measured environmental knowledge, attitudes, behavior, or sustainability competence.

Methodology

Research Design

This study adopted an exploratory, retrospective comparative design to examine students' perceptions of engagement and sustainability-related learning across two types of ESP activities: textbook-based activities and teacher-mediated AI-supported task-based activities. Both activity types were incorporated into the same ESP course, and all participating students experienced both.

Both activity types ran in parallel throughout Weeks 2-11, and in most sessions the textbook-based activities were followed by the teacher-mediated AI-supported activities, although the order was adjusted on one or two occasions because of time constraints. Textbook-based activities focused on developing technical vocabulary, reading comprehension, and English-language skills for engineering communication through materials covering a range of engineering disciplines. By contrast, the teacher designed and adapted the AI-supported task-based activities to provide more specifically contextualized civil engineering tasks involving

professional communication, role-play, collaborative problem-solving, and sustainability-related issues. The comparison therefore concerned two types of classroom activity experienced by the same students within the same course.

At the end of the course, each student completed two versions of the same questionnaire, one referring to textbook-based activities and the other to AI-supported task-based activities. This within-student comparison captured students' retrospective perceptions of the two activity types based on their experiences during the instructional period.

The study used intact classes and retrospective questionnaire data, with no random assignment or pre- and post-testing. The two activity types also differed in several instructional characteristics, including task structure, social organization, degree of professional contextualization, and opportunities for interaction and problem-solving. The findings are therefore interpreted as descriptive comparisons of students' perceptions of the two activity types, with AI considered as one component of the broader teacher-mediated instructional design.

Participants

The participants were 48 fourth-year civil engineering students enrolled at the École Nationale Supérieure d'Arts et Métiers (ENSAM), Morocco. They belonged to two intact classes of 24 students each and were taught by the researcher in their ESP course. The students had varying levels of English proficiency. While most participated comfortably in English, a few required additional linguistic support during classroom activities. All participants had sufficient English proficiency to engage with the instructional materials and complete the study questionnaire. The use of intact classes reflected the existing course organization.

Course Context and Implementation

The ESP course comprised 11 instructional weeks, with the course examination scheduled for Week 12. Week 1 included an introductory session and an informal needs-analysis discussion to identify students' English-learning goals, professional interests, and communication needs related to civil engineering.

During Weeks 2-11, the course incorporated textbook-based activities from *Cambridge English for Engineering* by Mark Ibbotson alongside teacher-mediated AI-supported activities. The textbook was designed for B1-B2 learners in civil, mechanical, and electrical engineering and covered a range of engineering contexts rather than focusing on civil engineering. The textbook also addressed sustainability. Students were introduced to information comparing some engineering materials in terms of sustainability and, through a listening activity, to the concept and steps of an environmental audit, including the principle that assessing the environmental impacts of materials requires consideration of their pre-use, in-use, and post-use phases. The supplementary AI-supported activities were designed to connect English learning more closely with civil engineering contexts and professional communication.

While preparing these supplementary activities, ChatGPT and Claude served as exploratory resources to develop and diversify civil engineering scenarios, explore professional communication situations, and draft instructions for classroom activities. The students' identified needs and the course objectives informed the selection and development of the activities. The teacher reviewed, selected, adapted, and contextualized all AI-generated material before classroom use, considering its disciplinary relevance, linguistic suitability, and feasibility within the course.

Overview of the Teacher-Mediated AI-Supported Instructional Sequence

The teacher-mediated AI-supported activities included preparatory language work and more complex, professionally situated activities. The activities introduced in Weeks 2 and 3 focused on civil engineering vocabulary, translation, and technical reading. They provided linguistic and disciplinary preparation for subsequent activities but were not treated as the principal communicative tasks in the stricter task-based language teaching (TBLT) sense.

From Week 4 onward, the activities increasingly required students to apply their linguistic and disciplinary resources in professional or engineering-related situations. They included a sustainable-building role-play, technical pitches, an environmental-audit simulation, collaborative problem-solving, professional email writing, integrated tasks, and simulated job interviews. Depending on the activity, students communicated information, exchanged perspectives, made decisions, solved problems, or developed responses to engineering-related challenges. Table 1 summarizes the teacher-mediated AI-supported activities and their pedagogical focus; it does not list the textbook-based activities.

Table 1
Overview of the AI-Supported, Teacher-Designed Instructional Activities

Week	Sample activity	Activity description	Activity focus
2	Vocabulary Matching and Translation (Civil Engineering)	Matching key civil engineering terms with definitions and translating them	Technical vocabulary; language use
3	Technical Reading Task	Reading and discussing a text on civil engineering projects	Reading comprehension; technical literacy
4	Sustainable University Building Project (Role-Play)	Group role-play presenting a sustainable building project to an investor	Collaborative communication; problem-solving
5	Technical Pitch Presentation	Oral presentation explaining a design solution, such as material choice or stress resistance	Oral presentation; professional speaking
6	Environmental Audit Role-Play	Simulated audit of a civil engineering project focusing on environmental impacts	Professional communication; environmental awareness
7	Collaborative Problem-Solving Task	Group discussion addressing a real-life engineering challenge	Collaboration; decision-making
8	Writing a Project Update Email	Writing a professional email reporting project progress or modifications	Professional writing; communication
9	Creative Problem-Solving	Students address an engineering problem and develop creative solutions	Problem-solving; critical thinking
10	Integrated Task and Reflection	Completion of a complex task followed by guided reflection on language use and the task process	Language use; task reflection
11	Extreme Interview	Simulated job interview emphasizing technical reasoning and communication under pressure	Speaking fluency; professional communication

Data Collection

Data were collected through four complementary sources: a study-specific questionnaire, classroom observations, student artifacts, and focus-group discussions. These sources were intended to provide a broader account of students' engagement and experiences with the two instructional approaches.

