

Chemistry Discipline Network

Final Report 2013

Queensland University of Technology

Report prepared by Co-Director

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Chemistry
DISCIPLINE NETWORK

<chemnet.edu.au>

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Network summary

The Chemistry Discipline Network was formed to improve the teaching of chemistry at Australian Universities through the creation of a community of practice among chemistry academic staff. In addition, we were tasked with overseeing the implementation of the Threshold Learning Outcomes (TLOs) for Chemistry, which were published at the time of our formation (late 2011). We have close links to the Royal Australian Chemistry Institute (RACI) and our members have worked on linking the TLO process to the RACI accreditation process for chemistry degrees.

Network Outcomes

- A landscape profile of the chemistry curriculum taught across 12 institutions around Australia in 2011. This profile reveals both similarities and important differences in content taught and provides a starting point to inform discussion of what content should be taught, within TLO 2.1.
- A detailed map of the whole chemistry degrees at three Australian institutions in 2011 against the chemistry TLOs. This map shows that work needed to be done to ensure that all TLOs are taught and assessed, and some TLOs seem to be particularly problematic.

These two outcomes are described in detail in the paper Schultz, M., Mitchell Crow, J., & O'Brien, G. (2013). Outcomes of the Chemistry Discipline Network Mapping Exercises: Are the Threshold Learning Outcomes met? *International Journal of Innovation in Science and Mathematics Education*, 21, 81-91.

- A website including a calendar of upcoming events, discussion fora and a resource repository. The website has both public areas (for the calendar and released reports) and login areas (for minutes of meetings, discussion fora and internal information).
- Significant progress in defining and clarifying the nature and extent of the chemistry-specific TLOs, TLO 2.1 (principles and concepts of chemistry) and TLO 3.3 (laboratory practice). These outcomes resulted from a series of face to face meetings of chemistry academics held during 2012 and 2013. They are to be published as the Chemistry Academic Standards Statement by the Office for Learning and Teaching. One of our members, Kieran Lim from Deakin University, wrote an article about this process for the magazine of the RACI, Chemistry in Australia (Lim, K. F. (2013). Threshold Learning Outcomes. *Chemistry in Australia*, Mar, 35.).
- Seed funding of eight small projects (<\$5 K) at eight different Australian institutions to help chemistry academics conduct and publish the results of chemistry education projects, our Catalyst Grants. The funded projects were diverse in scope, aims and institutions and are still in progress; reports will be available in 2014.
- Multiple connections between individual academics around Australia that will outlast the Network. These are difficult to quantify but will be evident in future chemistry education publications and applications for OLT grants.
- Creation of an inclusive, cooperative and open community of practice within the chemistry education community in Australia.

The final outcome represents the core achievement of the network, it has been described in an article in the newsletter of the Higher Education Research and Development Society of Australasia (Schultz, M. (2012). The chemistry discipline network: background, benefits and challenges. *HERDSA News*, 35, 4-5.) and in two Chemistry in Australia articles (Schultz, M., & Mitchell Crow, J. (2012) Networking for the next generation. *Chemistry in Australia*, Feb, 38. and Schultz, M. (2013) Mixing research and teaching, *Chemistry in Australia*, Jul, 30-31.). The outcomes of our first year were also described in a paper published in a special issue of the Australian Journal of Education in Chemistry, on Networks in Chemistry Education (Mitchell Crow, J., O'Brien, G., & Schultz, M. (2012). The Chemistry Discipline Network: One Year on. *Australian Journal of Education in Chemistry*, 72, 6-8.).

Contribution to learning and teaching

The Network has contributed in many ways to the learning and teaching of chemistry at Australian universities, including providing fora for discussion among chemistry academics. These fora include monthly skype meetings, online discussion fora and multiple face to face meetings, both at the Australian Conference on Science and Mathematics Education and three dedicated working group meetings. Through the exchange of ideas in these fora, individuals have modified both their teaching strategies (eg using POGIL or clickers or lecture demonstrations) and content (eg using different laboratory experiments).

