



Building Capacity for Sustainable Education in Outdoor Campus Spaces:

A Framework for Change

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Abstract. As the effects of the current poly-crisis for ecosystems, food security and human health become increasingly evident, a significant role can be played by higher educational institutes (HEIs) in addressing emerging challenges. While HEI campuses provide rich resources that can be adapted or repurposed to address evolving needs, this is not without obstacles, and HEIs as organisations can be resistant to change. This paper examines the processes involved in re-imagining and re-creating outdoor campus learning spaces for sustainability, and the problems that may arise, with the aim of uncovering possibilities for addressing these. To this end, a case study of a pilot project to create an outdoor learning space for sustainability is provided. This adapted and drew guiding principles from the Connecting Nature Framework (Hölscher et al., 2021), a framework designed to address the governance problems involved in complex systems transition, when implementing nature-based solutions in cities. A collaborative, co-creative and reflexive approach was used to ensure the involvement of relevant stakeholders and allow possibilities for on-going learning.

Keywords: Sustainable Education, Co-creation, Co-production, Reflexive Monitoring.

1 Introduction

While the role that HEIs can have in providing spaces for navigating complex sustainability challenges (Mc Intyre et al., 2024) has been widely acknowledged, it has been argued that the response of the higher education sector has been limited, or indeed itself part of the problem (e.g. Stewart et al., 2022; Sterling, 2021; Orr, 2024; Mc Geown & Barry, 2023; Wals, 2025). For this reason, it has been argued that education systems themselves, as learning organisations, need to transform at a deeper level: this involves learning in the education system so that the “system itself is changed” (Sterling, 2021, 5). Such a transformation would involve a shift within education so that it is underpinned by a more ecological worldview - what Sterling has termed “sustainable educa-

tion". This participative and holistic worldview recognises the deep and reciprocal interdependencies between humans and ecosystems, with peace, social justice and planetary limits being important considerations (*ibid*).

This paper explores the use of a transdisciplinary framework that addresses some of the challenges inherent in such systemic change, through an account of a pilot project aimed at designing and developing an outdoor learning space for sustainability in the Atlantic Technological University (ATU) Sligo campus, in the North-West of Ireland. The project adapted aspects of the Connecting Nature Framework (Hölscher et al. 2021), developed as an adaptable three-phase, iterative process for the design and implementation of Nature-based solutions in European cities. This framework- designed to address challenges such as climate justice, biodiversity and governance-combines a co-creation approach with reflexive monitoring (Collier et al., 2023). It was chosen for its relevance in addressing some of the difficulties involved in complex systems transition and its use of participative and reflexive methods.

The question of how systems of education can be reconfigured or reimaged to effectively respond to sustainability challenges (Sterling, 2024) has been widely researched, with a large body of literature specifically addressing sustainability in higher education (Aghajani et al., 2025). Whilst earlier work focused on environmental education and the greening of campus operations, attention later shifted towards how education could help develop the "collective agency, personal capabilities and capacities" (Wals & Blewitt, 2010, 56) needed in the context of the wider contribution of HEIs to a more sustainable society. Later work incorporated the Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (Mc Intyre et al., 2024; Leal-Filho et al., 2023), and emphasised the development of sustainability competencies (UNESCO, 2017; Brundiens et al., 2021; Wiek & Redman, 2022). Other work emphasises the need for an underlying dynamic process of (re) learning, viewing sustainability as an emergent property of complex evolving systems where unsustainable patterns need to be recognised, challenged and disrupted (e.g. see Wals, 2025). Addressing complex sustainability challenges in ecologically and socially accountable ways may involve difficult processes of learning, including multiple perspectives and diverse knowledges (Stein, 2024). Questions of being, knowledge and value here might extend beyond the classroom (McCowan, 2023). A critical element is a re-appraisal of the relationship between humans and the natural world.

