

## **University of Strathclyde New Approaches Case Study**

### **Main Approach: Industry engagement in design and delivery**

#### **University of Strathclyde**

#### **Programme**

MSc Civil Engineering with Industry: Constructing a Student-led Design

#### **New Approach**

Experiential Learning: Student-led design for field scale construction

The students design and build a structure. Industrialists run design workshops to guide students through the design process, leading to a weeklong construction of the student's design on site (Constructionarium Scotland).

#### **About the programme**

The newly formed and innovative MSc Civil Engineering with Industry at the University of Strathclyde is a project-based, industry-focused master's level qualification. The programme incorporates all of the core modules available to standard MSc civil engineering students with the addition of a student-led design project based on experiential learning.

Students learn directly from industrial practitioners during several design workshops and a weeklong construction to build their own design. During the design process students are required to develop a concept design for their structure, show a full estimate of material costings for their project, interrogate construction drawings of their design, create a program of works and bill of quantities of their design and develop the necessary health, safety and environmental risk assessments.

During the construction week students are required to manage the whole construction process, get hands-on experience of construction activities – such as pour concrete, work with timber, surveying and use reinforcement steel ties – adapt to challenges as they happen and follow construction drawings; including raising technical queries with a professional engineer. Throughout the module students grow into their roles and learn directly from the construction experience.

#### **Overview of the new approach**

- The students design and build a structure.
- The module is taught by industry.
- Students present to industrial mentors who provide immediate feedback during the whole module – design and construction.

The skills the students learn from the industrial mentors go far beyond what is available in a traditional academic environment. The students must learn how to communicate in technical and non-technical language to a variety of participants: industrialists, academics, clients, engineers on site and site operatives.

Students are pulled from their comfort zone to learn about the softer skills that need to be employed to be successful in industry, such as emotional intelligence, planning and communication.

The engagement from industrial practitioners is vital at all stages of the learning journey from initial concept design through to outline design, detailed design and planning for site. The on-site construction is where the students learn about the challenges and the realities of design deliverables and hands-on construction.]

### **How the programme relates to other New Approaches facets**

- Incorporating creativity into engineering. The first task set for students involves creative thinking without calculation. The creative concepts developed by the students are then carried forward into the construction of the structure. They are encouraged to be creative in finding innovative solutions to practical problems during construction.
- A strong emphasis on project work. An authentic design and build experience is the spine of the module – student-led but with industrial advice and feedback throughout the process. Site operatives are on hand to provide guidance to the MSc students who acted as the management team. MSc students are tasked with passing on that guidance to additional volunteers, sourced from local schools and colleges, embedding an authentic project experience into their early education.
- Experience of the workplace for students. On site, the students take on all aspects of construction – they are guided through this by industrialists. Students are presented with design problems that must be overcome and presented to the client, who provides immediate feedback. This builds workplace simulation into the module by replicating real-world industrial feedback at the point of presentation. Live real-time feedback is therefore provided to all students who must adapt as the project moves on.

### **Leading and managing the change**

The new module is led by an academic with industrial experience. This is key to the success of the module. The change in emphasis from purely academic-led assessment and feedback to industrial-dominated feedback in real-time – on the site and in the classroom – is a departure from traditional models of assessment and feedback.

There needs to be a strong linkage between industrialists involved in the planning and delivery of the programme and the academic learning outcomes that result in the award of the degree. This linkage is managed through collaborative working and a people-oriented approach to the module delivery.

Students are encouraged to reflect on their journey to reap the full benefits of this unique programme of study. They are also encouraged to provide feedback to the academics and industrialists on the module content, affording opportunities to manage the development and delivery of this collaborative learning experience and improve the future iterations of the module.

## **Benefits of the new approach**

A notable benefit of the module is that students' confidence in their roles grows as they gain better presentation and communication skills. They are able to operate much more effectively by the end of the module, compared to the start.

The students learn a unique skill set during the programme that enables them to cope with real-world challenges in both design and construction. There are many technical skills learned due to the practical, hands-on nature of the programme. These are augmented by softer skills gained in emotional intelligence, planning and communication, which are all needed for a successful career.

The university benefits in the following ways:

- Galvanises Strathclyde's position as the place of useful learning.
- Increased knowledge exchange with key industrial partners.
- Opportunity to grow this important MSc programme based on the success of the first running of this type of module.
- Broadening of our already impressive portfolio of MSc programmes on offer to both home and international students.

## **Making the changes: learning points**

The unique and rewarding nature of the industrial element of the programme is clear through the progress of the students. There still remains a strong need for academic guidance, particularly in the early stages of the project.

Master's level students struggle to carry out simple design calculations that inform outline design. In this programme they have tended to delve straight into technical calculations that are only necessary for detailed design. The true benefit of an industrial-led, project-based design workshop is that the students are faced with the limits of their own academic learning. The challenges of transferring core theoretical principles to the real world are illuminated to the students through the necessity to "get the job done". A student can proudly present their detailed calculations to the client, but there remains an important question: do the structural details matter when you are performing an outline design?

To get the most from the industrial engagement in the module, students need to be guided through the process of simplifying the problem in front of them to provide a reasonable and appropriate level of detail in the work they carry out. This is a crucial experience for the students and guidance from the academic team is important to help students with the transition from academia to industry.

## **Quotation from student**

"This experience has been immensely beneficial in so many ways that I could simply never have imagined. It's given me the opportunity to improve on many skills and highlighted many other areas where I still have lots to improve on. But equally it's given me insight into how this may be done...and perhaps more importantly given me the incentive and encouragement to do so. I think the thing that caught me by surprise the most – knocked me sideways, if I am honest – was how much it boosted my confidence."

## **Statistics**

- This is the first year of the course, the current students will complete the programme in 2020.
- Five Msc students are currently on the programme.
- There are 12 volunteers on the course varying from school pupils to undergraduate-level engineering students.
- The gender balance is 12 males and five females.