

Quantifying SDG curriculum alignment using a GenAI–assisted, expert validated mapping approach

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Edoardo Bertone

*Griffith School of Engineering and Built Environment, Griffith University,
Gold Coast, Australia, and Australian Rivers Institute, Griffith University,
Brisbane, Australia*

Sherif Mostafa

*Griffith School of Engineering and Built Environment, Griffith University,
Gold Coast, Australia, and Griffith Institute for Human and Environmental
Resilience, Brisbane, Australia*

Ivan Gratchev

*Griffith School of Engineering and Built Environment, Griffith University,
Gold Coast, Australia*

Tommy Soesmanto

Griffith Business School, Griffith University, Gold Coast, Australia

Jo McCormack

*Griffith School of Allied Health, Sport and Social Work, Griffith University,
Gold Coast, Australia, and*

Harry Kanasa

*Griffith Institute of Educational Research, Griffith University,
Gold Coast, Australia*

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Abstract

Purpose – This study aims to develop and apply a generative artificial intelligence (genAI)-assisted approach for mapping the alignment of university curricula with the United Nations Sustainable Development Goals (SDGs). It addresses the challenge of systematically quantifying curricular contributions to sustainability education.

Design/methodology/approach – Using Achtenhagen's (2012) curriculum-instruction-assessment triad to structure analysis across learning outcomes, teaching activities and assessment, and Boud and Soler's (2016) sustainable assessment to guide evaluation of assessment relevance, 241 undergraduate course profiles from 13 programs at an Australian university were analysed. A genAI model assigned SDG relevance scores (0–1 scale) based on course learning outcomes, assessment tasks and summaries, which were subsequently reviewed and calibrated by a panel of disciplinary academic experts ($n = 8$).



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Findings – Results reveal clear disciplinary patterns: Health and Education programs strongly align with SDGs 3 and 4, while Science programs emphasise SDGs 9 and 11. Business programs show broader but less intense engagement with specific SDGs. Notable gaps were found for SDG 5, 6, 14 and 15. AI-generated scores showed high consistency with expert revisions, demonstrating the potential of genAI for efficient SDG curriculum mapping.

Originality/value – This study introduces a quantitative, genAI-assisted approach to SDG curriculum mapping that is both transferable and scalable. By combining automated analysis with expert oversight, the approach offers a transparent and efficient means of benchmarking and improving sustainability integration within higher education curricula. While demonstrated within a single institutional context, the framework is designed for adaptation across settings, with expert validation mitigating potential biases associated with genAI-driven analysis.

Keywords Generative artificial intelligence, Higher education, Sustainability education, Sustainable development goals, SDG curriculum mapping

Paper type Research paper

1. Introduction

Higher education institutions (HEIs) play a critical role in advancing the United Nations Sustainable Development Goals (SDGs), not only through research and operations but especially through curriculum design and teaching. Integrating the SDGs into university programs has become a global priority, yet many institutions continue to face challenges in meaningfully embedding sustainability across disciplines. Existing approaches to SDG curriculum mapping are often labour intensive, qualitative, or inconsistent across courses, making systematic benchmarking difficult.

Recent developments in genAI create opportunities to address these constraints by enabling scalable, consistent analysis of course documentation. However, questions remain regarding the reliability of genAI-assisted SDG mapping, the interpretability of outputs, and how such tools can be integrated responsibly into curriculum evaluation workflows.

This study addresses these gaps by developing and applying a genAI-assisted approach to mapping SDG alignment across undergraduate programs at an Australian university, combined with expert academic validation. The aim is to assess disciplinary patterns of SDG engagement, identify coverage gaps and evaluate the potential of genAI to support large-scale curriculum mapping. The novelty lies in combining a standardised genAI first-pass weighting process with structured academic validation, yielding a transparent and scalable approach that remains context-sensitive and auditable.

2. Background

2.1 Sustainable Development Goals and the role of higher education institutions

The world is facing mounting sustainability challenges: climate change, biodiversity loss, widening inequality and accelerating resource depletion. Launched by the United Nations in 2015, the SDGs integrate social, economic, environmental and governance dimensions, reflecting the interconnected nature of sustainability and providing a shared framework for coordinated action across sectors (UN, 2015). SDG 4 (*Quality Education*) is widely regarded as a meta-goal because education equips learners with knowledge, competencies and skills needed to address global challenges (Pham Xuan and Håkansson Lindqvist, 2025) and contribute to broader sustainability outcomes.

HEIs therefore play a pivotal role: by shaping future professionals, researchers and citizens, they contribute directly and indirectly to the full breadth of the SDG agenda across their mandates in teaching, research, outreach and institutional operation (Australia/Pacific, S, 2017; Bhowmik *et al.*, 2017). Recent analyses suggest that post-2015 SDG engagement in

higher education has increasingly focused on research outputs and institutional strategy rather than systematically examining curriculum-level implementation (Filho *et al.*, 2025). This gap is significant, as curriculum design, teaching practices and assessment structures ultimately determine the knowledge and capabilities that students develop. This reinforces the need to move beyond institutional rhetoric and examine how SDG commitments are operationalised within teaching and assessment structures. Ultimately, if HEIs don't meaningfully engage the SDGs, then the broader global agenda risks being undermined.

2.2 Challenges in curriculum level Sustainable Development Goal integration and assessment

Embedding the SDGs in HEIs has become a growing scholarly theme. HEIs are expected to contribute through teaching and learning (SDG 4), research outputs, institutional operations and community engagement (Serafini *et al.*, 2022). However, for these institutional commitments to translate into meaningful impact, SDG integration must occur at the level that most directly shapes student capabilities: the curriculum. Yet translating this expectation into concrete curricula, programmes or assessment systems remains a challenge as institutions struggle with fragmentation (governance, silos between disciplines) and with measurement. How do we know that a course, program or institution is contributing meaningfully to one or more SDGs? Because graduate knowledge, skills, values and behaviours are formed through course content, assessment design and disciplinary framing, the lack of in-depth inclusion of SDGs in curricula risks leaving sustainability commitments aspirational rather than educationally transformative.

Recent research emphasises that superficial inclusion of SDGs, such as isolated sustainability topics, does not achieve transformative learning. In fashion education, it was argued that authentic integration of SDGs requires multi-level mapping and cooperative inquiry to avoid superficial “greenwashing” and ensure that sustainability principles permeate program design and assessment (Underwood *et al.*, 2025). This implies systemic curriculum redesign, including reducing redundancy, strengthening coverage across courses and embedding higher-order cognitive skills like analysis, evaluation and creation (Gregori-Giralt *et al.*, 2025). Several frameworks attempt to address this. For instance, HEIs have strong potential to advance SDGs 4, 11 and 13, but progress is constrained by fragmented indicators, misaligned stakeholder perceptions and implementation barriers (Basheer *et al.*, 2025). The UN has produced guidance volumes on “HEI assessment for the SDGs” (Volumes 1, 2, 3) to assist institutions in designing or interpreting assessments of SDG contributions (HESI, 2020). Specific methods for assessing SDG alignment include: mapping learning outcomes of programmes to sustainability attributes (Kioupi and Voulvoulis, 2020), bibliometric or text analyses of research outputs linked to SDGs and interdisciplinarity (Cottafava *et al.*, 2022), and self-evaluation tools such as SET4HEI (UNESCO, 2025). Despite these advances, the assessment landscape remains uneven. Many institutions rely on qualitative or perception-based approaches (e.g. surveys, interviews), while robust, quantitative and comparable indicators remain limited. As a result, benchmarking across institutions is scarce, and the link between course-level delivery and demonstrable SDG impact remains unclear. These challenges converge around three persistent tensions: scalability (the effort required to assess large numbers of courses), consistency (variation in interpretation across evaluators) and comparability (limited benchmarking across programs and institutions).

2.3 Existing Sustainable Development Goal mapping approaches and limitations

Recent literature has begun to catch up with practice. For instance, a scoping review of SDG integration in higher education (2015–2021) found that integration was most frequent in

bachelor programmes, particularly within disciplines such as engineering/technology and business/administration. Common methods of integration included courses, workshops, lectures and projects. However, approaches were skewed to high-income countries and a limited range of disciplines (Amorós Molina *et al.*, 2023). This constrains the generalisability of findings and highlights the need for approaches that can be applied consistently across institutional and disciplinary contexts. Another study of Hong Kong's public universities found that SDG policy rhetoric often outpaces actual implementation in curricula and institutional structures (Park and Savelyeva, 2022). While sustainability performance is more easily quantified at the operational level, these approaches tend to focus on infrastructure and environmental impacts, offering limited insight into educational delivery or course-level design (Giusti *et al.*, 2024).

Boarin and Martinez-Molina (2022) highlighted the growing (but still insufficient) embedding of sustainability and SDG-related content into architectural curricula. Bertone *et al.* (2025) analysed course-level teaching and assessment materials within an Australian Bachelor of Architectural Design and proposed a structured quantification system, demonstrating the feasibility of detailed, course-level SDG mapping within a single institutional context. This fully expert-based assessment followed a comprehensive manual review of all course materials, including lecture content, tutorials and assessment tasks, with SDG contributions classified using a structured competency-based framework (Values, Knowledge, Skills, Application), enabling a detailed but resource-intensive evaluation of curriculum content.

Reviews such as that by Gutierrez-Bucheli *et al.* (2022) identified only 16 articles post-2015 that quantitatively examined how engineering education addressed sustainability, exposing a paucity of detailed quantitative research. Many HEI-SDG integration evaluations rely on self-reported data or institutional surveys rather than universally accepted measurement tools; benchmarking remains underdeveloped due to the scarcity of comparative quantitative data across institutions. These limitations reinforce the need for approaches that are quantitative, scalable and comparable across courses and programmes, while remaining sensitive to disciplinary context. At the same time, the prevalence of single-institution case studies, including the present study, shows the importance of interpreting findings as context-specific while contributing towards more generalisable methodological frameworks.

2.4 Generative artificial intelligence in Sustainable Development Goal / curriculum analytics

Artificial intelligence (AI) can support HEI programs in addressing the SDGs (Leal Filho *et al.*, 2024) by identifying and quantifying the deep interconnections between goals (Moallemi *et al.*, 2021; Moallemi *et al.*, 2022). With the emergence of genAI, and particularly large language models (LLM), there is growing interest in applying machine learning methods to SDG-related analysis.

Early computational approaches to SDG classification relied on keyword matching, ontologies and topic modelling (e.g. Sutherland *et al.*, 2020), followed by supervised and deep learning tools such as SDG-Meter (Guisiano *et al.*, 2022) and open-source classifiers like OSDG (Pukelis *et al.*, 2020). More recent work has explored LLM-based classification and reasoning (Cadeddu *et al.*, 2025a; Cadeddu *et al.*, 2025b), demonstrating improved semantic interpretation but also raising concerns regarding consistency and explainability.

In higher education contexts, applications remain limited. For example, Borsatto *et al.* (2024) applied natural language processing to discuss alignment of community outreach projects with the SDGs, but this was not applied to curricula/programmes

specifically. [Yeh et al. \(2021\)](#) proposed machine learning tasks across seven SDGs including education, climate action and health, but its application is not specifically directed to HEIs. While these studies demonstrate the broader applicability of computational approaches to SDG classification, they highlight a lack of methods tailored to curriculum-level evaluation.

