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From Awareness to Action: An Integrated ENGAGE Framework for Enhancing Engineering Higher Education Engagement in Environmental Sustainability

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Abstract

Higher education institutions are urged to move beyond embedding sustainability awareness in curricula and to translate that awareness effectively into practice. Yet the evidence on how to transfer awareness into actionable practice, particularly within a specific discipline such as engineering, remains uncertain. This paper brings together two independent cross-sectional survey rounds conducted with undergraduate engineering students at the Applied Science University (ASU), Bahrain, to investigate students' awareness and engagement levels in sustainable development. The study develops a discipline-embedded framework for closing the gap between what engineering students know about sustainability and what they actually do. The first round ($N = 44$) measured the awareness, attitudes and self-reported pro-environmental behaviour among College of Engineering (CoE) students. Outcomes reveal high awareness and favourable attitudes to sustainability but a self-reported "commitment gap" shown by modest engagement in campus sustainability activities and pro-environmental practices. The second round ($N = 45$) investigated the barriers to and motivators for participation. Time pressure, limited information about events, lack of interest and uncertain perceived impact were the barriers most often rated major or significant, with small differences between them. Skill development opportunities, personal interest and discipline relevance were the leading motivators. Building on the survey outcomes, and on a three-year review of the CoE's own sustainability initiatives, the study proposes an integrated **ENGAGE** framework—***E**xperiential learning, **N**etworked mentorship, **G**uided curriculum integration, **A**ccessible participation, **G**rounded communication, and **E**mbedded policy*—tailored to engineering education. The study also proposes a three-year monitoring protocol for tracking whether the framework narrows the commitment gap over time. A worked example applies ENGAGE to the redesign of a GIS workshop as a descriptive pilot to illustrate how the framework could be implemented. The novelty of the work lies in an implementation model grounded in a measurement plan and a case example that turns the framework into something that can be evaluated rather than merely advocated.

Keywords: ENGAGE; Sustainable Development Goals; engineering education; environmental sustainability; Student Engagement; commitment gap; experiential learning; curriculum integration

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1. Introduction

Sustainability has moved, over roughly the past decade, from a topic occasionally mentioned in strategic plans to something universities are expected to demonstrate, report

on, and increasingly be measured against. The United Nations' 2030 Agenda, with its 17 Sustainable Development Goals (SDGs) and 169 targets, remains the reference framework for that expectation [1]. Goal 4 places education at the centre of the agenda, and target 4.7 in particular calls for learners everywhere to acquire the knowledge, values and skills needed to support sustainable development [2,3]. Higher education institutions sit awkwardly close to this target: they are expected simultaneously to teach it, model it in their own operations, and produce graduates who carry it into industry [4].

Engineering programmes occupy a particularly consequential position within that expectation. Engineers design the buildings, infrastructure, energy systems and industrial processes that determine a country's material footprint for decades after graduation, so how engineering students are taught to think about sustainability—and whether that thinking survives contact with a job—matters more than the size of any one cohort would suggest. Yet much of the empirical literature on student sustainability engagement is either generic, drawing on mixed-discipline samples, or focused on awareness and attitudes rather than on what happens once a student is asked to actually show up to something [5–11]. Few studies in engineering education move from measuring what students know, to explaining why they do not act on it, to designing an engagement model, and to specifying how a designed intervention could be tested.

This paper is an attempt to do exactly that within one institution. The College of Engineering (CoE) at Applied Science University (ASU) in Bahrain has, over the past several academic years, invested visibly in campus sustainability—a green-campus programme, sustainability-themed coursework, and a growing calendar of guest lectures, site visits and student competitions. Two structured surveys were fielded to gauge whether that investment was reaching students in a way that mattered to them. The first survey [12], administered in November–December 2023 to 44 engineering students, measured sustainability and SDG awareness, attitudes and self-reported behaviour; it found that students understood sustainability reasonably well and expressed positive attitudes toward it, but that actual participation in sustainability-related campus activity was low—a "commitment gap" between knowing and doing. The second survey [13], administered a year later (September–October 2024) to 45 students, went after the mechanics of that gap directly, asking what specifically got in the way of participation and what would make students more likely to take part.

Read together, the two studies suggest that engineering students are not indifferent to sustainability, and the commitment gap is not solely a motivational problem: logistical barriers, mainly time and information, sit alongside motivational ones. It looks more like a design problem—one of timing, visibility and relevance to the student's own discipline—which is, in principle, a solvable one. What neither paper did, on its own, was turn that diagnosis into something an engineering programme could act on, and specify how its effect could be checked.

That is the contribution of the present paper, and its point of departure from the two studies it builds on. Three things are new here. First, the paper integrates the awareness/attitude data (Phase 1) with the barriers/motivators data (Phase 2) into a single diagnostic picture, rather than treating them as two separate findings. Second, it proposes an integrated "ENGAGE" framework that is explicitly discipline-embedded rather than generic: it is built around, and grounded in, the kinds of activities an engineering college already runs—guest-speaker sessions mapped to specific modules, site visits to construction and manufacturing facilities, competitions and internships. Third, rather than stopping at a set of recommendations, the paper specifies a three-year monitoring protocol, with concrete indicators and data sources, for testing whether the framework closes the gap it is meant to close.

The paper is organised as follows. Section 2 reviews the wider literature on sustainability engagement in higher education and situates the commitment-gap concept within it, with attention to engineering-specific findings. Section 3 details the three-phase research design. Section 4 reports the Phase 1 and Phase 2 results and their cross-phase synthesis, followed by a discussion in Section 5. Section 6 presents the ENGAGE framework and the suggested monitoring protocol and an implementation case example. Sections 7–9 close with implications for practice, limitations and conclusions.

Relationship to previous work: The Phase 1 survey was reported in [12], and the Phase 2 survey in [13], both conference papers co-authored with M. Aouad, S. Awawdeh and S. A. Mahfoodh, who contributed to the early development of the questionnaires. The present author was the principal investigator and carried out all the analysis and writing. This article reuses only the survey data. All text, figures and tables are new. The data are analysed together here (Section 4.3), and the review of College activity, the ENGAGE framework, the monitoring protocol and the workshop case study are reported for the first time.

2. Literature Review

The idea that raising awareness is not the same as changing behaviour is not new to sustainability-education research, but it keeps reappearing because it keeps being confirmed. Zsóka et al. [8], working with Hungarian secondary and university students, found solid environmental knowledge sitting alongside comparatively modest everyday pro-environmental behaviour. Similar patterns have been reported among university students in south-eastern Texas [6], Greece [14], Vietnam [15], Obudu in Nigeria [16], and among Chinese university students, where Fu et al. [5] traced pro-environmental behaviour on the Tianjin University campus to a mix of personal motivation, social pressure and cultural habit rather than knowledge alone [17]. Students tend to overstate environmental awareness compared to real actions, showing an inconsistency. While knowledge increases, it does not always translate into action [18].

Within the Gulf Cooperation Council (GCC) region, a study of architecture and planning students at the University of Dammam in Saudi Arabia [19] revealed that students there were aware of, and concerned about, campus sustainability, yet only a minority reported willingness to participate in related initiatives. A similar study from Saudi Arabia reported the same knowledge–action gap [20]. Another study in the United Arab Emirates reported high awareness about sustainability but limited competency in applying particular SDG principles [21]. Across the studied literature, various terms were used to describe the problem—knowledge–action gap, attitude–behaviour gap, commitment gap—but the underlying finding is consistent enough that it now reads as an established regularity rather than a novel discovery [18].

Education for Sustainable Development (ESD), as articulated in UNESCO's learning objectives for the SDGs [2] and grounded in target 4.7 of the 2030 Agenda [1,3], was conceived partly as a response to that gap: the objectives are explicit that ESD should build not just cognitive understanding but socio-emotional and behavioural competence as well [4,22]. Universities have taken up that brief unevenly. Curricular integration—embedding sustainability content and SDG-aligned projects into existing courses rather than treating it as an add-on—is one of the more consistently recommended responses [23–25], and there is a small amount of engineering-specific work on how to do this: Abd-Elwahed and Al-Bahi [26] propose a teaching and assessment framework for building sustainability awareness directly into engineering curricula in one of the few studies that treat engineering education as needing its own approach rather than borrowing wholesale from the generic higher-education sustainability literature. Atallah [27] proposes a theoretical

framework that positions community engagement as a central driver of sustainable higher education outcomes.

Beyond the curriculum, campus-level interventions have been studied with mixed but generally encouraging results. Hamid et al. [28] found that social media use broadened sustainability understanding among students and staff and functioned as a practical channel for communicating campus policy. González-Ramírez et al. [29] surveyed students' willingness to pay a dedicated "green fee," finding a modest but real appetite (a mean willingness to pay of roughly USD 13–USD 15) that suggests students are not entirely unwilling to invest personally in sustainability, provided the ask is concrete. Bethurem et al. [30], studying efforts to reduce single-use water bottles on a US campus, found the main obstacle was not attitude but infrastructure—the absence of refill stations—a finding that maps closely onto what Phase 2 of the present study identifies as "perceived lack of impact" and practical access barriers, rather than disinterest. Nguyen Dang et al.'s work on a university green roof [31] adds a further nuance: students with more technical knowledge of the installation tended to weigh its environmental benefits more heavily, while less-informed users emphasised its social benefits—suggesting that depth of discipline-relevant knowledge shapes how students value an intervention, not just whether they show up to it.