Outdoor learning spaces on HEI campuses can play an important role enabling campus and local communities engage more deeply with nature through what they see, hear, smell, and touch (Alves et al., 2021). Natural spaces may inspire "hope and new visions or possibilities" (Tilbury, 2023, 6), potentially shifting worldviews (Ameli, 2022) and supporting involvement in sustainability initiatives (Krasny & Delia, 2015). They can facilitate rest and restoration as well as shared activities that contribute to overall health and well-being (Alves et al., 2021; Hartig et al., 2014; Krasny & Delia, 2015). As "living labs", HEI campuses may facilitate learning about real and complex problems through co-creation and co-development, bridging theoretical research and practical application (UBC, 2024). They thus provide an effective setting for applied transdisciplinary research, teaching, co-creation and student engagement (Gomez & Derr, 2023).

Despite this potential, the development of outdoor learning spaces on campus poses significant challenges around resourcing, management and governance. Sharp (2002), in an early paper on campus as a living lab, makes an important distinction between successful projects and institutional transformation. Changes in organisational structures and practices can be needed to enable the evaluation of impact and the adaptation of actions in a process of on-going learning. Management and maintenance of spaces need resourcing. A strong working relationship between Estates staff and academic and support staff who are using the outdoor spaces is required: working practices of grounds staff may be affected and external contractors may be involved. Different views within the university and local communities may exist on what the campus grounds should look and feel like, and diverse needs might need to be considered. Factors influencing the more successful embedding of sustainability in curricula and campus practices have included broad stakeholder participation, face to face dialogue, interdisciplinary spaces for relationship-building, integrated planning, a clear organisational vision and strategy, clear communication, coordination of initiatives, a collaborative environment and well-developed internal and external networks (Weiss et al., 2021; Leal-Filho et al., 2019; Pflitsch et al., 2018; UBC, 2024).

The Connecting Nature Framework (Hölscher et al., 2021) was designed to address the need for stakeholder participation, providing structured guidance for how engagement could be incorporated at all three stages of the process: planning, co-production and stewardship. Its co-creative approach emphasises collaboration, inclusivity and the integration of diverse knowledges to generate contextually relevant and actionable knowledge (Frantzeskaki et al., 2025; Wittmayer et al., 2024). Governance requirements are considered from the outset, and the inclusion of reflexive monitoring ensures that learning and reflection are integral to the process. Designed to be open-ended and flexible, aspects of the framework could be easily adapted to a pilot campus project.

2 The Project: Developing an Outdoor Learning Space

This project arose through a series of scheduled (though informal) lunchtime “interdisciplinary conversations” around sustainability. Most of the work took place between January and December 2024. The initial team included an artist/social scientist who had worked on a wide range of sustainability-related projects, with a focus on inclusivity; an ecologist who was currently engaged with campus biodiversity issues; a lecturer in sustainability who had previously worked as campus sustainability officer; two computing lecturers – one who had led a prior organic garden project in the college, the second with a research background in sustainability transitions in higher education; a science lecturer with a research background in education for sustainability (in particular considering accessibility, inclusivity and community engagement), and an engineering lecturer with a strong research background in sustainability, including community engagement and nature-based solutions. Funding for the development of a prototype outdoor learning space was awarded by the Irish Higher Education Authority’s NTutor initiative which focused on capacity-building for learning in higher education institutions (HEIs).

2.1 Objectives and Initial Considerations

Integrating a range of concerns, initial considerations for the space included:

- Learning for sustainability as a central theme.
- The need for the space to visibly embody sustainability principles, and to provide an environment that would inspire creativity.
- The need to consider diverse communities on campus and to provide an accessible resource that could be used for a variety of purposes.
- The need for consultation with key stakeholders, in particular, Estates Management and staff, who would be critical to the project's feasibility and long-term success.
- The need to consider ongoing stewardship of the space, including how it would be maintained and governed over time.

These concerns highlighted the need for a more participatory approach and the integration of this initiative with other activities on campus. It was important to build relationships and strengthen capacity within the organisation for transdisciplinary research and teaching. This was seen as essential for embedding sustainability more deeply within the culture and operations of the institution. Finally, drawing on the prior experiences of team members and acknowledging the challenges of sustaining initiatives—such as shifting priorities, limited resources, and staff/student turnover—it was deemed critical to involve both senior management and those likely to be responsible for the long-term care and maintenance of the space. Thus, while the initial aim of the pilot project was to design and develop an outdoor learning space that would contribute to sustainability on campus, a more important research aim emerged: to develop, pilot and learn from a framework that could contribute to future projects and build learning capacity in the organisation.