Study-Specific Student Engagement and Perceptions Questionnaire

The principal quantitative instrument was a study-specific questionnaire developed for the present study. It comprised 25 Likert-scale items organized into five sections. Items 1-20 addressed four dimensions of student engagement (behavioral, cognitive, emotional, and social), with five items assigned to each dimension. Items 21-25 examined students' perceived sustainability-related learning and awareness in civil engineering, covering environmental impacts, environmental trade-offs, sustainable materials and practices, professional responsibility for sustainability, and interest in sustainable engineering practices. All items were rated on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

The items were developed by the researcher with reference to the conceptualization of engagement adopted in the study and the specific instructional context and objectives of the course. The questionnaire was not formally piloted or psychometrically validated. During administration, students could seek clarification about unclear items, and the researcher checked their understanding of the wording before they proceeded. The instrument was therefore used to obtain descriptive information about students' reported perceptions rather than as a validated measure of engagement or sustainability-related competence.

Two versions of the questionnaire were used to elicit students' perceptions of textbook-based activities and activities developed and implemented outside the textbook (Appendices A and B). Both versions contained the same Likert-scale items and response scale, with references to the respective activity type adjusted accordingly. Both were administered at the end of the course, and all 48 students completed both versions. Their responses therefore reflected retrospective perceptions of activities experienced throughout Weeks 2-11 rather than measurements of changes in engagement over time.

In the questionnaires, the term *task-based activities* referred to activities developed and implemented outside the textbook. References to AI were deliberately omitted to reduce the chance that mentioning the technology would influence students' ratings. Instead, the focus was on students' experiences and perceptions of the activities, regardless of the tools used to prepare them.

Both questionnaire versions also included three open-ended questions asking students which activities they found most engaging and why, how the activities contributed to their English learning and development as engineering students, and what difficulties or limitations they experienced. However, most students did not answer these questions. The responses were therefore not subjected to systematic qualitative analysis and are not reported as a separate source of findings.

Classroom Observations

Classroom observations provided supplementary contextual information about students' participation, attention, collaboration, use of English, and persistence during instructional activities. Brief observational notes were recorded during sessions when relevant behaviors or interactions were observed, and more detailed field notes were prepared immediately after each class. The observations focused particularly on students' responses to different activity formats, including collaborative and professionally situated tasks. No standardized observation instrument or rating scale was used. The notes were considered alongside questionnaire responses, student artifacts, and focus-group accounts to contextualize students' reported engagement.

Student Artifacts

Student artifacts, including written outputs such as emails and meeting reports produced during role-plays and other course activities, were collected as supplementary material. All written outputs produced during these activities were retained rather than selectively sampled. The artifacts were considered in relation to the activities for which they were produced and provided contextual information about students' task participation and language use. They were not subjected to independent systematic coding or treated as a separate measure of engagement.

Focus-Group Discussions

The researcher collected qualitative student feedback through six focus-group discussions involving 30 of the 48 students, with five students in each group. Participation was voluntary. The discussions took place after students completed the questionnaire and before the final examination, a standardized assessment administered independently by another teacher. The teacher-researcher moderated the discussions, conducted them in English, and kept them to about 15-20 minutes each. Students were not informed that AI had been used to prepare the task-based activities, so their accounts focus on the activities themselves rather than the technology behind them. Participants quoted in the Results section are identified by anonymized codes.

Several features of the procedure should be considered when interpreting these data. Participants volunteered, so their perspectives may differ from those of the 18 students who did not take part. The moderator was also the course instructor, and although the examination was administered independently, the discussions took place before it, so social desirability effects cannot be ruled out. Conducting the discussions in English may have limited how fully some students could express their views, and the brief sessions probably limited the depth of the accounts. The focus-group findings are therefore reported as participants' accounts and are not treated as representative of the entire cohort.

Data Analysis

Quantitative questionnaire responses were analyzed descriptively. Means and standard deviations were calculated for each of the four engagement dimensions for the textbook-based and teacher-mediated AI-supported task-based activities (Table 2). The five sustainability-related items were analyzed individually, and their mean scores are reported in Table 3. The findings reflect descriptive patterns in students' retrospective perceptions rather than evidence of statistically significant differences or causal effects.

No statistical significance tests were conducted for three reasons. First, the questionnaire was developed specifically for this study and had not been formally validated as a psychometric instrument, so inferential statistics would rest on unverified measurement assumptions. Second, the ratings were retrospective self-reports collected at the end of the course, after students had experienced both activity types. Responses may therefore have been influenced by recall, order, recency, contrast, novelty, or social desirability effects, which significance tests would not address. Third, the two activity types differed in contextualization, task structure, opportunities for collaboration, and disciplinary specificity, and the study involved intact classes without random assignment. Statistical testing would not resolve these design limitations or establish that any observed differences were attributable specifically to AI-supported design. Because

individual responses are no longer available, paired tests could not be added at this stage in any case, since paired comparisons require each student's ratings of both conditions.

