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Using the perceptions of chemical engineering students and graduates to develop employability skills

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ABSTRACT

Recent years have seen increased global industry sector demand for chemical engineers, subsequent growth of Chemical Engineering (CE) degrees, producing additional qualified graduates. The Confederation of Business Industry have regularly indicated that employers are dissatisfied with skills sets offered by graduates; a 2004 World Chemical Engineering Council (WCEC) survey of experienced and newly employed chemical engineers' perceptions of their own work skills indicated highest importance for general transferrable skills, with technical knowledge ranked considerably lower. A decade later, we investigate whether chemical engineers, both employed and in education, have similar skills perceptions, by surveying CE undergraduates in penultimate and final years of study, and CE alumni employed in CE roles; all from the University of Strathclyde. Again, transferrable skills were perceived as most important to respondents; as undergraduates gained industrial experience, a shift in perceived relative importance of technical knowledge occurred, again similar to the WCEC survey, otherwise, alumni and students had similar opinions regarding perceived degree of learning of various skills. Alumni were more critical of the quality of education with regards to management and transferrable skills, while female participants perceived business skills as undertaught, feeling considerably overexposed to the potential of research compared to male colleagues. Focus groups showed that male undergraduates valued '*technical knowledge*' and '*communicating professionally*'; by contrast, female graduates highlighted '*initiative*' and '*business skills*'. Consequently, training sessions were developed, focussing on transferable skills identified as important by all groups, to be delivered during academic year inductions, aligning skills to year curricula.

1. Introduction

Chemical Engineering (CE) is a versatile discipline, both in education and employment. The taught curriculum is varied, offering problem solving, design, control, management, materials science, safety, economics and environmental impact, in tandem with CE fundamentals, which all prepare students for a range of roles within industry and research. This accrual of knowledge, in itself, is only part of the educational process, which ideally also sees students develop key transferable skills required within chemical and engineering industries. Often, such 'soft' skills are latent within the curriculum with the consequence that participants may not immediately perceive the degree of learning or of opportunity to learn. Hence, students are encouraged to engage with professional development activities to reflect on their own progress. However, it is also essential for staff, as educators, to similarly understand when and how such transferable skills are being developed.

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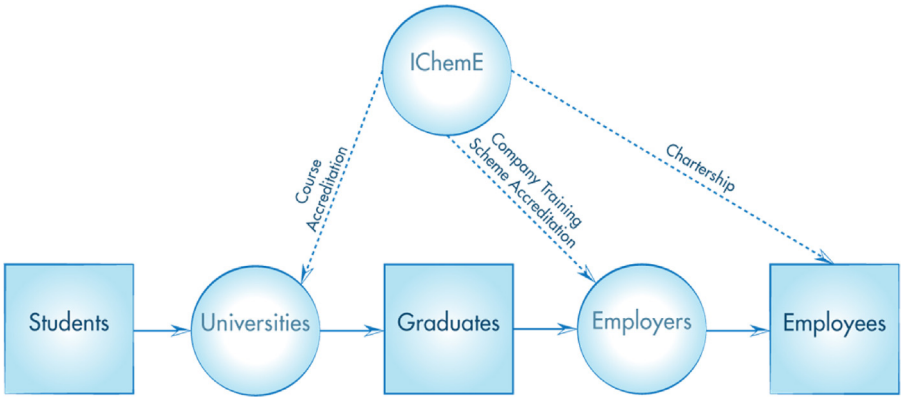

Fig. 1 – The route from CE student to employee and the various agencies involved.

In the UK alone, there has been an overwhelming increase in interest in CE degrees. Successively from 2000 to 2014, CE degree intake has seen growth. In 2013, there was a record 2790 enrolments on CE courses across the UK compared to 1820 enrolments in 2010 (UCAS, 2015). With this growth in student recruitment, it is vital that the CE student cohort is provided with a high quality education, fit for industrial standards. As with many other disciplines, a professional body will often accredit university courses for quality assurance but such accreditation alone may not perfectly capture the success or otherwise of 'latent' skills development. This paper focusses on understanding the perceived skills development and shortages within the recent CE degree programme delivery at the University of Strathclyde (UoS). By canvassing recent undergraduates and Strathclyde alumni, the aim is to understand those skills perceived to be under taught within the current programme and how these may be further developed within the current curriculum.