More relevant studies have applied genAI techniques to educational content. [Adams et al. \(2023\)](#) deployed ChatGPT, a genAI model, but only as a method to enrich a list of SDG-related keywords which were then used to evaluate the SDG coverage of different Science and Engineering modules. A similar approach, relying on keywords and semantic matching, was used in [Prior et al. \(2025\)](#) for thousands of courses in an Australian university, finding SDG 4 and SDG 17 as the most common ones. However, such approaches remain largely reliant on surface-level text matching and may not fully capture the depth of learning design or assessment alignment.

Recently, curriculum-analytics research has begun testing LLMs as “co-curriculum reviewers”, including producing weighted mappings that align strongly with expert judgement, suggesting that LLMs can support scalable quality assurance and mapping tasks beyond simple keyword matching ([Jayalath et al., 2025](#)). However, systematic evaluations indicate that performance depends strongly on model selection and prompting strategy, and that more structured approaches (e.g. retrieval-augmented methods) can significantly improve reliability ([Xu et al., 2025](#)).

Another study analysed LLMs for their attitudinal alignment with the SDGs, pointing out discrepancies in how LLMs and humans treat SDG values ([Wu et al., 2024](#)). Parallel developments in intelligent construction education emphasise integrating AI and big data into curricula to align with sustainability and industry 4.0 demands ([Liu et al., 2025](#)). These signal that there is potential for AI-driven tools to assist rapid extraction, classification or quantification of SDG contributions for courses and programmes. AI-based weighting, however, needs grounding in domain-expert frameworks and oversight: simply matching keywords does not guarantee meaningful learning, attitude or behavioural change. Recent syntheses of genAI in higher education highlight both opportunities (e.g. content generation, workload reduction) and risks for curriculum, instruction and assessment ([Liang et al., 2025](#)). Recent work highlights the transformative potential of genAI for advancing SDG 4 through personalised learning, adaptive feedback and scalable educational support ([Nedungadi et al., 2024](#)). Yet much of this discussion remains conceptual or focused on pedagogical enhancement rather than on validated, auditable SDG mapping methodologies embedded within curriculum analytics workflows.

In addition, responsible application should align with established AI ethics principles, such as transparency, fairness, accountability, data governance and human oversight, as articulated in international and regional guidelines ([Commission, E, 2022](#); [UNESCO, 2022](#)). Systematic reviews reveal that while LLMs can enhance critical thinking and provide adaptive feedback, their integration must be guided by clear pedagogical objectives and robust governance frameworks to avoid over-reliance and ensure academic integrity ([Peláez-Sánchez et al., 2024](#)).

This reinforces the importance of designing approaches that are both methodologically transparent and subject to expert validation. Accordingly, we implement a human-in-the-loop workflow in which genAI provides consistent first-pass SDG weighting from course profiles, and discipline experts validate and revise those weights prior to analysis, aligned with international ethical guidance for AI in education ([Commission, E, 2022](#)) and trustworthy AI risk management principles ([NIST, 2023](#)).

2.5 Theoretical lens and study positioning

The literature reveals a persistent tension between the demand for scalable, comparable indicators of SDG engagement and the risk of superficial measurement when curriculum mapping relies on coarse textual proxies. Manual and framework-based approaches typically offer stronger interpretability and contextual sensitivity, but they are resource-intensive and difficult to implement consistently at scale or to benchmark across programs. Automated approaches, by contrast, scale more readily but can be brittle to wording and may convey unwarranted precision unless carefully designed, documented and validated. These trade-offs motivate approaches that produce consistent, course-level measures while remaining auditable and anchored in curriculum and assessment evidence; particularly learning outcomes and assessment design, where the depth of engagement is most credibly signalled.

In this work, we proposed a hybrid approach combining automated extraction, expert validation and cross-course comparison. This design responds directly to structural limitations identified in prior research, including fragmentation, lack of benchmarking and the resource intensity of manual coding, while aiming to preserve accuracy, interpretability and consistency.

This study is guided by a curriculum-and-assessment lens that integrates two complementary perspectives (i) the curriculum–instruction–assessment (CIA) triad (Achtenhagen, 2012; Liang *et al.*, 2025) and (ii) sustainable assessment (Boud and Soler, 2016). The CIA triad emphasises that educational practice is shaped by decisions about what is taught (curriculum), how it is taught (instruction) and how learning is evaluated (assessment), and that these components jointly determine program quality and graduate capabilities. This perspective is grounded in the theory of constructive alignment (Biggs, 1996), which emphasises that intended learning outcomes, teaching activities and assessment tasks must be coherently aligned to support meaningful learning. Building on this, sustainable assessment argues that assessment should not only certify current achievement but also develop learners' capacity for informed judgement and learning beyond a single course; therefore, evidence of applied or authentic assessment is a stronger indicator of meaningful learning than superficial topical coverage.

Because genAI introduces benefits and risks, our hybrid design also aligns with established principles for responsible AI use in education, including transparency, accountability and human oversight, which support using AI outputs as decision support rather than replacing expert judgement. This approach positions genAI not only as an operational tool but as a theoretically grounded response to the methodological challenges identified in SDG–curriculum alignment research, reinforcing its relevance from the outset. This theoretically grounded approach positions the study not only as a technical contribution, but as a methodological response to the central challenge identified in SDG–curriculum alignment research: how to achieve scalability and comparability without sacrificing pedagogical meaning and validity.

3. Methods

3.1 Programs description

This section provides a brief overview of the programs included in the analysis (Section 3.1), providing essential contextual information for interpreting the data set. Detailed program descriptions are provided in Supplementary Material A. Griffith University has a long-standing institutional commitment to sustainability, reflected in its governance structures, strategic frameworks and strong performance in global SDG rankings. The analysed programs span diverse disciplines, including architecture, education, engineering, nutrition and dietetics, business and construction management. These programs vary in structure, accreditation requirements and incorporation of work-integrated learning (Table 1), but

Table 1. Key information for selected programs

Programme	Duration	Credit points	Key structure	Accreditation	WIL component
Architectural design	3 years	240 CP	5 streams	AACA pathway	Studio-based, optional courses
Education	4 years	320 CP	Foundation + majors	AITSL, QCT	80 days practicum
Engineering (civil)	4 years	320 CP	Core + specialisations	EA (implicit)	IAP placement
Nutrition and dietetics	4 years	320 CP	Core + electives	ADC	100 day placement
Business	3 years	240 CP	Core + majors	AACSB, EQUIS	Optional
Construction management	4 years	320 CP	Core + electives	AIB	IAP placement

Note(s): Key: AACA – Architects Accreditation Council of Australia; AITSL – Australian Institute for Teaching and School Leadership; QCT – Queensland College of Teachers; EA – Engineers Australia; ADC – Australian Dietetic Council; AACSB – Association to Advance Collegiate Schools of Business; EQUIS – European Foundation for Management Development (EFMD) Quality Improvement System (EQUIS); AIB – Australian Institute of Building; IAP – Industry Affiliates Placement

collectively provide a representative cross-section for assessing SDG alignment at the curriculum level. They were purposively selected to provide coverage across the University's four broad academic groupings, ensuring disciplinary diversity and enabling cross-domain comparison of SDG integration. Selection was also informed by (i) the availability of complete and comparable course profile data, (ii) the presence of recent or ongoing curriculum renewal processes, which allow examination of SDG alignment in contemporary program structures and (iii) availability of experts (e.g. program directors or advisors) to review the raw weights. While not exhaustive of the University's full curricular offering, the selected programmes are broadly representative of its disciplinary breadth and pedagogical approaches. Accordingly, this study is positioned as both a methodological contribution (validating a genAI-assisted SDG curriculum mapping approach) and an applied comparative analysis of SDG integration across degree programs within a single university context.

3.2 Data collection and analysis

Consistent with the CIA triad and sustainable assessment, we operationalised SDG alignment using course profile evidence about intended learning outcomes and assessment design, assigning higher weights where learning and assessment indicated deeper engagement rather than superficial mention. SDG attribution is based on explicit curriculum evidence (learning outcomes and assessment tasks) rather than disciplinary categorisation or assumed thematic relevance. The SDG "contributions" derived through this weighting system reflect the extent of curriculum-level alignment with SDG targets, based on documented learning outcomes, teaching content and assessment tasks. They do not constitute a measure of student learning, behavioural change, or graduate outcomes.

Information for the courses of the analysed programs was extracted from the most recent (i.e. either Trimester 3 2024, or Trimester 1 or 2 in 2025) course profiles, freely accessible from the Griffith University website. The SDG mapping draws on three observable constructs available in course profiles:

- (1) course overview (scope and topical emphasis);
- (2) intended learning outcomes (stated competencies); and
- (3) assessment items (task type and demanded performance).

A total of 241 course profiles were accessed, from 13 different degree pathways (Figure 1). A genAI model (ChatGPT, GPT-5, free web version) was used to systematically review course profiles and align each course with relevant SDGs, assigning relative weights (between 0 and 1) to each SDG based on the extent to which the course learning outcomes, assessments and content addressed those sustainability dimensions, based on a standard, consistent prompt provided together with the copied/pasted course profile information. The same structured prompt was applied across all courses to ensure comparability. Prior to full analysis, a pilot comparison was conducted on a subset of 15 courses to assess model consistency between ChatGPT (GPT-5) and Microsoft Co-pilot. Evaluation criteria included completeness of SDG coverage, alignment with disciplinary expectations and stability of output structure. ChatGPT was selected due to more consistent alignment with expert interpretation across these criteria. Other LLMs were not included at this stage as the study focused on establishing a single-model, reproducible baseline rather than a multi-model benchmarking exercise. Although newer versions such as GPT-5.2 are now available, analyses were completed using GPT-5 to ensure internal consistency.

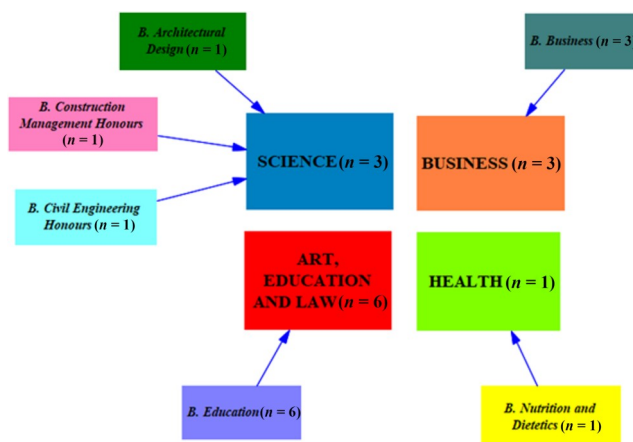


Figure 1. Number (n) of analysed programs/program pathways within Griffith University's four Groups

The provided prompt was as follows:

Apply the SDG identification method below, based on course profile information from undergraduate university courses that I will copy below. Think which SDGs are directly or indirectly addressed. For each SDG, assign a weight between 0 and 1, and assign a higher weight if your perception, from the content provided, is that that SDG is addressed at higher cognitive levels (e.g. not only content in slides, but hands on work).