The retained quantitative summaries comprised means and standard deviations for the four engagement dimensions and means for the five sustainability-related items. Individual questionnaire responses were no longer available for further analysis. Consequently, item-level response distributions and internal-consistency coefficients, including Cronbach's alpha, could not be calculated. Several mean scores were toward the upper end of the five-point scale, raising the possibility of ceiling effects. However, without the individual response distributions, their extent could not be assessed.

The focus-group recordings were transcribed, and the transcripts were examined manually by the researcher without qualitative analysis software. The analysis was guided by the four engagement dimensions (behavioral, cognitive, emotional, and social), which provided an initial framework for examining participants' accounts. The analysis was conducted by a single researcher, and no second researcher independently checked the coding. Quotations were selected to illustrate recurring patterns in participants' accounts.

No clearly critical or negative accounts of the task-based activities were identified in the transcripts. However, given the voluntary nature of focus-group participation, the moderator's dual role as course instructor, and the brevity of the discussions, the absence of critical accounts should be interpreted cautiously. The open-ended questionnaire responses were not subjected to systematic qualitative analysis because most students did not answer these questions.

Classroom observations and student artifacts were considered alongside the questionnaire and focus-group findings to contextualize students' reported experiences of the two activity types. These sources provided supplementary context for interpreting the descriptive patterns; they were not treated as independent measures of causal effects.

Ethical Considerations and Declarations

Ethical Considerations

Participation in the research was voluntary. Before data collection, students were informed verbally that the study aimed to examine their experiences with different approaches to English for Specific Purposes (ESP) instruction and to inform course improvement. Verbal consent was obtained from participants. They were informed that their participation and responses would not affect their course assessment and were encouraged to provide honest feedback, including critical or unfavorable comments. The final language examination was a standardized assessment administered to all fourth-year students. The researcher was not involved in its design, administration, or marking. The questionnaire and qualitative data were anonymized for analysis and reporting, and this article presents no identifying information.

No formal institutional ethical approval was obtained for this study. Because the researcher was also the course instructor, the possibility of perceived pressure to participate or provide favorable responses cannot be entirely excluded. This potential influence, together with the possibility of social desirability bias, was considered when interpreting the findings.

Results

Quantitative Findings: Students' Perceptions of the Two Instructional Approaches

Engagement Ratings

Questionnaire responses were summarized descriptively for the two instructional approaches. Means and standard deviations were calculated for the four dimensions of reported engagement, as shown in Table 2.

Table 2
Students' Reported Engagement across the Two Instructional Approaches

Engagement dimension	Textbook-based activities M (SD)	AI-supported task-based activities M (SD)
Behavioral engagement	4.0 (0.7)	4.5 (0.5)
Cognitive engagement	4.2 (0.6)	4.2 (0.5)
Emotional engagement	4.0 (0.5)	4.3 (0.6)
Social engagement	3.4 (0.5)	4.4 (0.5)

Note. N = 48. Ratings were provided on a five-point scale (1 = strongly disagree, 5 = strongly agree). In the student questionnaire, the second condition was labeled "task-based activities" without reference to AI (see Section 3.5.1).

Most mean ratings were at or above 4 on the five-point scale, corresponding to agreement with the questionnaire statements. Behavioral engagement was rated higher for the teacher-mediated AI-supported task-based activities (M = 4.5, SD = 0.5) than for the textbook-based activities (M = 4.0, SD = 0.7). Emotional engagement showed a smaller descriptive difference (M = 4.3, SD = 0.6 vs. M = 4.0, SD = 0.5). The largest difference was observed in social engagement (M = 4.4, SD = 0.5, compared with M = 3.4, SD = 0.5). Cognitive engagement received the same mean rating under both approaches (M = 4.2), with similar standard deviations (0.5 and 0.6). These results describe patterns in students' retrospective ratings; they do not establish statistically significant differences or isolate the contribution of AI-supported design.

Perceived Sustainability-Related Learning, Awareness, and Responsibility

Items 21-25 examined students' perceptions of sustainability-related learning, awareness, and responsibility in civil engineering; they did not measure environmental knowledge, attitudes, behaviors, or competence. The items addressed environmental impacts, environmental trade-offs, sustainable materials and practices, perceived professional responsibility for sustainability, and interest in sustainable engineering practices. Table 3 presents the item-level results. Four of the five items received higher mean ratings for the AI-supported task-based condition, with small differences for environmental impacts (4.5 vs. 4.3) and trade-offs (4.4 vs. 4.1). The largest difference in the study concerned perceived responsibility for sustainability (4.6 vs. 3.5), followed by interest in sustainable engineering practices (4.5 vs. 3.9). Because individual responses could not be retrieved, item-level variability could not be examined, and these differences should be interpreted cautiously. They are discussed with their limitations in Section 5.3, and the related focus-group accounts are reported in Section 4.2.5.

The mean rating for sustainable materials and practices was slightly higher for the textbook-based activities (4.4) than for the task-based activities (4.2). This difference is small and is not interpreted further here (Section 5.3).

