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Do you need to be mad to work here? Reflections on leading extremely large-scale interdisciplinary team project modules

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ABSTRACT

There is a growing acknowledgment that across society and industry, the complexities and uncertainties of today's global challenges cannot be adequately addressed through isolated disciplinary approaches. As accreditation bodies require the addition of more contextual skills-based development into curricula, an increase in team projects, among other things, is a key way to address this. The development of these interdisciplinary and transdisciplinary competencies and skills is challenging since it is affective and connected to the state of "being" of the student. The complexities escalate when classes are scaled up and there is no pedagogical development for lecturers to facilitate these teaching engagements. The skill set required to lead interdisciplinary team project teaching is very different to that of traditional lecture or seminar-based teaching. As part of a broader project on evaluating frameworks and structures for delivering interdisciplinary teamwork at extremely large scale and understanding this modern teaching role, here we will focus on the comparison of the professional journeys of two leading practitioners of large-scale interdisciplinary team project modules. In reflecting on the similarities and differences of our contexts (global north and global south) and approaches, we identify the future direction and needs of this specialist area. This paper aims to start

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a sector-wide discussion of the requirements of this contemporary teaching role, and starts to outline how to better prepare and support those undertaking these roles.

1 INTRODUCTION

Today's problems are multifaceted and interconnected, spanning social, environmental, economic, and other domains simultaneously, requiring different skills for the future workplace (World Economic Forum, 2023). This requires a pedagogical shift towards interdisciplinary education (Van den Beemt et al., 2020) that prepares students for the complexities of real-world challenges by cultivating ways of thinking, being, and practising that transcend traditional disciplinary boundaries (Strachan et al., 2019).

By fostering a learning environment that promotes interdisciplinary thinking and action, universities can nurture graduates who are not only socially aware, empathetic, and emotionally intelligent but also deeply connected, cooperative, and ethically responsible (Strachan et al., 2019; Kamp, 2018). Often these are addressed via active learning methods, such as project-based learning (PjBL) (Feldman, 2006; Gavin, 2011), and in particular the introduction of interdisciplinary team projects (Kolb, 2015, Graham, 2018).

Engineering programs often have large class sizes (300+) due to the subject's popularity and government initiatives aimed at increasing STEM graduates. Teaching such large cohorts using a PjBL framework can be ineffective without proper curriculum oversight and adequate scaffolding of PjBL skills for students (Edström and Kolmos, 2014). Directly scaling methods designed for small classes is not viable due to resource constraints. Consequently, coordinators of large-scale team projects have had to develop or adapt approaches to create and deliver these teaching events (Truscott et al., 2021; Smith and Trent, 2020; 2021).

Alongside the lack of large-scale active learning methods, much of the literature is focused on student experience rather than staff experience in this context (Truscott et al, 2023). This makes it hard for staff who would like to move into teaching interdisciplinary teamwork with their large cohort, to know what to expect or how to get started, particularly as there may be very few people within their institution working effectively in this area.

In this paper, we will start addressing these two gaps in the literature, by comparing the career journey and experience of two well-established and internationally recognized practitioners of extremely large-scale (900+) interdisciplinary teamwork. As a first step we unpack the requirements of this role, identifying the skill set needed and how to better support those undertaking this role.

2 METHODOLOGY

2.1 Context

The two practitioners are situated in leading institutions in the global north and the global south. Both practitioners use active learning, cross departmental teaching frameworks.

The Joint Community Project (JCP) is compulsory for all 1650 second-year students across 18 different programmes in the Faculty of Engineering, Built Environment and IT at University of Pretoria, South Africa. The module aims to develop social awareness, teamwork competency and civic responsibility. Service learning is used as an active pedagogical approach to provide the students with the opportunity for hands-on skills-development within a community context. Each student has 40 hours that is used towards preparation for their 40 hours of field work in the community. Ideally in preparation for their community engagement, students should be observed during their team interactions, as well as their interactions with the community partners (who range from professionals working in NGOs to community leaders in townships) and supported through feedback and an opportunity to repeat the engagement. The scale of the cohort, which breaks down to 350 interdisciplinary teams of 5 students and more than 60 community partners requires carefully designed strategies to ensure authentic development of the students. The two unique strategies are: 1) a vertically integrated mentorship/coaching team of senior students framed as a “company”; 2) a series of scenario based experiential learning engagements.

