# ONLINE CO-DESIGN OF A UNIVERSITY WORK-BASED LEARNING DEGREE PROGRAMME: LESSONS LEARNED FROM COMPARING CASES IN UNITED KINGDOM AND ESWATINI

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## ABSTRACT

Greater collaboration is required between universities, industry and society to provide the engineering education that will tackle society's challenges. Work-based learning (WBL) programmes offer an industry-aligned, academically-informed education to support such socio-economic development. Co-design of such programmes is vital with responses to the COVID-19 pandemic innovating alternative ways to design programmes. Knowles et al (2021) [1] outlined an approach to online programme co-design in the UK university context, framed using Signature Pedagogy and through online conferencing and Miro (online whiteboard). Subsequently, the approach has been utilised to co-design a WBL degree programme in Electrical Engineering in Eswatini, supported by Knowles and other UK and Eswatini colleagues.

This paper compares and contrasts cases from UK and Eswatini, and from this address the research question, "What considerations are required to support an effective online process to co-design a work-based learning programme in Engineering?" A collaborative autoethnographic methodology based around field notes, observations and reflections is used to allow exploration across pedagogy, technology, work practices, expectations and challenges.

Many aspects of the approach worked well in both cases (for example, effectiveness of Signature Pedagogy, Miro as shared space), whereas differences arose related to limitations in the synchronous use of technologies, and readiness to adopt an

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outcome-focused approach. Addressing these differences, along with balancing progress against full participation and having clear expectations of participants, are key considerations in online co-design of WBL programmes. Moreover, the approach of Knowles (ibid) has shown to be adaptable with potential for broader adoption.

## 1 INTRODUCTION

Engineering must be at the heart of providing solutions to the societal challenges of the next decade and beyond, and to do so then engineering education has to adapt [2]. This change must happen across the spectrum of delivery modes to meet the needs of individuals, organisations, the economy and society – from full-time to lifelong learning. Additionally, engineering educational approaches must now support the development of a more holistic engineer and engineering graduate, and that authentic learning experiences offer clear potential to achieve this goal. Moreover, greater collaboration between academia and society is required, whether to provide challenges, to develop required transversal skills, to support ongoing employability or to learn how to work with and address complex, 'wicked' problems.

In terms of current engineering curricula and outcomes, there exists a long history of employers' dissatisfaction with the capabilities of graduate engineers, and by implication the academic system which produces them [3]. Moreover, newly qualified graduates often feel 'incompetent' [4], and experience difficulty in transitioning into the workplace as graduate engineers [5] [6]. This is perhaps unsurprising, given that that there is little, if any, correlation between academic performance and success in the workplace [7]. It should, perhaps, be noted that the call for graduates who can 'hit the ground running' with appropriate skills is contested; indeed, previous studies suggest that education is about 'higher skills' which equips students to be leaders in their chosen professions [7] [8]. On the other hand, there is some argument that the development of workplace skills is better done in the workplace [9].

Work-based learning (WBL) is a form of partnership between academia, students and organisations (typically industry) that is and will be an important mode of engineering education to meet the above challenges. WBL embraces different forms of engagement, from placements and internships to a fully co-designed (and co-delivered) programme – a challenge in itself [10]. In terms of co-creation in higher education research has typically considered the dyadic partnership between students and learners and the various levels of engagement [11], whereas in WBL there is a need to engage all stakeholders throughout the design and delivery. In terms of co-creation of WBL programmes, then there are some general guidelines [12], but a gap in terms of models of programme co-design, specifically around work-based learning. Co-creation of programmes is challenging as it involves working across boundaries (whether these are organisational, language or epistemic) and to reap the full benefits of collaboration requires an approach that will facilitate genuine dialogue and consensus building between the partners. Additionally, programme design is complex, as is underpinned by a mixture of wider educational theory including Outcome-Based Learning [13], Concept Mapping [14], and discipline-specific theoretical approaches which have emerged out of Engineering Education Research (for example [15]). Disappointingly in Engineering, course design is often

criticised as being too content focused and a sum of its modules (inputs) [16], rather than a coherent and authentic learning experience [9].

To address the potential deficiencies in collaborative programme design, Signature Pedagogies [17] represents an important epistemological standpoint as it encapsulates an applied pedagogy in which the *habits of 'head', 'hand' and 'heart'* are central drivers in how the curriculum is designed and delivered [18]. These are derived from the things that professional engineers do ('hand'), what they believe and their worldview ('heart') and how they think and engage with knowledge and practice ('head').

