



Development of key skills and attributes in chemistry

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For decades employers of chemistry graduates have been expressing dissatisfaction with the preparedness of graduates for the workplace (Coldstream, 1997; ACCI, 2002; Andrews and Higson, 2008; Lowden *et al.*, 2011). Rather than specific gaps in chemistry knowledge and understanding, they usually cite deficiencies in what are usually referred to as key, generic or transferable skills. These skills usually include problem solving, critical thinking, communication, team working, time management, flexibility, independent learning, numeracy and information technology (Dearing, 1995; HM Treasury, 2006; Prinsley and Baranyai, 2015). Recent studies have surveyed new graduates in their first post-university role and have found compelling evidence for these skills gaps (Hanson and Overton, 2010; Sarkar *et al.*, 2016). Despite the fact that these issues have been well known for many years there has been little research published on the development of these skills within the chemistry curriculum. That is not to say that there has not been much effort in developing innovative learning resources and pedagogies that support the development of these key skills, as there undoubtedly has, and our undergraduates are now exposed to activities designed to

develop key skills much more often than they were a generation ago. However, much of the chemistry education research literature still focuses on enhancing the knowledge and understanding of chemistry itself rather than developing skills through the study of chemistry. The aim of this themed issue is to try to address this imbalance. The call for contributions has unearthed some well-designed research programmes with interesting outcomes that should be of value to colleagues across chemistry.

Several papers in this themed issue focus on student perceptions of skills, their attitudes and their aspirations whilst other authors have tackled measuring and rewarding skills development. Canelas *et al.* (C7RP00014F) report students' increased self-reported learning gains in transferable skills following a flipped classroom. Ogunde *et al.* (C6RP00248J) focus on students' self-efficacy and career aspirations and find some interesting geographical and gender differences. Galloway (C7RP00011A) explores undergraduates' perception of employability skills whilst Danczak *et al.* (C6RP00249H) provide interesting insights into undergraduates, academic and employer descriptions of critical thinking. Yuriev *et al.* (C7RP00009J) provide useful insight into helping undergraduates succeed in problem solving whilst Harsh *et al.* (C6RP00222F) describe an instrument that can be used to measure students' scientific thinking skills. The laboratory is not neglected in this issue with Seery (C7RP00003K) describing the award

of digital badges to recognise skills development.

Collectively, these contributions provide an insight into students' perceptions of transferable skills, of their aspirations and motivations as well ideas on how to enhance or measure their skills development. We hope this themed issue provides a focus and stimulus for further research in this important area.

References

- Andrews J. and Higson H., (2008), Graduate employability, 'soft skills' versus 'hard' business knowledge: a European study, *High. Educ. Eur.*, **33**(4), 411–422, DOI: 10.1080/03797720802522627.
- Barton A. C. T., Australian Chamber of Commerce and Industry [ACCI], (2002), *Employability skills – an employer perspective*, Canberra, Australia.
- Coldstream P., (1997), Chemistry Education for a Changing World, *Univ. Chem. Educ.*, 15–18.
- Dearing R., (1995), *Skills For Graduates In The 21st Century*, Cambridge: The Association Of Graduate Employers.
- Hanson S. and Overton T., (2010), *Skills required by chemistry graduates and their development in degree programmes*, Higher Education Academy Physical Sciences Centre.
- HM Treasury, (2006), *Leitch Review of Skills: Prosperity for all in the Global Economy – World Class Skills*.

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- Lowden K., Hall S., Elliot D. and Lewin J., (2011), *Employers' perceptions of the employability skills of new graduates*, London, UK: Edge Foundation.
- Prinsley R. and Baranyai K., (2015), *STEM skills in the workforce: What do employers want?* Occasional Paper Series, Canberra, Australia: Office of the Chief Scientist.
- Sarkar M., Overton T., Thompson C. and Rayner G., (2016), *Int. J. Innov. Sci. Math. Educ.*, **24**(3), 31–48.