4.4

Developing Transferable Sustainability and Entrepreneurship Competencies through Vertically Integrated Projects at the University of Strathclyde

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This chapter examines the integration of Education for Sustainable Development (ESD) and entrepreneurship competencies within the Vertically Integrated Projects for Sustainable Development (VIP4SD) programme at the University of Strathclyde, in Glasgow, UK. Designed as a scalable model, VIP4SD embeds sustainability, interdisciplinary collaboration, and transferable competencies across undergraduate curricula by aligning research- (or inquiry)-based learning with Sustainable Development Goals (SDGs) challenge areas to effectively operationalise Research-Based Education for Sustainable Development (RBESD). The chapter traces the evolution of VIP4SD, its theoretical underpinnings, and its implementation across faculties. Recognising VIP4SD's alignment with institutional strategy and sector-wide momentum for ESD, the chapter offers practical guidance for its adaptation in different contexts. With a practitioner focus, it details mechanisms for competency development through scaffolded workshops and authentic assessment, enabling students to recognise, reflect on, and articulate their growth throughout their project journeys. This approach enhances students' self-awareness, reflective capacity, and employability. VIP4SD is presented not only as a curricular innovation, but as a strategic vehicle for embedding competency-based, sustainability-driven education across higher education.

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1 What is VIP4SD and how did it evolve?

1.1 The Strathclyde context

With around 30,000 students and 3,500 staff, the University of Strathclyde is a leading technological university in Glasgow, the UK's sixth most populated city. It comprises four faculties: Engineering, Science, Humanities and Social Sciences (HaSS), and the Strathclyde Business School.

The Vertically Integrated Projects for Sustainable Development (VIP4SD) programme began in Engineering and has since expanded across all faculties, though unevenly due to curriculum and resource constraints. Engagement is strongest in Engineering (involving around 45% of students, mainly in two departments) and in HaSS (ca. 55%, largely through the School of Education), with limited participation in Science and the Business School (ca. 10% combined). The university is encouraging of wider VIP4SD participation where possible to enable more interdisciplinary undergraduate research collaboration of the type outlined in section 1.5.

1.2 Origins and emergence of VIP

Vertically Integrated Projects (VIP) is a model invented by Professor Ed Coyle at Georgia Institute of Technology (GTech) to integrate research-based education (RBE) into undergraduate curricula. It was introduced at the University of Strathclyde in 2012.

The VIP model evolved from his previous work on Purdue University's Engineering Projects in Community Service (EPICS) programme (Allebach, 2006; Jamieson et al., 1996), which began in 1995 with the aim of engaging engineering students in long-term, community-focused projects. A vertically integrated dimension to the project structure was developed to enhance project sustainability and continuity. This was achieved by enabling students across different year groups to stay involved with the same project for multiple years (i.e., vertical integration), which had the consequence of creating project teams filled with students from different years of study. To encourage greater staff participation, the project pivoted towards the inclusion of a research dimension alongside community engagement, where staff could align their team's objectives with their research interests while retaining the strong civic ethos of EPICS. This approach fostered the development of research competencies and skills in undergraduate students as well as sustained staff involvement.

This VIP model has since been honed and mainstreamed at GTech, where one in every three of their graduates have benefited from participation in the VIP programme. 50+ universities across the world now operate VIP programmes as part of an international consortium (VIP Consortium, n.d.), including the University of Strathclyde, where around 250-300 students per year participate. Strathclyde has expanded VIP across faculties and sustained a stable, institution-wide programme since its introduction in 2012. It was also the first institution within the consortium to intentionally align its VIP programme with the UN Sustainable Development Goals (SDGs) (United Nations, 2015) and to position the model as a vehicle for explicitly embedding Education for Sustainable Development (ESD), entrepreneurship, and competency development

within the curriculum. This led to its rebranding of the programme in 2017 to Vertically Integrated Projects for Sustainable Development (VIP4SD). This chapter explains how that evolution took place and how the model now operates.

