

Collaborative Approach Highlighting the Benefits of Diversity in Future Engineering

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Abstract: This paper looks at the key outputs and outcomes from the 3 year Erasmus+ KA2 Project PEETS (Promoting Excellence in Employability and Transversal Skills) which was awarded a CATE (Collaborative Award for Teaching Excellence) by AdvanceHE for its innovative and collaborative approach where 117 students from Glasgow, Scotland; The Hague, Netherlands and Lahti, Finland worked together during three separate 8 day intensive study periods over the three years supported by industry partners and ExpLearn. The theme of renewables was threaded through the three years which gave context to the project activities for the built environment, engineering and applied sciences students. Whilst having students participating from six of the seven continents and more than fourteen participants who's first language was not English ensured cultural diversity throughout the program. During the early stages of vetting of applicants letters of motivation all the project team had agreed on a policy of inclusivity, breaking down of the traditional barriers which may have precluded some applicants from participating. The initiative has resulted in the development of a range of outputs including an experiential learning model, readily transferable to different educational sectors, levels and disciplines. Outcomes have included enhanced learning experiences for students and staff leading on to further individual and organisational benefits.

Keywords; Diversity, Transversal Skills, Interdisciplinary, Multicultural, Inclusivity, Teamwork.

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1. INTRODUCTION

1.1 Original aim and development

We wanted to develop an approach to teaching and learning around the concept of “Global Citizenship” (Belgeonne et al 2014) using a sustainable development initiative that inspired our students and supported their graduation and employment. Central to this was working across disciplines and borders necessitating students developing transversal skills and engaging in teamwork and industry challenge.

PEETS (Promoting Excellence in Employability and Skills) is an award winning interdisciplinary and multicultural initiative that used a range of learning activities to develop HEI students (and staff) in Scotland, Finland and the Netherlands. It brought together nearly 150 students and staff from a diverse range of disciplines, backgrounds and cultures to develop skills to solve some challenges related to renewable energies through “hands-on” engineering and team-work activities. It was developed to provide learning opportunities not normally available in individual engineering degree courses through 10 day Intensive Study Periods.

The original idea stemmed from observing our Environmental Civil Engineering (ECE) students participating in the then Constructionarium Scotland (now ConstructED) from around 2010 onwards. It was clear from the outset that this type of project based learning was very beneficial to students – especially to those who had limited “industrial experience”.

Over the same period at GCU we also took our 2nd year construction related students on a 5 day short term study trip to Europe. This incorporated a range of intercultural activities including visiting local Universities and industry in Spain, Finland, France, Italy and Germany. Feedback from students indicated how much they had learned and enjoyed such study trips especially the opportunities to get to know their own cohort and HE staff as well as students from the different countries and backgrounds (Gilmour & Gallagher, 2016). We therefore set about exploring options for developing a discrete initiative that could combine the benefits of project based learning in an interdisciplinary and multicultural context.

1.2 The development of the PEETS Erasmus+ Strategic Partnership

In late 2014 we became aware of the Erasmus + Strategic Partnership scheme and after reviewing the criteria we explored who in our network may be interested in partnering us in preparing an application. Whilst our first application to the British Council (administrators of the Erasmus+ initiative in the UK) was unsuccessful, our enhanced application in 2016 provided nearly €300K in funding to support a 3-year project. Perhaps just as important was the additional year in preparing our application to ensure our plans were clearer and our objectives SMARTer fitting in more closely with the Erasmus+ criteria.