What is comparatively underdeveloped in this literature, and what motivates the present paper, is the step after diagnosis. Many of the studies above end with recommendations—integrate the curriculum, communicate better, offer incentives—that are broadly sensible and also broadly generic, in the sense that they would read the same way for a business school as for an engineering college. A smaller number of studies propose frameworks with named stages or pillars [25,32], but few of these are built specifically around the activity types an engineering programme already runs as a matter of course—site visits, accreditation-mapped guest lectures, design competitions, internships—and fewer still pair the framework with a concrete plan for measuring whether it works once implemented.

Within this context, the paper builds on two earlier studies of engineering students. The Phase 1 study [12] documented high SDG awareness (68% of respondents had heard of the SDGs; 70% correctly identified that there are 17 goals) alongside low participation (27% had taken part in any campus sustainability event), consistent with the awareness–action gap reported elsewhere in the literature but with the added specificity of engineering-related SDGs (SDGs 6, 7, 9, 11 and 13). The Phase 2 study [13] moved from documenting the gap to explaining it, finding that practical constraints—chiefly time (44.4% rating it a major or significant barrier) and event visibility (40%)—were among the main obstacles. Interest was uneven across the student body, and discipline relevance was a particularly strong lever: 76% of respondents said they would be more likely to participate if activities were tied to their field of study. That last finding is, in a sense, the hinge on which the present paper turns: if discipline relevance is what students say would move them, the framework built in response should be organised around discipline-specific activity, not generic sustainability programming borrowed from elsewhere on campus. That is the gap in the existing literature that this paper sets out to close.

3. Methodology

3.1. Overall Research Design

The methodology is developed in three phases (Figure 1). Phase 1 and Phase 2 are two previous independently developed cross-sectional surveys conducted a year apart with separate samples of undergraduate engineering students in the CoE at ASU. All survey measures in this study are self-reported. Phase 3 (i) synthesises the Phase 1 and Phase 2 findings into a single diagnostic account of the commitment gap, (ii) designs an integrated ENGAGE framework informed by an inventory of the CoE's sustainability-related

activities over three academic years, (iii) recommends a three-year monitoring protocol for tracking engagement outcomes, and (iv) presents a case example of a redesign of a "GIS for Sustainable Development" training workshop based on the ENGAGE diagnosis.

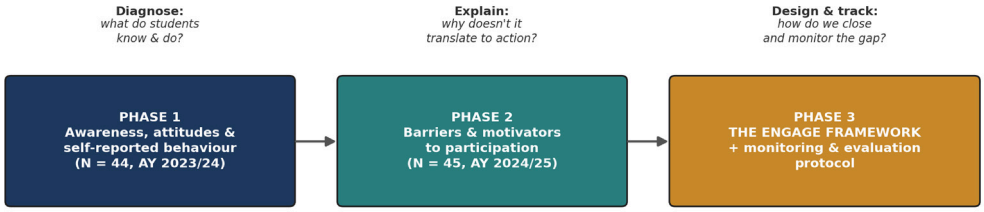

Figure 1. Flow diagram of the research methodology in three phases: diagnosis (Phase 1), explanation (Phase 2), and design-and-tracking (Phase 3).

3.2. Phase 1: Assessing Students' Awareness, Attitudes and Self-Reported Engagement in SDGs

The Phase 1 study used a sustainability questionnaire, developed from a review of the sustainability-education literature and refined through informal discussions with faculty members and students and hosted on Microsoft Forms, structured in three sections (40 items in total). Section 1 (19 items, a mix of yes/no, Likert-scale and open-ended questions) gauged general sustainability and SDG awareness. Section 2 (two sets of eight Likert-scale items) measured, respectively, attitudes toward and self-reported frequency of specific sustainability-related behaviours (energy and water conservation, recycling, community participation, and so on). Section 3 (five items) probed knowledge, attitude and engagement specifically with five SDGs judged most relevant to engineering disciplines: SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action). The Phase 1 study received approval from the institutional review board of ASU. The questionnaire was hosted on Microsoft Forms, and the link was distributed to students through their university email accounts. Participation was voluntary: respondents were first shown an informed consent statement and could view and answer the questions only after agreeing to it. Ethical approval and informed consent are described in the Institutional Review Board Statement and the Informed Consent Statement at the end of the article. All 127 registered CoE students—across the Civil Engineering, Architectural Engineering, Mechanical Engineering and Electrical and Electronic Engineering programmes—were invited by email; 44 responded (34.6% response rate), during a window open November–December 2023 (Table 1). Responses were coded and analysed descriptively in Microsoft Excel. The survey responses were treated as anonymous and were not linked to individual respondents.

3.3. Phase 2: Assessing Barriers to and Motivators for Engagement in Sustainability Initiatives

Phase 2 followed roughly a year later with a Sustainability Engagement Questionnaire, structured in six sections: demographics; awareness and understanding; participation and engagement; barriers to participation (Likert-scale and open items covering time, information, interest, relevance and perceived impact); motivators for participation; and open suggestions for improvement. Its barrier and motivator items were drafted from the Phase 1 findings and the literature and refined through informal discussion with faculty members and students. The Phase 2 study was covered by the same institutional review board approval. The questionnaire was hosted on Microsoft Forms and distributed to students through their university email accounts. Participation was voluntary: respondents were first shown an informed consent statement and could view and answer the questions only after agreeing to it.

Phase 2 participation was restricted to the CE and AE programmes, the two programmes with students across all academic levels. The ME and EEE programmes were not included in Phase 2. They were newly launched, and at the time of the Phase 1 survey their students were enrolled at foundation level (Level S) only; only three of them responded (two ME and one EEE), too few to be representative. By Phase 2, these programmes had students at Level S and Level 4 only. To avoid the same problem, and to keep the two surveys comparable, Phase 2 was restricted to the CE and AE programmes, which have students across all academic levels. This choice also reduced the invited population (73 students, compared with 127 in Phase 1) and therefore raised the response rate. Since most Phase 1 respondents were also CE and AE students (93%) at senior levels (half in the final year or already graduated), the Phase 2 sample is broadly similar in composition to the Phase 1 sample from the previous academic year, which supports reading the two surveys as complementary. The two surveys were anonymous and were never linked at the individual level, so overlap between respondents cannot be excluded.

Seventy-three students from the Civil Engineering and Architectural Engineering programmes were invited; 45 responded (61.6% response rate), during a window open September–October 2024. As in Phase 1, data were coded and analysed descriptively in Excel, with open-ended responses reviewed thematically.

3.4. Phase 3: Synthesis and Design of the ENGAGE Framework

Phase 1 and Phase 2 datasets were re-read jointly rather than sequentially. The cross-reading was carried out by the author, who assigned each finding to an ENGAGE component and evidence category (Table 2; Table S1). The ENGAGE structure was further reviewed through informal discussions with faculty. Barriers and motivators identified in Phase 2 were cross-referenced against the corresponding awareness, attitude or behaviour items in Phase 1 to identify where the two datasets reinforced, qualified, or added nuance to one another. Open-ended responses were grouped by themes in Phase 1 and reviewed thematically in Phase 2. This cross-reading is the basis for the designed *ENGAGE* framework presented in Section 6.

To ground the framework's discipline-specific components in the College's actual provision, a review of CoE sustainability-related activities was carried out for AY 2023/2024, AY 2024/2025 and AY 2025/2026, with AY 2023/2024 as the baseline year. The review drew on the College's activity calendar, end-of-year reports, attendance registers and post-event feedback forms. The review used aggregated administrative records (attendance and feedback summaries) that contain no student identifiers; no additional data were collected from students for it, and no separate ethical approval was required for this use. The activity calendar includes various activities organised or endorsed by the College and open to engineering students, in one of six categories: guest-speaker sessions, site visits, workshops, competitions, internships and summer training placements. Each activity was counted once per academic year. In total, the review covered 190 activities and placements: 56 in AY 2023/2024, 62 in AY 2024/2025 and 72 in AY 2025/2026. All three academic years were complete at the time of the analysis. The number of activities in each year was compared with that in the baseline year. Attendance registers and feedback forms were reviewed, but only in summary form, and they are not analysed in this paper. The review was compiled by the author; because it draws on internal College records, the underlying inventory is not published, and only its main outcomes are reported. A monitoring protocol was then designed to specify how these activity categories would be tracked prospectively, with baseline, process and outcome indicators, over a three-year period.

4. Results

4.1. Phase 1: Awareness, Attitudes and Engagement

4.1.1. Phase 1 Sample

Table 1 summarises the Phase 1 and Phase 2 samples side by side. Phase 1 respondents were drawn overwhelmingly from the Civil Engineering (CE—47.7%) and Architectural Engineering (AE—45.5%) programmes, reflecting their larger enrolment relative to the newly launched Mechanical (ME) and Electrical/Electronic (EEE) Engineering programmes at that time (4.5% and 2.3%, respectively). Sixty-six per cent of respondents were female, consistent with the College's broader gender enrolment pattern. Half of the sample were in their final undergraduate year or had graduated in the preceding cohort, meaning the sample skewed toward students with more, rather than less, exposure to the curriculum.

Table 1. Demographic characteristics of Phase 1 and Phase 2 samples.