1.3 Theoretical foundations of VIP

From a theoretical standpoint, the VIP model is an active and experiential form of research-based education (Christie & De Graaff, 2016; Jamison et al., 2022), where students have the potential to become co-producers of knowledge through authentic, inquiry-driven research collaboration with staff and peers across different levels (vertical integration) and disciplines (horizontal integration). This aligns with (Griffiths, 2004; Healey & Jenkins, 2009) frameworks by moving beyond research-led or research-oriented teaching to fully immerse students in collaborative, interdisciplinary research projects, where they have the opportunity to develop the types of transferable competencies and skills that are rarely cultivated through traditional, subject-based teaching, where students act as passive recipients of knowledge. Furthermore, by providing staff and students with this vertical project pathway they gain the opportunity to build momentum and working relationships that are conducive to their ongoing competency development and the strengthening of their domain knowledge.

1.4 VIP4SD – embedding research-based ESD

Aligning our VIP programme with the SDGs had the planned effect of not only highlighting to academic and research staff the alignment of their research with the SDGs, but also appealing to the sensibilities of our students, who are keen to apply their disciplinary knowledge and develop research skills and other competencies in projects aimed at delivering genuine societal and/or environmental impact (University of Strathclyde, 2025b).

The UNESCO definition of ESD highlights how the SDGs act as contextual drivers for the development of key competencies through the application of transformative pedagogies (UNESCO, 2017, 2020). It underscores the critical importance of applying and cultivating these competencies and skills to *"equip people with the knowledge, skills, values, and attitudes to create positive and sustainable futures for both current and future generations".*

The three pillars of ESD (SDGs, competencies, and transformative pedagogies) are also integral to the CoDesignS ESD Framework (Toro-Troconis et al., 2024), which is designed to support the integration of ESD in the curriculum (ALDESD, n.d.). When research-based education is used as a pedagogical approach to embed ESD within the curriculum, the SDGs can serve as context or a thematic lens through which students can actively engage with authentic, real-world discipline-specific and interdisciplinary research challenges. This requires students to actively apply and cultivate a range of transferable competencies and skills aligned with those defined by UNICEF (2019), but also sustainability competencies, such as systems thinking, anticipatory reasoning, normative competency, and strategic thinking as defined by UNESCO (2017). These competencies are integral to both future professional and personal development. The

nature of these global challenges also presents fertile ground for interdisciplinary student and staff engagement within our VIP4SD programme through *horizontal integration* across departments and faculties.

1.5 VIP4SD – horizontal (interdisciplinary) integration

While the SDG anchor may not be as central in other institutions across the 50+ member consortium as it is at Strathclyde, our leadership in this area has influenced many partners to map their projects to relevant SDGs. This also led to the promotion of interdisciplinary RBESD, that is, horizontally integrated projects, enabling students from different disciplines to work collaboratively towards a common project objective, led by academic staff. Not all projects at Strathclyde are interdisciplinary, often due to curricula constraints, discussed in Section 3 and 7, but almost all have an engineering focus. Where interdisciplinarity can be justified and supported, the projects and the students have the opportunity to benefit greatly as the open-ended and ill-structured (so-called 'wicked') problems that they focus on. These often require multiple disciplinary perspectives, unlike project-based learning, where the focus is often on the delivery of a well-specified product by a cohort from a shared discipline (Brassler & Dettmers, 2017). Therefore, where an interdisciplinary dimension exists, this enables students to develop specific communication skills that involve articulating and exchanging disciplinary knowledge across disciplinary boundaries, involving communication using shared vocabularies, and recognising and respecting the complementary contributions other disciplines can make toward achieving a unified, successful project outcome.

Example 1. The GridMaster

The GridMaster VIP4SD project consists of a combination of Electrical and Electronic Engineering students and Computer Science students, focusing on the development of a software tool that supports the design and cost estimation of minigrids for deployment in Sub-Saharan Africa. It is supported by a social enterprise and university research group with specific interests in Malawi.

Example 2. Apps4Good

Apps4Good is a VIP4SD project where Electrical and Electronic Engineering, Computer Science, and Business students work together to develop an app that supports a homelessness charity's street-outreach work. The app lets members of the public pin the location of people who appear to be sleeping rough, triggering notifications to volunteers, who then self-select attendance based on proximity and other priorities. Engineering and computing students lead the technical development, while business students design marketing strategies to raise awareness and encourage public engagement with the app.