To further clarify the conceptual meaning of the weights, each SDG value represents the degree and depth of alignment between the course and that SDG, where higher weights reflect not only the presence of relevant content but also higher-order learning and assessment tasks indicating deeper engagement. “Higher cognitive engagement” is operationalised as a proxy based on assessment design and task demands described in the profile (e.g. applied projects, design tasks, analysis/evaluation activities), rather than being directly measured. This aligns with the CIA triad and sustainable assessment logic used to interpret course profile evidence. The full prompt consisted solely of the core instruction statement reported in the manuscript, with no additional hidden or undocumented instructions. The response format remained consistent for approximately 10–15 courses; however, at times, the model altered the structure and weighting scheme (e.g. by assigning weights with two decimal places or selecting only the top three SDGs). When this occurred, the original prompt was reapplied without modification, and no manual adjustment of numeric values was undertaken. This ensured that all final outputs were generated under identical conditions.

Generated weights were stored for validation and further analysis. Initially, the weights assigned to courses within each program were reviewed by at least one academic expert with direct responsibility for the relevant program or course; specifically, all analysed programs were analysed by the respective program director, and in two instances, the program advisor also provided their availability for additional review and feedback. Supplementary Material B shows an example course output with expert-revised weights with changes visible and related comments/justifications. The experts were chosen for their detailed knowledge of course content, learning outcomes and assessment structures, which is necessary to confirm whether the AI-assigned SDG weights accurately reflected each course. This validation step

ensured content accuracy of the final SDG mapping. Final decisions were made by consensus. While not SDG specialists, all such reviewers had institutional familiarity with the SDG framework through curriculum governance processes. Reviewers were provided with official UN SDG descriptions to support consistency of interpretation (Supplementary Material B). The review process was not blind, as contextual knowledge of course design was necessary for valid interpretation of alignment. Our weighting logic is consistent with the concept of sustainable assessment, which emphasises assessment designs that support learning beyond a single course and develop learners' capacity to make informed judgements over time (Boud, 2000; Boud and Soler, 2016).

To support consistent interpretation of SDG weight magnitudes across programs and figures, we introduce the following numerical thresholds:

- negligible contribution: < 0.10 ;
- low contribution: $0.10\text{--}0.24$;
- moderate contribution: $0.25\text{--}0.49$; and
- strong contribution: ≥ 0.50 .

While initially informed by interpretability considerations, the final threshold bands were refined following preliminary inspection of the distribution of raw genAI-generated SDG weights, ensuring that category boundaries broadly reflected observed clustering patterns rather than purely arbitrary cut-offs. These bands are therefore intended as heuristic interpretive ranges rather than statistically derived thresholds.

Overall, to ensure transparency and accuracy, we applied the following standardised procedure:

- Fixed inputs: Only course overview, learning outcomes and assessment items were used for each course.
- Fixed prompt: The same prompt was applied to all courses.
- Format control: If the model output deviated from the required structure, the original prompt was reissued to regenerate the output in the standard format (no manual adjustment of numeric weights).
- Expert validation: Program experts reviewed AI-generated weights and revised only where the mapping did not reflect actual course content/assessment design.
- Final dataset: Only expert-revised weights were used for reporting program and Group-level results.

The revised weights were stored, and overall analysis was performed in Microsoft Excel and R environments (R Studio 2024.04.2 Build 764). The resulting expert-revised data set was used for all program and Group-level analyses (Supplementary Material C). Differences between raw and revised weights are reported as an indicator of where AI outputs required correction; small differences indicate stable first-pass performance, while larger differences highlight context-dependent ambiguities requiring expert judgement. We report (i) cumulative SDG weights (sum across courses) to represent total program-level exposure to each SDG and (ii) average SDG weights per course to represent typical intensity of integration. For elective components, we report standard deviation to characterise heterogeneity in elective offerings, which is analytically important given student choice and variability in elective content. Programs were grouped using the university's formal organisational structure (Science, Business, Health, Arts/Education/Law – Figure 1) to support interpretable comparisons aligned with institutional governance and reporting;

Group-level results are interpreted as indicative of the analysed programs rather than exhaustive of all degrees within each Group.

4. Results

4.1 Weights validation

Figure 2 presents a qualitative comparison between the SDG assessment of the Bachelor of Architectural Design conducted by Bertone *et al.* (2025) briefly introduced in Section 2, and the current assessment of the same program. A dual-axis format was used because the previous (“former”) SDG weighting method produced values on a different scale compared to the current genAI-assisted method; a single axis would have compressed one data set and obscured interpretability. The purpose of Figure 2 is therefore to compare patterns across SDGs rather than direct numerical equivalence. The dual-axis representation does not imply linear rescaling between methods; it is used solely to allow visual comparison of relative SDG profiles across approaches.

Given the recent and in-depth nature of the earlier study, this program offered a unique opportunity for comparison and validation. When comparing the raw (i.e. pre-revision) genAI-generated weights with the expert-revised ones, differences were generally marginal (<25%), with the most notable variation observed for SDG 7, substantially underweighted in the raw assessment. This pattern is consistent with the broader results across programs (Figure 3), where discrepancies between raw and revised weights were typically minor. Interestingly, however, the revised weights did not closely align with those reported by Bertone *et al.* (2025). For example, the cumulative weights assigned to SDGs 9, 11 and 13 were slightly reduced following expert review, but not to the substantially lower levels reported in the earlier study. Conversely, SDG 7 was assigned greater importance than in the raw assessment, yet still less than in the previous evaluation. As explained in Section 5, this

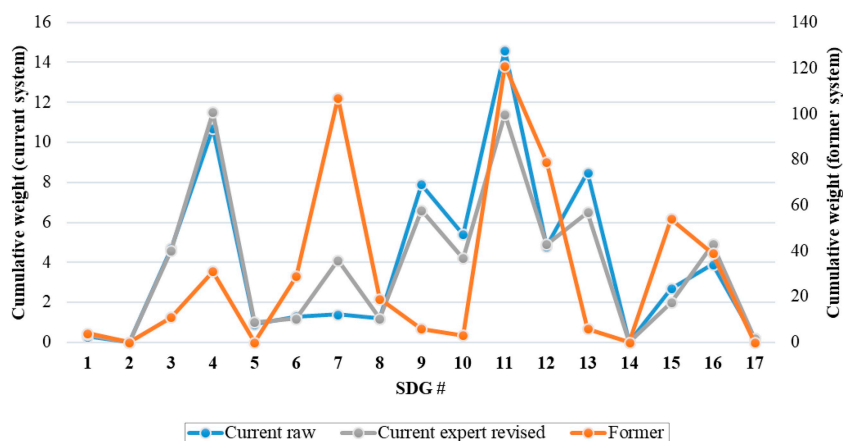


Figure 2. Cumulative (sum for all individual courses for the program) weights assigned to the 17 SDGs. Left vertical axis corresponds to the current weighting system used in this study (raw genAI output and expert-revised values). Right vertical axis corresponds to the former system reported by Bertone *et al.* (2025). Dual axes were used due to substantial scale differences between the two systems, enabling pattern comparison across SDGs. A legend differentiates the former system, current raw AI weights and current expert-revised weights

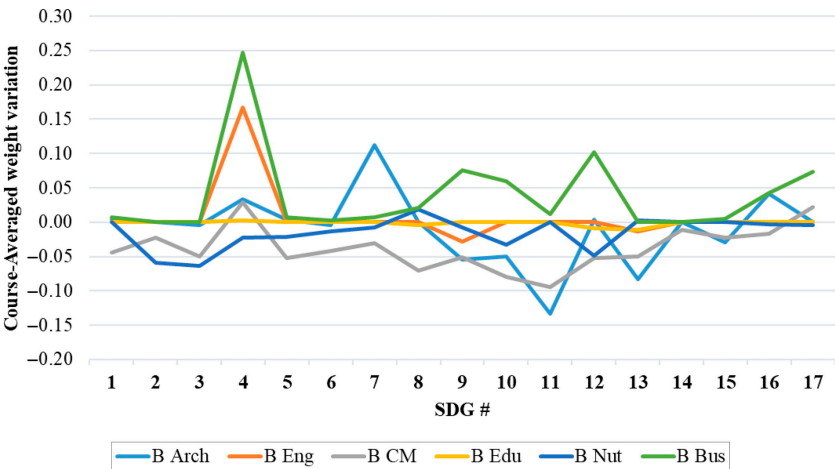


Figure 3. Average per course weight variation between raw and expert-revised assessment. All programs

divergence is partly attributable to curriculum changes, but also to the potential limitations of the earlier approach, relying only on expert assessment.

Figure 3 shows the course-averaged variation in weights, between the raw gen-AI assessment and the expert-revised assessment. This was calculated by dividing the cumulative weights by the number of courses and then subtracting the raw weight from the expert revised weight. No formal statistical significance testing was conducted, as the objective of this comparison is pattern validation rather than hypothesis testing; however, effect magnitudes are reported to support interpretability. Differences (expert–raw) represent the magnitude and direction of expert corrections to the AI first-pass mapping. These differences should be interpreted as a diagnostic of where contextual course knowledge altered SDG alignment, rather than as an accuracy metric in isolation. Overall, the differences are very small, with weights often not revised by more than 0.05 in absolute terms. Nearly negligible variations are reported for the Bachelor of Education. In the Bachelor of Architectural Design, SDG 7 weight was increased by 0.11 on average for each course, while SDG 11 was, on average, decreased by 0.13. For the Bachelor of Civil Engineering, the most substantial variation was an increase in the weight of SDG 4 by an average of 0.17, in line with the corrections applied for the Bachelor of Business (0.25 average increase), where an increase of ~0.05 / 0.1 was also consistently applied to SDGs 9–12 and 16–17. The Bachelor of Nutrition and Dietetics and Bachelor of Construction Management experts overall reduced the weights across most of the SDGs, but by very minor (<0.05 for Bachelor of Nutrition and Dietetics, <0.1 for Bachelor of Construction Management) margins.

4.2 Program-based assessment

In Figure 4, three programs with relatively simple structures are analysed. In the Bachelor of Nutrition and Dietetics, in addition to SDG 4 (0.63), the core 280 credit points (CP) place strong emphasis on SDG 3 (weight = 0.78), and moderate on SDG 10 (0.37), and SDG 17 (0.31). Students may complete the remaining 40 CP required for the degree by selecting from a pool of elective courses, which largely focus on the same SDGs.

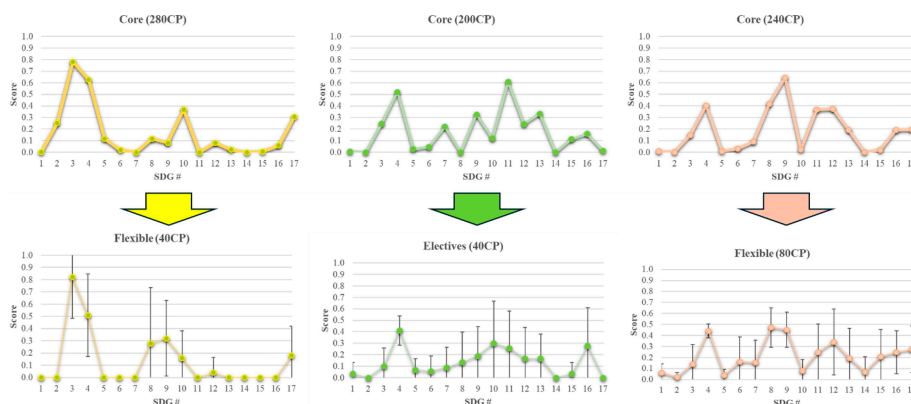


Figure 4. Average SDG weight per course for core (upper panels) and elective/flexible (lower panels) components of the Bachelor of Nutrition and Dietetics (yellow), Bachelor of Architectural Design (green) and Bachelor of Construction Management (pink). SDG weight magnitudes are interpreted using the following thresholds: negligible (<0.10), low (0.10 – 0.24), moderate (0.25 – 0.49) and strong (≥ 0.50). Error bars indicate standard deviation for electives to capture variability across course offerings

However, there is considerable variation between courses, particularly in their relative contributions to SDG 8 (0.28, $SD = 0.45$) and SDG 9 (0.32, $SD = 0.31$). Overall, electives demonstrate a lower average focus on the SDGs (average SDG weight = 0.14) compared to core courses (0.17).