2.2 Methodology: The Connecting Nature Framework

The methodology used was adapted from the EU Connecting Nature Framework (Collier et al., 2023) with a focus on participative, reflective, and co-creative aspects. For this project, the three-phase structure of the framework - involving planning, implementation and stewardship (Hölscher et al., 2021) - meant that considerations of longevity and sustainability of the project were made at an early stage. The built-in learning processes from the framework (Lodder et al., 2022) were adapted to encourage reflexivity and aid in navigating arising challenges.

The framework was used to guide the process, beginning with initial research, and a stakeholder and baseline analysis. Broadly adopting the phases of the framework, a series of three collaborative workshops were organised. These drew from relevant guidelines provided in the Connecting Nature toolkit- see Table 1 below - and were informed by World Café principles (Brown et al., 2005). An informal approach to reflexive monitoring was used throughout the project, with the aid of the Reflexive Monitoring Guidebook (Lodder et al., 2022) to navigate and reframe challenges. The three phases are described in more detail below.

Table 1. Elements of the Connecting Nature Framework used in the phases of this project.

Phase	Activity	Resource from Framework used	
Planning/ goal setting	Systems/ Stakeholder analysis	Connecting Nature Framework Guidebook (Hölscher et al., 2021)	<i>Connecting Nature Framework Guidebook</i> (Hölscher et al., 2021)
	Workshop 1 - Re-Imagining Campus Green and Blue Spaces	Connecting Nature Governance Guidebook (Vandergert et al., 2022)	
Delivery (co-design)	Workshop 2 – The Co-Design of a Space	Connecting Nature Co-Production Guide (Hölscher et al., 2022)	<i>Reflexive Monitoring Guidebook</i> (Lodder et al., 2022)
Stewardship	Workshop 3 – Living labs	Connecting Nature Impact Assessment Guidebook (Dumitru et al., 2022)	<i>Technical Solutions Guidebook</i> (Connop & Nash, 2022)

Planning and Envisioning. Drawing from the Connecting Nature Guidebook and influenced by transitions approaches (Loorbach et al., 2017), the planning and envisioning phase involved:

1. **Stakeholder analysis:** Key stakeholders/roles were identified by the group for invitation to an initial collaborative workshop: Re-Imagining Campus Green and Blue Spaces”. The initial set of invitees was designed to include key functions in the HEI, as well as a broad representation of students and staff across disciplines. The invitation was later extended to anyone on campus to fill the remaining places.
2. A **baseline analysis** of the existing campus space was conducted. This built on existing work done by the environmental science department. Video footage from campus biodiversity projects was compiled into a presentation for the initial workshop.
3. **Research and information-gathering** on best practices in other universities. These were compiled by the team into a presentation, printed as exhibition posters for the initial workshop and disseminated to participants in advance.

The **initial workshop** was attended by a broad group of stakeholders (15 in total plus the project group). These included representatives from campus management, the health and wellbeing office, the accessibility office, student induction, campus estates, the Maker Space, as well as students and academic staff from different disciplines. The main aims were to develop a shared vision for the campus space (a “future postcard”) and to identify challenges and opportunities. The workshop focused on three questions:

- What is your relationship (personal or professional) with the outdoor campus spaces?

- What could our outdoor spaces be: What are the core considerations for development?
- Which core values should inform their design?

Following the question rounds, participants were asked to build a more detailed vision of a green campus space that could bring most value going forward. These outputs from Workshop 1 were combined into a report. This was disseminated to attendees for comments/additions and used as input for Workshop 2. Participants were also asked for feedback on the running of each workshop (the very limited response to these was positive).

Co-Design. Following a process of reflection on the outputs from Workshop 1, a food and pollinator trail-a series of smaller inter-connected spaces- was identified by the group as a framing vision, and an existing and under-utilised outdoor amphitheatre space was chosen as a focus for Workshop 2 (Co-Design). This phase drew from the Connecting Nature Guidebook for co-design (Hölscher et al., 2022).