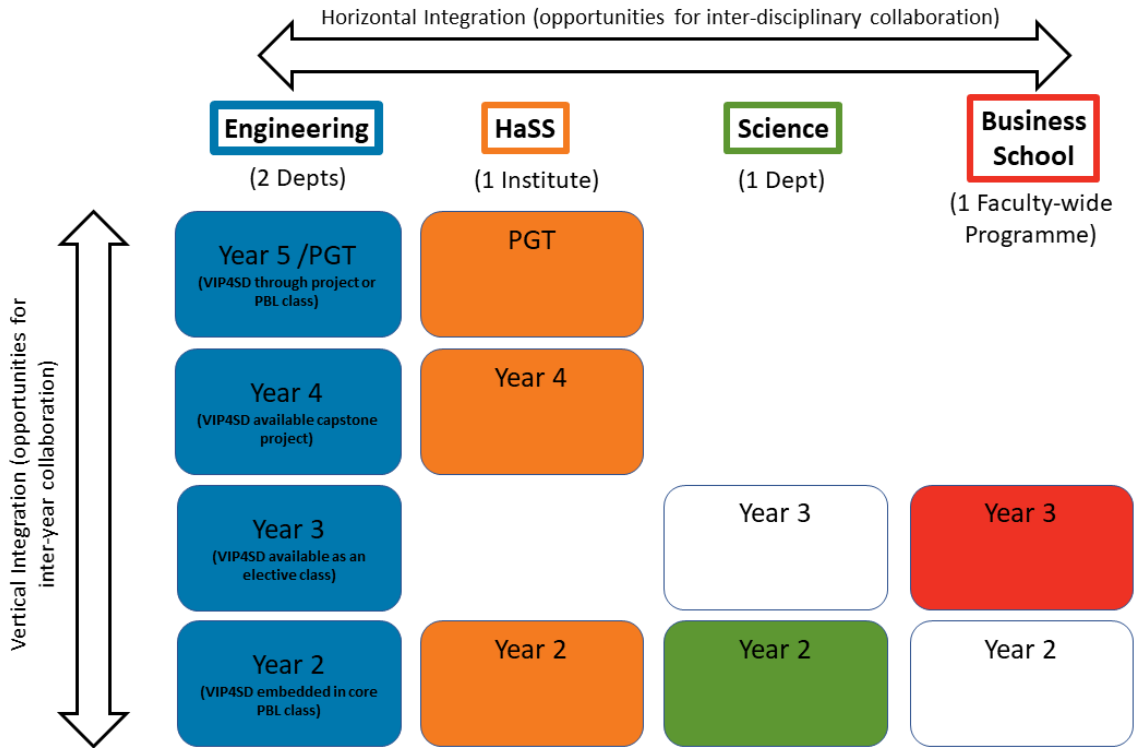

Figure 4.4.1: VIP4SD structure (Own Work by authors)

Fig. 4.4.1 illustrates the current VIP4SD structure across all four faculties. One Engineering department has a fully developed vertically integrated pathway, with the highest retention in Year 3 and options for students to continue through existing capstone and group projects. Other faculties are still developing their pathways. Empty boxes indicate potential curricular space for embedding VIP4SD, while blank areas show years where space is currently limited or absent, though these could be reconsidered in future curriculum reviews.

1.6 VIP4SD – Entrepreneurial mindset development

In addition to transferable, sustainability, and interdisciplinary competencies, the VIP4SD model at Strathclyde also focuses on the development of entrepreneurial mindset competencies: collaboration, communication, resilience, forward thinking, and value creation, following the framing and definitions offered by Mawson and Casulli (2024). They define the entrepreneurial mindset as "*a set of learnable cognitive and emotional competences conducive to developing and enacting behaviours to support value creation activity*", emphasising that these mindsets are not innate but can be developed and directly linked to creating value.

The vertically integrated of VIP4SD and the close, ongoing partnership it fosters between students and research staff provides the conditions in which these competencies are developed effectively. It offers students sufficient time, space, and collaborative environment, often absent from more conventional approaches to

student project work and supervision, because they only typically span a single academic year. This allows students to build momentum and develop genuine levels of domain expertise, become knowledge producers, and develop key competencies and skills that are substantive, including leadership, mentorship, and interdisciplinary working. In practice, collaboration and communication are embedded in daily activity; resilience and forward thinking are exercised in the face of uncertainty; and value creation is central, as success is measured through collective outcomes and impact rather than examinations. In early 2024, new project-led guidance and targeted workshops were introduced to help students recognise and articulate these competencies. VIP4SD now continues as a research-based approach to embedding ESD, while more intentionally and explicitly embedding competency-based education which also encompasses the entrepreneurial mindset.