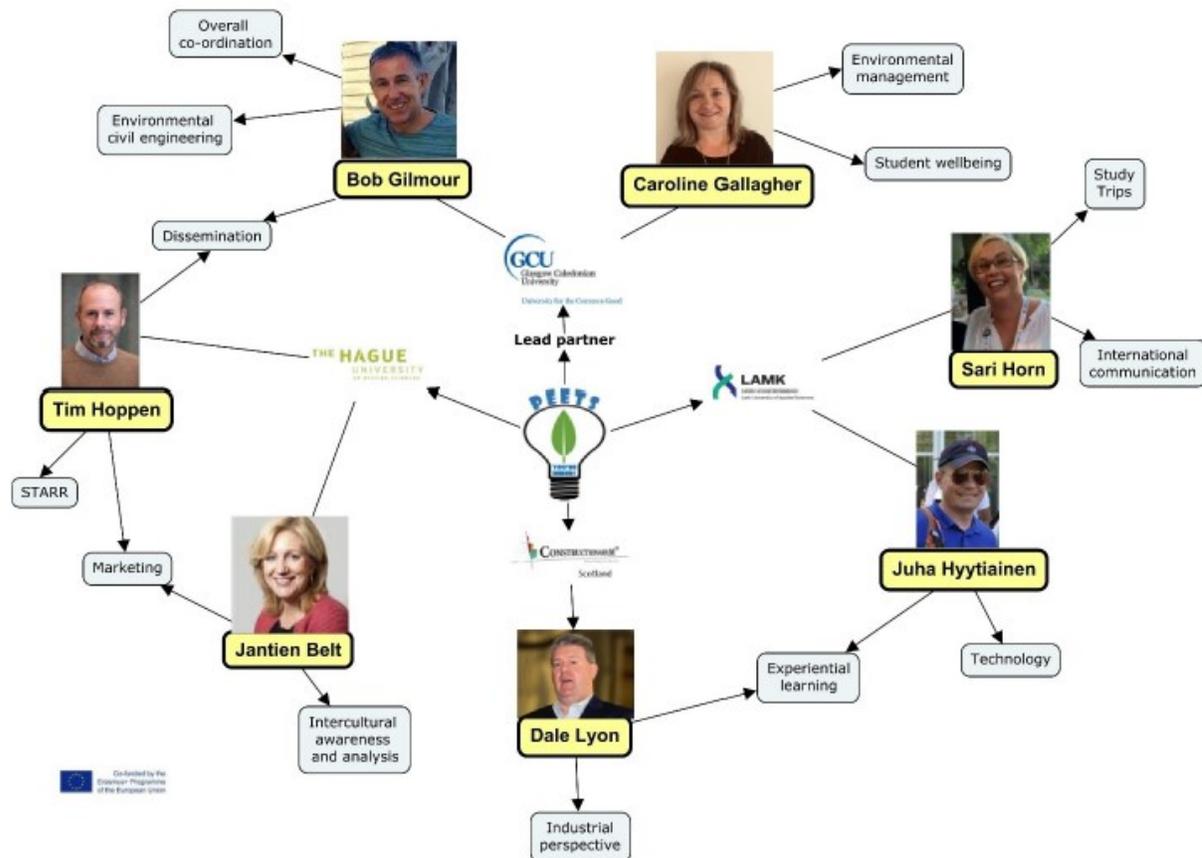


Figure 1 The PEETS Core team – roles and responsibilities

The PEETS Strategic partnership comprised Universities from Scotland (Glasgow Caledonian University), Finland (Lahti University of Applied Sciences) and the Netherlands (the Hague University of Applied Sciences) as well as an industry partner from Scotland (ConstructionairumScotland). Our core team were drawn from staff from a range of faculties (Engineering and the Built Environment, Business and Technology). The roles and responsibilities of the core team are shown in Figure 1.

2. PEETS STRUCTURE AND IMPACT

2.1 Our collaborative approach

This was set up at outset where each HEI took responsibility for hosting an intensive study period (ISP) in their own country. Our core team with our range of skillsets/approaches, met as a “management group” (both online and face to face (Figure 2)). This was enhanced by increasing direct engagement with students and their involvement as mentors