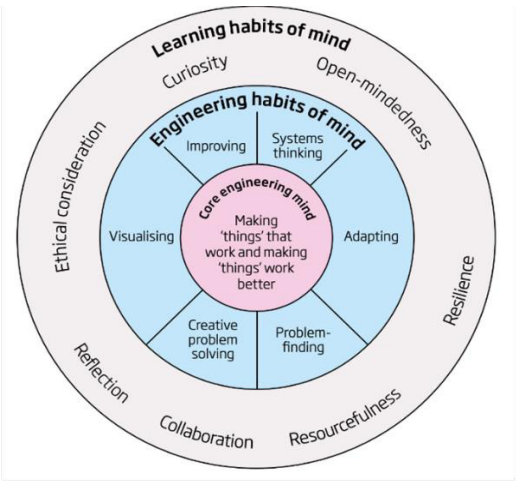


*Figure 1. Engineering Habits of Mind Lucas and Hanson [19]*

Taking this notion one step further and grounded in the Engineering Habits of Mind concept (Figure 1) [19], the approach developed in The University of Warwick represents a holistic model of student development. The focus is on the graduate characteristics in three distinct yet interlinked pillars of curriculum design, representing the affective, cognitive and functional aspects of education that are given equal consideration in developing a more connected and 'holistic' curriculum [20]. This approach has particular applicability in co-design spaces as industrial partners are uniquely well-placed to contribute to the understanding of graduate characteristics in the three areas which are relevant to their context.

Despite Signature Pedagogies having been around for a significant amount of time [17], there has been little evidence of attempts to significantly operationalise the concept beyond it 'informing' course design in largely unspecified ways. This means that the approach taken in this paper relates to a fuller operationalisation of the concept than has hitherto not been the case in the Engineering. The initial implementation of Signature Pedagogy to co-design of an Engineering WBL programme (in the form of Degree Apprenticeships) in the UK has been previously introduced [1]. The onset of COVID-19, when one Degree Apprenticeship was going through significant redesign and another about to enter the design phase, meant that a previously face-to-face approach of workshops, allowing for team building and constant adjustment of artefacts such as flip charts, post-it notes and diagrams to reflect the progress of the thinking needed to be re-imagined. The first challenge was to find an online collaborative environment which allowed for the easy and intuitive creation, combination and re-combination of artefacts representing ideas, concepts,

and processes. Upon investigation several design platforms were identified as viable options with Miro being selected as it was simple, intuitive, had good tutorial support to help staff get up to speed, and was free for academic use.

The second challenge was to adapt the process to an online environment. The principal adaptations were made as follows:

1. ***Using the online space:*** recognition that tolerance for working online is lower than in face-to-face situations. More but shorter group sessions were organised to avoid fatigue.
2. ***Supporting active engagement:*** The team was trained in the use of Miro and the sessions carefully facilitated to ensure that everyone was able to use the tool efficiently, and that everyone was contributing
3. ***Rebalancing the workload:*** elements of the work which had previously done in-workshop were set as homework with detailed guidelines and clear deadlines to allow the next workshop to continue. Staff facilitating this co-design approached, monitored and summarised the work done prior to the next session.

The online co-design methodology is shown below:

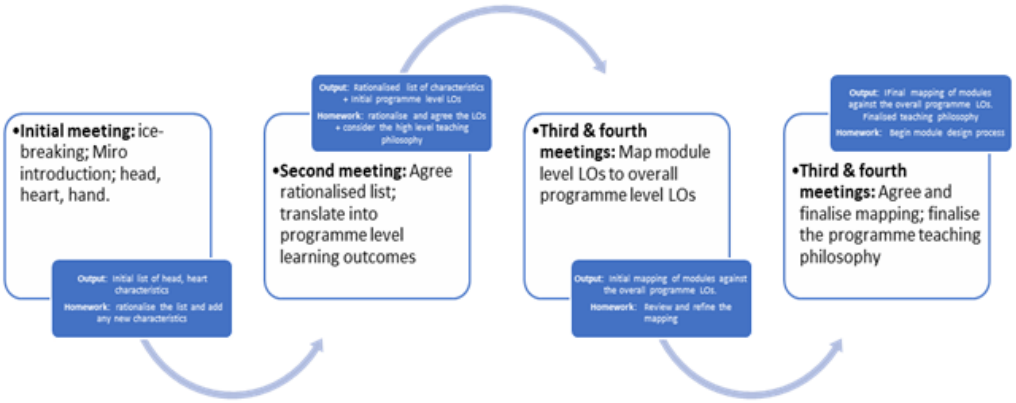


*Figure 2. Standard online co-design process*

In terms of institutions, then The University of Warwick is a member of the Russell Group of research intensive Universities in the UK. Situated in the middle of the UK and has almost 30,000 students registered, it is highly ranked in international league tables, including in employer reputation and targeted by UK employers. The specific unit within The University of Warwick has had a strong focus on academic-industry links, with co-creation being central to its accredited programmes with international employers.