2 Getting institutional buy-in for VIP4SD

2.1 Alignment with Strathclyde ethos

When VIP was first introduced to Strathclyde, its alignment with the University's ethos as "*the place of useful learning"* was immediately evident. The prospect of creating a programme that enabled students to apply their disciplinary knowledge in a meaningfully impactful, and therefore genuinely *useful* way, provided a compelling rationale for launching a pilot initiative, initially housed within the Faculty of Engineering.

The programme's subsequent alignment with the SDGs and entrepreneurial mindset further reflected Strathclyde's identity as a socially progressive, globally engaged institution, and so embedding these values into our teaching and learning was a logical extension that gained high-level buy-in early on.

2.2 Global advocacy and sector-wide demand and momentum for ESD

Advocacy for ESD across all levels of education had already gained significant momentum through global initiatives such as the UN's Decade of Education for Sustainable Development from 2005 to 2014 and the ESD for 2030 framework introduced in 2021 (UNESCO, 2020). These efforts, coupled with rising demand from students and employers (Dryson, 2015; SOS UK, 2025) have catalysed wider change across the higher education sector, prompting professional engineering institutions (Royal Academy of Engineering, 2024), professional practice bodies (ADVANCE HE et al., 2021), quality assurance agencies (QAA, 2023), and UK-based education-focused charities, such as AdvanceHE, to take more active roles in driving and supporting tangible systemic change to embed ESD in the higher education curriculum. Furthermore, a green competencies and skills gap was highlighted in the National Grid's report *Building the net zero energy workforce* (Dahl et al., 2022); similar challenges exist across Europe as a whole.

2.3 Shifting perceptions and a strategic opportunity for the expansion of ESD and competency-based education

Building momentum and demand has led higher education institutions to move from viewing ESD and entrepreneurship as adjunct, add-on, co-curricular, or optional offerings to something that should be fully integrated, mainstreamed within curricula, and made consistently available to all students through the core curriculum.

This evolution has transformed the dynamics of curriculum change around ESD and entrepreneurship integration, where an internal demand and strategic pull now exist due to the external levers in place. Consequently, faculties at Strathclyde must now actively seek proven, scalable approaches to integrate ESD and entrepreneurship into their programmes, which opens doors for initiatives like VIP4SD to expand.

Many institutions have gone further and enshrined their commitment to embedding ESD and entrepreneurship education within strategic objectives and/or KPIs. At Strathclyde, a KPI was introduced that commits to ensuring *"all education programmes have programme-level learning outcomes related to ESD by 2027, which encompass the integration of the UNESCO Education for Sustainable Development skills and competencies"*. A strategic objective was established to embed entrepreneurial mindset education into the Strathclyde student experience by *"building a range of experiential learning opportunities which equip students with entrepreneurial competencies"* (University of Strathclyde, 2025a).

Despite VIP4SD offering a proven approach to embedding ESD and entrepreneurship in the curriculum, barriers to operationalising and scalability persist, particularly related to siloed curriculum structures and resource allocation. The next section addresses these challenges.

3 Operationalising VIP4SD at Strathclyde

3.1 From pilot to scale-up

VIP4SD was initially developed as a pilot programme, attracting approximately twenty students, all coming from one Engineering department at Strathclyde. Even at such a small scale, the pilot programme offered a useful means of gaining insights into the resource requirements and the curriculum constraints associated with the programme implementation, highlighting the challenges that might be expected when opening and scaling the programme up across other departments and faculties.

The VIP4SD programme now regularly attracts approximately 250+ undergraduate students every year, with most coming from Years 2 and 3 of their degree. Some students will continue to engage with VIP4SD into Year 4 through their capstone project. While this is not groupwork, if students continue their VIP4SD research interests into this project, they can remain an integral part of the VIP4SD team, often assuming a leadership role. While their project may be complementary to the VIP4SD team's objectives, care must be taken by supervisors to ensure the individual student project is not dependent on VIP4SD group project output, to avoid any risk of compromising the student's output and final grade.

3.2 Curriculum integration challenge of finding vertical pathways

The main challenges for VIP4SD are finding space in the curriculum and identifying vertically integrated pathways through each year of the curriculum that allow students to engage with the same project for multiple years. While common challenges to the implementation of VIP4SD exist across institutions, faculties, departments, and degree programmes, a tailored approach to its implementation within any given context is often required. Fundamentally, at Strathclyde, this has involved identifying existing modules with learning outcomes centred on professional skills development, often found in established project-based modules. These modules typically enable students to engage with pre-defined project topics that support the application of disciplinary knowledge, while cultivating key competencies such as collaboration, project management, problem solving, and reflective practice.

