

AUSTRALIAN COUNCIL OF DEANS OF SCIENCE

Network of Associate Deans (Teaching and Learning)

1. Introduction

In a historic first, the ACDS, under the leadership of Professor John Rice, has facilitated and supported a meeting of associate deans (teaching and learning) in the natural and physical sciences. The meeting took place on June 5-6, 2008 at the Marquee Hotel in Sydney, with participants representing 24 universities.

This first meeting of associate deans (teaching and learning) with responsibility for innovation and promotion of quality in undergraduate science education within their institutions, has already proven highly valuable for the exchange of innovative practices and the discussion of current issues.

This paper provides a summary of the meeting, outlines the key emerging issues, and concludes with recommendations for the way forward.

2. Proceedings of inaugural meeting

The two-day program included segments for the dissemination of new developments and sharing of good practice, and time slots for the discussion of hot issues identified by the participants. Networking was also a big part of the meeting; there was not enough time to meet with every participant, but it was a good start.

A brief summary of the structured component of the program is outlined below.

The ACDS ALTC (ex Carrick) Project

Presenters: *Prof Sue Thomas (UCBR), Prof John Rice (UTS) and Dr Paddy O'Toole (Flind)*

The project "*Re-conceptualizing tertiary science education for the 21st century*" conducted by the Australian Council of Deans of Science and funded by a Discipline Based Initiatives Pilot Grant from the AL&TC (Australian Learning and Teaching Council, formerly The Carrick Institute). At the broadest level the project is embarking 1) on an investigation of the precise role of laboratory classes in science courses, 2) the graduate attributes obtained from a science degree that are not obtained in other courses of study and 3) the relationship between these two questions, if any.

The project has commissioned a review of literature exploring the purpose and role of laboratory classes in tertiary science. It has revealed such a literature for secondary school science but little for tertiary science education.

The major part of the project is a pilot study of first year laboratory subjects in nine universities. The design of the pilot study is three by three; Physics, Biology and Chemistry laboratory subjects

are investigated in separate universities from each of the Go8, IRU and ATN. In each case interviews are conducted with Department Heads, Subject Coordinators, demonstrators and students. Subject documents are analysed, and some laboratory observations conducted. So far, seven universities have been visited and fifty-two interviews conducted. The research study uses a qualitative approach, and the methods of analysing the interview data were briefly explored.

The presentation concerning this project provided some 'snapshots' of data collected so far. These are not findings and will almost certainly be modified and perhaps overturned in some cases as the investigation continues. What seems to be emerging so far, however, is:

- An almost universal rejection of the idea that science could be learned without direct laboratory experience.
- Significant differences in the level of support for group/team work as opposed to individual work.
- Wide variations in demonstrator training that appear to affect the achievement of learning goals.
- An absence of explicit overall learning objectives for the laboratory component of subjects as opposed to individual experiments.
- No consensus on the relationship between theory and laboratory work.
- Little appreciation or even interest in the potential of ICT to transform laboratory classes, although there were some notable instances where this was addressed.

Innovation in learning spaces for science

Presenters: *Prof Gordon Sanson (Monash) and Prof Mick Mc Manus (UQ)*

Professor Gordon Sanson talked about the redevelopment of a lab space in the School of Biological Sciences at Monash University to create an environment conducive to more meaningful and interactive learning experiences. Professor Sanson stressed the need to rethink the approaches to teaching 'Generation-Y', and highlighted the importance of academics working in partnership with industry to influence the development of new technologies for teaching.

Professor Mick McMannus talked about the new inquiry-based Bachelor of Science introduced at Queensland University, and emphasized the need to re-conceptualise the learning spaces required for supporting students to get a sense of what it means to be a scientist. Professor McMannus showed some examples of such learning spaces, in particular spaces in the College of Minnesota and in his own institution.