The main aim here was to provide a brief for the design of a prototype outdoor learning space that could inform more detailed design and construction. This would encompass the values and vision expressed in Workshop 1, subject to planning constraints, as specified by the Estates Office. The 15 attendees (plus the project group) included some of the Workshop 1 participants. Invites had also been openly extended to enable broader participation.

A set of objectives for the space were derived from the outputs of Workshops 1 and 2 (see Table 2) and key themes were also mapped (teaching, learning and research; inclusivity; connection; environment; health and wellbeing). These were used as input to Workshop 3 to identify mechanisms for impact assessment.

Table 2. Objectives from Workshops 1 and 2

Our Joint Objectives for the Outdoor Learning Space
To promote mental and physical health and wellbeing on campus
To enhance the relationship of students, staff and the local community with nature.
To increase biodiversity on campus, including pollinators
To provide a resource for learning about sustainability issues
To create a space that is inclusive and accessible
To illustrate/expose the processes of learning- innovation and creativity on campus
To enable trans-disciplinary research/ build relationships around sustainability.

Impact Assessment: Campus as a Living Lab. The aim of the third workshop, attended by 10 people (plus the project group) on living labs was to explore how we could build learning processes into (future) activities, and ensure that the objectives for the space, as identified in previous workshops (see Table 2), could be monitored and eval-

uated. The workshop adapted tools from the Connecting Nature Guidebook for the design of impact assessment. The tools aided in the clarification of objectives for the spaces, as well as potential secondary benefits. Indicators could then be chosen to measure outcomes via a mapping process, where the relationship between actions and the expected impact could be determined (Dumitru et al., 2022).

The list of objectives shown in Table 2 were used in the workshop to guide discussion of how the campus spaces could be used. Two main possibilities for use emerged: a calendar of events and an interactive trail. We then examined how we could measure and evaluate the outcomes of actions identified in order to assess whether and how our objectives were being achieved. In particular, we focused on what the quantitative and qualitative indicators might be, and how data for these could be gathered. Outputs from the workshop were disseminated to participants for correction and comment.

Reflexive Monitoring: An Iterative Process. All three phases of the Connecting Nature Framework involve built-in processes of learning and evaluation in the form of “reflexive monitoring”, to aid in addressing complex challenges (Lodder et al., 2022). This helps evaluate day-to-day activities and respond to issues while considering the bigger picture. Activities are thus aligned with the long-term aims and impact of a project, and users can gain insight into the progress and direction of the project in real time (ibid). Guidelines for reflexive monitoring from the Connecting Nature Guidebook on Reflexive Monitoring were used in an informal way throughout the process, where learning questions were identified at critical junctures, and different perspectives sought.

In the earlier stages of the project, lunchtime weekly meetings provided an opportunity to identify and discuss obstacles. This helped reframe challenges and foster learning, in particular at critical turning points. The reflective process adopted when writing this paper involved reconstructing the timeline from emails and meeting minutes, to reflect critically on actions taken at these turning points, identify gaps, ensure learning for the future and consider the ongoing stewardship of the project.

2.3 Results: Creating the Outdoor Learning Space

The outcomes of the workshops reflected the broad stakeholder engagement¹ achieved throughout the process. The first workshop provided a rich set of ideas for projects, and raised the first major challenge for the group, in determining where the focus should be moving forward. A food and pollinator trail joining a series of “learning spaces” was envisaged as a potential “roadmap” that would enable evolution, connect disparate projects and provide a template for future developments. Walking this potential trail helped identify the focal point for Workshop 2 - an amphitheatre space that was under-utilised,

¹ Stakeholders attending the workshops included academic management, including the acting head of campus; academic staff and students from different disciplines; representatives from the Students’ Union and Student services including the Student Access office and the Student Induction officer; representatives from the Estates office, the Maker lab, and the campus Health and Wellbeing office,

but which had the potential to draw students outside. In addition to accessibility issues, walking and viewing this space by Workshop 2 participants helped uncover some of the barriers to the use of this space, such as a lack of shelter and background traffic noise. These findings were subsequently used to inform planting decisions by the Estates Office. From the first two workshops also, a clear set of objectives to guide the creation of future outdoor learning spaces was provided. Workshop 3 then focused on how these objectives could be met and how impact could be monitored and measured or evaluated over time.