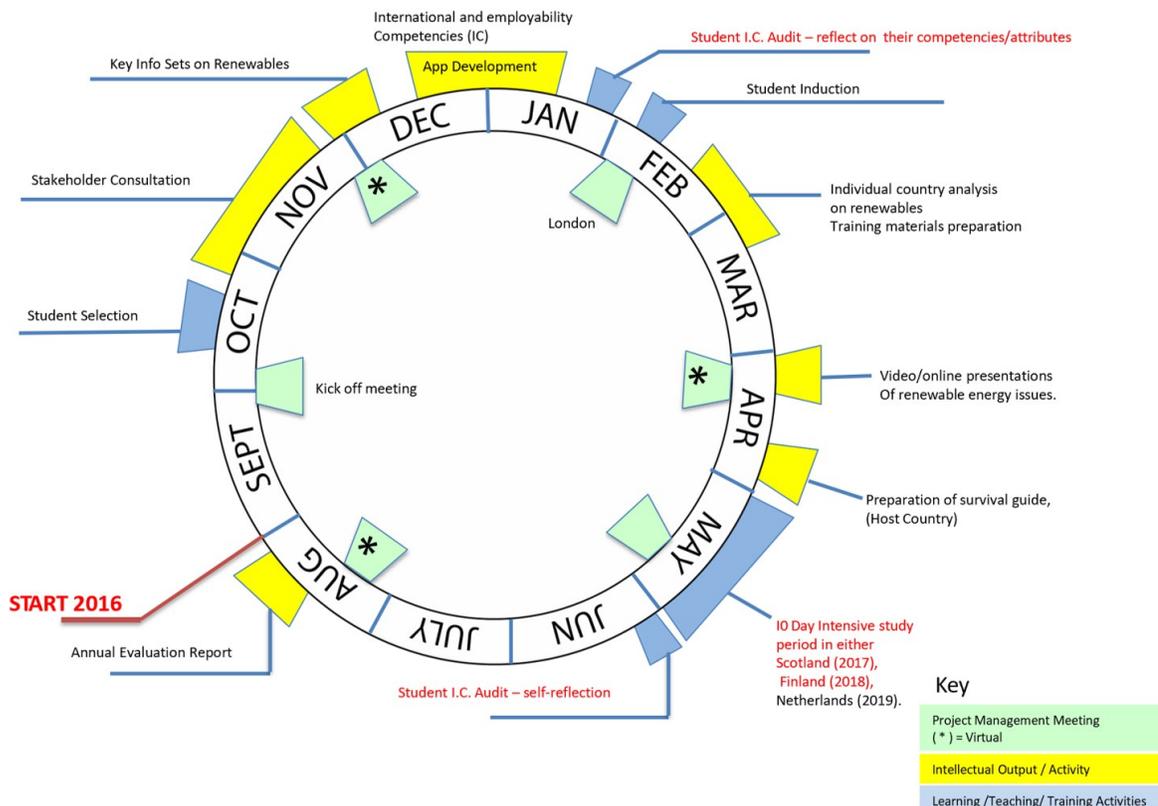


Figure 2 Annual collaborative cycle

Each intensive study period (ISP) had a different renewable energy related focus :

- ISP1 – wind energy and construction of 5 m tall mini wind turbines
- ISP2 – solar energy and the construction of small portable solar charging stations
- ISP3 – ground heat capture and construction of small electrical pump

Students for each year were asked to undertake research on their topic for their own country (including energy policy, facilities and capacity) and share it with the students from the other two Universities. The students were then split into interdisciplinary and multicultural teams working

initially competitively and then collaboratively to solve a range of challenges/problems and also construct the renewable energy facility for their respective year.

Diversity

Our student participants (52% male, 45% female, 3% other) came from a wide range of widening participation backgrounds and disciplines. Over the 3 years we had students from 8 disciplines (mostly environmental civil engineering/management, marketing and international business), 14 different nationalities, approximately 5% declared disability (some also undiagnosed at that time), an age range of 20 to 50 and 1 student with refugee status.

2.2 Cross cutting themes of PEETS

We designed PEETS to cut across a number of thematic priorities and deliver numerous benefits associated with intercultural learning (O'Mahoney, 2014) and education for sustainable development. Staff development has also resulted in revising modules to include a greater focus on experiential learning and ensuring internationalisation is incorporated more explicitly into the curriculum.

For employability, key priorities addressed include:

- careers expertise input from planning to implementation and review
- developing questionnaires for employers in the training needs assessment and also ISP review of employability skills
- PEETS LinkedIn group - information on jobs and skills development
- access to local Industry (partners arrange site visits and/or presentations) during ISP (eg Scottish Power, ABB [large multinational technology company])
- STARR (Situation, Task, Action, Result, Reflection) used as a tool for students for interviews
- further monitoring (LinkedIn and DLHEⁱ) the effect of PEETS on employment for participants as they leave their HEI

"I doubt that there are few situations where a university programme has achieved so much for career and employability skills, including a transversal dimension."

Audrey Sullivan, Careers expert ⁱⁱ

We set up a range of monitoring processes to facilitate evaluation of the reach, value and impact of our activities. These included:

- ICApp results (20 questions pre+post questionnaires) (all participants consented to the project utilising such data etc).
- Students' pre+post ISP online questionnaires (100 questions)
- Staff feedback on all activities
- Independent external evaluation of annual activities
- Students/staff ISP attendance
- Numbers of hits - website, LinkedIn and Facebook pages
- Student grades pre+post PEETS
- Graduates' employability and first job destination tracking (LinkedIn, DLHE)

2.3 Outputs, outcomes, benefits/impacts

We have been delighted with the reach, value and impact of PEETS and illustrated them (Figure 3) through a number of shared thematic priorities including

- Student experience and performance
- Staff expertise and professionalism
- Institutional impact
- Transferable learning outputs

Whilst we cannot claim direct causation with all outcomes, there is growing evidence of significant *correlation* between graduation success/employment and participation in PEETS:

- >80% of PEETS graduates gain 2.1 or 1st class honours (or equivalent) (compared to >70%)
- >95% of PEETS graduates are in appropriate high level jobs or studying for PG (several students now outside their home country)

“The project is an excellent way of developing students in terms of understanding global skills and knowledge, through real life experiences. The students are developing excellent employability skills through their innovative experiences of working with industry.”