In the Bachelor of Architectural Design, core courses predominantly address SDG 11 (0.61) and SDG 4 (0.52). Unlike the Bachelor of Nutrition and Dietetics, this program also shows non-negligible (low/moderate) contributions to several other SDGs, including SDG 9 (0.33), SDG 7 (0.22), SDG 13 (0.33), SDG 3 (0.25) and SDG 16 (0.16). On average, elective courses do not exhibit a strong sustainability focus, with a lower average SDG weight (0.13) compared to core courses (0.18). Nevertheless, due to the high standard deviation, students may enrol in electives with above-average SDG alignment.

The Bachelor of Construction Management, like the Bachelor of Architectural Design, demonstrates moderate contributions to SDG 11 (0.37) and SDG 4 (0.40), as well as SDG 8 (0.42) and SDG 12 (0.38), but the highest average weight was assigned to SDG 9 (0.64). It also includes non-negligible (low) contributions to SDG 13 (0.19), SDG 16 (0.19) and SDG 17 (0.20). This program offers a substantial number of elective options, with average SDG contributions relatively well distributed across most of the 17 SDGs, generally within the low-to-moderate range (0.2–0.5). In this case, the average SDG weight of elective courses (0.21) exceeds that of core courses (0.18), although there is considerable variability among the available electives.

The Bachelor of Civil Engineering (Honours) features a more complex structure, comprising core and flexible modules shared across various Engineering degrees, as well as additional core and flexible modules specific to the Civil Engineering pathway (Figure 5). Aside from SDG 4 (0.94), the primary SDG addressed in the 120 CP of general core courses is SDG 9 (0.62). The Civil Engineering-specific core courses also place strong emphasis on SDG 11 (0.75), resulting in a higher average SDG weight (0.21) compared to the general core courses (0.14).

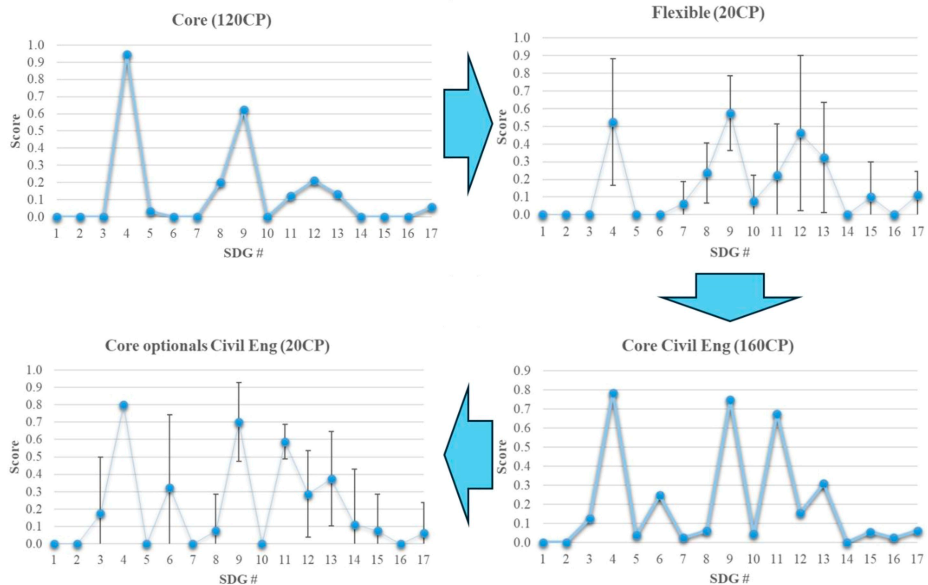


Figure 5. Average SDG weight per course for the Bachelor of Civil Engineering (Honours), showing: (i) general core courses, (ii) general flexible courses, (iii) Civil Engineering-specific core courses and (iv) Civil Engineering-specific optionals. SDG contributions are interpreted using the defined weight thresholds: negligible (<0.10), low (0.10–0.24), moderate (0.25–0.49) and strong (≥ 0.50). These categories support comparison of SDG emphasis across structural components of the program

The general flexible modules provide students with opportunities to enrol in courses that contribute more strongly to SDG 12 (0.46) and SDG 13 (0.33). In addition, Civil Engineering-specific core optionals show notable moderate contributions to SDG 6 (0.33). On average, however, the SDG contributions of these modules are comparable to those of the core courses, with average weights of 0.16 for general flexible modules and 0.20 for Civil Engineering-specific core optionals. Importantly, only 40 CP of electives are included in this 320 CP program, meaning that the SDG contributions from core and flexible modules will dominate the overall sustainability profile of the degree.

The Bachelor of Business (Figure 6) follows a similar structural model, comprising 100 CP of general core courses, 80 CP of electives and 60 CP of major-specific core courses. In addition to SDG 4 (0.61), the general core courses place strong emphasis on SDG 8 (0.60) and moderate on SDG 10 (0.41), with low but non-negligible contributions to SDG 9 (0.19) and SDG 17 (0.24). The electives reflect similar priorities but with lower average SDG weights (0.12) and considerable variability across courses, as indicated by a high standard deviation (0.16).

The Marketing major enables students to select courses with moderate-strong contributions to SDG 12 (0.57), SDG 17 (0.35) and SDG 8 (0.62), although contributions to SDG 4 (0.40) and SDG 10 (0.12) are lower than those observed in the general core courses. The Finance major exhibits a comparable pattern, but with stronger alignment to SDG 9 (0.58) and weaker contributions to SDG 17. The Sustainable Business major, while not demonstrating any strong (i.e. > 0.5) contributions to individual SDGs, offers low-to-

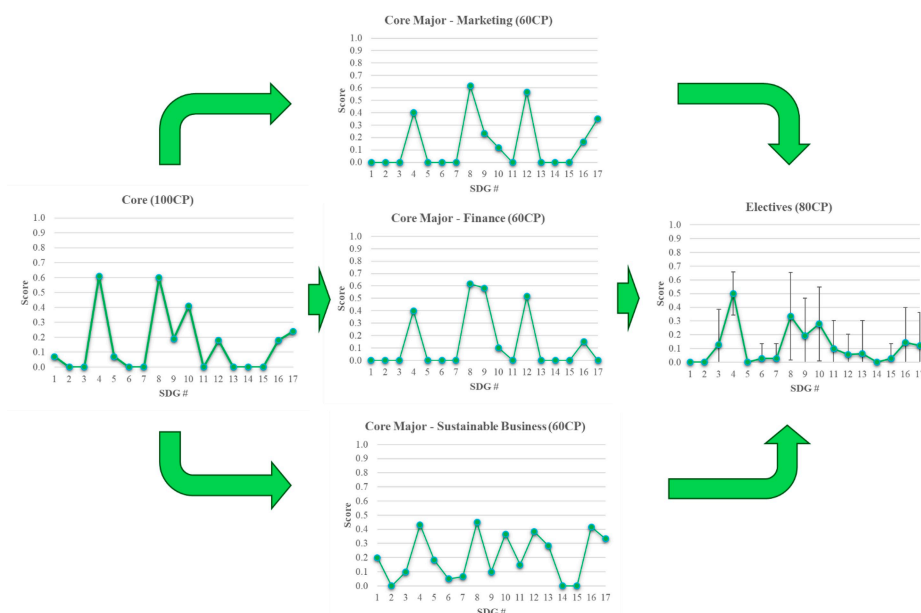


Figure 6. Average SDG weight per course for the Bachelor of Business across general core courses, electives and the three analysed majors (Marketing, Finance, Sustainable Business). Weight magnitudes follow the defined interpretation thresholds: negligible (<0.10), low ($0.10\text{--}0.24$), moderate ($0.25\text{--}0.49$) and strong (≥ 0.50). Standard deviation is reported for electives to reflect variability in sustainability alignment across elective options

moderate contributions across a broader range of goals. Specifically, it addresses all SDGs except SDG 2, SDG 14 and SDG 15, and has a higher average SDG weight (0.21) than both the Marketing and Finance majors (0.14) and the general core courses (0.15). Electives, on average, show the lowest SDG weight (0.12), though with substantial course-specific variability ($SD = 0.16$).

For the six analysed Bachelor of Education majors (Figure 7), a consistent pattern emerges. All general courses (i.e. both core and those common across primary education majors) as well as major-specific courses, demonstrate an extremely strong contribution to SDG 4 (>0.8), alongside moderate-strong contributions to SDG 10 ($0.38\text{--}0.69$). The average SDG weight is 0.13 for core courses and 0.14 for the general courses across all analysed Primary Education majors. SDG 16 shows the highest contribution (0.35) among the core courses, while SDG 10 is most prominent (0.64) in the Primary Education – Special Needs Education double major.

Non-negligible low contributions to SDG 8 (0.13) are observed in the English Education and Early Childhood Education majors. The latter also shows higher contributions to SDG 3 (0.54) and SDG 5 (0.46) and records the highest average SDG weight (0.17) among all majors. SDG 3 is also more prominently addressed in the Special Needs Education (0.39) and Health and Physical Education (0.56) majors.

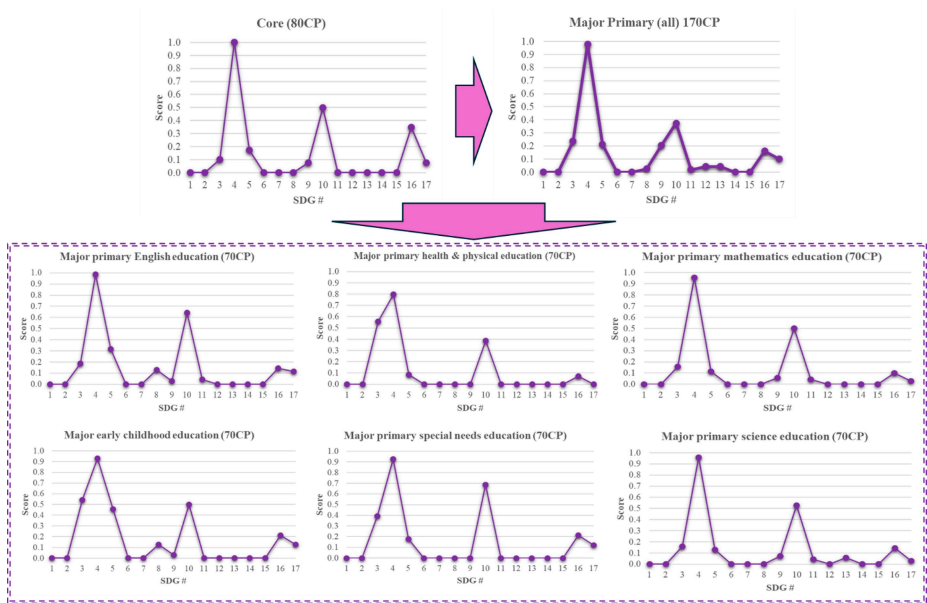


Figure 7. Average SDG weight per course for the Bachelor of Primary Education: core courses, general Primary Education courses and the six analysed majors. Interpretation follows the thresholds for negligible (<0.10), low (0.10–0.24), moderate (0.25–0.49) and strong (≥ 0.50) contributions

4.3 Cross-program Sustainable Development Goal integration consistency

When comparing, in absolute and simplified terms (i.e. not as an absolute measure of SDG attainment or compliance with SDG targets and indicators), the average SDG contributions of different programs, the differences appear to be minimal (Figure 8). For all programs, the average weight assigned to any SDG in courses of the core program components sits between 0.1 and 0.2, with the Bachelor of Education having the lowest weight for this component (0.13) and the Bachelor of Business the highest (0.21).