Bioassess and Threshold concepts (ALTC Project)

Presenter: *Dr Charlotte Taylor (USYD)*

The project Bioassess (now completed) consisted of pulling together ideas and resources for teaching and learning in biological sciences. The compilation of these resources involved talking to tertiary teachers across Australia to learn about how they approach teaching and assessment in biological sciences. These resources are freely available on a website within the ALTC domain: www.bioassess.edu.au.

Reflecting on the process of carrying out the Bioassess project, Dr Taylor concluded that the team worked very well despite meeting mostly online, and that having a dedicated project officer was crucial to its success. A byproduct of the project was the establishment of a network of academics who participated in workshops, and who now can come together to embark on other projects. On the other hand, a drawback of the project is that the resources are hosted within the ALTC website; this website is static and hence does not allow for updates and further improvements.

The second project reported by Dr Taylor was *Threshold concepts*. This project, still at its early stages, sets to explore and articulate how biologists work, think and teach, with the aim of improving student understanding of key concepts in biological sciences. As in the previous project, this work is being done through meetings and interviews with practitioners around Australia. The long term aim is to develop a model for the teaching of key concepts in other disciplines.

Scientists Leading Scientists (ALTC Project)

Presenter: *Dr Karen Burke Da Silva (Flind)*

This project sought to improve teaching and learning in science, by increasing the value that research-active scientists placed on teaching. The project, which involved the three universities in Adelaide, set to change institutional culture to support scientists in developing their leadership skills in teaching and learning and, more broadly, to improve teaching and learning of science.

An important aspect of the project was to bring scientists together to help each other in increasing their scholarship of teaching. This approach was based on the fact that participation of scientists at teaching conferences and professional development programs is typically very low; these are seen by scientists as too generic to be relevant to them.

Progress towards the project aim was achieved by identifying twenty good teachers at the three participating universities. Targeted professional development was provided for these academics to form a critical mass of leaders who would be empowered and energized to increase the scholarship of teaching in science within their working environments. These twenty leaders organised a symposium where exemplars of good teaching practices were presented by leading scientists from around the country. Participation at this conference was very high, proving that scientists leading scientists is a successful model for raising the profile of teaching amongst science academics.

Physclips (ALTC Project)

Presenter: *Prof Joe Wolfe (UNSW)*

Physclips is a multimedia resource for supporting the learning of first year physics concepts. The project deliverables are five web modules freely available online (www.physclips.unsw.edu.au) covering key topics in mechanics, electricity and magnetism. The modules are based on video clips of demonstration of key concepts, with access to different levels of explanations and analysis of the topics.

The modules are designed to be used in lectures or as an additional resource to be used by students outside structured classes.

ACELL

Presenters: *Prof Scott Kable, Dr Justin Read, Prof Geoff Crisp*

The Australian Chemistry Enhanced Laboratory Learning project provides a large data base of chemistry experiments which are validated by practitioners around Australia through a rigorous process which includes student and academic staff evaluation. The project also provides professional development workshops to increase the standard of teaching and learning in chemistry. In addition, by involving academics from all around Australia to share their experiments, ACELL has enabled the development of a national community of practice in chemistry education.

Discussion followed around the applicability of the ACELL model in other areas of science. The issue of whether other discipline areas would fit inside the existing ACELL framework or they would need to have their own framework developed became the focus of the discussion. It was commonly agreed that there were likely to be sufficient differences between discipline areas to

warrant development of individual frameworks (a group of physics educators are already considering adapting the model to their area), but it was acknowledged that it would be highly desirable to keep the broad ACELL structure, i.e. to 'franchise' the ACELL framework into other areas, and to maintain a broad oversight of such activities. A possible model suggested was ASELL ('science' rather than just chemistry) as the oversight project. Further discussion is needed about how to progress this concept.