The Network has also encouraged research in the Scholarship of Teaching and Learning in the area of tertiary chemistry, both by enabling people with similar interests to connect formally and informally, and through funding eight small Catalyst grants for members to complete and publish their projects.

One of our goals was to engage with and improve communication between academics at smaller, regional universities who are often isolated and in very small chemistry departments. Academics from UNE, JCU (Cairns), Ballarat and SCU joined the network, attended several of our meetings and discussed their teaching with others, evidencing the impact of the Network in this area. Three of the eight Catalyst grant holders are at regional universities.

Factors contributing to productive networking

The Network achieved an unprecedented level of inclusiveness, with a final total of 130 Network members, all of whom hold chemistry academic positions around Australia. All of our face-to-face meetings included members from at least 12 different institutions and several meetings had over 30 attendees, representing over half of the Australian universities at which chemistry is taught. This excellent turnout allowed the Network to discuss issues for regional universities, non-research intensive universities, as well as research-intensive (including Go8) institutions. This level of engagement reflected a need for some mechanism to bring academics together to share ideas and perspectives, which the Network met.

Crucial to the success of the Network was an active and energetic champion who was able to progress Network goals, host skype meetings and keep things running even during busy teaching periods. Communication, and particularly sharing information obtained through a wide variety of channels, via monthly emails, kept the Network moving. Although all academics receive many emails, we are also adept at prioritising and replying to important messages. Keeping the emails to the whole Network monthly meant that they were neither too long nor too frequent.

Barriers to productive networking

There were two major factors that represented significant barriers to networking in Australia and the Network enabled opportunities to overcome these with mixed success.

Distance

The sheer scale of Australia is a challenge for arranging face-to-face meetings but this hurdle was evident even within the same city. Combined with the hectic academic calendar it was difficult to have virtual or face-to-face meetings with a large number of members simultaneously. This meant that some members had to rely on second hand information about the outcomes rather than contributing directly to the workshop meetings.

Our attempts to breach the distance included regularly scheduled skype meetings, with a reminder sent the day before, so that anyone who was available could attend. This resulted in turnouts up to 18 people. We also held multiple face-to-face meetings and covered travel

costs for some of these to ensure a representative turnout. Finally, we scheduled our general meetings to coincide with the Australian Conference on Mathematics and Science Education, to which a reasonable number of our members were already travelling. In addition, at each of those meetings, a list was prepared of all chemistry academics in the host city (2011: Melbourne, 2012: Sydney, 2013: Canberra) and a personal invitation was sent to each of those people. This allowed people who had previously had no contact with the Network to participate in a meeting and become involved in the Network.

Time

The monthly skype Network meetings provided an opportunity to overcome the issues with distance; however, the fluctuations in numbers reflects the demands on academics' time and the difficulty in establishing a common time that is valid across a 12 month academic calendar. Participants engaged when they were not teaching, and feedback indicated that they valued the opportunity to have this option for discussion. Detailed minutes and other notes covering the outcomes of all of our meetings (including minutes of the skype meetings) were made available on the website for those unable to attend.

Activity on our website was much less than originally envisioned; although 60 members registered for log in and password access, the discussion fora were used by less than 15 members in total. It seems with all the other calls on their time, academics do not have time to engage in such asynchronous discussion of their teaching issues.

What the network offers

The Chemistry Discipline Network can be a mentor and matchmaker to people new to educational research. It includes a massive repository of experience in the members who are senior in the Australian chemical education community and who have been publishing in the Scholarship of Teaching and Learning (SoTL) for many years. For academics who are new to SoTL and for those who have already been working in the field, the Network has proved to be a way to generate fruitful discussions and to get to know people (in person and virtually).