University of Eswatini is located in a small country based in Southern Africa, classified by the World Bank as a lower-middle income country having a young-aged population. However, the distribution of wealth is highly skewed with nearly 60% of the population, predominately from rural areas, living below the poverty line **(**living on less than US$1.9 a day**)** with 20% being considered extremely poor. University of Eswatini has three campuses with 7000 enrolled students across 40 Bachelor's and Masters' degree programmes, as well as two PhD programmes. Its programmes are typically four years in duration (with Engineering being five years), being mainly traditional academic programmes – either delivered on campus or through distance

learning. In the context of this paper, then University of Eswatini has limited experience in the creation of co-designed WBL programme in Engineering, but through a Royal Academy of Engineering funded project that began in 2019, it has committed itself strategically to develop a range of WBL programmes, starting with Electrical and Electronic Engineering. It is in this context, that the methodology previously applied at The University of Warwick was selected to support the co-design during COVID-19 at University of Eswatini, thereby offering an opportunity to compare and contrast the implementations between the UK and Eswatini contexts.

Consequently, this paper aims to answer the question “What considerations are required to support an effective online process to co-design a work-based learning programme in Engineering?” Next, the methodology will be outlined before the initial findings from this research will be detailed, with conclusions and next steps being outlined finally.

## 2 METHODOLOGY

A qualitative methodology was chosen to answer the above research question, by seeking to capture the experiences and insights from those leading the co-design process. In this research, the authors are both researchers and active participants in the process, so collaborative autoethnography has been chosen as it allows reflective and reflexive consideration and shared sense-making of lived experiences. Autoethnography is a qualitative research methodology that has emerged from the authentic exploration of under-represented voices, but it is increasingly being used in areas of professional practice. The research involves the self, a process and culture, and offers an approach that goes beyond autobiographical (personal ‘stories’), as auto-ethnography is about interpreting those stories/experiences – the interplay between the individual and others. As co-design involves different stakeholders, then the interaction between individuals and their context is an important dimension of success. Collaborative auto-ethnography emphasises more clearly the collaborative aspect – where participants seek to explore, outline (and potentially make sense) of shared experiences [21].

Throughout the co-design processes, the co-researchers have made notes about the process, their reflections and experiences – along with what worked well and what worked less well. The co-researchers then have used these notes to write an individual reflection around the experiences that sought to capture views from before the co-design process started (previous approaches to programme design) to their experiences of the online co-design process in Eswatini. These individual reflections were then shared with each other, reviewed separately by each co-researcher, commented on and then individual observations were discussed together in online discussions to extract the main considerations (differences and similarities) between the two implementations. These shared perspectives and insights around key considerations are shared in the findings section.

## 3 FINDINGS

The discussions around the individual reflections highlighted several shared perspectives that are relevant to the research questions, namely the considerations

that influence the on-line co-design of a WBL programme, these being 1) Organisational environment; 2) People and culture; 3) the co-design methodology and 4) Technology and its use in the co-design process. In terms of sharing the findings, we identified that in the case of Eswatini that the knowledge transfer around the co-design methodology and designing the programme happened contemporaneously, so our findings provide insight into both the methodology, and around factors that influence its adoption.

Firstly, any programme development takes place within an organisational context that includes the systems, policies and processes, administrative structures, relationships and roles and responsibilities. It was common in reflections to acknowledge that the existing university programme development processes were often seen as bureaucratic and overly content focused. Additionally, that these processes relied on a small group of academics, with varying levels of engagement with industry and other stakeholders, so any new programme (re)developments were often iterative rather than a stepped change. In essence, don't rock the boat. In contrast, co-design resulted in positive examples of co-operative development that created a shared vision and collective accountability - a positive aspect for the ongoing health of the programme. We recognised that policies and procedures and their embodiment in practice are important, as this can provide a shared language and set of expectations, e.g., around outcome-based design. Without that collective understanding, then collaborative design is more challenging, so establishing common ground between participants is key.

Where commonality is not present then recognising that there is an ongoing change process was viewed as another key consideration. For example, the engaged form of shared development mentioned above required a change – in outlook, and in methodology – and often having the right people in place. Management of change requires sustained levels of senior management support, leadership, time and resources, and accompanying training. The readiness to change is also important. In the case of Eswatini, then having an externally funded project was supportive to such an endeavour, whereas in the UK new standards and a clear institutional vision for a new model brought about a shift in mindset and approach in the team (industry and academia).

