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Towards a new future in engineering education, new scenarios
that European alliances of tech universities open up



PROCEEDINGS



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Developing Strategic Partnerships through a Sustainability Enrichment Week

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ABSTRACT

This paper describes the development of a mini-module focused on sustainability and timber engineering as a component of a strategic partnership designed to broaden Transnational Education, increase staff/student mobility, and further develop industry and community links within two universities. Edinburgh Napier University (ENU) draws students from around the world and is internationally recognised for timber construction and wood science. The New Model Institute for Technology and Engineering (NMITE) is a new higher education provider in England pioneering an innovative approach to engineering education integrating business, engineering, the liberal arts, and professional skills. ENU and NMITE leveraged these strengths to develop a strategic partnership that brings together staff, students, industry, and the community for opportunities that create impact beyond traditional learning approaches. This can be seen through the development of a Sustainability Enrichment Week hosted by NMITE's Centre for Advanced Timber Technology (CATT) and attended by ENU Master's in Environmental Sustainability students. Students investigated interfaces between buildings, humans, and nature through experiential learning based around the construction of the CATT building, which has been developed as a Living Lab. Each day featured activities aligned to identified learning outcomes and was themed around one of five sustainability competencies: systems thinking, values thinking, strategic thinking, future thinking, and collaboration. The Sustainability Enrichment Week also served as a trial for a short course soon to be offered as part of a Timber Technology, Engineering, and Design programme. This project could be a model for other universities seeking to create similar strategic partnerships and learning experiences.



1 INTRODUCTION

Universities have long recognised the value of strategic partnerships that can help achieve institutional goals such as strengthening links to industry, adding value to programmes through additional talent and resources, and increasing knowledge exchange, all of which can ultimately lead to new student recruitment markets and therefore additional revenue streams. However, it is often hard for administrators to find space within traditional programme structures to add these kinds of activities, and while academic staff may see the value in these initiatives, they may not have the time to embed them within their existing modules. What can be done to overcome these challenges to creating strategic partnerships?

The purpose of this paper is to show how the development of a short course or mini-module can provide the opportunity to build relationships with industry and the community, to focus on broader or more holistic themes that may help students tie together their academic knowledge and experiences, to provide staff and students at different institutions the chance to collaborate in new ways, and to trial innovative pedagogies and technologies.

2 CONTEXT AND LITERATURE REVIEW

Over the past two years, an educational alliance has emerged between Edinburgh Napier University (ENU) and the New Model Institute for Technology and Engineering (NMITE) located in Hereford, England. Given the track record of ENU in timber construction and wood science research, the relationship is centred on co-developing a timber technology, engineering and design educational programme aligned with the NMITE integrated and challenge-based learning ethos. ENU and NMITE aim to leverage these roles and institutional strengths to develop a mutually beneficial strategic partnership that brings together staff, students, industry, and the community to create impact beyond traditional learning approaches. Besides creating learning opportunities for students and staff, this alliance also has the potential to create financial and reputational advantages to both institutions. One of the actions taken to strengthen this partnership has been the development of a Sustainability Enrichment Week for students in ENU's MSc Environmental Sustainability programme hosted in Hereford by NMITE's Centre for Advanced Timber Technology (CATT).

The theme of Sustainability was chosen not only because of its intrinsic importance; it was also a theme that unites the mission of the the CATT (to promote innovations in timber technology and engineering that lead to sustainable construction) with content in the ENU programme, which contains modules such as water and waste management and building energy performance. The Sustainability theme was also broad enough that it enabled interaction with several companies and organizations that might not ordinarily consider partnering with an engineering programme, leading to new potential avenues of engagement and support for both universities.

Additionally, Sustainability could easily be linked to the modules in NMITE's Master's in Integrated Engineering (MEng), meaning that learning experiences could be



developed that benefited students from both NMITE and ENU and could be delivered collaboratively with faculty from both institutions.

Rationale for development of this themed mini-module rests in recent scholarship in several areas. Firstly, using sustainability as a theme can bring students and staff from different backgrounds together for a common goal [1]. Indeed, learning about sustainability in a way that is not dependent on specific technical knowledge and that speaks to integrated, interdisciplinary solutions will be increasingly important in both engineering education and for achieving breakthroughs in sustainability. Secondly, given that Scotland and England have two different higher educational systems, this experience can fall under the umbrella of Transnational Education. Research on students who engaged in short-term study abroad has shown that even these brief experiences can be effective at achieving higher-order learning outcomes [2]. Thirdly, more effective industry and community engagement can be fostered even through these short, intensive sessions [3]. Fourthly, faculty who are involved in these types of short-term study activities have viewed them as a professional development opportunity due to the difference from the roles they play and interactions they typically have in a confined classroom setting [4]. Finally, while there is not as much research about these types of non-graded enrichment weeks that sit outside the proscribed curriculum, there is anecdotal evidence to show that students find these opportunities a valuable part of their educational programmes [5].