Table 3
Students' Perceived Sustainability-Related Learning, Awareness, and Responsibility across the Two Instructional Approaches

Sustainability-related item	Textbook M	AI-supported task-based M
Environmental impacts of engineering projects	4.3	4.5
Environmental trade-offs in engineering solutions	4.1	4.4
Sustainable materials/practices	4.4	4.2
Perceived professional responsibility for sustainability	3.5	4.6
Interest in sustainable engineering practices	3.9	4.5

Note. N = 48. Ratings were provided on a five-point scale (1 = strongly disagree, 5 = strongly agree). Item-level standard deviations are not reported because the retained quantitative summaries included item means only (see Section 3.6).

Qualitative Findings: Classroom Observations and Student Feedback

The qualitative findings provided further insight into students' experiences of the two instructional approaches, highlighting patterns of engagement, opportunities for interaction, professional contextualization, and reflections on sustainability in civil engineering.

Behavioral Engagement

Classroom observations recorded in field notes indicated that students generally remained involved in the task-based activities until completion. In some instances, students continued working beyond the allocated time or requested additional time to complete or present their outputs. These observations provide contextual evidence of participation and persistence, but they were not based on a standardized observation instrument and were made by the teacher-researcher who designed the activities. Students' continued involvement may also have reflected task length or difficulty rather than engagement alone.

Focus-group accounts provided further insight into students' participation. Participants described becoming actively involved in role-plays and other task-based activities, particularly when they were required to respond to a simulated professional situation. These accounts provide qualitative context for the higher behavioral engagement ratings associated with the task-based activities. However, the two activity types also differed in task structure, contextualization, and opportunities for active participation, so the qualitative findings do not isolate the contribution of any one feature, including AI-supported design.

Cognitive Engagement

The two types of activities differed in their cognitive demands. Textbook-based activities included technical vocabulary and reading, whereas the task-based activities involved interpreting professional situations, considering alternatives, evaluating possible responses, and formulating solutions. These differences describe features of the instructional activities rather than establishing how all students experienced their cognitive demands.

Classroom observations recorded in field notes also provided examples of students drawing on their disciplinary knowledge and professional experiences. During professional email-writing activities, some students referred to managers or other professionals they had encountered during internships. In project-based activities, students developed engineering projects in response to recognizable societal needs, including the provision of facilities such as hospitals. These examples illustrate how some students connected task requirements with familiar professional experiences and real-world concerns, although they do not establish how widespread this was or independently demonstrate higher cognitive engagement.

Perspective-taking was another feature of several role-play activities, in which students adopted professional positions such as workers, managers, architects, or other project stakeholders. One participant described this experience:

> "It was interesting to keep changing roles. This forced me to try to understand how different people in different positions think differently." (S4)

This account illustrates one participant's reflection on the cognitive demands of changing professional roles. Another participant compared the role-play problems with textbook activities:

> "The problems in the role plays felt real, and I unconsciously felt forced to try hard to solve them, not like the ones in the textbook." (S5)

This comment connects perceived realism with the effort the participant described investing in problem-solving, while also expressing a personal contrast with textbook activities.

Cognitive engagement received the same mean rating for both instructional approaches (M = 4.2). The observations and focus-group accounts illustrate particular experiences involving prior knowledge, perspective-taking, and problem-solving, but they do not establish whether the overall level or nature of cognitive engagement differed between the two approaches.

Emotional Engagement

Classroom observations and focus-group accounts suggested that students responded positively to role-plays, presentations, simulations, and problem-solving activities that situated English use in recognizable professional contexts. The focus-group accounts illustrate these responses. One student, reflecting on four years of English learning at the institution, stated:

> "This is my fourth year in this institution, and those role plays were the best English activities we have ever had." (S1)

Another participant highlighted the combination of enjoyment and professional seriousness:

> "I loved when we role-played the meeting, and I was the manager. I loved that it was really fun and serious at the same time." (S3)

These comments suggest that students' positive responses were linked not only to enjoyment but also to opportunities to assume professional roles and participate in situations they perceived as meaningful. Classroom observations likewise recorded students' responses to role-plays, presentations, simulations, and problem-solving activities situated in recognizable professional contexts. Together, these accounts provide qualitative context for the higher mean emotional-engagement rating for the teacher-mediated task-based activities (4.3 versus 4.0), although the respective contributions of relevance, variety, active participation, and professional contextualization cannot be isolated.

Social Engagement

Social interaction was a feature of several task-based activities (Table 1), which required students to exchange ideas, negotiate responses, provide peer feedback, and work jointly toward solutions. Collaborative role-plays also required students to consider different stakeholder perspectives. One participant explicitly valued these opportunities for interaction:

> "It is great that through these activities we have opportunities to negotiate issues with each other and to actually talk to each other. That's great." (S2)

The comment illustrates the value this participant placed on communication and negotiation with peers. Other participants also expressed appreciation for opportunities to interact with classmates, which they described as uncommon in their disciplinary studies. These accounts suggest that the activities provided opportunities to use English for collaborative problem-solving rather than only for producing individual responses.

The qualitative accounts provide context for the higher mean rating for social engagement in the task-based condition (M = 4.4) than in the textbook-based condition (M = 3.4). However, the two activity types differed in their organization: several task-based activities involved collaboration, whereas textbook-based activities included a greater proportion of individual vocabulary and reading work (Sections 3.1 and 3.3). The higher social engagement ratings co-occurred with greater opportunities for peer interaction. Four of the five social engagement items (16, 17, 19, and 20 in Appendices A and B) asked about working or communicating with classmates or others, so this result partly reflects the more collaborative format of the task-based activities. Students' comments about the limited opportunities for such interaction elsewhere in their studies may also have shaped their perceptions. The data do not isolate the contribution of collaboration from other features of the task-based activities, including AI-supported design.