Characteristic	Category	Phase 1 (N = 44)	Phase 2 (N = 45)
Gender	Female	29 (65.9%)	34 (75.6%)
	Male	15 (34.1%)	11 (24.4%)
Programme	Civil Engineering	21 (47.7%)	22 (48.9%)
	Architectural Engineering	20 (45.5%)	23 (51.1%)
	Mechanical Engineering	2 (4.5%)	—
	Electrical & Electronic Engineering	1 (2.3%)	—
Academic level	Level S (Year 1)	5 (11.4%)	7 (15.6%)
	Level 4 (Year 2)	7 (15.9%)	5 (11.1%)
	Level 5 (Year 3)	10 (22.7%)	8 (17.8%)
	Level 6 (Year 4)	11 (25.0%)	14 (31.1%)
	Graduate	11 (25.0%)	11 (24.4%)
Survey	Invited/responded	127/44	73/45
	Response rate	34.6%	61.6%

4.1.2. Awareness

Students reported comparatively strong general sustainability literacy: 84% could define sustainability in their own words, most commonly in terms of meeting present needs without compromising the ability of future generations to meet their own; 68% had heard of the UN SDGs; and 70% correctly identified that there are 17 goals. Seventy-three per cent could name at least three SDGs unprompted, most often No Poverty, Quality Education, and Sustainable Cities and Communities. Awareness thinned considerably, however, once the question turned from the SDGs in the abstract to sustainability activity on the ASU campus specifically: only 30% reported being aware of any campus sustainability initiative, and only 27% had participated in one (Figure 2).

4.1.3. Evaluating Attitudes and Self-Reported Engagement (Behaviour)

Attitudes were consistently favourable and, on several items, close to unanimous: roughly three-quarters of respondents strongly agreed or agreed with reducing food waste and reducing single-use plastics, and a similar share endorsed practising water conservation in daily activities (Figure 3). Willingness to educate themselves about sustainable living was similarly high. Agreement was noticeably softer, however, on the one item that required collective rather than individual action—participating in community or campus clean-up initiatives—where agreement dropped to roughly a quarter of respondents, and a comparable share actively disagreed.

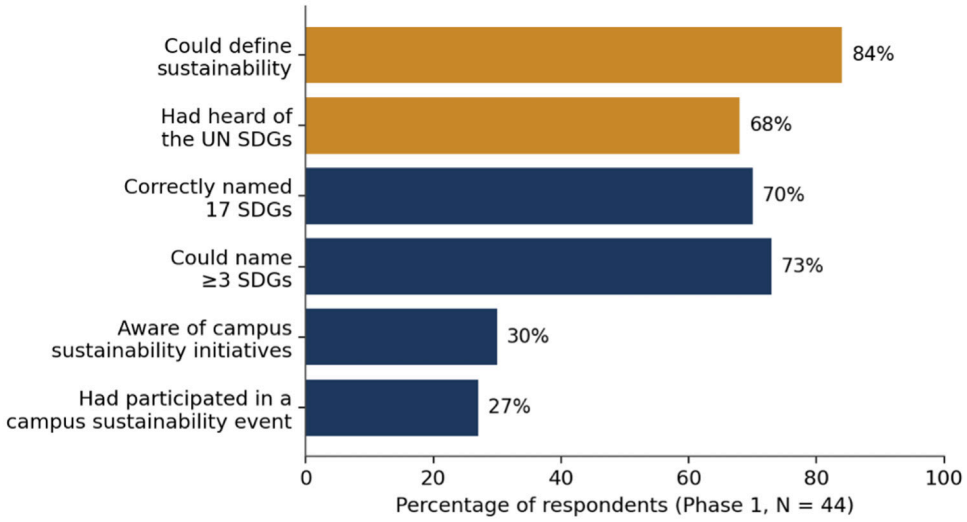

Figure 2. Sustainability and SDG awareness levels for Phase 1 research sample.

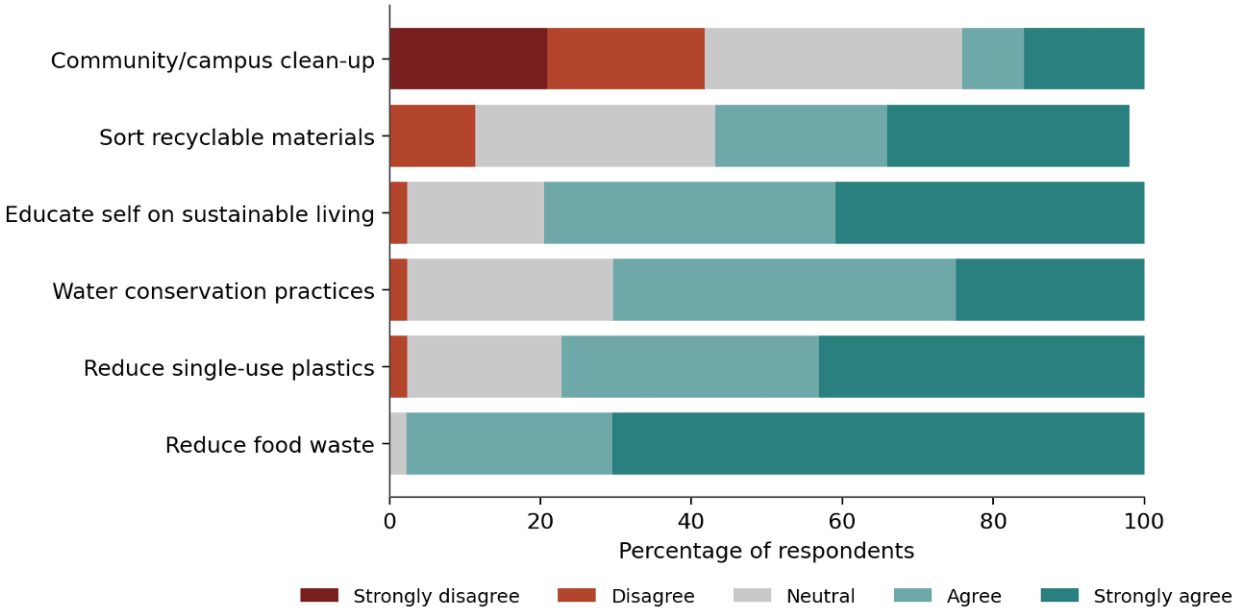

Figure 3. Attitudes and self-reported sustainability engagement in pro-environmental practices on a five-point Likert scale (Strongly Disagree–Strongly Agree), Phase 1.

A similar pattern held for self-reported frequency of specific behaviours (Figure 4). Individually convenient, cost-saving actions scored well: only 9.1% of students said they rarely chose energy-efficient appliances and lighting, and 38.6% said they always reduce paper use. Actions that were more visibly social, or that depended on infrastructure the student does not personally control—using public transportation or carpooling instead of driving, in particular—were the weakest link, with roughly half of respondents reporting they rarely or never did so.

4.1.4. Engagement with Engineering-Specific SDGs

Across the five selected SDGs, knowledge and attitude levels consistently outpaced actual engagement. SDG 6 (Clean Water and Sanitation) had the highest reported knowledge, with 87% of students describing their understanding as very high, compared with 41% for SDG 7 (Affordable and Clean Energy) and SDG 9 (Industry, Innovation and Infrastructure). Attitude levels were strongly positive across all five SDGs, ranging from 64% to 98% report-

ing a very high attitude level depending on the goal. Engagement levels were consistently lower than either knowledge or attitude for every SDG, with high-or-very-high engagement ranging from 18 to 64% depending on the goal, and SDG 7—the goal with the clearest existing foothold in the engineering curriculum through energy-systems coursework—recording the strongest engagement of the five despite not leading on knowledge.

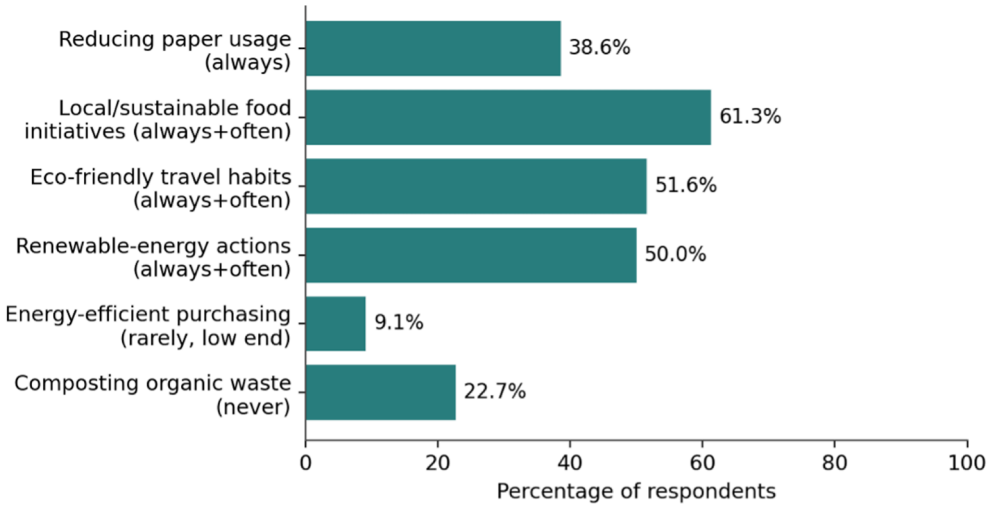

Figure 4. Self-reported frequency of selected pro-environmental behaviours, Phase 1 (Never–Always scale).