Such modules can serve as effective container classes or surrogates for VIP4SD projects; where they span successive years of study, they offer the potential to establish vertically integrated pathways, allowing students to return to the same project across multiple years. In cases where pre-existing container modules do not exist in a study year, where possible, new elective or optional modules can be developed to accommodate VIP4SD.

3.3 Supervision and peer-led mentorship structures

Resourcing is a critical consideration in curriculum development, especially where project-based learning requires sustained supervisory input, which results in higher staff/student ratios than more efficient (though less active) teaching modes. The VIP4SD model helps offset this perceived supervision burden by embedding peer-to-peer mentorship as a core feature of its team-based structure: students with more VIP4SD experience organically assume leadership roles, onboarding and mentoring incoming members.

This onboarding process enables senior students to develop leadership and facilitation skills (Lu et al., 2016), while junior members benefit from scaffolded support from their peers. This rapidly brings them up the learning curve to become productive knowledge and project contributors earlier on in their VIP4SD journey than would otherwise be the case.

VIP4SD supervisors act as research directors, meeting with their teams every couple of weeks, while teams are expected to meet regularly in sub-groups and/or outside supervision meetings. Groups ensure accountability through taking of formal meeting minutes, and prepare agendas for supervision meetings, ensuring students take responsibility for driving these meetings, fostering professional practice. Additional supervisory support may come from PhD students, particularly when the project aligns with their research interests.

4 Translating the VIP4SD experience into recognised competencies and skills

4.1 From implicit to explicit: recognising competency development

The VIP4SD programme has been successfully implemented across multiple departments, despite the challenges highlighted around curriculum space in Section 3. The cumulative effect has been that VIP4SD at Strathclyde has operated at a scale comparable to that of a standard cohort, demonstrating its viability as a mainstream curricular offering.

During this time, students engaged constructively with diverse areas of research and development topics, underpinned by a wide range of SDG challenges, from improving energy access in developing countries to creating STEM resources for primary schools and developing healthcare solutions. However, students' skills and competency development were generally regarded as implicit until recently (circa 2022). The intuitive assumption was that if students could demonstrate a tangible and constructive contribution to project objectives, both individually and as part of a well-functioning team, then this provided sufficient evidence of their ability to apply transferable competencies such as problem solving, collaboration, communication, and resilience. However, the same assumption was not necessarily made for less successful projects, where success was measured in terms of the group's meeting project objectives. This neglected the fact that competency development can often become stronger with increasing project adversity, and so project success may not necessarily be a proxy measurement for competency development. Also, these more familiar competencies are often easier for students and staff to recognise and connect with, as they sit within cognitive and psychological domains rather than more intangible competencies associated with the affective domain.

It was therefore acknowledged that a gap existed between project output, competency development, and competency articulation. While students were developing and applying relevant competencies through authentic project work, there was limited structured support to help them recognise, evidence, and transfer this learning (including from failure) into employability contexts. This challenge mirrors a broader issue in engineering and higher education. Research-based and project-based pedagogies often assume that authentic practice is sufficient for skills development (Kirschner et al., 2006). As Brown et al. (1989) argue: unless students are scaffolded to reflect on, evidence, and communicate their growth, much of this learning remains tacit.

4.2 Scaffolding competency articulation: Enhancing employability and self-awareness

VIP4SD coordinators and supervisors increasingly recognised that students needed more targeted, practical support to fully benefit from the experience, by making competency development more explicit and communicable, without encroaching on the capacity of teams to focus on their research and delivering impact in their particular SDG challenge area. It was established that students required clearer

scaffolding to help them identify and articulate their competency development throughout their VIP4SD project journey. This would strengthen their employability credentials by enabling them to clearly articulate and evidence to prospective employers their project contributions, framed in terms of the competencies they applied and developed throughout, and how these translated to outputs. At a meta-level, enhancing the students' abilities to recognise and articulate these competencies also serves to strengthen their self-awareness competency as well as their communication skills.

The approach taken to the scaffolding of students' competency articulation was to engage students in a series of workshops delivered by the Careers Service and Strathclyde Inspire, the University's dedicated 'Entrepreneurship for All' support unit, that was created to support its 2030 strategic commitment to mainstream entrepreneurship education.