Sustainability Awareness and Professional Responsibility

Sustainability was addressed in both instructional approaches, although through different materials and formats. The task-based activities were designed specifically for civil engineering and included role-plays and scenarios on sustainable building projects and environmental audits, with stakeholders such as civil society (Table 1). The textbook covered engineering in general and provided information on sustainable materials and environmental auditing (Section 3.3). The qualitative findings should therefore be read in the context of two approaches that addressed sustainability differently.

Focus-group accounts suggested that some participants saw a closer relationship between sustainability and civil engineering than they had previously recognized, and some of them attributed this to the task-based activities. Participants also reported increased awareness of the

complexity of sustainable engineering decisions, particularly the need to balance environmental considerations with technical, financial, and other requirements.

Regarding perceived professional responsibility, which showed the largest difference between the two conditions (4.6 versus 3.5; Section 4.1.2), participants did not explicitly link their sense of responsibility to the task-based activities. Instead, their accounts highlighted the perceived connection between civil engineering and sustainability and the complexity of sustainable engineering decisions. One participant said that, given the climate crisis, civil engineers, among others, are responsible for ethical and sustainable practice. This account does not show whether or how the task-based activities shaped that sense of responsibility, and the result is discussed with its limitations in Section 5.3. These accounts reflect participants' perceptions, not measured changes in environmental knowledge, professional competence, or future behavior.

Table 4
Summary of Qualitative Findings

Theme	Main qualitative pattern
Behavioral engagement	Sustained participation, effort, and persistence during task completion
Cognitive engagement	Perspective-taking through role-play, consideration of alternatives, evaluation of responses, and problem-solving
Emotional engagement	Positive responses associated with relevance, variety, enjoyment, and professional roles
Social engagement	Negotiation, peer interaction, collaboration, feedback, and joint problem-solving
Sustainability awareness and responsibility	More perceived connection between civil engineering and sustainability, increased awareness of complexity, no explicit link between participants' sense of responsibility and the task-based activities

Discussion

The findings indicate a more favorable pattern for the AI-supported task-based activities in behavioral, emotional, and social engagement. In contrast, cognitive engagement showed similar mean ratings across the two approaches. Qualitative accounts further highlighted sustained participation, peer interaction, perspective-taking, problem-solving, and the perceived realism and professional relevance of several activities.

These findings should not be interpreted as evidence that AI itself caused higher engagement. The AI-supported activities were part of an integrated pedagogical approach that combined teacher-mediated AI support with task-based learning, professional contextualization, collaboration, role-play, problem-solving, and sustainability-related content. The observed differences in engagement may therefore reflect the combined influence of these features rather than AI's contribution in isolation. The findings are best understood as evidence of students' reported experiences of two differently designed sets of activities within a particular ESP context, rather than as evidence of a causal effect of AI on engagement.

AI as a Teacher-Mediated Resource for Contextualized ESP Task Design

A practical contribution of the study concerns the potential of AI as a teacher-mediated resource for developing and diversifying task-based ESP activities. In the present study, ChatGPT and Claude were used to explore possible professional situations relevant to civil engineering, generate contextualized scenarios and task instructions, and support the development of activities involving professional communication, problem-solving, collaboration, and decision-making. The teacher remained responsible for evaluating, selecting, adapting, and contextualizing the generated material.

This teacher-mediated use is particularly relevant to ESP, where designing professionally meaningful activities requires attention to learners' disciplinary contexts and anticipated communicative needs. In the design process described here, generative AI served as a practical resource for expanding the range of situations and task formats available to the teacher, which matters most when existing course materials do not fully reflect learners' specialized needs. In the present study, the resulting activities addressed recognizable professional situations, including sustainable buildings, environmental audits, project communication, meetings, and simulated interviews. Some students also connected these activities with experiences from internships or professional contacts.

The qualitative accounts indicate that students experienced several of these activities as realistic, relevant, and meaningful. This perception was supported by tasks that required students to draw on disciplinary knowledge, assume professional roles, communicate with peers, and address problems in recognizable engineering contexts. The role of AI in this process was therefore embedded within teacher decision-making: AI provided a resource for generating and diversifying possibilities, while the teacher determined their disciplinary relevance, pedagogical suitability, and contextual fit.

These findings have implications for ESP practice. Generative AI can serve as a teacher-facing resource for exploring professional scenarios, diversifying task formats, and developing contextualized materials. At the same time, teachers remain responsible for evaluating accuracy, disciplinary relevance, pedagogical suitability, and alignment with learners' needs. The present study also illustrates the importance of embedding AI-supported materials within purposeful task-based activities. The engagement patterns observed in the study are therefore best understood in relation to the broader instructional configuration, in which teacher-mediated AI support was combined with task-based learning, professional contextualization, and sustainability-related content.