Additionally, in co-design, there are not just intra-organisational dynamics but also inter-organisational relationships. In the context of change, then the reflections and discussions highlighted positive and trusting relationships as crucial: between colleagues, across internal organisational boundaries and between organisations. For example, in the case of Eswatini, then key relationships amongst industry and academic colleagues was vital, particularly when there were frustrations (e.g., around pace and progress, as well as understanding their role within the process); they were the lynchpins. The co-design methodology did provide opportunities for sharing and building confidence in each other, but as trust was growing through this process, then we felt that levels of engagement in workshop activities were influenced accordingly.

Encompassing this last point, around relationships and trust, then the second area was around people and culture. Specifically, the importance of having the right people in place, with the required vision, knowledge and relational skills was identified. Whilst leadership - "*champions*" (C2) - was known to be important traditionally, the broader set of skills for co-design amongst academic programme development leaders was expressed by several of co-researchers. As mentioned above, colleagues in Eswatini were learning about the process at the same time as using it. However, core members at University of Eswatini had gained a deeper understanding of WBL through a placement in the UK and ongoing knowledge exchange, and this knowledge around the vision for WBL and the co-design process was key for maintaining progress and answering questions from their academic and industry colleagues. Additionally, these change champions were vital to bridge the differences between industry and academic colleagues, and to highlighting uncertainties and how best to adapt the methodology. In the UK, having both champions in industry and academia was found to benefit the process. Furthermore, the influence of different working cultures on how participants engaged with the development process was evident – with greater asynchronous discussions in Eswatini, as compared to the directness in the UK case in synchronous activities "*I have time in my diary so let's get this done now*" (C6).

The third area was around the co-design methodology. The underpinning concept – Signature Pedagogies – was found to be applicable in both cases. It encouraged greater collaboration and engagement between academia and industry with a focus on the outcome of the programmes, and not on content. Differences between the two implementations emerged around the balance between synchronous workshop activities and asynchronous/offline development – with the UK activities being more focused around synchronous workshop activities with less done off-line, and in Eswatini considerable progress on 'homework' between workshops was achieved (facilitated by change champions mentioned above). As discussed below, some of these differences in implementation may be due to technology limitations, but may also reflect that colleagues were learning about the methodology and applying it concurrently, so the inter-workshop meetings provided a space to reflect and take forward the activities. The time for this new approach was identified as unexpected (due to the need for greater collaboration) with a lesson being that reminding colleagues about the overall vision, process and benefits needed to be repeated several times. Related to this, the division of labour (between industry and academia) represented a change in previous working, with differences between the two cases evident (UK were more comfortable being involved with details of programme design, whereas in Eswatini after agreeing overall programme outcomes, the expectation was for academics to develop the detailed programme for review by industry). Such differences potentially reflect that various levels of engagement are possible in co-creation [11], and that engagement throughout the process appears to be dynamic. Such variation in engagement (and therefore perceived progress) needs to be managed well.

Finally, as this process was conducted online using online tools, then there were technology-related issues. Miro did provide a shared working space in both cases, but was used differently – in UK case for both synchronous and asynchronous work, whereas for Eswatini was a tool for synchronous workshops and a record of consensus building. Additionally, in Eswatini there were technical issue accessing Miro – initially related to firewall configuration – but consistently related to bandwidth constraints. Moreover, for new users of Miro, it takes time to learn how to navigate and use tools, so greater attention needs to be paid to introducing the tool and how to use it before it is used as part of the co-design methodology process. Other online tools (e.g., Padlet) were found to work better for some later activities in the process, so careful consideration to the mix of online tools in each case is another key consideration for future application. Finally, we felt that the online tools failed to develop the same level of relationships, which as identified above is important for the success of this approach.

## 4 SUMMARY AND ACKNOWLEDGMENTS

In response to the research question, “What considerations are required to support an effective online process to co-design a work-based learning programme in Engineering?” then, through a collaborative auto-ethnographic methodology, we have identified four main considerations: 1) ensuring the correct organisational environments (industry and academia) for a co-design approach to succeed; 2) the importance of having appropriate people with the necessary knowledge and skills to lead that process (in both academia and industry); 3) that the Signature Pedagogy approach worked well to facilitate agreement on desired outcomes, but that the detailed aspects of the co-design methodology needed to be adapted to the working cultures and expectations. Moreover, the importance of reminding co-participants around the vision and benefits of this approach, was seen as vital; 4) that different technology tools can facilitate the online collaboration necessary for co-design, but being clear about how tools will be used, and aligning to bandwidths as well as proficiency in these tools is important for their successful use. These findings indicate that this co-design methodology is applicable in a significantly different context with the above identified adjustments.

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