5 Supporting VIP4SD students to recognise and articulate their competency development

5.1 Student journey overview

The competency workshops run across the academic year, with two delivered in semester 1 and two in semester 2. They are strongly encouraged for students enrolled in VIP4SD, though not mandatory. VIP4SD's vertically integrated structure means students participate across different years and programmes, making universal scheduling impractical. Workshops therefore run on Wednesday afternoons, an institutionally protected co-curricular period. Attendees are primarily from Engineering and Science disciplines, though representation varies by project.

The workshops complement project activity by providing structured opportunities for students to reflect on VIP4SD experiences and articulate competency development. Across the four sessions, a Modelled-Scaffolded-Independent approach (Beed et al., 1991) supports the development of STAR (Situation, Task, Action, Result) reflection capability (National Careers Service, 2024). The first workshop models examples; later sessions progressively reduce facilitator support, and the final workshop requires students to articulate competencies independently with peer interaction and optional facilitator feedback.

5.2 Workshop design

Each session follows a consistent format of reflection, group activity, articulation practice, and signposting to optional development opportunities. Students first engage with their own experiences, then identify their competencies through collaborative tasks, and finally practise communicating their learning using the STAR framework.

Each workshop covers one Strathclyde entrepreneurial mindset competency as the main focus; however, UNESCO sustainability competencies were also referenced and signposted to encourage further reflection with respect to these competencies.

Collaboration workshop

Students complete a constrained group task titled 'Collaborate in Confines'. Each group designs a mascot representing Strathclyde's 2030 strategy, under communication restrictions: one student asks questions only, another draws only, and the third answers, using only 'yes', 'no', or 'more'. The activity draws on desirable difficulties (Bjork & Bjork, 2011), where learning is strengthened through manageable obstacles. Collaboration becomes necessary rather than optional, requiring groups to negotiate roles and adapt communication strategies.

During reflection, students connect the activity to project tensions. Interdisciplinary teams describe challenges aligning technical feasibility with partner, user, and collaborator expectations, particularly when disciplines approach problems differently. STAR reflections often reference miscommunication delaying progress and requiring clearer roles and shared decision making. The workshop mirrors these dynamics, allowing students to rehearse collaborative adjustment before returning to their projects.

Value creator and anticipatory thinker workshop

This workshop explores how students define and pursue value. Students begin by mapping value across personal, academic, professional, and competitive contexts. This encourages recognition that value creation extends beyond financial outcomes to include social and personal impact. Students then produce a value creation statement in the format: *'In [situation], I want to create [value] because [reason].'* This structure requires them to define context, type of value, and motivating purpose, moving abstract ideas of value into concrete intentions.

Example 3. GridMaster VIP4SD value creation statement

In developing a minigrid design tool in the GridMaster VIP4SD project, I want to create technical, social, and environmental value by enabling minigrid developers to quickly and accurately design and estimate the cost of minigrids, because this will help them design minigrids that are suitably sized and costed, ultimately ensuring their investments are sound — meaning communities benefit from affordable and reliable, clean sustainable energy systems.

Example 4. Apps4Good VIP4SD value creation statement

In developing an app within the Apps4Good VIP4SD project, I want to create social and operational value by designing an app that enables members of the public to pin the location of rough sleepers, so that volunteers in the charity's street team can respond more efficiently and effectively, because this will improve the timeliness and quality of support and care provided to people experiencing rough sleeping.

Forward thinking is introduced as the mechanism for achieving these aspirations. Students complete a reverse-engineering exercise identifying routines, mindsets, and

commitments supporting success. The activity emphasises transferable practices that support long-term progress and aligns with backcasting (Dreborg, 1996), where a desired outcome is identified and the steps required to reach it are mapped backwards.

During shared STAR reflections, students often ground value creation in ongoing project goals. Teams working on sustainability challenges articulate value beyond technical outputs, including community engagement, behaviour change, or environmental impact. When applying forward thinking, students reference planning cycles, prototype iterations, and deadlines. The reverse-engineering activity prompts reflection on how practices, documentation, and accountability influence long-term project outcomes.

Resilience workshop

The resilience workshop asks students to consider how they respond when things do not go to plan. The session distinguishes persistence from resilience: persistence involves repeating the same action, whereas resilience involves adaptation, learning, and progress. This reframes resilience as an evolving capability rather than simple endurance.