Programs with larger or more flexible structures, such as the Bachelor of Business and Bachelor of Education, show greater internal variation between components, suggesting that the consistency of SDG integration varies considerably among their individual courses. In the Bachelor of Business, for example, the Core Major – Sustainable Business component has the highest overall mean SDG weight (0.21) but also the largest internal variation ($SD = 0.22$), indicating that some courses are highly aligned with SDGs while others contribute little. Similarly, in the Bachelor of Education, mean SDG weights range from 0.11 to 0.17, with average within-component SDs between 0.06 and 0.12, suggesting that while some majors (e.g. Primary Mathematics Education, $Mean = 0.12$) maintain moderate consistency, others (e.g. Primary Major overall, $Mean = 0.14$, $SD = 0.12$) show substantial course-level diversity.

In contrast, programs with more prescriptive and technically focused curricula, such as Architecture and Civil Engineering, exhibit lower within-component variability. The Bachelor of Architecture shows a narrow range in mean SDG weights (0.13–0.18) with moderate course-level variation ($SD = 0.15$ –0.17), suggesting a relatively uniform, though limited, embedding of SDG-related content across its courses. The Bachelor of Civil

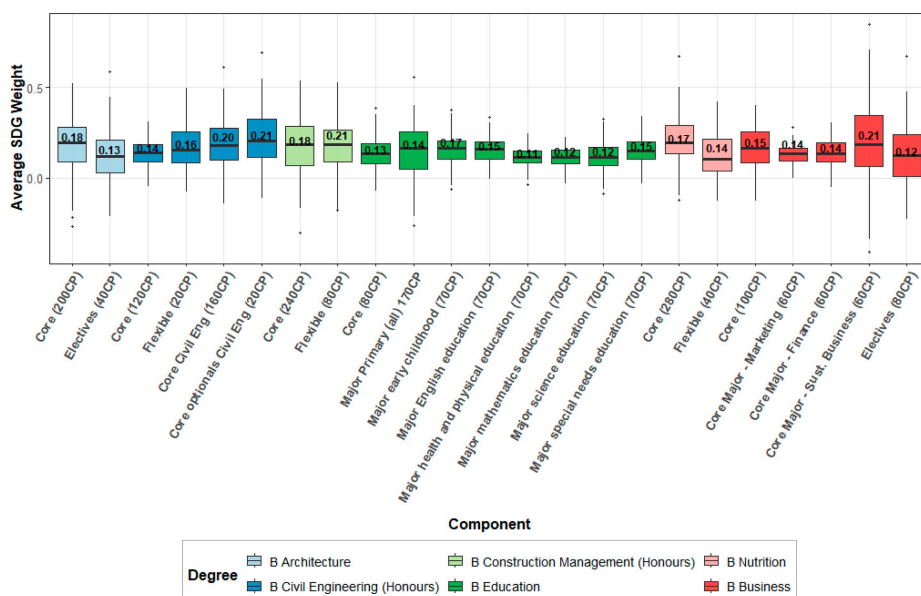


Figure 8. Box plots for average SDG weights for the different components of the analysed programs. Numbers represent the mean SDG weight, while the spread reflects the variability in SDG weights (averaged across the 17 SDGs) among the different courses of that specific program component

Engineering (Honours) similarly demonstrates stable internal patterns, with component means between 0.14 and 0.21 and average SDs from 0.07 to 0.15, implying a more consistent treatment of SDGs within its tightly structured program.

Overall, programs with flexible structures tend to show higher internal diversity in course-level SDG engagement, while more prescriptive programs display greater consistency but narrower thematic integration, reflecting how curriculum design shapes the evenness of sustainability incorporation rather than its absolute intensity.

Across disciplinary groups (Figure 9), SDG engagement remains uneven, with distinct thematic emphases observed across fields. The Health Group-related program showed the strongest alignment overall, particularly with SDG 3 (0.77) and SDG 4 (0.59), consistent with its intrinsic connection to human health and education outcomes. Its relatively high weights for SDG 10 (0.31) and SDG 17 (0.27) further suggest a social and collaborative framing of sustainability within Health curricula for the analysed programs.

The Sciences Group programs analysed display a more distributed but environmentally focused pattern. High weights for SDG 4 (0.57) and SDG 9 (0.52) reflect an alignment with education and technological themes, while moderate emphasis on SDG 11 (0.43) and SDG 12 (0.27) indicates attention to sustainability through applied environmental science. However, the Group's limited engagement with social or equality-oriented SDGs (e.g. SDG 5, 0.03; SDG 10, 0.08) suggests a narrower scope than ideal, while extremely low contributions to SDG 6, 14 and 15 may be partially unexpected for these degrees.

The Arts, Education and Law (AEL) Group programs assessed demonstrate a pronounced focus on SDG 4 (0.95), by far the highest single alignment across all Groups, and moderate association with SDG 10 (0.50). Beyond these, most SDG weights remain below 0.1,

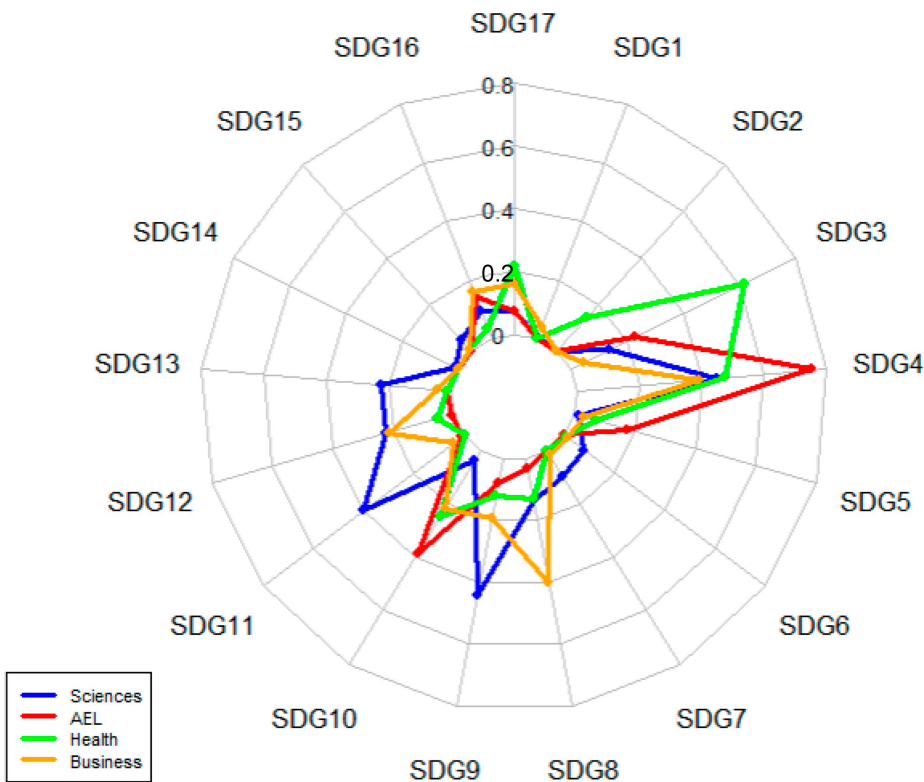


Figure 9. Course-averaged, expert-revised SDG weights, average across programs from the same Group. Sample sizes (number of courses analysed per Group) are: Health ($n = 37$), Sciences ($n = 96$), AEL ($n = 66$), Business ($n = 42$)

indicating limited integration of broader sustainability dimensions such as environment or industry.

The Business Group programs analysed show a more balanced but shallow engagement, with moderate attention to SDG 8 (0.50), SDG 4 (0.49) and SDG 10 (0.27). The relatively even spread of low-to-mid weights across SDGs 8, 9, 12 and 17 hints at cross-cutting exposure rather than deep integration, consistent with the sector’s multi-theme but outcome-oriented teaching approach.

The disciplinary patterns shown in Figure 9 reflect not only the observed SDG weight distributions but also the underlying educational logics of each field. In the Health Group, the strong emphasis on SDG 3 and SDG 10 aligns with the sector’s core pedagogical mission, i.e. promoting human wellbeing, health equity and population-level outcomes, which naturally positions these SDGs at the centre of curriculum design. The Sciences Group shows higher alignment with SDGs 9, 11 and 12, consistent with the applied, problem-solving orientation of science and engineering programs, where sustainability is commonly framed through technological innovation, environmental systems and infrastructure. For the AEL Group, the dominance of SDG 4 reflects the central educational focus on developing teachers capable of supporting inclusive, high-quality learning; these programs are

inherently structured around the pedagogical and social justice dimensions of sustainability rather than environmental or industrial ones. Business programs display a broader but shallower SDG distribution, mirroring the breadth of contemporary business education, which typically integrates sustainability through themes such as organisational behaviour, ethical leadership, responsible production and global partnerships rather than a single disciplinary anchor point.

In summary, for the limited programs analysed, Health and AEL demonstrate strong, theme-specific alignments (health and education respectively), while Science and Business show broader but less intense patterns. The absence of significant engagement with social justice and gender-focused SDGs (e.g. SDG 5) outside the Health Group may indicate disciplinary silos in how sustainability is framed across higher education curricula; similarly, the lack of any significant contribution towards key environmental SDGs such as 14 and 15, and limited contemplation (aside for Science) of the climate-focused SDG 13 may require further investigation and curricular improvements. These patterns should be interpreted within the scope of the specific programs analysed rather than as definitive representations of all degrees within each Group at Griffith University, but they nevertheless illustrate how SDG engagement is shaped by the epistemic traditions, professional competencies, and curriculum frameworks of each discipline.

5. Discussion

This study highlights several important insights and implications for advancing and automating SDG assessment within higher education curricula. Interpreted through the CIA triad ([Achtenhagen, 2012](#)) and constructive alignment principles ([Biggs, 1996](#)), these patterns reflect not only the presence of SDG-related content, but the extent to which sustainability is embedded across intended learning outcomes, teaching activities and assessment design. From a sustainable assessment perspective ([Boud and Soler, 2016](#)), the observed variation further indicates differences in the degree to which curricula support the development of longer-term evaluative judgement and applied sustainability competencies rather than isolated topical exposure.