Engagement across Dimensions: Levels and Forms of Involvement

The higher behavioral, emotional, and social engagement reported for the AI-supported task-based activities may be related to their greater contextualization and perceived relevance. By placing language use in recognizable professional situations and incorporating interaction, role-play, and problem-solving, these activities may have created more opportunities for participation and interaction than the textbook-based activities. In particular, the higher social-engagement rating needs to be interpreted in relation to the more collaborative organization of the task-based activities. These findings therefore highlight the importance of the broader pedagogical design surrounding AI, rather than AI itself, when interpreting the observed engagement pattern.

Cognitive engagement presents a more nuanced pattern. Although the mean rating was identical for textbook-based and AI-supported task-based activities (4.2), students' accounts of the task-based activities point to forms of cognitive involvement that a single overall rating

does not capture. Students described task-based activities that required them to interpret information, consider alternatives, make decisions, solve problems, and adopt different professional perspectives. Thus, similar overall ratings may have reflected different forms of cognitive engagement rather than equivalent cognitive experiences. This finding resonates with the mixed evidence on cognitive engagement reported in research on ChatGPT-supported learning (Lo et al. 12). Their systematic review highlighted the lack of consistent evidence on cognitive engagement, suggesting a need to further investigate the processes underlying students' cognitive involvement. The present findings do not resolve this uncertainty, but suggest that examining the nature and processes of cognitive engagement may provide a more nuanced understanding of students' experiences in AI-supported learning. In this study, the task-based approach may therefore add value less by increasing overall perceived cognitive engagement than by providing opportunities for particular forms of cognitive involvement.

Perceived Sustainability-Related Learning, Awareness, and Responsibility

The sustainability items measured students' perceptions of their learning and awareness, not environmental knowledge, attitudes, behaviors, or sustainability competence. The findings were mixed: four of the five items were rated higher for the AI-supported task-based activities, with the largest differences for perceived professional responsibility and interest in sustainable engineering practices (Section 4.1.2), while one item reversed.

The largest difference in the study concerned perceived responsibility for sustainability (4.6 for the AI-supported task-based activities versus 3.5 for the textbook-based activities, a difference of 1.1 points), and it should be interpreted cautiously. Focus-group accounts indicated that some participants perceived a closer connection between civil engineering and sustainability and a greater awareness of the complexity of sustainability-related decisions; some attributed these perceptions to the AI-supported task-based activities. Participants did not, however, explicitly attribute a stronger sense of responsibility to these activities. This may partly reflect the wording of the questionnaire item, which asked whether the activities encouraged students to "recognize my responsibility, as a future civil engineer, to consider the sustainability implications of my professional decisions." Recognizing responsibility is not necessarily the same as feeling more responsible or being prepared to act on it in practice, and the ratings may have reflected the perceived connection between civil engineering and sustainability more than a distinct sense of professional responsibility.

Other factors also warrant consideration. The AI-supported task-based activities were designed specifically for civil engineering, whereas the textbook addressed engineering more generally, so disciplinary specificity may have influenced students' ratings. Social desirability may also have affected responses, particularly because the course instructor administered the questionnaire. Students' prior orientations toward sustainability could not be assessed because no baseline measure was collected. Furthermore, only item means were retained for the sustainability questions, preventing examination of whether the difference was consistent across individual students. The 1.1-point difference is therefore a notable descriptive finding that warrants further investigation, not evidence that students' sense of professional responsibility increased. Although the AI-supported task-based activities invited students to consider environmental implications when evaluating engineering decisions and trade-offs, whether such professionally situated decision-making makes questions of responsibility more salient remains a hypothesis for future research. This could be investigated using validated measures, pre- and post-course data, and independent evidence of students' sustainability-related decision-making. The present study cannot test this hypothesis.

One item reversed: textbook-based activities received a slightly higher rating for sustainable materials and practices (4.4 compared with 4.2). One possible explanation relates to how sustainability was addressed in the textbook, which explicitly introduced a comparison of the sustainability of some engineering materials and the steps of an environmental audit (Section 3.3). By contrast, the AI-supported task-based activities did not provide the same explicit explanatory information; instead, they required students to apply sustainability-related considerations in professionally situated scenarios. This difference between explicit information and opportunities for application may help explain the slightly higher rating. It is a hypothesis about the course design, not a finding, and the data cannot test it. Because the item also referred to civil engineering, disciplinary specificity alone cannot explain the pattern across items.

Sustainability appeared in both sets of activities, but they also differed in task structure, collaboration, professional contextualization, and disciplinary specificity, so the observed differences cannot be attributed to AI-supported design. The reversed item also cautions against reading the overall pattern as consistently higher sustainability-related learning or awareness.

Limitations and Future Research

Several limitations should be considered when interpreting the findings. First, the study involved 48 students from a single engineering institution and used intact classes rather than random assignment. The findings are therefore context-specific, and their transferability to other ESP settings requires further investigation. Second, the questionnaire was administered only at the end of the course and captured students' retrospective perceptions of the two instructional approaches. Consequently, the study does not measure changes in engagement over time or establish causal effects. In addition, because textbook-based activities generally preceded AI-supported task-based activities, the order and recency of the activities may have influenced students' retrospective ratings. Because students rated both approaches during the same end-of-course administration, they may also have compared them directly, potentially introducing contrast effects.