Students reflect on experiences of failure and discuss what they learned from them. Drawing on growth mindset theory (Dweck, 2016), setbacks are reframed as feedback that supports development. Rather than signalling inability, challenges become opportunities to refine strategies and improve understanding.

During STAR reflections, students frequently cite technical setbacks or miscommunication as moments requiring resilience. Discussions often shift from frustration to learning when these experiences are reframed through growth mindset principles. Reflections move from describing a failed attempt to articulating how consultation, redesign, or revised testing improved understanding of the project process.

Effective communication workshop

The final workshop supports students in communicating competency development achieved through VIP4SD. Drawing on Mawson and Casulli (2024), students practise articulating experiences using the STAR framework in interview-style scenarios. Positioned at the end of the workshop series, the session builds on experiences gained through both project work and earlier workshops.

Students initially describe achievements in broad, collective terms. Through iterative rehearsal and peer feedback, explanations become more precise. Students refine their articulation to clarify individual responsibility, decision making and impact within the team.

Effective communication functions as the capstone competency. Competency development carries limited professional value if it cannot be clearly evidenced. This workshop ensures students leave with both substantive experiences and the ability to articulate them confidently in professional contexts and settings.

6 Authentic assessment in VIP4SD programme

Authentic assessment focuses on students' ability to undertake tasks and deal with situations they might experience in their personal or professional life. This section presents forms of authentic assessment that have been incorporated into the VIP4SD programme at Strathclyde to support students in the articulation and development of key competencies.

Assessment includes a group poster presentation at the Strathclyde Sustainability Festival, a short group executive summary, and an individual competency-based interview, in addition to one formative competency reflection in each semester.

6.1 Competency-based interviews

Mock competency-based interviews were introduced as an assessment piece to offer students an active and authentic form of assessment designed not only to evaluate students' ability to evidence and articulate their development (i.e., assessment of learning), but also to act as a learning experience encouraging reflection and growth (assessment as learning), and ongoing competency development (assessment for learning).

Here, assessors and students role-play interviewer and interviewee respectively, providing an opportunity for assessment, but more importantly a practical and developmental benefit that readies students for the real-world demands of presenting themselves and articulating their attributes in job interviews and assessment centres.

The theoretical framing for this approach drew on theories regarding assessment for learning, emphasising that assessment should function as part of the learning process rather than as a detached measurement exercise (William, 2011). By deliberately designing the assessment to be both summative and evaluative, and educational and formative, this method sits at the nexus of assessment of, for, and as learning (Earl & Katz, 2006). It thus addresses the so-called 'competency articulation gap' (Kovalcik, 2019), by supporting students in the effective communication of their competencies for employability.

6.2 Poster presentation and VIPer pitch symposium

Embedding a poster assessment within an event such as the Strathclyde Sustainability Symposium elevates it beyond routine assessment, by providing students with an authentic, real-world environment to showcase their work to a diverse audience. Many programmes use similar approaches through simulated tradeshows or showcase events that blend assessment with public engagement.

This format develops key competencies such as communication, problem framing, and critical thinking, as students must tailor explanations to audiences with different levels of expertise and knowledge. The poster presentation format introduces a constructive pressurised environment where students are required to be more agile in their interactions, which builds confidence, resilience, and professional composure. This also builds networking skills in both academic and industry contexts, and encourages peer engagement, with students acting as critical audiences for one another.

The VIP4SD programme includes an informal assessment called the VIPer Pit, an investor-style pitch competition held during the Sustainability Symposium. While it carries no academic credit, teams are incentivised by the opportunity to voluntarily pitch for project funding provided by the Lady Curran Fund through the University's Alumni and Development Department.

Students gain valuable experiential learning by submitting a short, pre-recorded pitch video and then taking part in a live Q&A with a panel of senior professionals before the symposium audience. This encourages students to engage professionally, developing competencies such as communication, critical thinking, resilience, and strategic thinking, which judges probe during Q&A. The VIPer Pit offers an authentic platform for students to engage in authentic professional practice, develop confidence, and invest further (personally and financially) in their VIP4SD projects.

7 Recommendations for implementation

This section outlines recommendations, drawn from the programme team's experience in developing and running VIP4SD, to support practitioners seeking to establish similar programmes.