The Network also offers a central point of contact to the large group of Australian chemistry academics who are interested in improving their teaching. This group includes research-intensive and teaching-focussed academics at all levels. Using the Network as an organiser has allowed the process of elucidating the TLOs to be inclusive and representative. The Network has been recognised both by the Royal Australian Chemical Institute and the Australian Council of Deans of Science as the key player in establishing standards and assessment of threshold learning outcomes, and helping develop new accreditation standards.

Not for publication

Office for Learning and Teaching

Networks

Final Report – Part 2. October 8, 2013

Chemistry Discipline Network SI11-2118

Queensland University of Technology

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Please refer to the document, *Project Management Information*, available on the OLT website,
<http://www.olt.gov.au/grants-and-projects/project-management>.

Project summary data

Network Details	
Network Reference No.	SI11-2118
Network Title	Chemistry Discipline Network
Amount funded (ex-GST):	\$100 000

1 Network outcomes

Please tick the box (✓) where the statement is applicable to your Network.

1. Consultation and collaboration with external groups or other institutions during the Network funding period.	✓
2. Provision of information through material on a website or conference presentations.	✓
3. Provision of information through peer-reviewed publications such as journal articles.	✓
4. Provision of information through a publishable report.	✓
5. Potential for any Network outcomes to be adopted into practice in the discipline or institution of the Network team within one year of completion of the funding period.	✓
6. Potential for any Network outcomes to be adopted into practice in disciplines or institutions outside the Network's discipline or institution within one year of completion of the funding period.	✓

2 Potential for ongoing engagement and systemic change

Please tick the box (✓) where the statement is applicable to your Network.

1. Potential for the Network leader to remain engaged in the Network, and change learning and teaching practices in higher education.	✓
2. Potential for the Network team to remain engaged in the Network, and change learning and teaching practices in higher education.	✓
3. Potential for the department/school/faculty or institution of the Network leader/team members to remain engaged in the Network, and change learning and teaching practices in higher education.	

3 Events

Provide details of Network events held, including those reported upon in the Year 1/Stage 1 Report. Events include workshops, forums or colloquiums involving participants outside of the Network team.

Event date	Event title and host city	Brief description of purpose of event	Number of:		
			Participants	HEI represented	Other institutions represented
2011: 29/9	Discipline Day, U Melbourne	First meeting at ACSME	31	20	
30/11	skype meeting	first meeting, design of meeting structure	8	7	
2012: 10/1	Dan Bedgood visited Brisbane	design of mapping pilot	2	2	
25/2	skype meeting	update to members	19	13	
28/3	skype meeting	update from working groups	10	8	
2/5	skype meeting	update from working groups	9	8	
20/5	skype meeting	update from working groups	7	6	
27/6	skype meeting	general discussion	4	2	
2/7	Symposium Adelaide	Discussion on Benchmarking and standardised exams to assess chemistry	85	30	
19-20/7	ACDS L&T conference, Sydney	Meeting of Deans of Science with leaders of Discipline Networks	50	20	
25/7	skype meeting	general discussion	10	9	
29/8	skype meeting	general discussion	6	5	
26/9	Discipline Day, U Sydney	Workshop on how to assess TLOs at ACSME conference	35	20	
3/10	skype meeting	general discussion	10	8	
31/10	skype meeting	general discussion	10	8	
28/11	skype meeting	general discussion	8	8	
12/12	TLO to standards	to articulate the concepts and principles of chemistry for TLO 2.1	15	12	