4.2. Phase 2: Barriers and Motivators

4.2.1. Phase 2 Sample

The Phase 2 sample ($N = 45$) was drawn from the Civil Engineering (49%) and Architectural Engineering (51%) programmes only (Table 1). Three-quarters of the respondents were female (76%). The sample skewed toward senior students: 31% were in Level 6 (fourth year) and a further 24% were fresh graduates of AY 2023/2024, so more than half (55%) had completed or were completing the programme, while 16% were in their first year (Foundation Year, Year 1), 11% in the second and 18% in the third. Responses were collected between 25 September and 7 October 2024 through Microsoft Forms. Of the 73 students invited, 45 responded (61.6%). As in Phase 1, the sample therefore leans toward students with more, rather than less, exposure to the curriculum.

4.2.2. General Awareness and Records of Prior Participation

Two-thirds of Phase 2 respondents (67%) reported not having participated in any campus sustainability initiative, a pattern consistent with Phase 1. This suggests the gap is not specific to one cohort, although the two surveys may have sampled different students and cannot show stability over time.

4.2.3. Identification of Major Barriers to Participation

Asked directly what got in the way, students converged on a small number of practical obstacles rather than a diffuse lack of interest (Figure 5). Lack of time was the most cited barrier, rated major or significant by 44.4% of respondents combined; insufficient information about events followed (major or significant for 40%); lack of interest was rated a major barrier by 24.4% but a somewhat significant one by a further 37.8%, suggesting interest is uneven across the student body rather than uniformly absent; and lack of visible impact of participation was cited as a major barrier by 24.4% of respondents. Notably, perceived irrelevance of initiatives was the barrier students were least likely to endorse (26.7% major

or significant; 24.4% not a barrier at all). Read alongside the time and information findings, this points toward a largely logistical explanation for low participation, although lack of interest was still rated at least somewhat of a barrier by 71.1%. With $n = 45$, the differences between the barriers are small (26.7–44.4% major or significant), so their order should be read as indicative only.

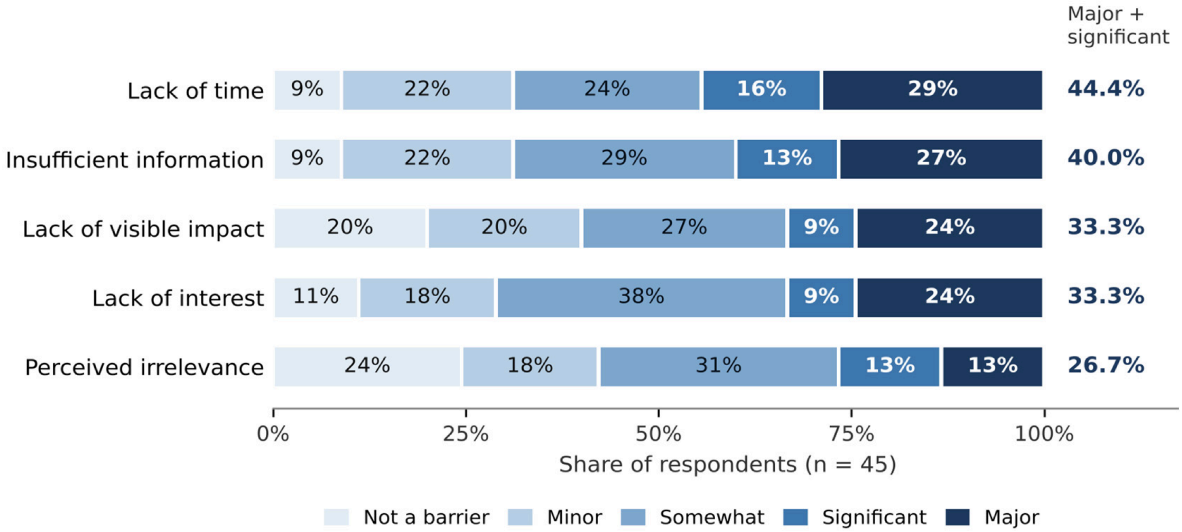

Figure 5. Barriers to participation in sustainability initiatives, Phase 2 ($n = 45$): full distribution of ratings on the five-point scale. The right-hand column gives the share rating each barrier as major or significant.

4.2.4. Identification of Major Motivators for Participation

When asked what would motivate participation, students most often cited opportunities to develop new skills (27% of selections) and personal passion for environmental issues (25% of selections), followed by networking with like-minded peers (18% of selections), recognition or incentives such as certificates (16% of selections), and support from faculty or staff (12% of selections) (Figure 6). Consistent with the barrier findings, 76% of respondents said they would be more inclined to participate if initiatives were tailored to their field of study, and 71% said embedding sustainability into coursework would increase their willingness to engage.

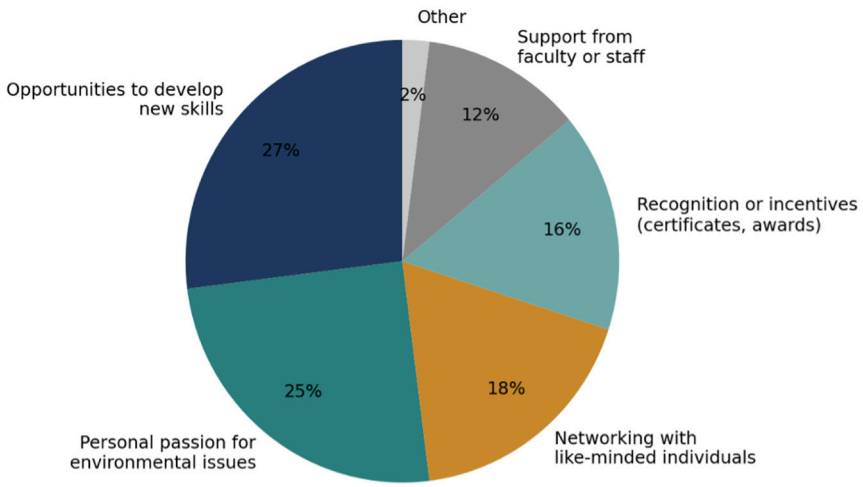

Figure 6. Major motivators for participation in sustainability initiatives, as rated by students, Phase 2.

Preferences for activity type and timing reinforce the same picture. Students most preferred workshops and training sessions (58%) and community service projects (24%) over passive formats such as awareness campaigns (4%) (Figure 7); and preferred timing clustered around the afternoon (29%) and morning (25%) slots, with Semester I and the summer semester favoured over other points in the academic calendar (Figure 8).

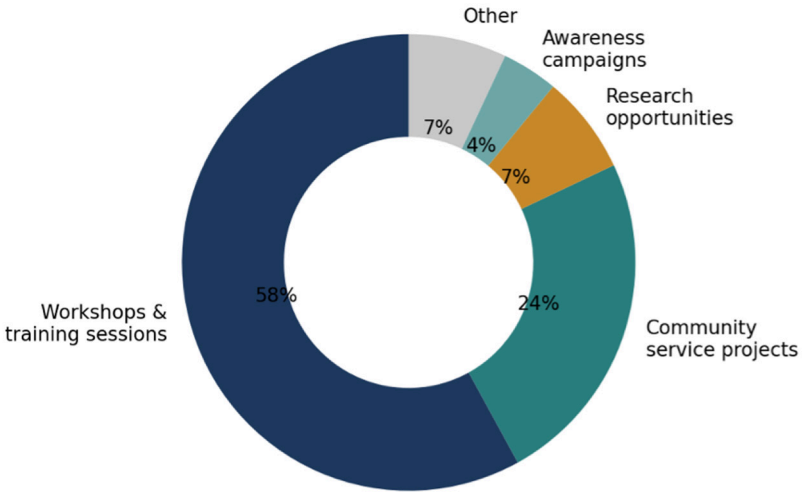

Figure 7. Preferred type of sustainability initiatives, as rated by students, Phase 2.

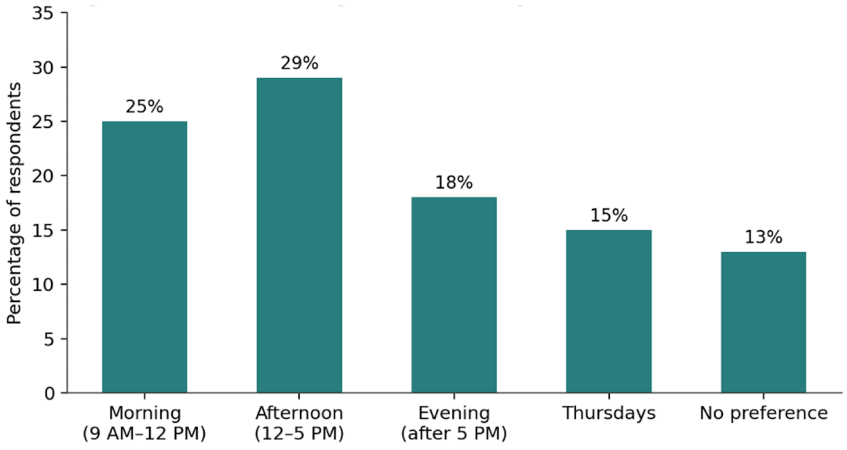

Figure 8. Preferred timing of sustainability events, as rated by students, Phase 2.

