

Canterbury Christ Church New Approaches Case Study

Main Approaches: Industry engagement in design and delivery.

Canterbury Christ Church University

School of Engineering, Technology and Design

Programme

All BEng Engineering programmes with Foundation Year.

New Approach

Industry-sourced inclusive Conceive Design Implement and Operate (CDIO) projects.

About the programme

All the BEng (Hons) with Foundation year in Biomedical/Chemical/Mechanical/Product Design Engineering programmes have been designed with the underlining principles of inclusive engineering and the CDIO approach to learning.

The CDIO education approach has been shown to close the engineering skills gap and produces professional practicing engineers [1]. The engineering educators are also adopting Beddoes Toolkit [2] to ensure the facilitation of good inclusion practice.

The projects have been identified and provided by local industry. The approach is to enable the programme to develop engineering principles and practice of the students, and also enable the students to engage and contribute to local businesses. As all the engineering programmes are newly developed and a new offering to the Kent and Medway region in terms of engineering provision, the curriculums have been co-designed with local industry to support the development of industry-ready engineering graduates.

Overview of the new approach

The programmes integrate the CDIO approach and focus on industry-sourced practical and applied projects. The programme learning on the foundation year is focused on practical work. All modules will make use of the 'flipped classroom' model and online resources are provided to scaffold and support student learning of concepts to solve industrial problems.

Module laboratory sessions provide students the opportunity to explore using the CDIO approach. Students are supported to conceive, design, implement and operate laboratory experiments that prove and support the concepts and theory being learnt in lectures. The aim of the foundation year is to support the student learning by spending more time 'doing science' and hence making the learning more effective and exciting.

The theory and practical learning is developed through CDIO projects. Students have the opportunity to be creative and innovate through these industry-sourced problems with this approach.

How the programme relates to other New Approaches facets

All the programmes have been designed to be inclusive in that they are able to accommodate all protected characteristics of the Equality Act 2010, but ensure the programmes appeal to all, are accessible to all, support and facilitate the learning of all and are inclusive in the curriculum content and operation.

For example, engineering solutions to problems consider all users of the resultant system, not designed for person statistics based on the average white male. The foundation year has been designed to support access to engineering without the usual A-level prerequisites of maths, further maths and physics. Not everyone can access science A-levels in the region of Kent, therefore there is a large disparity of science provision in the UK's south east [3]. The programmes will develop underpinning engineering applied maths and science to support student learning and progression in their chosen field of engineering.

Leading and managing the change

This innovative approach has been possible through the Kent and Medway Engineering, Design, Growth and Enterprise (KM-EDGE) Hub project initiative. The EDGE Hub is an ambitious development to provide a holistic and inclusive approach to addressing regional engineering and technology skills shortages and address sector diversity while promoting participation and social mobility in higher education. The project is helping raise the profile of engineering and technology in Kent and Medway, establishing it is a good place for companies to invest, grow and flourish.

The EDGE Hub project is being led by Professor Helen James, Senior Pro Vice-Chancellor (Education, Enhancement and Student Experience), and has the support of the university's senior management team and governors. It sits across all the university faculties – this is important to back the interdisciplinary knowledge required to support the engineers to appreciate and attempt to solve industry-sourced CDIO projects.

The engineering team can draw upon support from the faculty and university where required. Expertise is available from teaching and research teams in allied health, medicine, sport science, sustainability, education, epistemic insight, psychology, business, media, design and more.

Benefits of the new approach

Students will graduate with a unique set of practical engineering and professional skills that meet the demands and expectations of today's potential employers. Through project-based work that is engaging and industrially relevant, students are given the opportunity to develop their:

- Scientific and technical knowledge
- Creativity
- Practical and problem-solving skills
- Six engineering habits of mind
- Communication, teamwork and project management skills
- Social awareness.

Students are encouraged to realise their full potential and gain the confidence needed as a practicing engineer.

Thanks to this new approach, the university can bridge the gap between traditional engineering pedagogy and real-world engineering demands. Standing out from competitive institutions, the university offers engaging programmes that appeal to the next generation of students who face a very competitive job market.

Making the changes: learning points

- Make sure you give voice to all stakeholders – including industrialists and students.
- Communicate clearly and often with teaching and management staff about the new vision for engineering education. Whenever there is resistance, make sure to focus on the vision.
- Give examples, anecdotes, exercises, practices and projects that are relevant for an engineer and connected to reality.
- Create tasks and activities that foster student/teacher interaction as well as peer interaction.
- Provide the support needed by students for them to fully invest in the process. This is particularly important for new students, who may lack the confidence to engage on an equal footing.
- Include the operation feature in the CDIO project, because this is what closes the creative cycle and connects mind, body and reality. Essentially, this is what others in the sector usually leave aside.

Quotations from students

Student reflections on the CDIO project as part of the Foundation Year General Science Skills module:

“The project enabled me to develop my creativity.”

“The project has helped me to develop good verbal and electronic communication with my group.”

Student reflections on the inclusiveness of the programme:

“The foundation programme was very inclusive; everyone was given an opportunity to learn and contribute in lectures and workshops.”

“The programme was open to everyone and was free from bias.”

Statistics

- Eight of the 10 students on the 2018 BEng (Hons) Chemical Engineering with Foundation Year intake are female and all seven of the BEng (Hons) Chemical Engineering with Foundation Year students are male. Seven of 15 BEng (Hons) Biomedical Engineering with Foundation Year students are female, as are two of the 19 BEng (Hons) Mechanical Engineering with Foundation Year 2019 students. Three of the nine BEng (Hons) Product Design Engineering with Foundation Year students and one of the five BEng Software Engineering students are female.

- Completion of academic year one withdraw, one temporary withdraw, one trailing a module, seven passed BEng (Hons) Chemical Engineering with Foundation Year started 2018. |

References and footnotes

[1] Crawley, E. F., Malmqvist, J., Östlund, S., Brodeur, D. R., & Edström, K. (2014). The CDIO approach. In *Rethinking engineering education* Springer, Cham. pp. 11-45.

[2] Beddoes, K., Panther, G., Cutler, S., & Kappers, W. M. (2018). Training and Resources for Gender Inclusive Teamwork., [online] *Scholarly Comms* [viewed 12 September 2019], available from: <https://doi.org/10.15394/2018.1791>

[3] Nortcliffe, A., Barley, R. and Andrews, J. (2018) Are We (Engineering Education) Missing Engineering Student Potential?, [online] *Proceedings of the 6th Annual Symposium of the UK & IE Engineering Education Research, Network*, [viewed 12 September 2019], available from: https://drive.google.com/file/d/1K6gmuemyQm_vj08HjphMiFnuuwjLdCrg/view |