Overall, the project seeded student engagement, helped inform planting decisions on campus, and contributed to the implementation process of constructing a food and pollinator trail. Workshops also fostered social connection and network-building on campus, helping to develop relationships and start conversations on the importance of the campus outdoor environment. There were three main areas of achievement:

1. **Creation of campus outdoor spaces: Building biodiversity on campus.** The identification of a potential trail, and the co-design brief for the amphitheatre space informed broader campus planting decisions. Fruit trees (funded by EU GREEN) were planted behind the amphitheatre to provide shelter and food. Native hedging was also planted to provide further shelter and encourage biodiversity. In the longer term, the hedging and trees will contribute to the use of the amphitheatre space as a focal point for interaction. It will also contribute to a learning infrastructure to enable students, staff and local communities learn more about biodiversity and native ecologies. Funding was also used to create a herb garden beside the canteen, a further element to the food and pollinator trail, suggested in the workshops. Finally, signage has been designed and developed for the food and pollinator trail which connects with on-going work on biodiversity and pollinator planting, and other trails on campus.
2. **Catalysing future work and promoting campus engagement:** The design brief from Workshop 2 was passed on to architecture students as a “vertical” one week project at the start of the academic year, involving students from all years working on different themes. This fostered a strong student engagement with biophilic design. It also led to the involvement of architecture students with work on campus biodiversity and the student Green Campus Committee, contributing the award of a biodiversity green flag later in the academic year. Other student projects included marketing students, who looked at sustainable marketing strategies to drive community engagement with the trail and computing students who designed a campus augmented reality game. An end of term exhibition provided a showcase for projects.
3. **Relationship Building:** In general, the project offered opportunities for the building of relationships between diverse groups of staff and students, that fed through into other projects and initiatives.

3 Reflection and Discussion

Following these outcomes, the final phase of the project involved a retrospective analysis. Using a reflexive monitoring approach, email chains and meeting minutes were

used to identify critical turning points and reflect on how these were addressed. The five group members were also asked to use guidelines on reflexive monitoring to provide feedback on the transdisciplinary approach used, to identify critical turning points encountered, and to comment on their experience with the use of the adapted Connecting Nature Framework.

3.1 Inter-/Transdisciplinary Approach

The interdisciplinary approach and involvement of multiple stakeholders from an early stage in the project were generally seen by the group as resulting in positive outcomes. Inclusivity, interdisciplinary dialogue, and listening were prioritised. Here, the experience of team members who had worked on community engagement projects on sustainability was invaluable. Links made with other projects (e.g. Green Campus Committee work on biodiversity) and teaching activities (e.g. in marketing, architecture and computing) in later phases led to more student engagement with the campus, and the inter-connection of activities across campus. Despite this, one group member noted a lack of student perspective in the process, particularly of those from marginalised backgrounds.

The diverse nature of the project team provided different perspectives in discussions and decision-making. In the earlier stages of the project, this countered the lack of time allocated, through energising team members and promoting learning, as noted by one team member:

The strength of the whole project for me lay in the people – the diversity, knowledge and experience and personalities of the group. Meetings were fun, engaging and never really felt like work (well until the end!). I think this was key given there was no buy-out of time. People needed to be invested and want to be there. For me the people were the draw even more than the project. I learned so much at every session.

In particular, the importance of a creative, humanities-based approach to the use of outdoor campus spaces helped open the group to a much broader view of what the campus could be. As observed by one team member, this voice can often be absent in initiatives that interpret the idea of campus “living labs” in a more scientific/engineering sense. Having input from a previous initiative involving a “head, hands and heart” approach to sustainability greatly enriched the project and underscored the need for a more holistic approach. As another team member reflected, this broader perspective was particularly important when looking at the role of the outdoor space. For instance, it was suggested that we look out at the space from inside the building at what might be needed to draw people outside: here the space needed to be not just accessible, but meaningful. This perspective also informed methods to evaluate the usage of spaces: in particular, including a qualitative approach in impact analysis, to ensure that people’s perceptions and feelings could be more richly represented was seen as important.