4.3. Integrated Diagnosis of the Commitment Gap

Not mainly a deficit of general awareness: Phase 1's awareness figures (68–87% depending on the specific measure) suggest that general awareness of the SDGs is not the main limiting factor, although this study did not test applied or technical knowledge of sustainability practice; Phase 2's barrier data are consistent with this, showing that perceived irrelevance was the least endorsed barrier (26.7% major or significant), and lack of interest, although rated at least somewhat of a barrier by 71.1%, was less often rated major or significant (33.3%) than time (44.4%) or information (40.0%).

Strongly discipline-conditional: Phase 1's finding that engagement with SDG 7 (Affordable and Clean Energy) was comparatively strong and Phase 2's finding that 76% of students want activities tied to their field point in the same direction: students engage more when sustainability content sits inside, rather than beside, their engineering identity.

Logistical alongside motivational: Time and information were the barriers most often rated major or significant, ahead of lack of interest, although lack of interest was rated at least somewhat significant by about seven in ten students, so logistical and motivational

factors are treated here as co-equal. The behaviours that scored worst in Phase 1 (community clean-ups, public transport use) were precisely those requiring coordinated group action or infrastructure the student does not personally control, rather than those requiring more conviction.

The three above observations confirm that the commitment gap is not explained by communication alone or by incentives alone. They support a framework that treats discipline relevance, logistics and motivation as co-equal design problems—the ENGAGE structure adopted in Section 6.

The activity review described in Section 3.4 adds institutional context to this diagnosis. The review of CoE activities showed that the College is already running a substantial and varied activity calendar. It covered 190 activities and placements in total, rising from 56 in the baseline year to 62 and then 72 (+29% over the baseline year). Site visits numbered 20, 10 and 14 across the three years, workshops and guest-speaker sessions eight, nine and 12, competitions 13, six and five, and internship and summer-training placements 15, 37 and 41. Attendance registers and feedback forms are held by the College but were not tabulated for this article. These are descriptive, institution-level trends from administrative records. They are not attributable to any single measure, and they do not establish that the commitment gap has narrowed among the surveyed cohorts. They show that the activity base on which the proposed ENGAGE framework builds is established and growing, and that the question the proposed monitoring protocol addresses is whether this growth is sustained and reaches students who currently do not take part.

5. Discussion

The pattern that is emerging from this research sits comfortably alongside the wider literature reviewed, including Zsóka et al.'s finding that Hungarian students' environmental knowledge outpaced their behaviour [8], Abubakar et al.'s near-identical result among Dammam architecture and planning students [19], and Bethurem et al.'s conclusion that infrastructure, not attitude, was the binding constraint on bottled-water reduction [30]. What the ASU data add to that picture is specificity about which lever matters most for an engineering cohort. The 76% of Phase 2 respondents who said discipline-tailored activities would increase their participation is a substantial share, and it is corroborated indirectly by the Phase 1 finding that SDG 7—the one SDG with the clearest existing foothold in the engineering curriculum—outperformed the other four on engagement even though it did not lead on knowledge. Read together, these findings suggest the relevant unit of intervention is not "sustainability education" in general but sustainability content routed through a student's own programme: a civil engineering student is arguably more likely to act on a message about SDG 11 (Sustainable Cities) delivered through a design-studio brief than the same message delivered through a campus-wide poster campaign, even if the poster technically reaches more students.

The logistical finding is, in a sense, the more actionable of the two. Time and information problems are, unlike deep-seated attitudes, the kind of obstacle an institution can address directly and relatively cheaply—through scheduling, calendar design and communication channels—without first needing to change how students feel about sustainability. That the CoE already runs a substantial calendar of discipline-adjacent activity (guest-speaker sessions mapped to specific modules, site visits to construction and manufacturing sites, competitions, internships) is therefore a genuinely useful starting position: the raw material Phase 2 respondents said they wanted—skill-building, discipline relevance, tangible outcomes—already exists in the College's activity mix. The open question, which this paper cannot yet answer empirically, is whether that existing activity is explicitly framed around the SDGs at all, or whether it runs in parallel to the sustainability agenda rather than

as part of it. If a site visit to a construction site, for instance, is not explicitly connected in students' minds to SDG 9, 11 or 13, then simply running more of them may raise participation numbers without narrowing the commitment gap Phase 1 and Phase 2 were designed to measure. This is the specific design problem the framework in Section 6 tries to solve: not more activity, but activity that is legibly connected to the SDGs it is meant to advance.

The clean-up and public-transport findings in Phase 1 deserve a second look for a related reason: both are behaviours that depend on coordinated action or infrastructure beyond an individual student's control, and both were the weakest items in an otherwise favourable attitude profile. This is consistent with Phase 2's motivator data, where networking with like-minded individuals and faculty or staff support were named as levers—students appear to be signalling that collective-action behaviours need collective-action scaffolding (a group to join, a faculty member modelling the behaviour, a visible peer network), rather than simply more individual encouragement. A framework that addresses only individual-level motivation—more badges, more posters—would be poorly matched to this part of the diagnosis; one that also builds peer and faculty infrastructure is better matched to it.

Finally, it is worth being explicit about what this discussion does not claim. The commitment gap identified in Phase 1 and explained in Phase 2 is observed in this self-reported sample, but neither survey establishes a causal mechanism, and neither can, on its own, tell us whether the ENGAGE framework can actually narrow the gap once implemented. Accordingly, a monitoring protocol is proposed to track the progress in narrowing the commitment gap rather than treating the framework as self-evidently sufficient.

6. The ENGAGE Framework

6.1. A Discipline-Embedded Students' Engagement Framework

Building on the outcomes of this research, we propose an integrated **ENGAGE** framework—***E**xperiential learning, **N**etworked mentorship, **G**uided curriculum integration, **A**ccessible participation, **G**rounded communication, and **E**mbedded policy* (Figure 9)—for translating engineering students' sustainability awareness into sustained engagement. The framework is grounded in six interconnected components (strands) that touch on the discipline, logistics and motivation dimensions of the gap and should be integrated in combination rather than used alone (Figure 10).

Figure 9 uses short names (Learning, Mentorship, Curriculum, Access, Messaging, Policy); the full names used in the text, tables and Figure 10 are given below.

- **E—Experiential and Industry-Linked Learning:** This is the framework's discipline-specific component, well grounded in literature [33] and the one most directly grounded in Phase 2's finding that discipline-tailored, hands-on formats are what students say they want. It covers guest-speaker sessions mapped to specific modules, site visits to construction sites and manufacturing facilities, internships and summer training. The task for this component is less to invent new activity than to make the SDG connection in each of these events explicit to students—naming the relevant goal in the session title, the site-visit brief, or the workshop description—so that participation in an activity a student would likely attend anyway also registers, in their own mind, as sustainability engagement. Technology can strengthen this component: Building Information Modelling (BIM), Geographic Information Systems (GIS), simulation tools and digital platforms give students hands-on, discipline-specific ways to work on sustainability problems, as the GIS workshop in Section 6.3 illustrates.
- **N—Networked Faculty and Peer Mentorship:** Addressing the collective-action gap (community clean-ups, carpooling, etc.) requires visible role-modelling and peer infrastructure, not just individual encouragement; this requires faculty to model and

embed sustainability into their own research and mentoring. It also extends to explicitly include sustainability-ambassador roles, for example, from student-led structures such as the ASU Engineering Club and the existing ASU-ICE Student Chapter.

- **G—Guided Curriculum Integration:** SDG themes should be embedded inside existing modules—design studios, capstone and graduation projects, laboratory briefs—rather than delivered as a standalone sustainability elective [34]. The CoE's own graduation-project practice already gestures toward this: external jurors reviewing AY 2024/2025 architectural engineering graduation projects specifically noted alignment with Bahrain's Vision 2030 and the SDGs, suggesting the mechanism—embedding SDG criteria into capstone assessment—is workable within the existing programme structure and simply needs to be made deliberate and consistent across cohorts and modules, rather than emerging incidentally in some projects and not others.
- **A—Accessible and Flexible Participation:** Given that time pressure was the single most cited barrier in Phase 2, activities should be offered in varied formats and time slots—short, single-session commitments alongside longer ones, morning and afternoon options, and activities scheduled around Semesters I and II and the summer semester, rather than concentrated into a narrow band of the academic calendar. Certificates, digital badges, or inclusion of sustainability participation in co-curricular records respond directly to the 16% of Phase 2 respondents who named recognition as a motivator, and align with the professional-certification pathways the CoE already runs and which could plausibly be extended to include a recognised sustainability-engagement credential of similar standing.
- **G—Grounded Strategic Communication:** Insufficient information about events was the second most-cited barrier in Phase 2 (40% major or significant). Given that guest-speaker sessions and site visits already exist at meaningful scale, the communication problem here is arguably one of framing and channel rather than volume: promoting activities through the channels and language students said they respond to, and explicitly labelling SDG-relevant sessions as such in event titles and calendars, rather than leaving the sustainability connection implicit.
- **E—Embedded Policy and Green Infrastructure:** Students' behaviour is also shaped by what the institution itself visibly does, not only by what it says. Continued investment in green-campus infrastructure and sustainability-oriented policy reinforces the credibility of the other five strands; a college that asks students to reduce single-use plastics while visibly doing the same in its own operations sends a more coherent message than one that asks without modelling.