The study also relied substantially on students' self-reported perceptions. Although the questionnaire provided a structured account of four dimensions of engagement, it was developed specifically for this study and was not formally validated. Similarly, the sustainability-related items examined students' reported perceptions of learning and awareness rather than objectively assessed environmental knowledge, attitudes, behaviors, or sustainability competence. The qualitative component involved 30 volunteer students, introducing the possibility of self-selection bias, while the teacher-researcher role may also have influenced students' responses or classroom behaviors.

Individual questionnaire responses are no longer retrievable (Section 3.6). The quantitative findings are therefore reported as dimension-level means and standard deviations for engagement and item-level means for the sustainability-related questions, and the distribution of individual responses and the questionnaire's internal consistency (e.g., Cronbach's alpha) could not be examined, so the reliability of the study-specific questionnaire remains unestablished. Several mean scores were toward the upper end of the five-point scale, suggesting possible ceiling effects, although the extent cannot be determined from the reported summary statistics.

Finally, AI support was embedded in a broader pedagogical approach that combined task-based learning, professional contextualization, collaboration, role-play, problem-solving, and sustainability-related content. The two instructional approaches also differed in task structure, opportunities for interaction, and disciplinary specificity (civil engineering versus engineering

in general). The observed differences therefore cannot be attributed specifically to AI-supported design. Future research could address these limitations with larger, more diverse samples; pre- and post-course designs; validated engagement measures; direct assessment of language and professional outcomes; and comparisons between AI-supported and non-AI task-based instruction with comparable task structures, content, and opportunities for collaboration. Studies involving multiple teachers and institutions could also help examine whether similar patterns emerge across different ESP contexts.

Conclusion

This study examined AI as a teacher-mediated resource for designing task-based ESP activities for engineering students. Students reported more favorable perceptions of the AI-supported task-based activities in behavioral, emotional, and social engagement, while cognitive engagement received similar ratings across both approaches. Qualitative findings also highlighted engagement with professionally situated problems, peer interaction, perspective-taking, and problem-solving. Sustainability-related activities provided a context for connecting English learning with environmental concerns relevant to engineering practice, although the sustainability findings were mixed and perception-based. The largest difference concerned perceived professional responsibility for sustainability. However, the focus-group accounts did not link it to the activities, so it is reported as a notable descriptive finding that warrants follow-up with validated measures.

In this study, AI served as a design resource that helped the teacher develop varied, contextualized, and professionally relevant ESP tasks, with every output selected, adapted, and contextualized by the teacher. Such use can complement existing ESP materials and expand the range of professionally situated activities available to teachers.

Given the context-specific design, retrospective measurement, and reliance on self-reported perceptions, the findings are exploratory and do not establish causal effects of the instructional approach or isolate the contribution of AI. Nevertheless, the study offers an example of how teacher-mediated, AI-supported task design can connect language learning with engineering practice and sustainability-related concerns. Further research using larger, more diverse samples; longitudinal or pre- and post-course designs; validated measures; and direct assessments of language, professional, and sustainability-related learning outcomes could examine whether similar patterns emerge across different ESP contexts.

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Appendix A: Student Engagement and Perceptions Questionnaire (Textbook-Based Activities)

Purpose

This questionnaire examines students' reported engagement with instructional activities in the English course and their perceptions of sustainability-related learning and awareness. The engagement items draw on established conceptualizations of behavioral, cognitive, emotional, and social engagement. The questionnaire was developed specifically for the present study.

The information collected will be used for research purposes only. Your participation is voluntary, and your responses will not affect your grades, academic results, or evaluation in this course. Please answer honestly based on your own experience.

Instructions

Please indicate how much you agree with each statement based on your experience with the textbook-based activities in this course.

Response scale: 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree

A. Behavioral Engagement

No.	Statement	1	2	3	4	5
1	I actively participated in the textbook-based activities during the course.	☐	☐	☐	☐	☐
2	I made a consistent effort to complete the textbook-based activities.	☐	☐	☐	☐	☐
3	I stayed focused and attentive during the textbook-based activities.	☐	☐	☐	☐	☐
4	I made an effort to use English during the textbook-based activities.	☐	☐	☐	☐	☐
5	I persisted with the textbook-based activities, even when they were challenging.	☐	☐	☐	☐	☐

B. Cognitive Engagement

No.	Statement	1	2	3	4	5
6	The textbook-based activities required me to think carefully about what I was learning.	☐	☐	☐	☐	☐
7	I revised or refined my ideas while completing the textbook-based activities.	☐	☐	☐	☐	☐
8	The textbook-based activities helped me connect English learning with my engineering knowledge.	☐	☐	☐	☐	☐
9	The textbook-based activities required me to evaluate different ideas or solutions before making decisions.	☐	☐	☐	☐	☐
10	The textbook-based activities encouraged me to generate different ideas or solutions to problems.	☐	☐	☐	☐	☐

C. Emotional Engagement

No.	Statement	1	2	3	4	5
11	I found the textbook-based activities interesting.	☐	☐	☐	☐	☐
12	I found the textbook-based activities relevant to my future career in engineering.	☐	☐	☐	☐	☐
13	I enjoyed learning English through the textbook-based activities.	☐	☐	☐	☐	☐
14	I felt confident using English during the textbook-based activities.	☐	☐	☐	☐	☐
15	I felt motivated to express my ideas during the textbook-based activities.	☐	☐	☐	☐	☐