Based on this research, several aims of the Sustainability Enrichment Week were articulated to address the needs and expectations of a variety of stakeholders:

1. To enhance knowledge exchange between institutions via ENU's School for Engineering and the Built Environment and NMITE's Centre for Advanced Timber Technology, and between each institution's industry and community partners;
2. To provide a template for further staff/student mobility that enhances learning opportunities for both groups;
3. To promote, develop, and further deploy NMITE's interdisciplinary and experiential pedagogy that is an innovation in engineering education;
4. To create learning opportunities that bring together people from diverse backgrounds, bridging international as well as urban/rural divides;
5. To contribute to efforts that advocate for socially and globally responsible and responsive engineering.

2.1 Determining Student Outcomes

After agreeing upon aims of the Sustainability Enrichment Week, it was necessary to determine what outcomes could be most beneficial and desirable to students registering on this extracurricular module. An informal review of the modules in ENU's MSc Environmental Sustainability revealed that they contain rigorous content in specific subject areas like waste, water, energy, and construction, but it was less



clear how the modules worked together coherently to result in a holistic professional approach to and understanding of environmental sustainability. Since NMITE's curricular approach is based on learning taxonomies that culminate in synthesis (tying together knowledge) and phronesis (whether or not knowledge or action is wise or valuable), it became clear that the enrichment week activities should focus on professional competencies in sustainability that stretch across and beyond technical disciplines to encompass these higher-order concerns.

Therefore, it was decided that the outcomes of the enrichment week would be to develop skills in the five sustainability competencies as promulgated by Arizona State University's School of Sustainability: systems thinking, values thinking, strategic thinking, future thinking, and collaboration [6]. Each day in the week was to focus on one of these competencies as a learning outcome, and contain a variety of interdisciplinary, experiential activities to support that learning.

2.2 Determining Module Activities

The construction of the Centre for Advanced Timber Technology building allowed for a specific case study through which to frame the week's activities. The building is a 2,500m² purpose-built educational facility that reflects the NMITE pedagogical approach and combines it with the capability to service the needs of the growing timber engineering industrial sector. On this basis the building is a "Living Lab" creating the necessary conditions for research to be undertaken on the building itself and the innovations created within it. Formed as a hybrid structure combining cross laminated timber, glue laminated timber, closed panel timber systems and steel braced and portalised frames, the building is measured and monitored utilising sensors and digital technologies acting as an ongoing educational toolkit. Since construction was being completed in spring 2022, this building site enabled the sustainability enrichment week to focus on the interfaces between buildings, humans, and nature. It also provided real-world experience and engagement with timber and monitoring technologies, construction management, and place-based learning.

For instance, in a day themed around the outcome of Systems Thinking, activities included: an introduction to the Living Lab building monitoring system; a tour of the CATT building construction site with its project manager; a lunch and learn session with the Sustainability Lead of the construction company; a workshop on environmental impacts within construction supply chains, and a seminar to reflect on the variety of systems involved in products, buildings, and communities.

This combination of learning, doing, exploring, and reflecting allowed for a multidimensional perspective on the systems thinking outcome, and showcased how systems thinking is required by real-world professionals in authentic situations. These activities also had a dual purpose: not only did they help achieve the aims of the sustainability enrichment week, but they also served as a testing ground for



some of the content in NMITE's Timber Technology, Engineering, and Design course now in development.

3 RESULTS

Some uncertainty surrounded the initial development of the Sustainability Enrichment Week: it was unclear if and how students would respond to the opportunity, or if administrators and industry/community partners would be supportive. Additionally, there was little time for planning since the idea was developed in mid-February 2022 and executed in mid-May 2022. However initial conversations with various stakeholders were uniformly positive, and 6 staff from ENU and 6 from NMITE participated in various activities, with 8 companies and organizations outside the universities also being involved.

