Educating the Engineering Workforce of the Future

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What are the challenges?

IET Skills and Demand in Industry report 2014:

- 42% of companies report graduates lacking practical experience
- Workplace and professional skills – leadership, communication, working on own initiative, literacy, numeracy and teamwork – flagged as a a particular problem

By 2019:

- 73% of companies report candidates with academic knowledge but inadequate workplace skills (59% at graduate level)
- 86% of companies report technical skills gaps (57% at graduate level, up from 46% in 2017)
- There remains a shortfall in the number of engineers, and a lack of diversity.

What does HE need to do?

Focus on development of intellectual ability in engineering: deploying knowledge in analysis, creating solutions and value, and exercising judgement (Wood & Gibbs 2019)

- Provide knowledge, and technical and professional skills
- Use authentic learning experiences that allow students to make connections, and apply their learning to real(istic) problems

Engage with employers as experts in industry-relevant skills and applications

- Apply pedagogical knowledge to interpret industry needs in curricula

Work with employers and other levels of education to promote engineering

- Start earlier, and adopt a train-the-trainer approach
- Provide resources, aligned with the National Curriculum.

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A positive finding...

81%

agree that **businesses have a responsibility** to support the transition from **education and training** into the workplace, to get people with the **right skills**

What does industry need to do?

Work with education – only 26% of companies report doing this. Scope to:

- Provide authenticity to learning experiences
- Shape learning so it's aligned with industry needs
- Benefit current staff through upskilling opportunities

Strengthen and expand placement and work experience provision

- Good numbers of year in industry opportunities – and uptake increasing
- Harder for students to get shorter placements, e.g. summer work (IET reports less than 40% of companies offer work experience to university students) – focus tends to be on lack of immediate value to business, but there's great value to students and this builds the pipeline
- Opportunities for academic staff to have industry experience

Help us to fund these initiatives – but that's not necessarily very expensive: £1-5k goes a long way!

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Some examples from Sheffield – SELA

SELA works in partnership with industry to develop selected high-potential engineering undergraduate students into leaders of tomorrow

Programme of skills workshops and guest speakers to build skills and knowledge

Experience in industry

Integrative projects

- Year-long, real projects, with deliverables and a budget
- Link students with real issues locally and nationally, so they can see their impact and recognise their agency
- Space to practise, check understanding, and integrate learning.

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Examples of projects:

- **Promoting STEM to young people**, linking engineering with the National Curriculum by creating an escape room-style lunar base, and an augmented-reality museum installation – reaching 12,000+ people;

- **Industry 4.0 adoption**, addressing the decline in manufacturing by creating an energy monitoring solution for an SME manufacturer, demonstrating efficiencies to initiate conversations with other manufacturers;

- **Urban Sensing and Climate Change**, utilising urban sensing research to effect attitudinal change, establishing 'Urban Champions' to influence children and their caregivers;

- **Budget challenges in health and social care**, networking digital technologies to support independent living, whilst considering ethical issues.

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Partnership with industry is crucial: shaping the projects, mentoring the students, introducing networks, etc.

Students greatly value the experience (Habbershaw, Sharp & Wood 2019):

- 'Focus shifts from grades to output value'
- 'Connects learning to applications – so we can practise and recognise value'

Value to industry:

- "The students came from multiple disciplines … [they] bring new skillsets and help us innovate, using new ways of thinking. … The business has changed. We look at things in a new way. We're looking at how we can actually introduce some of the changes that the students have suggested."

Some examples from Sheffield – MEC

SELA's model has influenced our development of a new curriculum for our Mechanical Engineering degree programme

Also guided by input from industry partners, our recent graduates, and students returning from year in industry

New structure includes:

- Engineering Science modules, to retain 'outstanding' technical ability

- Semester-long projects to integrate learning across modules and simulate industry application of knowledge

- Reduced, but more meaningful/authentic assessment – at the project level rather than modular level

- Integrated spine of professional skills development, with increasing autonomy and responsibility for students – empowering them to take responsibility for their own CPD, and preparing them for chartership.

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Conclusions

- Clear success with students, educators and industry working in partnership – partnership is crucial

- Authentic or real learning experiences greatly enhance students' preparedness for the workplace

- We need the reconsider the transition from HE to industry:

  • HE prepares students to be professional engineering graduates, not specific types of engineers – there will always be a need for industry induction and development

- We need to take a longer-term view, if we are going to solve the numbers problem.

References

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Thank you!

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