

Threshold learning outcomes (Note [†])

Universities have long enjoyed the academic freedom to set their own curricula and standards. In contrast, schools and TAFE institutions have had to conform to external curricula and standards. However, Universities will now have to meet the Higher Education Standards Framework, administered by the Tertiary Education Quality and Standards Agency. Standards for academic knowledge content and skills will be based on the Threshold Learning Outcomes (TLOs), which represent minimum outcomes.² Conceptually, TLOs are the achievements of graduates, who have only just passed their university units. The average graduate would achieve much more than these thresholds.

In 2010, the Australian Learning and Teaching Council (ALTC) appointed Professors Susan Jones and Brian Yates as Discipline Scholars for Science, and charged them with the task of preparing a set of science TLOs, which would apply to a range of disciplinary areas, including: agricultural sciences, biological sciences, chemical sciences, earth sciences, environmental sciences, mathematical sciences, and physics and astronomy. Discussions between the Discipline Scholars, the Australian Council of the Deans of Science, RACI President-Elect Professor Mark Buntine, and others, resulted in chemistry being one of only two science disciplines to have a separate working party to adapt the science TLOs and, if appropriate, define additional TLOs. During 2010-2011, much work was done on the chemistry TLOs, including a RACI-sponsored workshop in February 2011. The resultant chemistry TLOs are included as an appendix to the Science TLOs, which were published by the ALTC in September 2011.² Since then, the Chemistry Discipline Network³ has been given the task of refining the chemistry TLOs, and making the TLOs into standards. Three ChemNet-sponsored workshops have been held in September 2012, December 2012 and February 2013.

The chemistry TLOs are grouped into five statements, related to: (TLO 1) understanding the culture of chemistry; (TLO 2) scientific knowledge; (TLO 3) inquiry, problem solving and critical thinking; (TLO 4) communication; and (TLO 5) personal and social responsibility. Part of the challenge is that the TLO statements need to be sufficiently specific that they are meaningful, but also sufficiently general to encompass the various chemistry degrees at different Australian universities. At the same time, the TLO statements are not intended to define any syllabus or curriculum. For example, every chemistry graduate would be expected to have threshold knowledge about chemical bonding (a key idea and understanding that underpins TLO 2.1), but some students might achieve mastery through the context of the structure and reactivity of organic molecules, while another university's students might gain equivalent understanding via quantum mechanics in a more traditional physical chemistry setting. In another example, all chemistry graduates would be expected to be appropriately documenting the essential details of procedures undertaken, key observations, results and conclusions (TLO 4.2), but the statements cannot prescribe a particular technology or medium for the documentation, or exclude as-yet-unpredicted advances in technology.

The TLOs will better define the essential skills and knowledge in a chemistry degree. What is the nature and extent of chemistry? The chemistry TLOs will differentiate chemistry degrees from other degrees. A side-benefit is that they will also help employers better understand the difference between diploma-level, bachelor-degree-level, and other qualifications.

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Four of the five chemistry TLO statements address skills and capabilities that can be used in various contexts, including non-chemistry workplaces. Since a chemistry degree is a prerequisite for Chartered Membership of the RACI, the TLOs will help us better promote the value of a chemistry degree.⁴

All RACI members are invited to contribute to the chemistry TLOs and accompanying notes. Reports about the chemistry TLOs are available from ChemNet <<http://chemnet.edu.au>>. You are also invited to participate in future workshops planned for mid-2013 and September 2013, the latter at the Australian Conference on Science and Mathematics Education (Canberra). For further information, please contact the ChemNet TLO Working Party: Simon Pyke (Chair, Adelaide), Ian Jamie, (Macquarie), Kieran Lim (Deakin), Danielle Meyrick (Murdoch), Glennys O'Brien (Wollongong), Siggie Schmid (Sydney), Chris Thompson (Monash), Richard Thwaites (RACI), James Mitchell Crow (ChemNet Project Officer, <james.mitchellcrow@qut.edu.au>).

- 1 K. F. Lim, "Threshold learning outcomes", *Chem. Aust.*, 2013, **2013 (March)**, 35.
- 2 S. Jones, B. Yates and J.-A. Kelder, *Science: Learning and Teaching Academic Standards Statement*, Australian Learning and Teaching Council, Strawberry Hills (NSW), 2011 <<http://www.altc.edu.au/standards/disciplines/science%3E>>.
- 3 M. Schultz and J. M. Crow, "Networks: Networking for the next generation", *Chem. Aust.*, 2012, **2012 (February)**, 38.
- 4 M. A. Buntine, "From the President", *Chem. Aust.*, 2013, **2013 (March)**, 28.

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