Science and engineering perspectives contributed to the design and evaluation phases of the project, through providing prototype models and expertise in measurement and monitoring that could feed into future student projects and community engagement activities. The involvement of an ecologist in the team added the knowledge

needed to integrate ideas with other activities promoting biodiversity on campus, as well as providing a critical scientific perspective on potential solutions. Some team members were also involved in the award of the Green Campus biodiversity flag, and this further helped integrate this project into the ongoing process of campus greening.

A further perceived strength of the project was the fostering of relationships with management and Estates staff, as a means of strengthening dialogue and generating cross-institute support for current and future initiatives.

3.2 Critical Turning Points

There were a number of critical turning points in the project, identified through analysis of meeting minutes, email chains and team reflection. The first occurred after the first workshop, when it became apparent that there were vastly different interpretations of the workshop outputs. It also became clear that the project needed to be supported by the Estates Office and that we lacked the resources to implement and maintain some of the initial workshop proposals, such as an organic garden. Adopting the dynamic learning approach adopted in reflexive monitoring led us to go back outside, listen – to each other, and to the spaces- and re-appraise the area, enabling consensus to be gained on a focal point for Workshop 2, in the context of a larger trail structure that could accommodate and link existing and future initiatives. The most difficult critical turning points emerged in the implementation phase, when the team had become depleted and the capacity of existing members was limited, due to teaching and other commitments. Staff time had not been funded, so as the availability of staff in the team varied, it was deemed vital to have a member who could keep things on track and document the process. Budgets needed to be spent and accounted for in a limited timeframe. Again, a reflexive monitoring approach proved useful here. The goals that had been set in consultation with the broad range of stakeholders helped guide decisions, and longer-term stewardship considerations helped align these decisions with the ongoing campus developments facilitated by the Estates Office.

3.3 The Connecting Nature Framework

Guidelines from the Connecting Nature Framework were found to be highly useful in informing the process in general and workshop design in particular. The materials (videos, guidelines) provided were accessible, clear, and practical, supporting overall project design and workshop development. In particular:

- The planning guidelines in the framework, including systems and stakeholder analysis, provided a useful structuring mechanism, as well as raising considerations of longer-term sustainability issues for the outdoor campus learning space.
- The co-creative approach proved useful for getting a wide range of perspectives on the campus learning space from different stakeholders.
- The initial envisioning workshop gave a clear set of objectives that would prove useful in guiding later decisions.

- The co-design workshop provided a brief that seeded student projects and engaged a wide range of students with the campus.
- The Connecting Nature guidelines on monitoring and evaluation provided useful templates for the living lab workshop design that helped create evaluation frameworks for the outdoor learning space.

The holistic approach adopted for evaluation included the collection of both qualitative and quantitative data to measure and evaluate impact in different ways, with materials generated that could be useful for future learning and research. The effectiveness of these has yet to be established, however, as methods and metrics identified for monitoring/evaluation have yet to be put into practice. Throughout the process, aspects of reflexive monitoring proved to help navigate critical junctures, as well as providing a useful template for reflective analysis.

4 Conclusion

Despite time and resource constraints, both major aims of this pilot project - the design and development of an outdoor learning space that would contribute to sustainability on campus, and the development and piloting of a framework that could contribute to future projects and build learning capacity in the organisation - were achieved.

While the Connecting Nature framework was designed to enable the creation of nature-based solutions in the larger and more complex context of cities, it proved to be a valuable resource for use in reimagining HEI campuses as learning spaces for sustainability. The key strength of this framework lay in enabling a participative approach that also addressed the needs of longer-term implementation and stewardship. Central to this application of the framework was an emphasis on building and connection, rather than re-invention. However, this synergistic and inherently collaborative approach requires time and space to enable relationship-building and meaningful engagement. In addition, capacity is needed to support the embedding of reflexive processes to facilitate responsive rather than reactive approaches to emerging challenges. The development of reflexive governance structures that would work in an academic context requires future research. These structures would aim to ensure that input from co-creative approaches is reflected in project outputs, and that learning from the use of spaces can be ascertained. Finally, resources are needed to ensure ongoing stewardship of any spaces created and dissemination of learning. These considerations have clear implications for organisational structures. In particular, dedicated staff time and accessible (physical and online) spaces for connection and coordination -such as local sustainability hubs- are critical.

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