

# Jo Ward, ACDS – Science Threshold Learning Outcomes

## Key points

- General comments – and then present a case study.
- Science Learning and Teaching Academic Standards (LTAS) Project has catalysed the **review, refinement** and **reinvigoration** of science curricula at (some) Australian universities.
  - It has led to an enhanced focus on TLOs (and indeed CLOs – where universities wish to demonstrate their points of differentiation) as a major tool for curriculum review and design.
  - It is also contributing to process of adapting science education to meet the needs of society in the 21<sup>st</sup> century.
  - This has had a very significant impact in an environment where arguably what we as scientists have been trying to do is to ‘calculate everything’ ... but possibly being able to explain little!!
  - The ACDS Executive agenda has been able to get deans of science to agree that we must agree on minimum (threshold) standards, and we must address the issue of how we can demonstrate that these have been achieved by graduates.
  - The Science threshold learning outcomes set the framework for development of learning objectives for individual science degrees, which cascades to individual subjects.
- **Benchmarking:** Importantly, it is expected that the Science TLOs (and their more specific Discipline counterparts) will be an important element used by TEQSA and Government as the benchmark for learning outcomes for science and mathematics degrees in Australia; that is for assessing L&T performance in Australian Universities. Messages from the Chair of the Higher Education Standards Panel, Alan Robson, suggest that this is likely.
  - This is great news as the TLOs have been developed by the science/discipline experts.
  - However, it also means that it is imperative that Faculties of Science now consider how TLOs will be expressed in their curricula and **how evidence for the achievement of threshold standards can be collected**. This last point is really critical, and I’ll say more about this later.

- I should note that as far as I know, the Science TLOs have not been used to benchmark courses or to develop achievement standards yet across universities. I understand that Business (through Mark Freeman's work on moderation) is much more advanced.
- How has this been achieved ...
  - The ACDS recognised that in order to advance this agenda it required buy-in from key staff.
  - The ACDS Executive developed strategies to engage the Deans / Associate Deans of T&L in Science – workshops, conferences, etc ...
  - The ACDS has also recognised the need for discipline level interpretation of the TLOs ... hence its support of discipline networks ....
  - And most recently, the ACDS has established a group to dig deeper .... What must we address?
- **Embedding:** Embedding the Science TLOs in course level learning outcomes is certainly happening at some institutions.
  - The TLOs are being used in the same way as university graduate capabilities – primarily for mapping the curriculum and as principles for subsequent course design.
  - **Variation:** There is considerable variation in how this is occurring:
    - Through a defined curriculum review process?
    - Across all science offerings?
    - On a more discipline focused basis – on the back of a discipline champion?
- Examples:
  - The University of Tasmania has **mapped their science curriculum against the Science TLOs** (LTAS @ UTas) led by their three discipline scholars, Brian Yates, Sue Jones and Jonathon Holmes.
  - The **Science TLOs were used as reference points for the redesign of the B Sc** at University of Western Sydney with the mapping done using Beverley Oliver's mapping tool.
  - An alternative approach is to **align the Science TLOs to other reference points.**

- Peter Meier at University of Technology, Sydney **mapped the Science TLOs to the UTS institutional graduate attributes and then used the GAs for mapping**, noting at the same time the relationship to the Science TLOs.
  - A similar approach was used by Cristina Varsavsky for review of the B Sc at Monash University. Cristina **aligned the AQF learning outcomes with the Science TLOs** and asked disciplines were asked to report against the aligned learning outcomes as part of the periodic self-review of the B Sc.
  - Liz Johnson at La Trobe reports that she used a similar approach as their big curriculum reform process was well underway while the Science TLOs were being developed. She aligned the **Science TLOs against the institutional graduate outcomes**. She is in the process of a gap analysis and, not surprisingly, it is TLO 1 **understanding science** that is most difficult to identify in assessment. She observed that staff think it is implicit in the curriculum but that they have little evidence one way or the other.
  
- **But what does it mean to embed TLOs in curriculum design and assessment?**
  - If I can simplify the approaches described above ...:
    - Determine TLOs
    - Map attributes to **current** assessment items across course/units/subjects.
    - If all Attributes are covered by at least one assessment item in one unit/subject then breathe a sigh of relief ... all is OK!!
  - But does this work ...
  
- Let me tell you a story of an OLT project: *After standards: engaging and embedding history's standards using international best practice to inform curriculum renewal* – (UNSW, UQ and UNE). This is not about Science – but almost certainly applies to it, as well as to other discipline areas including IT.
  - The project abstract states: The new threshold learning outcomes (TLO) and the new standards environment that TEQSA will oversee, present History with both a significant challenge (navigating the new environment when the discipline

has no standards experience) and a unique opportunity (using the TLO's promulgation to drive cognate agendas around curriculum renewal). This project will model, demonstrate and evaluate approaches and processes in dissemination and implementation that will be applicable to other discipline communities.

- The major finding of this project was that TLOs cannot be retro-fitted!!
  - What does that mean ... that we are very unlikely to be able to demonstrate that graduates have met course TLOs on the basis of existing assessment practices.
  - They demonstrated this by looking at a sample of courses across a number of universities – in each case, the university was happy that the TLOs had been appropriately embedded and that they could demonstrate that graduates met the TLOs.
  - Most of the assessment items in use were 'traditional' assessment items.
  - When a detailed analysis of those assessments was made for the CWA 50% type student – few had demonstrated achievement of the TLOs.
- So what is the message here ...
  - The TLOs must be central to what we do.
  - We must teach to the TLOs.
  - We must assess to the TLOs.
  - We must be able to provide documentary evidence that the TLOs have been met!!
  - The design of assessment is critical.
- What is the message I wish to send in relation to implementation?
  - Identify TLOs
  - Then consider how / what we need 'to teach'?
  - And the most appropriate assessment methods, remembering that we need to be able to provide evidence of achievement.
  - And don't be afraid to trial and review!!!
- What we are working on:

- Development of **exemplars** of:
  - learning activities that will support students to achieve TLOs
  - assessment tasks that will allow educators to demonstrate that their students have met the TLOs
  - 'student friendly' versions of the TLOs so that students better understand the value of studying science – and this needs to apply even if they do not wish to become a professional scientist.
- Challenges:
  - Identification of local champions
  - More general staff development