Discussion of hot issues

Three issues were given priority for formal discussion within the program:

1. How do you deal with teaching improvement and innovation in a research-intensive university? [Facilitator: Simon Pyke (Adelaide)]

Participants identified the followings key impediments and conditions for success to advancing the teaching and learning agenda:

Key impediments

- Many academics are too focused on their own research
- Difficulties with measuring the quality of teaching (current ALTC project should assist with this)
- Lack of shared vision of how teaching influences research
- Universities often impose unrealistic connections between teaching and the (financial) sustainability of the organisation
- Perception that teaching has lower status than research
- Perception that promotion criteria favour research
- Perceived or real lack of time
- Funding models
- The arrogance (ego) factor – "I am great researcher therefore I am a great teacher"
- A lack of knowledge on how to engage their (academic's) 'research brain' in their teaching (and evaluation of it) – a lack of scholarship in teaching
- Diversity (i.e. both teaching and research) is insufficiently valued
- Lack of reward for good practice (as per points above)
- Belief that teaching is an innate skill (i.e. it cannot be learned)
- Support (as against demand) for excellence from the top of institutions is often missing
- Legacy of emphasis on research (as per points above)
- Lack of budget control (unlike research)
- Status of education publications is significantly lower than research publications

Conditions for success – Breaking through the barriers

- Benchmark against other universities to overcome limitations of metrics
- More flexible promotion processes – i.e. higher weighting of teaching
- Implement more meaningful processes to evaluate teaching and programs
- networking of associate/deputy deans and practicing academics
- Need to extend to teaching the peer review that is already expected in research (mentoring would be required to do this)
- Creation of teaching and learning institutes (eg Charles Sturt)
- Establish teaching communities of practice (e.g. ANU) – peer based sharing on teaching
- Increased leadership from the top
- Teaching leadership appointments (e.g. UQ)
- Increased professional development options
- Linking "top" students to researchers

2. Research experience in undergraduate curriculum [Facilitator: Shelly Yeo (Curtin)]

The facilitator conducted an interactive gap analysis discussion that aimed to identify effective ways to engage undergraduate students in research. The statement “Research = Systematic enquiry made public” was used as the kernel of the discussion.

Participants identified the required **critical research attributes of graduates** as:

- the ability to critically evaluate the literature
- the ability to think independently
- curiosity and creativity
- the need to be ethical human beings
- having well-developed communication skills
- having the capacity to design
- having well-developed analytical skills

However undergraduate students at entry can be typically characterised as **lacking many critical attributes** that prevent them from successfully engaging with research. In particular they lack:

- logical and structured thinking
- higher order thinking skills
- independence
- responsibility for their own learning
- the ability to pose a good question
- the ability to free themselves of the need for a right answer for everything
- understanding of the role of science and scientists
- the ability to recognise learning as an objective
- maturity and ability to organise themselves
- confidence (need to feel that they are allowed to make mistakes)

Filling the gaps – Making it happen

- give students the chance to see/engage with research
- essential to get students to feel a sense of belonging (‘cohort building’)
- train them to take ownership of their project
- provide motivation
- practice in communication skills
- use problem-based learning with real problems
- provide formal teaching and assessment in team work (as most research takes place in teams)
- need to shift from ‘transmission model’ (students are ‘empty heads that need to be filled’) – instead give students the space to exercise their own minds
- provide adequate administrative support to help make it happen
- support students in their intellectual growth
- make sure students know their teachers are researchers by building this into our teaching from first lectures
- make clear differences between experiments and examples used in teaching, and the original discovery
- use relevant and real world applications
- use scaffolding to build research skills (www.adelaide.edu.au/clpd/rsd)

In discussion, it was recognised that addressing many of these issues will have significant resource implications. This will require commitment to put the resources behind such activities – the hard thing will be what we give up in order to fund these.

3. How to fully integrate generic skills developments into the science programs? [Facilitator: Emma Gyuris (James Cook)]

This session took a brief look at generic skills delivery within Science programs with the view to identify good practice as well as problem areas.