Prof M Bramhall, Sheffield Hallam Universityⁱⁱⁱ (independent evaluator 2017)

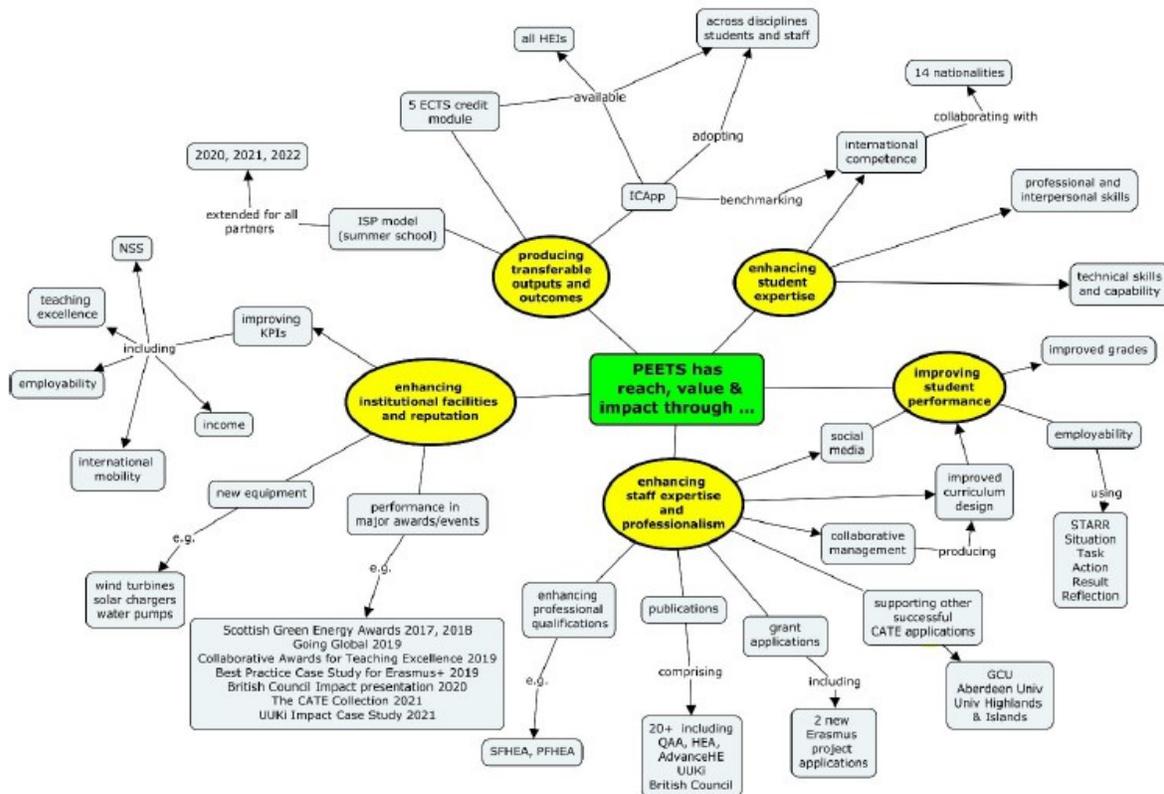


Figure 3 The reach, value and impact of PEETS

Perhaps one of the greatest accolades related to engineering education and learning for PEETS has been to receive the Collaborative Award for Teaching Excellence (CATE) from AdvanceHE in 2019 (AdvanceHE, 2019). This was the joint first CATE awarded to a Scottish HEI/Industry partnership. Our journey and impact has been further extended through being selected as a chapter in The CATE Collection (Tolson *et al*, 2021).