Engineering Challenges is a very large and complex core module for between 900 and 1000 students from across seven departments within the Engineering Faculty at UCL, UK. It is an interdisciplinary team-based project module taken by a majority of the first-year students within the faculty in term 1 and is central to UCL’s teaching framework. As the first team project experience for our undergraduate students, it aims to introduce them to how projects work and the skills needed to collaborate with others; the module focuses on what engineers do rather than what they know. While the structure and assessment pattern are common throughout the module, the content is tailored for each department to address problems and approaches relevant to that discipline. The module is delivered by a teaching team composed of 15-20 Departmental Leads assigned by departments, 40-50 Postgraduate Teaching Assistants (PGTAs) and a Module Lead working at faculty level. Engineering Challenges is split into two parts, a three week department based individual project and an interdisciplinary seven week team project. For the seven week team project, departments are paired up and work on aspects of an umbrella project, building a TB vaccine production plant in Uganda. Subsequently, the module is more like multiple modules running in parallel, each with different academic staff and content but all set within a common structure. The module is highly structured with a range of support mechanisms for both staff and students, including behaviour modelling, co-teaching and support workshops.

2.2 Approach

Two experienced, extremely large scale, interdisciplinary learning facilitators, located in research-intensive institutions in the global north and global south explored their role, development and challenges using autoethnographic writing (Ellis and Bochner, 1999; Choi, 2012) and a shared narrative inquiry (Chase, 2005). The two facilitators met monthly for the last 6 months to discuss challenges and experiences in facilitating interdisciplinary classes of 900+ students. The intention was simultaneously to share practice as well as challenges in the process of coordinating such a module. Based on these engagements and using questions drawing from a life course approach and reflective practice perspective (Du and Lundberg, 2021) the authors discussed 9 questions that could meaningfully capture their experience.

After these 9 questions had been agreed upon both researchers reflected and answered these questions and then read each other's reflections to further adapt their own. As a final step, both authors spend time discussing each of the question responses and reflecting on similarities and differences that could be identified. Based on these discussions, different themes were identified and shared as a means to unpack the requirements of this role, identifying the skill set needed and how to better support those undertaking this role.

3 RESULTS

In this section we share our findings after our reflections and discussions of the 9 questions.

1. *What motivated your focus/interest on teaching in the context of facilitating large interdisciplinary engineering classes?*

Smith and Truscott, possess a keen interest in personal development and transformation. Smith, trained as a yoga teacher and proficient in various coaching modalities alongside her PhD in Aerospace Engineering, while Truscott transitioned from Organic Chemistry to Chemical Biology and Biochemical Engineering before delving into Engineering Education, with extensive experience in outreach and community engagement.

Smith's teaching experience began with overseeing a 900-student interdisciplinary design module, focusing initially on logistical effectiveness and later emphasising authentic student development through peer support and reflective assessment. Truscott, on the other hand, started with smaller workshops and community engagement activities within an interdisciplinary research context. Her focus shifted towards facilitating communication across disciplinary boundaries, culminating in her work within large-scale educational contexts.

Both facilitators share a common interest in fostering overlooked professional competencies in engineering curricula. They draw from diverse backgrounds to identify specific abilities, guiding students towards expert-level proficiency through reflective engagements. Their diverse professional backgrounds drive their embrace of interdisciplinary teaching approaches, fuelled by curiosity about developing complex skills, particularly in large-scale educational settings.

2. *How did this focus become a significant aspect of your career, and what factors influenced its importance?*

Despite their differing backgrounds, Smith and Truscott share a common focus on facilitating and coordinating large-scale initiatives. They attribute their success to comfort with uncertainty, open curiosity, a willingness to explore new ideas, and a preference for learning through action rather than waiting for perfection—an unattainable goal at scale.

Both value self-reflection and recognize that personal transformation occurs through exposure to diverse disciplines, environments, and interactions, rather than merely through content. They are deeply invested in creating and curating such transformative experiences for their students, albeit challenging at scale. They emphasise the importance of maintaining relational connections, mentorship, and small group engagement, while managing resource constraints.