These six strands of the framework were derived from survey findings, institutional context and literature, and the evidence behind each is not equal (Table 2). The E—Experiential and Industry-Linked Learning, G—Guided Curriculum Integration, A—Accessible and Flexible Participation and G—Grounded Strategic Communication strands map directly onto the discipline-relevance, logistics and visibility findings. The N—Networked Faculty and Peer Mentorship strand has modest direct support (networking 18%, faculty support 12%) and rests partly on inference from the weakest Phase 1 behaviours. The E—Embedded Policy and Green Infrastructure strand has no direct survey item and is literature-informed. Tables 2 and S1 state, for each component, whether the evidence is direct, indirect, contextual or literature-informed.

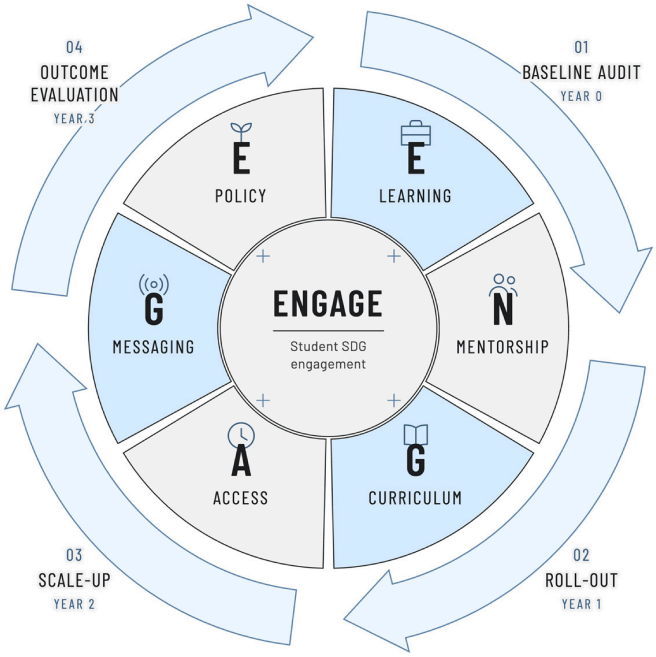

Figure 9. The proposed ENGAGE framework: a discipline-embedded model for engineering-student SDG engagement, linked to its monitoring and evaluation cycle.

Table 2. Strength of evidence behind each ENGAGE component (traceability of findings to components; finding identifiers refer to Table S1).

ENGAGE Component	Supporting Findings (Table S1)	Type of Evidence	Strength of Link
E—Experiential and Industry-Linked Learning	F7, F9, F11, F15, F18, F19	Survey (Phases 1 and 2); activity review	Moderate: two direct survey findings (F7, F9); the others are indirect (F11, F15) or contextual (F18, F19), and the growing activity base (56 → 62 → 72) adds context only
N—Networked Faculty and Peer Mentorship	F12, F13, F16	Survey (modest shares; behavioural pattern inferred)	Moderate: networking 18%, faculty support 12%; collective-action link is inferred
G—Guided Curriculum Integration	F8, F15, F20	Survey; institutional record; literature [34]	Moderate: direct item on coursework (71%); jurors' remark is anecdotal
A—Accessible and Flexible Participation	F4, F10, F14, F21	Survey (Phase 2)	Strong: time, timing and recognition items are direct (F4, F10, F14); F21 is contextual
G—Grounded Strategic Communication	F2, F5, F18, F19	Survey; activity review	Moderate: information barrier direct (40%); framing argument is inferential; review adds context only
E—Embedded Policy and Green Infrastructure	F16, F17, F22, F23	Indirect survey pattern; literature	Weak: no direct survey item; literature-informed and to be tested through the protocol

Evidence categories. Direct: A survey item or result addresses the component's mechanism. Indirect: The result is consistent with the component but needs an inferential step. Contextual: Activity review or institutional record only; descriptive and not causal. Literature: Published studies only. Finding identifiers (F1–F25) refer to Table S1 in the Supplementary Materials. Strength of link: Strong = most of the cited findings are direct and of substantial size; Moderate = some direct findings, the rest indirect or contextual, or direct but modest in size; Weak = no direct survey finding.

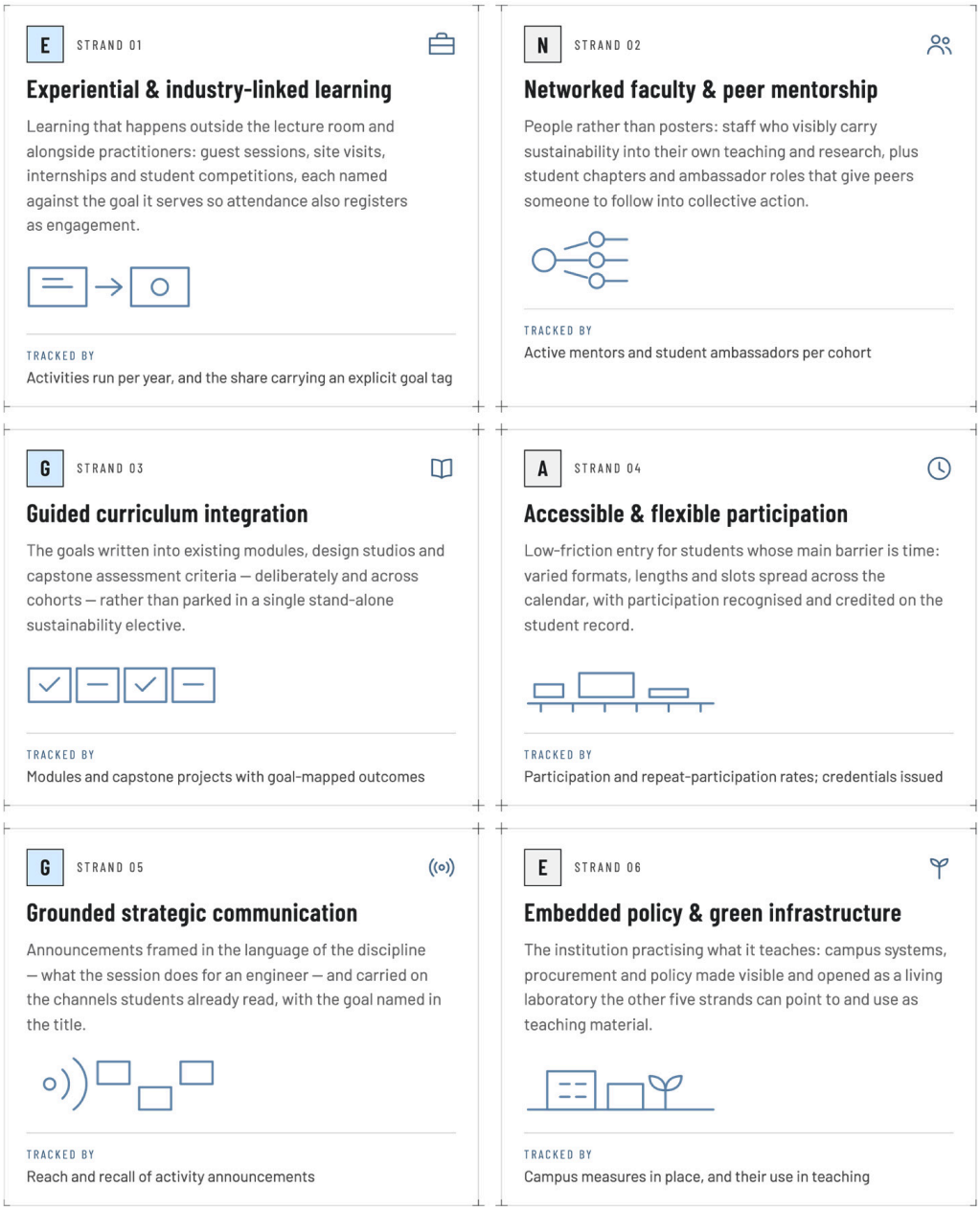

Figure 10. Description of the proposed integrated ENGAGE framework structured in six interconnected components (strands).

6.2. The Monitoring Protocol for Tracking Students' Engagement

A framework that is never evaluated is, in practice, indistinguishable from a list of good intentions. This section specifies a three-year monitoring protocol (Figure 11) for tracking whether the ENGAGE framework narrows the commitment gap. The monitoring protocol is a generic design to be adopted by any institution implementing the ENGAGE framework. The first year (Year 0) is the baseline reference point against which the subsequent three tracked years (1–3) are compared. The review of College activity in Section 4.3 covers the baseline year (AY 2023/2024) and the two following academic years. It was compiled retrospectively from administrative records. The monitoring protocol proposed here has not yet been run in full, and monitoring under it begins with Year 1. The case example provided in Section 6.3 (redesigned GIS workshop) is an example of how the framework may be implemented.