5.1 *Disciplinary signatures and patterns of Sustainable Development Goal integration*

In the Bachelor of Nutrition and Dietetics, the strong alignment with SDG 3 and moderate emphasis on SDG 4 and SDG 10 reflects the health sector's natural connection to human wellbeing and equity. Comparable findings have emerged in medical and health science education, where environmental and public health concepts are used to operationalise SDG 3 and related goals ([Field et al., 2023](#)). SDG 3 was also a predominant SDG addressed at a university level across thousands of courses at TU Dublin ([Lemarchand et al., 2022](#)) as well as across different universities in [Adams et al. \(2023\)](#). Viewed through constructive alignment and the CIA triad, the strong presence of SDG 3 indicates not only thematic relevance but also consistent reinforcement through learning outcomes and assessment design that prioritise applied, practice-oriented competencies in health contexts.

Both the Bachelor of Architectural Design and the Bachelor of Construction Management show dominant alignment with SDG 11 and SDG 9, similar to the Bachelor of Civil Engineering (Honours), which also adds to the SDG 11 through their Civil Engineering specific courses. This is consistent with global architectural and engineering programs, where sustainable design, urban resilience and construction innovation constitute the primary sustainability lenses ([Sánchez-Carracedo et al., 2021](#); [Adams et al., 2023](#)). [Hendawy et al. \(2024\)](#) stated that despite growing interest, SDG integration in architecture curricula is often partial, with SDG 11 most frequently addressed, and others overlooked.

Chang and Lien (2020) also highlighted SDG 9 as predominant SDG for Engineering and Science programs, though they presented a larger SDG 8 contribution, but lower SDG 11 contribution, compared to our study. The limited presence of social SDGs, such as SDG 5 or SDG 10, indicates a narrow technical framing of sustainability, a tendency also identified in the assessment of Chang and Lien (2020). Engineering programs worldwide often approach sustainability as a competency in problem-solving and infrastructure innovation, emphasising design tools and measurable impacts rather than socio-ethical reflection, as confirmed by assessments of similar programs highlighting SDG 7, 8, 9, 11, 12 as dominant (Chang and Lien, 2020; Magraner *et al.*, 2025; Rajabifard *et al.*, 2021; Boarin and Martinez-Molina, 2022) and little attention to e.g. SDG 2, 5, 10 (Chang and Lien, 2020; Sánchez-Carracedo *et al.*, 2021). While such focus aligns with the UN's emphasis on sustainable industrialisation, it risks underrepresenting the human and environmental dimensions central to the SDG framework. Overall, these results suggest that SDG selectivity is driven by a combination of disciplinary problem-framing (technical solutionism vs socio-ethical reflection) and accreditation-linked learning outcomes, which tends to privilege a subset of "proximal" SDGs while structurally sidelining others. From a CIA and sustainable assessment perspective, alignment with SDG 11 and SDG 9 reflects curricula where sustainability is primarily operationalised through design-based and technical assessment tasks rather than explicit socio-ethical framing.

The Bachelor of Business program demonstrates integration with a broader range of SDGs but less intensive engagement with specific ones, with moderate alignments to SDG 8, SDG 10 and SDG 17. In CIA terms, the broader but weaker SDG distribution suggests partial embedding of sustainability concepts across learning activities, but less consistent reinforcement through assessment structures that require sustained evaluative engagement with SDG targets. Limited availability of prior quantitative SDG curriculum mapping studies in Business education reflects a broader gap in the literature on responsible management education, where sustainability integration has often been discussed conceptually rather than operationalised at course-level granularity (Stubbs and Cocklin, 2008; Laasch and Conaway, 2015). The present findings therefore provide an initial empirical benchmark for comparing SDG integration patterns in business curricula against more established domains such as health and built environment education.

The Bachelor of Education programs exhibit deep and coherent integration of SDG 4 and SDG 10. From a sustainable assessment lens, the strong focus on SDG 4 indicates deep alignment between intended learning outcomes and assessment design, but also suggests limited curriculum exposure to cross-cutting sustainability competencies beyond the education sector. Sustainability competence frameworks emphasise that effective Education for Sustainable Development requires integration of interdisciplinary systems thinking, suggesting that a strong focus on SDG 4 alone may limit exposure to broader environmental and economic sustainability dimensions (Kioupi and Voulvoulis, 2019; Bianchi *et al.*, 2022), thus more cross-disciplinary pedagogical integration (Pham Xuan and Håkansson Lindqvist, 2025) may be required in this program.

5.2 Understanding systemic Sustainable Development Goal gaps across programs

When averaged across all core curricula, SDG weights cluster in the 0.1–0.2 range, indicating relatively low-intensity but broadly distributed sustainability exposure across disciplines rather than strong disciplinary differentiation., unlike what found in Amorós Molina *et al.* (2023). This could represent evidence of structural compliance rather than transformation, where universities report alignment without deep curricular embedding. Lemarchand *et al.* (2022) concluded that only 5% of 5773 analysed modules were

sustainability focused. From a measurement perspective, it indicates that SDG language may be present across curricula, but often at low intensity, suggesting that institutions may need to distinguish between baseline exposure and deliberate, higher-order integration when benchmarking SDG performance. The absence of substantial engagement in the analysed programs with SDG 5, SDG 6 and SDG 14 reinforces this pattern of selectivity, aligning with other work that show persistent neglect of socially complex and environmentally peripheral goals.

These gaps can be further understood when examining individual programs. For example, SDG 5 was largely absent in the Bachelor of Business (Marketing and Finance majors) and the Bachelor of Civil Engineering. In both cases, the curriculum is structured around technical, analytical or industry-oriented competencies, and gender-related content is not typically embedded in core disciplinary learning outcomes or assessment structures. Although these programs may indirectly address inclusivity or ethics, explicit SDG 5 linkages are uncommon. Similarly, SDG 6, 14 and 15 were not represented in programs whose curricula do not engage with water systems, marine environments or biodiversity. For instance, the Bachelor of Architectural Design and the Bachelor of Nutrition and Dietetics contain little content related to ecosystem management or hydrological systems, reflecting their professional scope and accreditation demands rather than a deliberate exclusion of these SDGs. These examples illustrate that the observed SDG gaps are not simply omissions but arise from the disciplinary boundaries, educational objectives and accreditation priorities that shape each program.

When comparing these gaps with related recent research, a similarly poor alignment with SDG 14 was found in [Lemarchand et al. \(2022\)](#) and in [Sánchez-Carracedo et al. \(2021\)](#), with the latter though highlighting a potential methodological issue, given that some of the analysed engineering programs would be expected to address it; in fact, in other research in similar engineering-related schools, SDG 14 was found to be one of the dominant ones ([Rajabifard et al., 2021](#)) and a recent review highlighted that biodiversity integration, related to SDGs 14 and 15, has gained structured attention in HEI policies and curricula ([Pinto et al., 2025](#)). [Adams et al. \(2023\)](#) noted poor coverage of SDG 5 and SDG 6 in their assessment of several curricula. A notable contrast emerges when these curricular patterns are set against Griffith University's strong institutional performance in the 2025 Times Higher Education Impact Rankings, where the University placed first in Australia and among the top globally for both SDG 6 and SDG 14. However, these rankings are constructed from a broader set of institutional indicators, including operational sustainability, research outputs and governance structures, rather than curriculum-level evidence. By contrast, the present analysis is restricted to teaching and assessment artefacts within selected programs. This creates an inherent measurement divergence between institutional-level sustainability performance and curriculum-level SDG integration, which limits direct comparability between the two. While our analysis does not cover all programs, particularly specialised environmental degrees, nor the broader operational and research metrics used in the rankings, the discrepancy may suggest a misalignment between institutional-level performance and curricular integration. Rather than undermining the rankings, this tension points to a strategic opportunity: strengthening curricular embedding of high-performing SDGs would allow the University to align its teaching more coherently with areas in which it already demonstrates global leadership.

5.3 Methodological evaluation and validation of the hybrid approach

While recent studies such as [Ferk Savec and Jedrinović \(2025\)](#) and [Jogezai et al. \(2025\)](#) discuss the strategic and conceptual alignment of AI with the SDGs, empirical evidence on

scalable, course-level SDG quantification workflows remains limited. [Raman et al. \(2024\)](#) focused primarily on adoption behaviour rather than operational curriculum analytics, and [Khan et al. \(2026\)](#) examined SDG alignment through organisational and psychological constructs rather than automated curricular mapping. In contrast, the present study operationalises a hybrid genAI–expert workflow to quantitatively map SDG integration at course granularity, thereby extending existing literature from strategic discourse and adoption analysis to validated, institution-ready curriculum analytics. In validating the applied, largely AI-driven, approach, [Figures 2 and 3](#) demonstrate that variations between raw and expert-revised SDG weightings were generally minor; this agreement should not be interpreted as independent validation of the genAI outputs, as expert reviewers adjusted pre-generated weightings rather than conducting blind assessments. As such, the results reflect the magnitude of expert intervention and may be influenced by anchoring bias.

However, notable discrepancies persisted when compared with the fully expert- and content-based assessment reported by [Bertone et al. \(2025\)](#). This divergence suggests that an accurate assessment of SDG relevance requires both a comprehensive understanding of course content and a thorough knowledge of all SDGs and their underlying targets. Although one might assume that a human-led assessment would naturally be more comprehensive, our comparison suggests that genAI can play a valuable supporting role, by systematically flagging SDG linkages that may be less visible, especially in cases where academics have varying levels of familiarity with all 17 SDGs ([Leal Filho et al., 2023](#)). In this sense, genAI complements rather than replaces expert judgement, helping to surface potential connections for experts to confirm, refine, or reject. The minor differences (typically < 0.05) observed between raw and revised SDG weights point to an intriguing interpretation: despite having limited access to detailed course content, genAI appears capable of identifying SDG linkages that may be overlooked in human assessments. However, this consistency should be interpreted as stability rather than accuracy, with expert review remaining necessary to interpret implicit content, resolve ambiguities and contextualise discipline-specific nuances.

The limited spread of average SDG weights across core program components ([Figure 8](#)) reflects broader structural patterns in curriculum design: core courses across disciplines tend to emphasise foundational content rather than targeted sustainability themes, and institutional course profile templates create comparable levels of detail across programs. Consequently, SDG engagement in core components often clusters around similar values. By contrast, the greater variability observed in elective courses is an expected feature of program flexibility, as electives span diverse disciplinary areas and cognitive demands, and some variation may also arise from differences in profile detail that influence AI interpretation. These patterns reflect program design characteristics rather than methodological instability.

Because validation relied on designated program experts rather than multiple independent raters per program, formal inter-rater reliability statistics were not computed; future work could evaluate inter-rater agreement across multiple convenors using standard reliability metrics. While the previous in-depth, expert-led evaluation ([Bertone et al., 2025](#)) was initially considered a reference point for validation, the comparison highlights that it should not be treated as a definitive “gold standard”. The two studies differ substantially in methodology, including the depth of content analysis, availability of course materials and the structure of the evaluation process. As a result, divergence between the findings is expected. Importantly, the comparison suggests that expert-only assessments may both omit less explicit SDG linkages and introduce subjective interpretation biases, while genAI-assisted mapping may over-identify connections based on textual cues. The combined approach adopted in this study therefore represents a synthesis of these perspectives, leveraging the

systematic coverage of genAI with the contextual judgement of domain experts. Future work could explore more detailed prompting strategies to capture SDG targets explicitly, improving the precision of sustainability quantification. However, this is currently constrained by the limited detail available in course profiles at Griffith University, which restricts the ability of even advanced genAI models to reliably map content against all 169 SDG targets. In addition, such granularity would substantially increase the burden and complexity of expert validation.