2.4 Industry benefits

On reflection some of the more surprising outcomes of the PEETS project have been in relation to the industry partner ConStructEd Scotland (formerly Constructionarium Scotland) and the company ExpLearn Limited. The first intensive study period was hosted by ConStructEd Scotland at their facility in Armadale, West Lothian Scotland with the students being challenged to work in three groups of 13 students to construct a 9m wind turbine and powerhouse per group, generating electricity by the end of three days (Lyon 2018). This was a project designed by Watermans Structures with the key outputs and learning outcomes developed by ExpLearn Limited. The non-consumables from this project have allowed ExpLearn Limited and ConStructEd Scotland to replicate the experiential learning activity both over the three days and with the versatility to expand the project into a five day project. The Westrigg Wind Farm Project has now become the most delivered project within those offered by ConStructEd Scotland.

The very nature of the components required to complete the Westrigg Wind Farm Project has aligned itself the flexibility to open up greater opportunities for delivery at different levels of ability. Through ExpLearn's work on the PEETS project they saw at first hand the benefits of inclusivity and gender balance within a multicultural participation project and also the need to introduce a contextualised dialogue to any experiential learning activity to ensure the participating students were to be taken out of their comfort zone and fully immersed in the learning environment.

As the PEETS project was concluding ExpLearn Limited connected ConStructEd Scotland with Equate Scotland and in 2019 ran the first 'Equate Women @ ConStructEd Scotland' events, which has just recently delivered its fourth edition, with funding in place for the next two years delivery. This three day program is a fully funded on site experience like no other for women studying, either full time or part time Higher or Further education programs within the STEM or Built Environment subjects where they replicate the first year on site project from PEETS, constructing the Westrigg Wind Farm in three groups of ten delivering a turbine and powerhouse per group. In the four years of running this event over a hundred women have participated and gained a first hands on site experience which has helped many to gain confidence in their own abilities and reinforce their learning path.

The 'Westrigg Wind Farm for Schools and Colleges' project is a further development of the original PEETS project. This now incorporates an e-learning health and safety pack with nine industry recognised modules prior to the site activity. This is also preceded by a one day Health & Safety Awareness course being delivered by a tutor in school allowing the participating senior phase secondary school pupils to sit their CSCS (Construction Skills Certification Scheme) 'touch screen' test. If the student gains 90% in this test they can then apply for their 'green card', operative's card, which is mandatory to work on many construction sites throughout the

UK. Having just concluded the pilot of this program we have already had over a hundred participants with a similar number already booked for delivery in the coming months.

ExpLearn are now looking at developing the 'Water Pump Project' from year three of PEETS as part of a 'quadruple helix project' with a Local Authority that is looking to invest heavily in Ground Source Heat Exchange systems and see using the 'Water Pump Project' as a great experiential learning activity which can also start the added conversation within the local community regarding their understanding of the proposed renewable energy source within specific communities. During PEETS year three's intensive study period this was exactly what Den Haag Gemeente set as the task for the participating students to research and present on.

Within the delivery of the other ConStructEd Scotland project weeks, not related to the PEETS project, even those that were already being ran prior to PEETS, the influence of the three-year European project can be evidenced. The focus of ConStructEd Scotland project weeks is now no longer on the completion of the representative structure but rather on the individual's journey throughout the process. Moreover in relation to the transversal skills of the participants, having been involved in the PEETS project it has highlighted the importance of the development of these softer skills within participants to enhance their employability credentials. Those participants who are studying a Civil Engineering degree course should be working towards the Institute of Civil Engineers Key Attributes if they are looking to become Chartered and the transversal skills developed during the ConStructEd Scotland activities are some of the key pillars on the route to gaining their professional qualification:

- Understanding and Practical Application of Engineering
- Management and Leadership
- Commercial Ability
- Health, Safety and Welfare
- Sustainable Development
- Interpersonal Skills and Communication
- Professional Commitment

The focus on these transversal skills during a project week now means that any student that participates in a project week would have the opportunity to reflect on their project activities and have experiences that could be shown as falling within each of the seven Attributes.

3. CONCLUSION

Our collaboration has developed from one HEI/industrial project to a growing number of like minded spirits collaborating internationally. Preliminary analysis of the feedback and independent evaluations indicated we had a successful model that enhanced the learning of students and staff through transformational experiences. This has been confirmed for all participants through the AdvanceHE CATE award and the success of consequent industry activities/benefits.

Whilst it may be difficult to identify all the key success factors of our initiative, undoubtedly the diversity of our team, both staff and students, has been a major factor. Likewise, our continuous

reflection and evaluation approach using participants and independent external evaluators, has been of significance.

The enhancement and application of our model to various levels of formal education, combined with the successful award of additional Erasmus+ Strategic Partnership funding to different disciplines/partners, confirms the broad applicability of such educational initiatives.

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