15 students attended the enrichment week, and these represented diverse demographic backgrounds. Some of the students had never before been to England, and most had never been to rural parts of the country. This group engaged with a cohort of NMITE's MEng students, which created another opportunity for students from both rural and urban and local and international backgrounds to interact.

Students were asked to fill out a pre-survey and a post-survey in order to elicit a comparison between their existing understanding of the sustainability competencies and their understanding after engaging in the week's activities. 8 students completed the pre-survey and 9 students completed the post-survey; in both cases they rated their own knowledge on a scale of 1 being the lowest and 5 being the highest. Table 1 provides averaged results from the surveys which indicate that knowledge increased across all 5 competency areas:

Question	Pre-Survey Average Rating	Post-Survey Average Rating
How would you rate your understanding of values (that is the principles, attitudes, and qualities related to concepts of justice, equity, and responsibility)?	4	4.78
How would you rate your understanding of the connection between values and sustainability ?	4.25	4.78
How would you rate your understanding of futures thinking (that is, the ability to anticipate how problems might evolve or occur over time)?	4.25	4.67
How would you rate your understanding of the connection between futures thinking and sustainability ?	4.38	4.67
How would you rate your understanding of systems thinking (that is, the way that problems cut across different systems and domains of knowledge)?	3.88	4.67



How would you rate your understanding of the connection between systems thinking and sustainability ?	4	4.56
How would you rate your understanding of strategic thinking (that is, how intentional plans and deliberate coordination can be leveraged to achieve transformational goals)?	4.25	4.67
How would you rate your understanding of the connection between strategic thinking and sustainability ?	4.13	4.56
How would you rate your understanding of collaboration (that is, how communication, leadership, empathy, and negotiation can achieve goals)?	4.25	4.78
How would you rate your understanding of the connection between collaboration and sustainability ?	4.63	4.78

Table 1. Comparison of student's self-rated understanding of sustainability competencies before and after the enrichment week.

These results demonstrate that even a short week of experiential learning can achieve significant gains in student understanding. Additionally, 100% of survey respondents said they would recommend the experience to another student.

4 CONCLUSION

The development process of the Sustainability Enrichment Week has been effective in terms of encouraging knowledge exchange between two universities and their industry and community partners, recruiting diverse students, and developing unique integrated and experiential learning opportunities that promote student and staff mobility. These learning experiences have shown to increase student understanding across five sustainability competencies.

The Sustainability Enrichment Week was developed by capitalising on what was already happening in the two institutions and leveraging existing resources and relationships. It took a themed learning approach that was not dependent on specific technical knowledge and that spoke to integrated, interdisciplinary approaches which will be increasingly important in both engineering education and achieving breakthroughs in sustainability. It got a lot of people within and beyond the universities excited about this work, and introduced students to a variety of perspectives and potential career paths. The experience in developing the Sustainability Enrichment Week can serve as a template for other institutions seeking to achieve similar aims.



REFERENCES

- [1] Fernandes, A., Facca, C.A., Alves, J.L., Rangel, B., Leite, R., Neto, B., and Barbosa, A.M.T.B. (2020), Sustainability as a theme of interdisciplinarity between design and engineering courses, Proceedings of the IEEE Global Engineering Education Conference (EDUCON), Cardoso, A., Alves, G.R., and Restivo, M.T., Porto, pp. 1370-1376.
- [2] Landon, A.C., Tarrant, M.A., Rubin, D.L., and Stoner, L. (2017), Beyond “Just Do It”: Fostering higher-order learning outcomes in short-term study abroad, *AERA Open*.
- [3] Harsh, M., Bernstein, M.J., Wetmore, J., Cozzens, S., Woodson, T., and Castillo, R. (2017), Preparing engineers for the challenges of community engagement, *European Journal of Engineering Education*, Vol. 42, No. 6, pp. 1154-1173.
- [4] Ozkan, D.S., Davis, K.A., Davis, J.C., James, M., Murzi, H., and Knight, D.B. (2020), Expectations and experiences of short-term study abroad leadership teams, *Journal of International Engineering Education*, Vol. 2, No. 1.
- [5] Kallail, K.J., Shaw, P., Hughes, T., and Berardo, B. (2020), Enriching medical student learning experiences, *Journal of Medical Education Curriculum Development*, Vol. 23, No. 7.
- [6] School of Sustainability, Arizona State University (2018). Key competencies In sustainability. https://static.sustainability.asu.edu/schoolIMS/sites/4/2018/04/Key_Competencies_Overview_Final.pdf