5.4 Practical implications for curriculum design and institutional strategy

This study has several practical implications for higher education institutions. Firstly, the findings demonstrate that genAI can consistently identify SDG linkages from course profile evidence, providing a standardised, low-burden first-pass analysis that would otherwise require substantial manual effort. Within the proposed hybrid workflow, genAI functions as a decision support tool that accelerates systematic extraction and highlights areas requiring expert interpretation, rather than replacing academic judgement. This creates a practical pathway for integration into existing processes, such as annual course profile updates, where SDG weightings could be automatically generated and validated by convenors, consistent with broader calls for data-driven curriculum analytics in higher education (Buckingham Shum and McKay, 2018; Viberg *et al.*, 2018). Implementation will depend on appropriate governance, including academic oversight, consistency in course documentation and safeguards to prevent over-reliance on automated outputs. Accordingly, while the approach is scalable, its adoption should be considered conditional on institutional readiness and supported by clear guidelines for responsible use.

Secondly, the approach provides a practical tool for curriculum improvement. The results revealed uneven SDG coverage across the program, including comparatively limited representation of SDGs 5, 6, 14 and 15, indicating that even sustainability-oriented curricula may contain structural gaps. Such patterns provide an evidence base for targeted interventions, including the redesign of assessment tasks, introduction of new electives, or integration of cross-disciplinary modules, aligning with established literature on embedding sustainability across curricula rather than through isolated courses (Barth *et al.*, 2007; Lozano *et al.*, 2019).

Thirdly, the method offers a more transparent and comparable basis for institutional or sector-wide SDG reporting. Because the weighting system is derived from explicit curriculum evidence rather than high-level declarations, it enables more auditable alignment with external frameworks such as the Impact Rankings, while reducing reliance on manual reporting processes. Finally, at a broader level, strengthening the consistency and scope of SDG integration within curricula contributes to improving graduate preparedness for addressing sustainability challenges, reinforcing the role of universities as contributors to the 2030 Agenda.

While prior studies are skewed towards high-income contexts, this study similarly draws on a single Australian institution; therefore, findings should be interpreted as context-specific, while contributing a methodological approach intended for broader application. The observed SDG patterns inevitably reflect local curriculum structures, accreditation requirements and the level of detail provided in that institution's course profile templates. Although HEIs in the Griffith University's country generally use comparable course profile formats due to shared regulatory expectations under the Higher Education Standards Framework (TESQA, 2021), SDG distributions should be interpreted primarily as institution specific and most useful for internal benchmarking. The hybrid workflow itself remains transferable: only minor adjustments to local course profile conventions and prompting

structure would be required, but future studies involving multiple universities would allow stronger cross institution comparability and a deeper examination of how institutional context shapes SDG alignment. As genAI model versions evolve, exact reproducibility of raw outputs cannot be guaranteed; however, the expert validation stage ensures stability and interpretability of the final SDG weights across institutional contexts.

It is important to note that the SDG “contributions” reported in this study refer to curriculum-level alignment rather than demonstrated educational impact. As such, the results identify opportunities for strengthening curricular emphasis on particular SDGs, but they cannot be interpreted as evidence of downstream behavioural or societal impact. Future work could integrate student-level data (such as assessment artefacts, reflective tasks or longitudinal graduate outcomes) to examine how curricular alignment translates into learning and behavioural change (Muroi and Bertone, 2019), consistent with emerging work on sustainability competencies in higher education (e.g. Wiek *et al.*, 2011).

6. Conclusions

This study contributes to emerging efforts to systematically assess higher education alignment with the Sustainable Development Goals by demonstrating a genAI-assisted, expert-validated approach to curriculum analysis. The findings highlight the value of a hybrid workflow that combines the scalability and consistency of automated analysis with the contextual judgement of academic experts. Differences observed across disciplinary groupings further suggest that SDG integration is shaped by underlying curriculum structures rather than being uniformly embedded.

The results indicate that genAI can provide a consistent and efficient first-pass identification of SDG linkages from standardised course documentation, with expert review playing a critical role in validation. However, these findings should be interpreted as indicative rather than definitive. The study is based on a single institution, relies on a single genAI model and does not include formal inter-rater reliability or blind expert validation. In addition, the SDG weightings reflect curriculum-level alignment rather than demonstrated student learning or behavioural outcomes.

Future research should extend this work through multi-institutional comparisons, longitudinal analyses of curriculum change and integration of student-level evidence to better link curriculum alignment with learning outcomes. Further evaluation of different genAI models and validation protocols would also strengthen the robustness and transferability of the approach.

Overall, the study presents a proof-of-concept for integrating genAI into SDG curriculum mapping, offering a structured approach that, with further validation, could support more transparent and evidence-based sustainability integration in higher education.

References

- Achtenhagen, F. (2012), “The curriculum-instruction-assessment triad”, *Empirical Research in Vocational Education and Training*, Vol. 4 No. 1, pp. 5-25.
- Adams, T., Jameel, S.M. and Goggins, J. (2023), “Education for sustainable development: mapping the SDGs to university curricula”, *Sustainability*, Vol. 15 No. 10, p. 8340.
- Amorós Molina, Á., Helldén, D., Alfvén, T., Niemi, M., Leander, K., Nordenstedt, H., Rehn, C., Ndejjo, R., Wanyenze, R. and Biermann, O. (2023), “Integrating the united nations sustainable development goals into higher education globally: a scoping review”, *Global Health Action*, Vol. 16 No. 1, p. 2190649.

- AUSTRALIA/PACIFIC, S (2017), "Getting started with the SDGs in universities: a guide for universities, higher education institutions, and the academic sector. Australia, New Zealand and pacific edition. Sustainable development solutions network – Australia/pacific, Melbourne".
- Barth, M., Godemann, J., Rieckmann, M. and Stoltenberg, U. (2007), "Developing key competencies for sustainable development in higher education", *International Journal of Sustainability in Higher Education*, Vol. 8, pp. 416-430.
- Basheer, N., Ahmed, V., Bahroun, Z. and Anane, C. (2025), "Sustainability assessment in higher education institutions: exploring indicators, stakeholder perceptions, and implementation challenges", *Discover Sustainability*, Vol. 6 No. 1, p. 252.
- Bertone, E., Bischleri, C. and Boddy, J. (2025), "Integration of the sustainable development goals (SDGs) in architecture curriculum – quantifying the extent of SDG contributions", *Environmental Education Research*, Vol. 31 No. 3, pp. 566-586.
- Bhowmik, J., Selim, S. and Huq, S. (2017), "The role of universities in achieving the sustainable development goals", CSD-ULAB and ICCCAD Policy Brief. ULAB, Dhaka, (accessed 5 March 2019).
- Bianchi, G., Pisiotis, U. and Cabrera Giraldez, M. (2022), "GreenComp the European sustainability competence framework", *Eur*, Vol. 30955, pp. 1-40.
- Biggs, J. (1996), "Enhancing teaching through constructive alignment", *Higher Education*, Vol. 32 No. 3, pp. 347-364.
- Boarin, P. and Martinez-Molina, A. (2022), "Integration of environmental sustainability considerations within architectural programmes in higher education: a review of teaching and implementation approaches", *Journal of Cleaner Production*, Vol. 342, p. 130989.
- Borsatto, J.M.L.S., Marcolin, C.B., Abdalla, E.C. and Amaral, F.D. (2024), "Aligning community outreach initiatives with SDGs in a higher education institution with artificial intelligence", *Cleaner and Responsible Consumption*, Vol. 12, p. 100160.
- Boud, D. (2000), "Sustainable assessment: rethinking assessment for the learning society", *Studies in Continuing Education*, Vol. 22 No. 2, pp. 151-167.
- Boud, D. and Soler, R. (2016), "Sustainable assessment revisited", *Assessment and Evaluation in Higher Education*, Vol. 41 No. 3, pp. 400-413.
- Buckingham Shum, S. and McKay, T. (2018), "Architecting for learning analytics: innovating for sustainable impact", *EDUCAUSE Review*, (Online).
- Cadeddu, A., Chessa, A., DE Leo, V., Fenu, G., Osborne, F., Recupero, D.R., Salatino, A. and Secchi, L. (2025b), "Polarity detection of sustainable development goals in news text", arXiv preprint, doi: [2509.19833](https://doi.org/10.21203/rs.3.rs-12509198/v1).
- Cadeddu, A., Chessa, A., DE Leo, V., Fenu, G., Motta, E., Osborne, F., Recupero, D.R., Salatino, A. and Secchi, L. (2025a), "A comparative study of task adaptation techniques of large language models for identifying sustainable development goals", *IEEE Access*, Vol. 13.
- Chang, Y.-C. and Lien, H.-L. (2020), "Mapping course sustainability by embedding the SDGS inventory into the university curriculum: a case study from national university of Kaohsiung in Taiwan", *Sustainability*, Vol. 12 No. 10, p. 4274.
- COMMISSION, E (2022), *Ethical Guidelines on the Use of Artificial Intelligence (AI) and Data in Teaching and Learning for Educators*, ISBN 978-92-76-54190-5, European Union.
- Cottafava, D., Ascione, G.S., Corazza, L. and Dhir, A. (2022), "Sustainable development goals research in higher education institutions: an interdisciplinarity assessment through an entropy-based indicator", *Journal of Business Research*, Vol. 151 No. C, pp. 138-155.
- Ferk Savec, V. and Jedrinović, S. (2025), "The role of AI implementation in higher education in achieving the sustainable development goals: a case study from Slovenia", *Sustainability*, Vol. 17 No. 1, p. 183.
- Field, J., Martin, N., Duane, B., Vital, S., Mulligan, S., Livny, A., Lindberg, P., Lundegren, N., Gummesson, C. and Long, R. (2023), "Embedding environmental sustainability within oral