2. Background

2.1. *Institute of Chemical Engineers (IChemE) Course accreditation*

The global professional body of membership for chemical engineers is the Institution of Chemical Engineers (IChemE), who provide accreditation of university degree courses and company training schemes, and award qualifying members with chartered status (Fig. 1) (The Institution of Chemical Engineers, 2012). Other engineering accrediting bodies take a similar role to the IChemE such as the Accreditation Board for Engineering and Technology (ABET) and Engineers Australia (EA) for chemical engineering programs within their respective countries and internationally too. The IChemE aim to ensure that the CE workforce remains skilled and, as an accrediting body, bring their experience of best global practice when assessing institutions and awarding chartership to members (The Institution of Chemical Engineers, 2012). Accreditation has the benefit of worldwide recognition for CE courses and provides a comprehensive benchmark with which CE departments and courses are evaluated. Accreditation also benefits students, with a structured route to chartered status once employed and satisfying the experiential requirements for chartership. Consequently, documentation is available from IChemE (The Institution of Chemical Engineers, 2012) that provides a thorough framework to which all participating institutions must adhere to if they wish to seek accreditation, wherein IChemE adopt an approach based on learning outcomes (LOs) as opposed to being content-driven, which has been the general paradigm shift across engineering education (Fitzpatrick et al., 2009; Felder et al., 2000a; Felder et al., 2000b). LOs focus on the student; highlighting the expected skill or capability, but not necessarily the method or content with which it must be achieved. As a result, this gives academia greater flexibility in teaching, however, it can be hard to explain the exact subset of skills developed in cohorts and assessing some outcomes can prove difficult. Furthermore without explicit knowledge of LOs, learners may not be aware of the aims of, or meet the requirements to achieve, these LOs (Fitzpatrick et al., 2009).

Nevertheless, accrediting bodies such as the IChemE, ABET and EA, have adopted and outlined outcomes in their respective guidelines. Some of the similar outcomes found in available documentation (The Institution of Chemical Engineers, 2012; Engineers Australia, 2005; Engineering Accreditation Commission, 1999) have been highlighted in Table 1.

2.2. *University of Strathclyde Chemical Engineering Department*

In line with the global trend, the University of Strathclyde (UoS) has seen significantly increased student enrolments in their undergraduate CE degrees, with a doubling of student intake over the past ten years (Fig. 2). Strathclyde's CE degrees

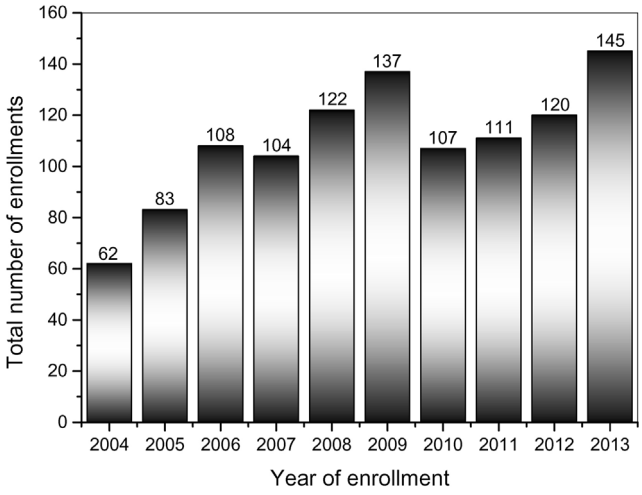

Fig. 2 – Enrolments to Year 1 degree programmes offered by the Department of Chemical and Process Engineering, University of Strathclyde, from 2004 to 2013

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