Smith focuses on streamlining logistical aspects and preserving the personal journey and connections for students within interdisciplinary large-scale modules, whereas Truscott emphasises ensuring the relevance and relatability of such modules to students.

3. Reflecting on your own development/practice, what specific actions did you take to support your ability to run interdisciplinary large scale modules?

Both facilitators inherited an existing module and then evolved it based on their teaching philosophy, experience and external circumstances. They both centred student experience and learning as well as developing methods to structure and integrate learning. They both had to develop ways to leverage limited resources (although it should be noted that Truscott's context in the global north does have more resources available overall compared to Smith's). Both primarily learnt through engaging with others in the Engineering Education community both internally and externally rather than through formal training programmes due to the unusual nature of their modules.

As Smith had more prior experience on teaching at a large scale, she came into Module 1 with a more focused idea of the challenges of large scale teaching and had a range of possible solutions planned. Truscott had less prior teaching experience and had more general ideas on interdisciplinary and skills based teaching. This is reflected in the way each facilitator answered this question, with Truscott focusing on the mechanics of the transition from a research focused role to a teaching one while Smith focused on the decisions that would need to be made within the module to make it efficient and more grounded in Engineering.

4. How do you see your own experiences enable you when teaching in a large scale interdisciplinary classroom?

Both practitioners lack formal education training from their universities. Truscott draws from diverse roles across institutions and contexts, while Smith, with 15 years of teaching experience at University of Pretoria, supplements her development with external training.

They perceive themselves as active flexible problem solvers, able to design structured plans while anticipating challenges and also able to respond to issues and challenges that always arise when one runs projects at extremely large scale. In this role, an indispensable personal attribute involves possessing resilience, characterised by the ability to manage stress effectively, maintain objectivity, demonstrate intellectual curiosity and humility, take risks and embrace failure as an opportunity for learning for both students and yourself.

Both have participated in workshops and groups focused on "large-scale" classrooms, quickly recognising that these discussions typically address class sizes ranging from 80 to 200 students, which differs from the scale they operate within. Learning from each other has been more valuable than any formal or informal training they have attended across their careers.

Both acknowledge the undervalued significance of facilitation roles in academia, often overshadowed by traditional educator or researcher roles, revealing a gap in existing academic structures. While UCL recognizes the researcher/teacher split, it does not acknowledge the teacher/facilitator role, whereas University of Pretoria does not recognize any such distinctions. This lack of institutional understanding

underscores the need to explicitly outline the requirements and demands of facilitation roles. Academic roles tend to compartmentalise and isolate functions, hindering flexibility. Both practitioners identify themselves broadly beyond their scientific or engineering backgrounds.

5. What challenges have you encountered and how did you cope?

Both facilitators encountered similar challenges, specifically regarding communication. The need for clear and effective communication with a large number of students and staff is critical, considering the scale of the cohort and the distinct student-facilitator dynamic compared to smaller classes. The smallest change or disruption at extreme scale can for example lead to 300 emails flooding your inbox overnight. Extreme scale increases the likelihood of encountering unique circumstances, requiring clear rules and processes for both staff and students to navigate effectively.

Another key challenge arises from the diverse range of student experience, knowledge, and skills in interdisciplinary projects, particularly amplified by the large scale. This requires catering to various abilities without the capacity to personalise learning journeys. Combined with the need for clear communication, this results in highly structured teaching and learning and it can limit creativity.

Extremely large-scale teaching has significant logistical challenges which need to be acknowledged and addressed creatively. The specific challenges are context dependent and both facilitators agreed that it was a large part of their role. Efficient module management to avoid excessive personal resource consumption is essential. Proxies in the classroom, such as staff members, external partners, or experienced students are very important. However, this also introduces additional challenges, including the training of these proxies and instances where they deviate from the established process or fail to grasp the intricacies of extremely large-scale teaching.

When teaching at this scale there is significantly more interaction with central administrative processes. There is an extra burden of explaining what is needed, problem solving and crisis management that is not seen in smaller modules. In these large-scale interdisciplinary modules, educational leadership takes on a distinct form, with a significant emphasis on negotiation, lobbying, persuasion, and facilitation due to the complexity of the module's components.