- health professional curricula—recommendations for teaching and assessment of learning outcomes”, *European Journal of Dental Education*, Vol. 27, pp. 650-661.
- Filho, W.L., Eustachio, J.H.P.P., Ávila, L.V., Dinis, M.A.P., Hernandez-Diaz, P.M., Batista, K., Borsari, B. and Abubakar, I.R. (2025), “Enhancing the contribution of higher education institutions to sustainable development research: a focus on post-2015 SDGs”, *Sustainable Development*, Vol. 33 No. 2, pp. 1745-1757.
- Giusti, G., Farrapo Junior, A.C., Silva, D.V. and Silva, D.A.L. (2024), “Linking the UN sustainable development goals to life cycle impact applied to a university campus”, *International Journal of Sustainability in Higher Education*, Vol. 26 No. 5, pp. 1051-1071.
- Gregori-Giralt, E., Benítez-Robles, C. and Menéndez-Varela, J.-L. (2025), “Implementing the sustainable development goals in the curricula of university degrees: initial steps”, *Sustainability*, Vol. 17 No. 14, p. 6355.
- Guisiano, J.E., Chiky, R. and DE Mello, J. (2022), “SDG-Meter: a deep learning based tool for automatic text classification of the sustainable development goals”, *Asian conference on intelligent information and database systems*, Springer, pp. 259-271.
- Gutierrez-Bucheli, L., Kidman, G. and Reid, A. (2022), “Sustainability in engineering education: a review of learning outcomes”, *Journal of Cleaner Production*, Vol. 330, p. 129734.
- Hendawy, M., Junaid, M. and Amin, A. (2024), “Integrating sustainable development goals into the architecture curriculum: experiences and perspectives”, *City and Environment Interactions*, Vol. 21, p. 100138.
- HESI (2020), *Assessments of Higher Education’s Progress towards the UN Sustainable Development Goals (Volume 1-3)*, In: INITIATIVE, H. E. S. (Ed.), Higher Education Sustainability Initiative.
- Jayalath, V., Barthakur, A., Dawson, S., Tingey, J., Crase, L. and Kovanović, V. (2025), TINGEY, “Scaling curriculum mapping in higher education: evaluating generative AI’s role in curriculum analytics”, in Cristea, A.I., Walker, E., Lu, Y., Santos, O.C. and Isotani, S. (Eds), *Artificial Intelligence in Education, 2025*, Springer Nature Switzerland, Cham, pp. 294-308.
- Jogezai, N.A., Koroleva, D. and Ivanov, I. (2025), “Generative artificial intelligence in higher education: challenges, opportunities and future course of actions to achieve sustainable development goals”, *International Journal of Educational Management*, pp. 1-25.
- Khan, A., Fang, S. and Zeb, I. (2026), “Relationship between university social responsibility and sustainable development goals in higher education: the mediating role of psychological capital”, *International Journal of Sustainability in Higher Education*, pp. 1-16.
- Kioupi, V. and Voulvoulis, N. (2019), “Education for sustainable development: a systemic framework for connecting the SDGs to educational outcomes”, *Sustainability*, Vol. 11 No. 21, p. 6104.
- Kioupi, V. and Voulvoulis, N. (2020), “Sustainable development goals (SDGs): assessing the contribution of higher education programmes”, *Sustainability*, Vol. 12 No. 17, p. 6701.
- Laasch, O. and Conaway, R.N. (2015), *Principles of Responsible Management:: Global Sustainability, Responsibility, Ethics*, Cengage, available at: www.cengage.com/c/principles-of-responsible-management-globalsustainability-responsibility-and-ethics-1e-laasch-conaway/9781285080260/
- Leal Filho, W., Simaens, A., Paço, A., Hernandez-Diaz, P.M., Vasconcelos, C.R.P., Fritzen, B. and Mac-Lean, C. (2023), “Integrating the sustainable development goals into the strategy of higher education institutions”, *International Journal of Sustainable Development and World Ecology*, Vol. 30 No. 5, pp. 564-575.
- Leal Filho, W., Ribeiro, P.C.C., Mazutti, J., Lange Salvia, A., Bonato Marcolin, C., Lima Silva Borsatto, J.M., Sharifi, A., Sierra, J., Luetz, J., Pretorius, R. and Viera Trevisan, L. (2024), “Using artificial intelligence to implement the UN sustainable development goals at higher education institutions”, *International Journal of Sustainable Development and World Ecology*, Vol. 31 No. 6, pp. 726-745.

- Lemarchand, P., Mckeever, M., Macmahon, C. and Owende, P. (2022), "A computational approach to evaluating curricular alignment to the United Nations sustainable development goals", *Frontiers in Sustainability*, Vol. 3, p. 909676.
- Liang, J., Stephens, J.M. and Brown, G.T. (2025), "A systematic review of the early impact of artificial intelligence on higher education curriculum, instruction, and assessment", *Frontiers in Education*, Vol. 10, p. 1522841.
- Liu, W., Zeng, Y., Liu, D., Huang, Y. and Hou, Y. (2025), "Intelligent Construction-Driven transformation of construction management education for sustainable development: from the educator's perspective", *Sustainability*, Vol. 17 No. 20, p. 9079.
- Lozano, R., Barreiro-Gen, M., Lozano, F.J. and Sammalisto, K. (2019), "Teaching sustainability in European higher education institutions: assessing the connections between competences and pedagogical approaches", *Sustainability*, Vol. 11 No. 6, p. 1602.
- Magraner, T., Gil-García, I.C. and Fernández-Guillamón, A. (2025), "Linking SDGs, competencies, and learning outcomes: a tool for curriculum alignment in higher education", *Sustainability*, Vol. 17 No. 19, p. 8910.
- Moallemi, E.A., Bertone, E., Eker, S., Gao, L., Szetey, K., Taylor, N. and Bryan, B.A. (2021), "A review of systems modelling for local sustainability", *Environmental Research Letters*, Vol. 16 No. 11, p. 113004.
- Moallemi, E.A., Hosseini, S.H., Eker, S., Gao, L., Bertone, E., Szetey, K. and Bryan, B.A. (2022), "Eight archetypes of sustainable development goal (SDG) synergies and Trade-Offs", *Earth's Future*, Vol. 10, p. e2022EF002873.
- Muroi, S.K. and Bertone, E. (2019), "From thoughts to actions: the importance of climate change education in enhancing students' self-efficacy", *Australian Journal of Environmental Education*, Vol. 35 No. 2, pp. 123-144.
- Nedungadi, P., Tang, K.-Y. and Raman, R. (2024), "The transformative power of generative artificial intelligence for achieving the sustainable development goal of quality education", *Sustainability*, Vol. 16 No. 22, p. 9779.
- NIST (2023), "Artificial intelligence risk management framework (AI RMF 1.0)", In *National Institute of Standards and Technology*, U.S.D.O.C. (Ed.), National Institute of Standards and Technology, U.S. Department of Commerce.
- Park, J. and Savelyeva, T. (2022), "An interpretive analysis of the 2030 sustainable development goals in Hong Kong public universities", *Asia Pacific Education Review*, Vol. 23 No. 4, pp. 543-558.
- Peláez-Sánchez, I.C., Velarde-Camaqui, D. and Glasserman-Morales, L.D. (2024), "The impact of large language models on higher education: exploring the connection between AI and education 4.0", *Frontiers in Education*, Vol. 9 volume2024.
- Pham Xuan, R. and Håkansson Lindqvist, M. (2025), "Exploring sustainable development goals and curriculum adoption: a scoping review from 2020–2025", *Societies*, Vol. 15 No. 8, p. 212.
- Pinto, M.D.F.D.R., Scavarda, A. and Machado, F.V. (2025), "The integration of SDGs and biodiversity in HEIs curricula and practices: a systematic literature review", *International Journal of Sustainability in Higher Education*, Vol. 26 No. 4, pp. 827-851.
- Prior, D.D., Seshadrinath, S.M., Zhang, M. and McCormack, M. (2025), "Measuring sustainable development goals (SDGs) in higher education through semantic matching", *Studies in Higher Education*, Vol. 50 No. 7, pp. 1556-1569.
- Pukelis, L., Puig, N.B., Skrynik, M. and Stanciasukas, V. (2020), "OSDg—open-source approach to classify text data by UN sustainable development goals (SDGs)", *arXiv Preprint arXiv*, :2005.14569
- Rajabifard, A., Kahalimoghadam, M., Lumantama, E., Herath, N., Hui, F.K.P. and Assarkhaniki, Z. (2021), "Applying SDGs as a systematic approach for incorporating sustainability in higher education", *International Journal of Sustainability in Higher Education*, Vol. 22 No. 6, pp. 1266-1284.
- Raman, R., Mandal, S., DAS, P., Kaur, T., Sanjanasri, J.P. and Nedungadi, P. (2024), "Exploring university students' adoption of ChatGPT using the diffusion of innovation theory and sentiment analysis with gender dimension", *Human Behavior and Emerging Technologies*, Vol. 2024 No. 1, p. 3085910.

- Sánchez-Carracedo, F., Segalas, J., Bueno, G., Busquets, P., Climent, J., Galofré, V.G., Lazzarini, B., Lopez, D., Martín, C. and Miñano, R. (2021), "Tools for embedding and assessing sustainable development goals in engineering education", *Sustainability*, Vol. 13 No. 21, p. 12154.
- Serafini, P.G., DE Moura, J.M., DE Almeida, M.R. and DE Rezende, J.F.D. (2022), "Sustainable development goals in higher education institutions: a systematic literature review", *Journal of Cleaner Production*, Vol. 370, p. 133473.
- Stubbs, W. and Cocklin, C. (2008), "Conceptualizing a "sustainability business model", *Organization and Environment*, Vol. 21 No. 2, pp. 103-127.
- Sutherland, I., Sim, Y., Lee, S.K., Byun, J. and Kiatkawsin, K. (2020), "Topic modeling of online accommodation reviews via latent Dirichlet allocation", *Sustainability*, Vol. 12 No. 5, p. 1821.
- TESQA (2021), "Higher education standards framework (threshold standards) 2021", In: *Department of Education*, CANBERRA, S. A. E., (ed.), Department of Education, Skills and Employment, Canberra, available at: www.legislation.gov.au/F2021L00488/latest/text
- UN (2015), "Transforming our world: the 2030 agenda for sustainable development", *Resolution Adopted by the General Assembly on 25 September 2015*, (A/RES/70/1). United Nations.
- Underwood, J., VAN Amber, R., Brown, S. and Junior, R.M. (2025), "Authenticating the integration of the SDGs into a higher education fashion program", *Environmental Education Research*, Vol. 31 No. 8, pp. 1601-1615.
- UNESCO (2022), *Recommendation on the Ethics of Artificial Intelligence*, United Nations Educational, Scientific and Cultural Organization, Paris, available at: <https://unesdoc.unesco.org/ark:/48223/pf0000381137>
- UNESCO (2025), *SET4HEI Self-Assessment User Guide (v. March 2025)*, In: ROSER-CHINCHILLA, J. and GALÁN-MUROS, V. (Eds), United Nations Educational, Scientific and Cultural Organization, Paris, the UNESCO International Institute for Higher Education in Latin America and the Caribbean (IESALC). Edificio Asovincar, Venezuela, Venezuela, available at: <https://set4hei.org/wpcontent/uploads/2025/03/SET4HEI-elf-assessment-User-Guide-V3-ENG.pdf>
- Viberg, O., Hatakka, M., Bälter, O. and Mavroudi, A. (2018), "The current landscape of learning analytics in higher education", *Computers in Human Behavior*, Vol. 89, pp. 98-110.
- Wiek, A., Withycombe, L. and Redman, C.L. (2011), "Key competencies in sustainability: a reference framework for academic program development", *Sustainability Science*, Vol. 6 No. 2, pp. 203-218, doi: [10.1007/s11625-011-0132-6](https://doi.org/10.1007/s11625-011-0132-6).
- Wu, Q., Xu, Y., Xiao, T., Xiao, Y., L.I., Y., Wang, T., Zhang, Y., Zhong, S., Zhang, Y. and Lu, W. (2024), "Surveying attitudinal alignment between large language models vs. humans towards 17 sustainable development goals", arXiv preprint, doi: [2404.13885](https://doi.org/2404.13885).
- Xu, Z., Li, X., Huan, Y., Minaya, V. and Yu, R. (2025), "From course to skill: evaluating LLM performance in curricular analytics", arXiv preprint, doi: [2505.02324](https://doi.org/2505.02324).
- Yeh, C., Meng, C., Wang, S., Driscoll, A., Rozi, E., Liu, P., Lee, J., Burke, M., Lobell, D.B. and Ermon, S. (2021), "Sustainbench: benchmarks for monitoring the sustainable development goals with machine learning", arXiv preprint, doi: [2111.04724](https://doi.org/2111.04724).

Supplementary material

The supplementary material for this article can be found online.

Corresponding author

Edoardo Bertone can be contacted at: e.bertone@griffith.edu.au