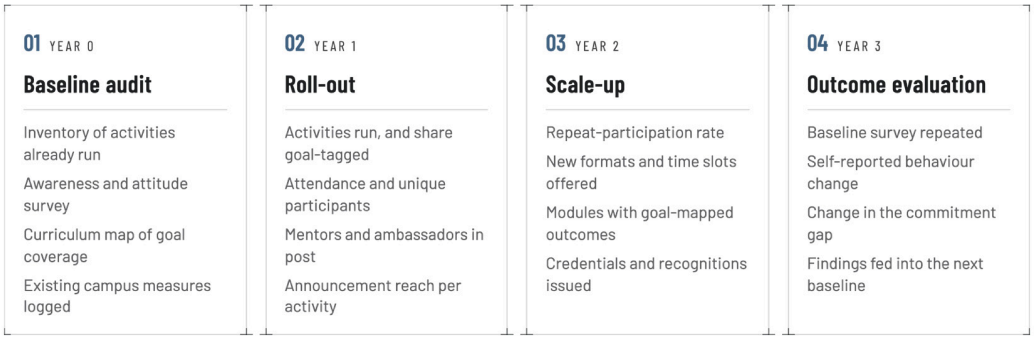

Figure 11. The proposed three-year monitoring protocol for tracking students' engagement in sustainable development.

Year 0—Baseline audit. Colleges need to establish a pre-intervention reference point (baseline) before any ENGAGE-aligned changes begin. This step involves preparing a current-state inventory for the college mapped against each of the six ENGAGE letters—not a generic activity count, but specifically: what curriculum touchpoints exist (G), what experiential/industry activity exists (E—Experiential), what communication channels are used (G), what recognition mechanisms exist (A), what mentorship structures exist (N), and what policy/infrastructure signals exist (E—Embedded Policy). Such information may be collected from multiple sources, including the existing institutional records (annual reports, event calendars, module handbooks) and does not necessarily involve a new data-collection exercise. A college adopting this protocol should ideally capture one full academic year of activity records before any framework-aligned changes are introduced. A before-ENGAGE diagnosis profile (before/after by component) is a typical deliverable institutions must prepare. Refer to the worked example presented in Section 6.3.

Year 1—Roll-out. This is the first full year of deliberate implementation across the six components of the ENGAGE framework, tracking the process indicators—detailed in Table 3—against the Year 0 baseline. Such indicators typically include the number of activities delivered, proportion of activities explicitly SDG-framed, breadth of participating programmes/departments, attendance rates, etc. Such process indicators show delivery and not the impact. To ensure successful implementation of the framework and institutional growth in sustainability engagement, a recommended starting strategy is to target a small number of flagship activities redesigned across all six components rather than attempting institution-wide change at once. Section 6.3 gives an illustrative example.

Year 2—Scale-up. The objective of this monitoring period is to extend the redesigned activities and programmes based on the outcomes of the monitoring period in Year 1. The same process indicators may be used to track delivery and change in activity. Effectiveness is assessed with the outcome indicators. A college would expect an uneven movement across indicators—some grow, some do not—and this is exactly why multiple indicators are tracked rather than one. It is recommended to pilot the outcome-indicator instrument (pre/post survey) on a subset during this year, so that it is validated before the full Year 3 push.

Year 3—Consolidation and outcome evaluation. This is the year when actual evidence of gap-narrowing gets collected. The protocol's final year would compare cumulative process and outcome indicators against the Year 0 baseline, using a repeat of the Phase 1/Phase 2 survey instruments (or a condensed combined version of the two) to test directly whether self-reported commitment-gap measures have narrowed. Two categories of indicators are specified, in line with standard programme-evaluation practice of separating what was delivered from what changed (Table 3). This stage uses the same before/after logic illustrated in Section 6.3, scaled from one activity to the whole institution.

Data sources are, deliberately, ones the College already generates in the normal course of running these activities—attendance registers, the Microsoft Forms survey infrastructure used in both prior phases, and existing event-reporting appendices of the kind already compiled for the College's own annual reflection reports—so that the monitoring burden sits on top of existing administrative practice rather than requiring a new data-collection system.

Table 3. Proposed monitoring process and outcome indicators for the three-year monitoring protocol.

Type	Indicator	Data Source
Process	Number of guest-speaker sessions, site visits, campus sustainability events and competition entries offered per semester, per programme	Event logs, CoE annual activity reports
Process	Proportion of activities explicitly framed around a named SDG	Event titles/briefs, communication materials
Process	Breadth of participation across the CE, AE, ME and EEE programmes	Attendance registers
Outcome	Proportion of students attending at least one sustainability-framed activity per semester	Attendance registers
Outcome	Repeat-participation rate (whether students who attend once return)	Attendance registers, MS Forms
Outcome	Pre/post score on a condensed commitment-gap instrument (drawing on Phase 1 and Phase 2 items)	Repeat survey administration at start and end of the 3-year window
Outcome	Proportion of capstone/graduation projects with an explicit, assessed SDG-alignment component	Graduation-project assessment records

6.3. Worked Example: Applying ENGAGE to a Sustainability Workshop

The following is a descriptive pilot implementation showing how the generic ENGAGE framework can be applied to one activity. The example illustrates the framework and is not a formal evaluation of its effectiveness, although the descriptive data reported below give a preliminary indication. The example is drawn from a "GIS for Sustainable Development" workshop typically offered on campus for engineering students. The workshop is linked to SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action). Prior to its redesign, the GIS workshop was delivered as a standalone, single-session activity, announced by email only, and no reference to the SDG framing was circulated among students. The workshop training was performed using standard example datasets common in US GIS textbooks, and was unconnected to any assessed coursework. Under this format, six of 45 invited students attended (13.3%) during the AY 2023/2024.

With ENGAGE, the workshop was rebuilt across all six components. It was tied to four modules, including the graduation project, with some modules embedding a coursework assessment that required students to apply GIS directly in a case study tied to environmental sustainability. Also, the SDG framing was explicitly mentioned on the promotional material and shared invites (G). The hands-on exercises were redesigned around real ASU green campus data rather than generic international examples (E—Experiential), directly connecting the technical content to the institution's own infrastructure (E—Embedded Policy). Promotion was extended from a single email to peer encouragement channels, WhatsApp

groups and Instagram, actively driven by student ambassadors and the Engineering Club (N, G). Certificates were introduced, alongside the embedded module assessment, as a recognition mechanism. Timing moved to an afternoon slot after teaching hours (matching Phase 2's stated preference); however, the workshop was still offered as a single session only, with no multiple time-slot options due to logistical limitations at that time (A). The redesigned workshop was offered again in AY 2024/2025 to the same eligible population (45 invited students from the programmes and levels targeted by the workshop: Level 5 and Level 6 CE and AE), with different students in each cohort. Attendance rose to 23 of 45 invited students (51.1%) (Figure 12). Table 4 summarises the ENGAGE diagnosis and the redesigned components of the GIS workshop.

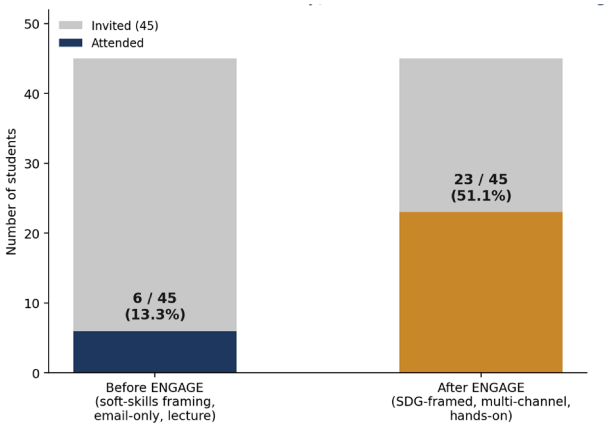

Figure 12. Attendance rates in the GIS training workshop before and after the redesign.

Table 4. Pre- and post-design of a "GIS for Sustainable Development" training workshop based on the ENGAGE framework.

#	Component	Before ENGAGE	After ENGAGE
E	Experiential and Industry-Linked Learning	✗ Classical lecture format; exercises used generic textbook example data (US-standard datasets)	✓ Hands-on exercises using real ASU campus data. SDG framing: SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).
N	Networked Faculty and Peer Mentorship	✗ No peer or faculty structure; email-only announcement	✓ Actively promoted and supported by student ambassadors and the Engineering Club
G	Guided Curriculum Integration	✗ Standalone workshop; no module linkage, no assessment	✓ Tied to four modules, including the graduation project; some modules embedded a coursework (CW) assessment requiring GIS use.
A	Accessible and Flexible Participation	✗ Single fixed session; no certificate; no credit	Partial ✓—certificates issued and a CW assessment embedded; timing moved to an afternoon slot after teaching hours (matching Phase 2's stated preference); however, still offered as a single session only, with no multiple time-slot options
G	Grounded Strategic Communication	✗ Official email only	✓ Expanded to peer encouragement, WhatsApp groups and Instagram, alongside ambassador and Engineering Club channels
E	Embedded Policy and Green Infrastructure	✗ No link to campus operations; used generic international examples	✓ Hands-on dataset was ASU's own operational/campus data related to green campus initiatives, directly linking the exercise to the institution's own infrastructure.

A pre-workshop poll (n = 12–13 of the 23 attendees) established an initial baseline: half of respondents had never previously heard of GIS, yet the same group already rated GIS as important for sustainable engineering (4.3/5) and for engineering practice generally (4.7/5)—a pattern consistent with this paper's broader finding that the commitment gap is not an attitude problem (Figure 13).