- Most participating institutions gave formal recognition to the need to develop generic skills (aka graduate attributes, personal, transferable, core, generic, common and work or employment related skills).
- The relatively high significance to employers of generic skills as against discipline related skills is well recognised by all
- Typology of generic skills is diverse and varied, but the problems for operationalisation, implementation and measurement seem to be common

The session also tried to gain insights into the following:

- For science faculties, how valid is the fear (identified in the literature) that only 'lip service' is being paid to the many skills that build graduate attributes?
- How systematic is the inclusion of these skills into the curriculum?
- How well planned is the development of generic skills/ graduate attributes across year levels within majors and programs?
- How effectively are staff teaching, practising and assessing the generic skills targeted in their subjects?
- Do students and institutions recognise/measure the extent to which graduates acquire generic skills?

The themes emerging from these semi-structured discussions and the discussions held informally throughout the meeting are highlighted in the next section.

3. Emerging themes

The conference outcomes can be aggregated into four themes:

(i) Perceptions about the importance of teaching and learning

The perceived low status and lack of career pay-offs flowing from efforts in teaching and learning were seen by all as a significant barrier to improving engagement with and the quality of teaching and learning.

(ii) Perceptions about the challenges of teaching and learning

There is a clear need to rethink and redevelop pedagogies that provide for the needs of 'Generation-Y'. This places unforeseen demands on teaching staff at a time when we are all required to do more with less (less time per student, less funding per student, sector-wide erosion of infrastructure).

The second major challenge to Science faculties at present is the decline in the number of students. To address this challenge and deliver a sustained improvement requires a sector-wide integrated approach. The network of Associate Deans L&T is a significant forum at which such integration of approaches and ideas can happen.

(iii) Institutional commitments: Financial and organisational

Improvements in teaching and learning outcomes are greatly influenced by a) how organisational culture values teaching vs research, and b) how critical infrastructure developments facilitate improved outcomes of student learning. As an example, significant variation in the appointment conditions of associate deans (teaching and learning) was identified in terms of fraction of time allocated to duties, clarity of role, level of support (induction, professional development, budget etc).

(iv) Cross-institutional cooperation

In an environment of relentless competition at all levels of academia (between universities, and between faculties and schools of the one university) several examples of cooperation (two of which were facilitated by the ALTC) emerged as examples worth expanding upon. *'Scientists Leading Scientists'* (cultural transformation raising the profile of teaching), *'Physclips'* and *'ACELL'* (alleviating the need to keep reinventing the wheel) will continue to provide benefit to multiple institutions and will aid in improving the standing of science education overall (recognised by all present as an urgent national priority).

Participants also noted that learning and teaching projects tend to be done in isolated pockets, and that their impact would be more effective if they were part of a national network for enhancing learning and teaching in science.

4. Recommendations

We recommend that:

- ACDS continue supporting at least annual meetings of associate deans (teaching and learning)
- All science faculties/divisions have an associate deans (teaching and learning), and that these be actively engaged in this network.
- Deans support their associate deans (teaching and learning) on projects and activities related to the network of associate deans (teaching and learning) (e.g. travel expenses for visiting other institutions, paying for invited speakers from other institutions, organising and/or attending regional activities, etc.)
- Associate deans (teaching and learning) are provided with the support necessary to allow the effective discharge of their roles in the continued improvement of teaching and learning outcomes of their faculties¹.
- ACDS establish a framework to support the strategic development of new initiatives to enhance science teaching and learning outcomes across all Australian Universities. In particular, that through this network, ACDS take an active role in influencing the definition of priorities for science projects funded by the Australian Learning and Teaching Council. As an example, it is recommended that ACDS assist in fostering the 'franchised' expansion of ACELL into ASELL.

Associate Deans (Teaching and Learning)
of ACDS member institutions
September 2008

¹ Southwell et al. (2008). Caught between a rock and several hard places. Cultivating the roles of the Associate Dean (Teaching and Learning) and the Course Coordinator. A report for the Carrick Institute for Learning and Teaching in Higher Education. 190 pp