D. Social Engagement

No.	Statement	1	2	3	4	5
16	I actively collaborated with my classmates during the textbook-based activities.	☐	☐	☐	☐	☐
17	The textbook-based activities gave me opportunities to learn from my classmates.	☐	☐	☐	☐	☐
18	I felt comfortable sharing my ideas and opinions during the textbook-based activities.	☐	☐	☐	☐	☐
19	The textbook-based activities encouraged meaningful communication with my classmates.	☐	☐	☐	☐	☐
20	The textbook-based activities helped me work with others to solve problems.	☐	☐	☐	☐	☐

E. Perceived Sustainability-Related Learning and Awareness

No.	Statement	1	2	3	4	5
21	The textbook-based activities helped me understand the environmental impacts of civil engineering projects.	☐	☐	☐	☐	☐
22	The textbook-based activities encouraged me to consider trade-offs between environmental benefits, economic costs, and technical requirements when evaluating engineering solutions.	☐	☐	☐	☐	☐
23	The textbook-based activities increased my awareness of sustainable materials and practices in civil engineering.	☐	☐	☐	☐	☐
24	The textbook-based activities encouraged me to recognize my responsibility, as a future civil engineer, to consider the sustainability implications of my professional decisions.	☐	☐	☐	☐	☐
25	The textbook-based activities increased my interest in exploring sustainable engineering practices in civil engineering.	☐	☐	☐	☐	☐

F. Open-Ended Questions

1. Which aspect of the textbook-based activities did you find most useful or engaging, and why?

2. How did the textbook-based activities support your English learning and your development as an engineering student?

3. What difficulties or limitations did you experience with the textbook-based activities?

Appendix B: Student Engagement and Perceptions Questionnaire (Task-Based Activities)

Purpose

This questionnaire examines students' reported engagement with instructional activities in the English course and their perceptions of sustainability-related learning and awareness. The engagement items draw on established conceptualizations of behavioral, cognitive, emotional, and social engagement. The questionnaire was developed specifically for the present study.

The information collected will be used for research purposes only. Your participation is voluntary, and your responses will not affect your grades, academic results, or evaluation in this course. Please answer honestly based on your own experience.

Instructions

Please indicate how much you agree with each statement based on your experience with the task-based activities in this course.

Response scale: 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree

A. Behavioral Engagement

No.	Statement	1	2	3	4	5
1	I actively participated in the task-based activities during the course.	☐	☐	☐	☐	☐
2	I made a consistent effort to complete the task-based activities.	☐	☐	☐	☐	☐
3	I stayed focused and attentive during the task-based activities.	☐	☐	☐	☐	☐
4	I made an effort to use English during the task-based activities.	☐	☐	☐	☐	☐
5	I persisted with the task-based activities, even when they were challenging.	☐	☐	☐	☐	☐

B. Cognitive Engagement

No.	Statement	1	2	3	4	5
6	The task-based activities required me to think carefully about what I was learning.	☐	☐	☐	☐	☐
7	I revised or refined my ideas while completing the task-based activities.	☐	☐	☐	☐	☐
8	The task-based activities helped me connect English learning with my engineering knowledge.	☐	☐	☐	☐	☐
9	The task-based activities required me to evaluate different ideas or solutions before making decisions.	☐	☐	☐	☐	☐
10	The task-based activities encouraged me to generate different ideas or solutions to problems.	☐	☐	☐	☐	☐

C. Emotional Engagement

No.	Statement	1	2	3	4	5
11	I found the task-based activities interesting.	☐	☐	☐	☐	☐
12	I found the task-based activities relevant to my future career in engineering.	☐	☐	☐	☐	☐
13	I enjoyed learning English through the task-based activities.	☐	☐	☐	☐	☐
14	I felt confident using English during the task-based activities.	☐	☐	☐	☐	☐
15	I felt motivated to express my ideas during the task-based activities.	☐	☐	☐	☐	☐

D. Social Engagement

No.	Statement	1	2	3	4	5
16	I actively collaborated with my classmates during the task-based activities.	☐	☐	☐	☐	☐
17	The task-based activities gave me opportunities to learn from my classmates.	☐	☐	☐	☐	☐
18	I felt comfortable sharing my ideas and opinions during the task-based activities.	☐	☐	☐	☐	☐
19	The task-based activities encouraged meaningful communication with my classmates.	☐	☐	☐	☐	☐
20	The task-based activities helped me work with others to solve problems.	☐	☐	☐	☐	☐

E. Perceived Sustainability-Related Learning and Awareness

No.	Statement	1	2	3	4	5
21	The task-based activities helped me understand the environmental impacts of civil engineering projects.	☐	☐	☐	☐	☐
22	The task-based activities encouraged me to consider trade-offs between environmental benefits, economic costs, and technical requirements when evaluating engineering solutions.	☐	☐	☐	☐	☐
23	The task-based activities increased my awareness of sustainable materials and practices in civil engineering.	☐	☐	☐	☐	☐
24	The task-based activities encouraged me to recognize my responsibility, as a future civil engineer, to consider the sustainability implications of my professional decisions.	☐	☐	☐	☐	☐
25	The task-based activities increased my interest in exploring sustainable engineering practices in civil engineering.	☐	☐	☐	☐	☐

F. Open-Ended Questions

1. Which aspect of the task-based activities did you find most useful or engaging, and why?
2. How did the task-based activities support your English learning and your development as an engineering student?
3. What difficulties or limitations did you experience with the task-based activities?