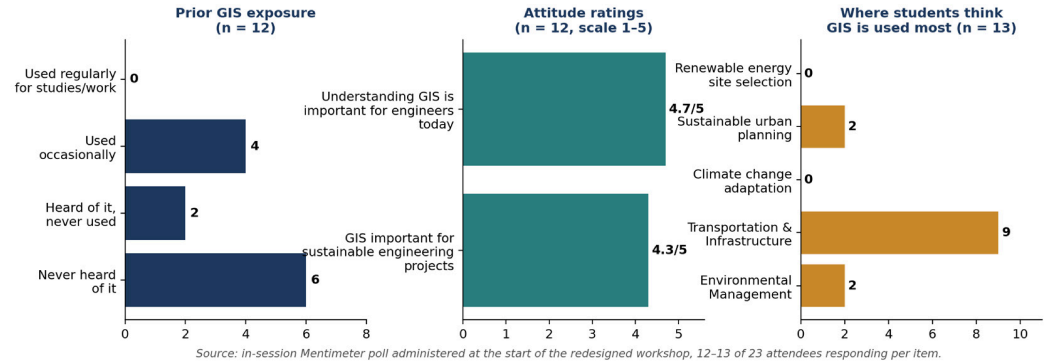

Figure 13. Pre-workshop responses of participants in the redesigned GIS workshop.

A post-workshop questionnaire (Figure 14) was administered immediately after the session. Sixteen of the 23 attendees (69.6%) responded, and not every respondent answered every item. Of the 16 respondents, 12 (75%) reported being confident or highly confident in using GIS for basic spatial analysis. Of the 15 who answered the usefulness item, 12 (80%) rated the workshop 4 or 5 on a five-point scale. Of the 16 who answered the motivation item, 14 (87.5%) reported being highly motivated (5 on a five-point scale) to apply GIS in sustainability-related studies or projects.

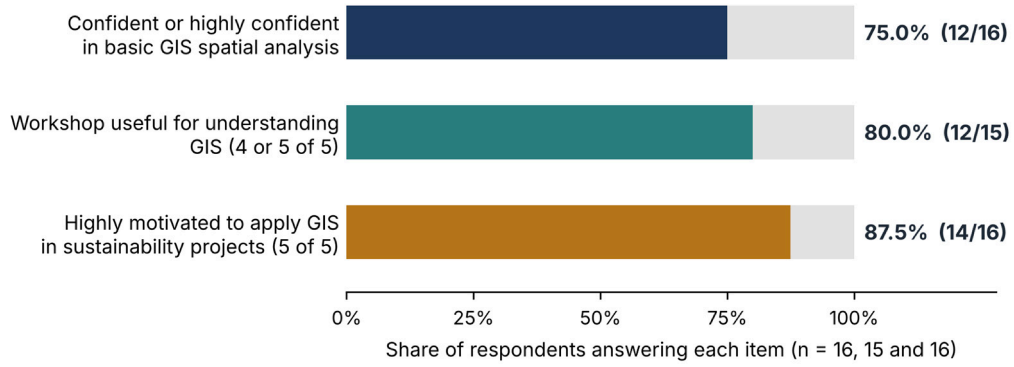

Figure 14. Post-workshop questionnaire results (AY 2024/2025). Bars show the share of respondents for each item (confidence n = 16; usefulness n = 15; motivation n = 16) among 23 attendees. Confident = confident or highly confident; useful = 4 or 5 of 5; highly motivated = 5 of 5.

These results can be read against the pre-workshop poll completed at the start of the same session (Figure 13), in which none of the 12 respondents used GIS regularly, and half (six of 12) had never heard of it. The two instruments were completed by different numbers of respondents and measured different constructs (prior exposure and attitudes before the session; confidence, usefulness and motivation after it), and the respondents may not be the same students, so the comparison is directional only and no change score is calculated. The direction, from little or no prior use to a majority reporting confidence and high motivation, is consistent with the rationale of the redesign. For the earlier workshop, only participation was recorded, and the authors' observation was that very few students went on to apply GIS in their coursework. Because that observation was not systematically recorded, it is offered as context only.

Taken together, the higher attendance (13.3% to 51.1% of invited students) and the favourable post-workshop responses are encouraging. They provide indirect, preliminary support for the idea that a workshop redesigned around ENGAGE components can engage more students and leave them more confident and motivated. They do not validate the framework as a whole. The design is a single-site descriptive pilot with different cohorts in consecutive years, voluntary attendance, a 69.6% questionnaire response rate, and several co-occurring changes to the workshop. Whether the framework is effective across contexts and which components account for the change remain to be tested with comparable pre- and post-measures and a comparison group. The novelty of the redesigned format, differences in the academic calendar between the two years and self-selection of attendees could also account for part of the difference.

7. Implications for Practice

For engineering programme leaders, four implications follow reasonably directly from the diagnosis and framework above.

- Build around existing activity rather than a parallel track. A great deal of the infrastructure Phase 2 respondents said they wanted—discipline-relevant, hands-on, skill-building activity—already exists in most engineering colleges in the form of guest lectures, site visits and competitions; the missing piece is often the explicit SDG framing rather than the activity itself.
- Design communication as deliberately as programming. With information gaps rated a leading barrier even in a college running a substantial activity calendar, supply of opportunity does not automatically produce awareness of it.
- Match the intervention to the behaviour type. Collective-action behaviours (clean-ups, shared transport, peer-led initiatives) likely need different scaffolding—faculty visibility, peer structures—than individual behaviours (recycling, energy use), which respond more readily to information and convenience.
- Build monitoring in from the outset, even modestly. Using data the institution already collects avoids the alternative of running activities and simply hoping engagement improves, which leaves no way to distinguish a genuinely effective intervention from one that merely feels effective to the staff running it.

8. Limitations and Future Work

Several limitations bear on how the findings here should be read. Both underlying surveys drew on convenience samples from a single institution, with modest sample sizes ($N = 44$ and $N = 45$) typical of single-college survey research but not large enough to support subgroup analysis by programme with confidence. Both instruments relied on self-reported behaviour, which is a reasonable proxy for actual behaviour but not equivalent to it, and neither phase used a control or comparison group, so the commitment gap described here is a within-sample pattern rather than a causally isolated effect. The questionnaires were developed from the literature and informal discussions with faculty and students and were not formally validated psychometrically.

The review of activities is descriptive and was compiled by the author from the College's own administrative records rather than from an independent count; the activity counts are not adjusted for cohort size or activity mix and are not evidence of a causal effect, and—as stated repeatedly above—it documents activity supply, not confirmed SDG framing or measured student outcomes; the extent to which existing guest-speaker sessions and site visits are already perceived by students as SDG-relevant is itself an open empirical question the monitoring protocol is designed to answer, not one this paper resolves. The GIS workshop is a descriptive pilot: cohorts differed between years, attendance was voluntary,

16 of 23 attendees completed the post-workshop questionnaire, and the pre- and post-workshop instruments are not equivalent. The synthesis of the survey findings and the assignment of findings to components were carried out by one researcher, without a second rater. Finally, the ENGAGE framework and the monitoring protocol are, by design, forward-looking proposals rather than tested interventions; their value should be judged once data from Years 1–3 under the protocol become available, and the author intends this paper as the first step in that longer study rather than as its conclusion. Future work could examine how emerging technologies, such as robotics and artificial intelligence, can support experiential sustainability learning in engineering programmes. Future work should also examine whether the discipline-relevance effect found here for engineering students replicates in other applied disciplines, and whether the relative weight of logistical versus motivational barriers shifts as students progress from early to final years of study.

9. Conclusions

Two survey rounds with engineering students at ASU, supported by a three-year review of College activity, point to the following: students are reasonably well informed about sustainability and the SDGs, hold favourable attitudes toward them, and, by their own reports, are nonetheless underrepresented in the activities meant to translate that awareness into action—not only because of limited interest but also because of time pressure, weak event visibility, and activity that does not always read as connected to their own discipline. The barriers were rated close to one another (26.7–44.4% major or significant), so their order should be read as indicative only. This paper has argued that closing that commitment gap is less a matter of persuading students to care more, and more a matter of redesigning how existing engineering-college activity—guest lectures, site visits, competitions, coursework—is framed, scheduled and communicated so that it visibly counts as sustainability engagement rather than running alongside it.

The ENGAGE framework proposed here is an attempt to specify that redesign concretely, anchored in what the CoE already runs rather than in generic sustainability programming; the three-year monitoring protocol proposed alongside it is an attempt to ensure the next iteration of this research can say, with actual data, whether the redesign worked. The GIS workshop pilot offers early, indirect support for the redesign logic, but validating the framework as a whole awaits the data from the monitoring protocol years. Universities are not short of frameworks for sustainability engagement; what is comparatively scarce is evidence, collected over time, that any particular framework changed anything. Closing that evidentiary gap, using the ENGAGE monitoring protocol, is the explicit purpose of the planned follow-up study.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/su182110875/s1: Table S1: Finding-level traceability matrix linked to the ENGAGE components.

Funding: This research received no external funding.

Institutional Review Board Statement: The study protocols and ethical aspects received approval from the Research, Innovation and Research Ethics Committee at Applied Science University (reference number ASU-DRG-500, approved 1 October 2023). The approval covered the Phase 1 and Phase 2 questionnaires and the workshop polls and questionnaire. The review of College activity used aggregated administrative records (attendance and feedback summaries) that contain no student identifiers; no additional data were collected from students for it.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The survey instruments and the aggregated results underlying this article will be shared upon reasonable request to the corresponding author. The College's internal activity inventory is not published (see Section 3.4); only its main outcomes are reported.

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Conflicts of Interest: The author declares no conflicts of interest.

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