Embed research-based education for sustainable development (RBESD). This means integrating RBSED into the core curriculum rather than limiting it to optional or peripheral modules to offer students sustained opportunities to engage with RBESD throughout their degree.

Connect RBE with ESD (RBESD). Frame RBE projects around the SDGs to demonstrate the role of students' disciplines and the importance of interdisciplinary engagement in addressing these sustainability challenges and delivering positive societal and environmental impact.

Use the VIP model to embed RBESD. This offers a vehicle for the delivery of RBESD, where vertical integration provides the space and time for students' competency development normally associated with intensive placement and internship experiences.

Legitimise ESD and competency development through quality assurance. Embed ESD and competencies in QA processes and mechanisms, making this structurally unavoidable (e.g., through dedicated sections in module descriptor forms requiring faculty approval and by encouraging sustainability challenge and competencies in module and programme learning outcomes). This will also support accreditation.

Engage staff and early career researchers. Aligning projects with staff research interests sustains engagement, while early career researchers build research management competencies and skills by leading VIP4SD undergraduate teams, offering opportunities for their own development and access to an untapped research resource.

Engage external partners. Stakeholder engagement raises the stakes for the students and engages them in a deeper level of learning and competency development. This

also strengthens links with industry for co-supervision and opportunities for real-world validation of project outcomes.

Integrate interdisciplinary within the programme (i.e., horizontal integration). Although often constrained by siloed curricula, creating cross-faculty and interdisciplinary collaborations can substantially enhance students' competency development, but requires careful curriculum planning. Partnering with like-minded colleagues in other faculties helps establish effective mechanisms for inter-curricular engagement.

Map vertical pathways. It can be difficult to find a vertically integrated curriculum pathway across different years of the programme. Therefore, collaborating with programme directors and module leaders is key to identifying existing project-based classes across years to carve out vertical pathways. Avoid wasting energy in departments where it may be clear the programme or VIP model is not going to fit.

Provide scaffolded support through structured workshop. Work with Careers and Entrepreneurship teams to help students articulate their competencies without disrupting project work. This support can be reduced as their confidence grows. Because reflective articulation is unfamiliar, some students will need time to recognise its value and may initially resist if the relevance to their VIP4SD project is not immediately clear or linked to employability.

Include the affective domain — resilience, self-awareness, and normative competencies are critical. While professional and transferable skills often emphasize cognitive and practical domains, the affective domain fosters emotional intelligence, ethical reasoning, and personal growth, which are vital to prepare students to navigate complex, real-world challenges with empathy and integrity.

Use authentic assessment to enhance learning and employability. Employing assessment formats such as mock interviews, poster presentations, and investor pitch competitions can provide authentic opportunities for students to both develop and showcase their competencies.

Align with institutional ethos and strategic aims and sectoral transformations. To gain buy-in at all levels, position VIP4SD within the university's strategic identity and ethos. Align it with KPIs and strategic institutional priorities (e.g., employability, sustainability, internationalisation, etc.), and sector-wide levers for change (e.g., accreditation, quality assurance requirements, etc.).

Use peer mentorship to accelerate onboarding and foster leadership. Embed peer mentorship structures to reduce supervisory burden, enhance team cohesion, and provide opportunities for students to demonstrate leadership and mentorship capabilities.

Keep workshop sessions short and engaging. The workshop activities do not need to mirror the projects themselves. The value of the workshop activity lies in identifying competencies, not in producing outputs for assessment. A safe, engaging, low-stakes

environment allows students to be honest and properly reflect on their assumptions and understandings.

Equip project leads. Project leads must be confident in the competency framework to sustain dialogue and build effective questioning in assessment settings. Academic leads should be supported through pre-assessment sessions, strengthening their ability to challenge students' reflections and mirror professional interview contexts.

8 Conclusion

The introduction of competency workshops within VIP4SD represents a transition from implicit to explicit competency development. By retaining the authenticity of research-based, interdisciplinary projects, while providing structured opportunities for reflection and articulation, the programme has enhanced both educational and employability outcomes. Students not only develop collaboration, communication, forward thinking, resilience, and value creation skills — which they would also have developed through participating in the innovative research approach — but they also learn how to evidence these competencies in ways that improve their employability outcomes. The Strathclyde approach demonstrates a transferable model for making competency development tangible and impactful and offers a pathway for institutions seeking to embed competencies associated with education for sustainable development and the entrepreneurial mindset across their curriculum.

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AI statement

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