There are contextual differences between the two facilitators which change the emphasis of different challenges. Smith's module size is closer to what is normal at University of Pretoria and so the infrastructure is designed for a similar size. The interdisciplinary nature is not normal. However Truscott's module is extreme for UCL both in size and complexity and so UCL's infrastructure isn't designed for a module like this. Truscott has access to more resources but also has to work within more constraints than Smith does due to the structure of the faculty and the engineering programmes.

6. What do we need from the environment we work in?

The primary factor required by both practitioners was acknowledgement of the complexity and difficulty of running extremely large scale interdisciplinary classrooms. Administrative and logistical support from local (faculty/dept) and central (university level) teams is critical as well as awareness and flexibility that their modules might not fit their typical procedures. It is also critical to communicate any

potential or pending policy or process changes as early as possible. A small change for example in a financial policy at University of Pretoria, led to delay for students' project funding for more than 4 months. It is far easier for smaller modules to fit existing policies and processes, so priority should be given to these extremely large scale modules if any changes are required or suggested.

7. How have you extended your insights to your colleagues and institutions?

Both facilitators have shared their insights with colleagues within their institutions as well as in national and international networks, via informal advice and support, meetings, visits and workshops. They have both started to publish on this unusual teaching role either in journals or at conferences. They have both brought their experience and expertise to the development of new programmes and the scaffolding of skills learning throughout curricula.

8. How do you develop/prepare someone to run a large scale interdisciplinary module?

Emphasis on facilitation skills, emotional intelligence, and ability to manage uncertainty as critical for large-scale interdisciplinary module coordinators. It is essential if possible to shadow and experience such engagements at this extreme scale to understand the complexity and chaos the coordination can be.

9. Looking forward, what do you believe is crucial for future initiatives focused on, and how can these efforts extend beyond the current scope?

Both facilitators agree that robust support systems for those running extremely large scale interdisciplinary team projects are crucial going forward. This includes specialised training for large-scale and interdisciplinary teaching as well as teaching of teamwork, acknowledgement of the very different role and requirements of someone leading this type of teaching and prioritisation of these modules to acknowledge and support the difficulties in logistics. Alongside support systems, institutional recognition of and action on the importance of learning these types of skills and the need for meaningful engagement from both staff and students in these activities.

4 SUMMARY

There are several key themes that can be extracted from the discussion of these nine questions. They fall into four areas, experience and identity, uncertainty, learning through doing and university support.

Experience and Identity

Diverse previous experiences, interests, and training benefit facilitators by bringing a range of skills, concepts, and methods into the classroom. This enables them to connect with students from various backgrounds. Both facilitators are naturally reflective and empathetic, shaping their teaching approach to focus on guiding and facilitating rather than instructing.

Uncertainty

Comfort with uncertainty and adaptability were emphasised throughout the discussion. Extensive planning was also necessary for the module's function,

including contingencies and flexibility for change. Facilitators needed to balance planning with adaptability, being comfortable with not having all the answers but knowing where to find them.

Learning through Doing

Openness to learning and experimentation is crucial in extremely large-scale interdisciplinary teaching where no set methodology exists. Both facilitators learned primarily through engagement with other educators, internally and externally, and through trial and error rather than formal training. They now communicate their insights through workshops, papers, and supporting others. Familiarity and comfort with experimental learning processes also aid in providing better support to students undergoing similar experiences.

University support

Institutional support for the implementation of non-traditional modules and roles must recognize and address several key factors. Firstly, there is a societal demand for individuals to fit neatly into predefined categories, conflicting with the interdisciplinary nature of these modules. Institutions must accept this non-conformity and support module leaders without expecting adherence to conventional stereotypes.

It is also critical that there is adequate agreement and support from both the faculty or department level and central university teams to ensure seamless coordination and operation. Robust logistical processes and clear communication channels are essential to navigate the complexities inherent in these roles. Managing the intricate relationship between central systems, students, and staff further underscores the need for comprehensive institutional support.

Global North/Global South

The differences between the Global North and Global South pose challenges when coordinating interdisciplinary, large-scale modules. These disparities include our starting points, the conditions we work with, and the political situations in our institutions. Even the facilitators themselves face context-specific differences that influence how we adapt our approaches. Understanding and addressing these

variations is essential for successful coordination, ensuring that our efforts meet the diverse needs and conditions in both regions.

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