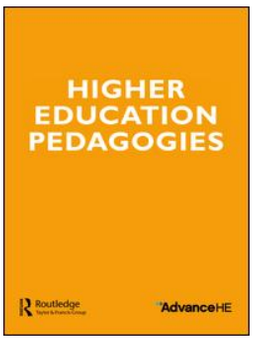

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Opinion piece: ensuring an effective higher engineering provision for STEM engaged applicants

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ABSTRACT

This paper is positioned at the junction between the requirements of the manufacturing industry for a significantly increased number of professionally registered engineers in the UK employment pool and the excellent work which is ongoing in and around the education sector to encourage more young people to follow a career in this field. Higher Education (HE) is a natural stepping stone between these two stakeholder areas of the skills pipeline and has an opportunity to make a unique contribution to ensure an effective HE engineering provision for Science, Technology, Engineering and Maths (STEM) engaged applicants.

KEYWORDS

Skills Gap; STEM; HE

Paper

Engineering UK, published a conservative estimate of an annual shortfall of twenty two thousand degree qualified engineering graduates entering the UK workforce until 2024 (Engineering UK, 2018). The shortfall is due in part to an aging workforce and while it is extremely difficult to make an exact assessment of this figure, the scale of the issue is highlighted in the results from a recent skills survey (Institution of Engineering and Technology [IET], 2017). The report cited that 55% of participating UK based companies expressed a real concern that recruiting the necessary skills in sufficient number is a threat to their businesses. If the shortfall is left unaddressed for these companies the required staff base will not be available to develop new products or service the ongoing needs of order books. This problem will be amplified for many companies who require an evolving skill set due to emerging requirements associated with industry 4.0. Issues such as big data and cyber security were traditionally seen as cross-sector skills rather than a core consideration of a manufacturing engineer for example (Strutt, 2016).

The *Review of Engineering Skills* (Perkins, 2013) made a number of recommendations to government and as a result has become a reference point and it has informed numerous initiatives to engage young people and raise awareness of the engineering profession. At the time of its publication, the UK was still very much feeling the negative effects of the global financial crisis which reached its peak around 2007–2008. Perkins highlighted the challenges facing industry in terms of the shortage of skills necessary for the UK to work towards reaching its financial potential. Perkins also emphasised throughout his report the importance of professional registration and drew attention to the many and varied routes to achieving this

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end goal. The options are largely split into academic or vocational pathways but with potential cross over between the two the number of permutations can be bewildering for those navigating their way along this journey. Despite the shortfall in people with the necessary skills, diluting the skills and knowledge of graduates in any way was not seen as an option to increase numbers; achieving professional registration Perkins stressed is relevant to industry and should remain as an industry benchmark.

In the five years since the Perkins report was published, the routes to professional registration remain largely unchanged. However, since the advent of University Technical Colleges and with a current prominence of higher and degree level apprenticeships, the boundaries between academic and vocational 'routes' are being challenged as distinct options. This notion is supported by *Our plan for Higher Education*, (Newton, Laczik, & Percy, 2017) in which the provision of higher education is not disputed but explicit challenges are set out to the sector to ensure that by the time of graduation, students have experienced meaningful careers advice and there are a number of decisive employability interventions as an inherent part of their programme. While these efforts are to be applauded, the introduction of T-Levels due in 2022 may reinforce the divide between academic and vocational education pathways. Further changes are also anticipated following the recommendations for government set out in the *Review of Post-18 Education and Funding Review*, (Augar, 2019). Although only recommendations at the time of writing, there are distinct boundaries highlighted between the Further Education and Higher Education sectors.

Over recent years, there have been a number of activities to raise awareness among young people of the skills gaps in engineering and present the sector as a viable and attractive career choice. A common theme of these initiatives is to provide opportunities for young people to experience engineering and therefore be in a position to make an informed choice. Such initiatives are both co-curricular and extra-curricular and include STEM Ambassadors scheme, Primary Engineer, STEM Clubs, Maker Faire, FabLab to name only a few. The main difference in the pre HE education landscape is therefore, the way in which young people engage in applied ways with the subject, this is increasingly taking place in informal ways outside of the classroom. Added to this, the digital context in which millennials live provides access to open-source (free) software and relatively low priced hardware which combine to make the possibility of designing and manufacturing working prototypes in a domestic situation a distinct possibility. Engineering UK (Engineering UK, 2016) presented an encouraging position that in 2016, 51% of young people aged 11–19 would now consider engineering as a career. This figure raised from 40% in four years which is a promising step in addressing the shortfall. The same report also highlights the importance of addressing the gender imbalance for engineering with only 16% of engineering and technology undergraduate entrants being female. Irrespective of gender however, HE is therefore a pivotal link in the skills pipeline and so pedagogic styles must also evolve to ensure that the needs and expectations of contemporary students are met. Failure to do so, may result in a lack of cultural relevance and possible alienation of students. HE should look to extrapolate the work of earlier initiatives when building knowledge and skills to meet the subject benchmarks and UK-SPEC for accredited degrees. Problem and Project based learning are seen as ways in which HE can address these challenges. The benefit is not only limited to knowledge and skills but provides development opportunities for

professional acumen. With a basis on technical fundamentals, problem solving, team working, innovation and creativity within political and financial constraints are much more akin to the 'work-ready' attributes of professional engineers entering their careers (Barge, 2010). University College London, Coventry University and The University of Warwick are three UK based examples of engineering departments offering 'real-life' or 'real-world' projects embedded within the curriculum. The inclusion of such pedagogical styles with more 'open-ended' assessments is an aspiration to many HE institutions, it must be recognised that realistic or indeed real life scenarios are already widely adopted in curricula and STEM engagement activities in education of 14–19 year olds. University Technical Colleges (https://www.utcolleges.org) are one example. Innovation within an isolated module will not be a challenge to many practitioners of HE; for those educating in engineering however, successful curricula design at programme level will also be required to achieve the requirements of UK-SPEC as defined by the Engineering Engineering Council (2014). Careful planning and design will permit accreditation of HE programmes and supports the progression of graduates towards full professional registration. How this is achieved must be contextualised to the culture of each institution, examples included in this paper range from an establish PBL approach across an entire institution to isolated interventions within modules. Another popular approach is to have dedicated periods of study where traditional class are suspended in favour of project based assignments. As the diversity of education options increased from ages 11–19, further consideration should also be made for individuals in HE to engage with a bespoke range of activities and initiatives to achieve the holistic programme learning outcomes.

Disclosure statement

No potential conflict of interest was reported by the author.

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