	workshop, Sydney	with a broad participant base and ownership from the chemistry academic community			
2013: 30/1	skype meeting	general discussion	12	12	
4/2	TLO to standards workshop, Sydney	(i) coming to agreement on the 4-5 statements for each big idea from the December 12 workshop, (ii) considering how to express these as standards to be met and (iii) considering how to evidence achievement or competence for each of the statements and big ideas	25	19	
22/2	ACDS Advancing the Science TLOs meeting (Melbourne)	Participants addressed the current state of the Science TLOs to standards and assessment process.	48	25	
27/2	skype meeting	general discussion	7	6	
27/3	skype meeting	general discussion	7	7	
24/4	skype meeting	general discussion	10	9	
29/5	skype meeting	general discussion	8	8	
26/6	skype meeting	general discussion	14	14	
9/7	TLO to standards workshop, Melbourne	the purpose of laboratory exercises in chemistry, what learning outcomes we hope to achieve from laboratory exercises, and examples of exercises that contribute to specific TLOs.	18	15	
31/7	skype meeting	general discussion	10	9	
28/8	skype meeting	general discussion	6	6	
19/9	Discipline Day, U Canberra	Workshop on how to assess TLOs 1.1 and 5.3 at ACSME conference	35	20	1
25/9	skype meeting	general discussion	4	4	

4 International collaboration

4.1 List international links and describe their contribution to the Network.

Members of the Network are involved in an international project funded by the International Union of Pure and Applied Chemistry (IUPAC) to benchmark the use of learning outcomes internationally. This link has contributed an international perspective to our TLO to standards work and allowed us to calibrate ourselves against similar work in other regions.

4.2 Provide details of any international fora where the Network has been represented, including those reported upon in the Year 1/Stage 1 Report.

Event date	Event title	Location: city and country	Brief description of participation
July 2012	International Conference on Chemistry Education	Rome, Italy	oral presentation on the formation and goals of the network
June 2013	Gordon Research Conference on Chemical Education	Rhode Island, USA	dissemination of our Network's activities
July 2013	Variety in Chemical Education conference	Limerick, Ireland	oral presentation on the formation and outcomes of the network
August 2013	World Chemistry Congress	Istanbul, Turkey	oral presentation on the formation and outcomes of the network

5 Names of key stakeholders and how they were involved in or engaged with the Network

Richard Thwaites: Chair of Accreditation Committee and President of Victorian Branch, Royal Australian Chemical Institute. Richard attended several of our TLO to standards meetings and has also contributed by email.

6 Outputs

6.1 List any outputs or materials incidentally arising from the Network and how they may be accessed, noting that the focus of Network funding is not output-based.

Include reports, websites, conference papers and journal articles.

Website: chemnet.edu.au

Reports on website:

Report from Chemistry Discipline Network Mapping Exercise
[http://www.chemnet.edu.au/sites/default/files/files/Report_Mapping_Chemistry_Australian_Universities\(1\).pdf](http://www.chemnet.edu.au/sites/default/files/files/Report_Mapping_Chemistry_Australian_Universities(1).pdf)

First Report from Chemistry Discipline Network Threshold Learning Outcome Mapping Exercise
http://www.chemnet.edu.au/sites/default/files/files/Report_TLO_Mapping_Chemistry_Australian_Universities.pdf

Conference papers:

Schultz, M., Buntine, M., Lawrie, G., O'Brien, G., Schmid, S., Southam, D., & Yates, B. (2012). The Australian Chemistry Discipline Network: a Forum for Sharing. *International Conference on Chemistry Education*, Rome, Italy, July 20-25, 2012.

Buntine, M., Lawrie, G., Mitchell Crow, J., O'Brien, G., Schultz, M., Schmid, S., Southam, D., & Yates, B. (2013) The Australian Chemistry Discipline Network. *Eurovariety in Chemistry Education Conference*, Limerick, Ireland, July 3- 5, 2013.

Schultz, M., Schmid, S., Buntine, M., Lawrie, G., O'Brien, G., Southam, D., & Yates, B. (2013) Combining Research with Teaching: The Australian Chemistry Discipline Network. *44th World Chemistry Congress*, Istanbul, Turkey, August 11-15, 2013.

Journal articles:

Schultz, M., & Mitchell Crow, J. (2012). Networking for the next generation. *Chemistry in Australia*, Feb, 38.

Schultz, M. (2012). A personal reflection on the formation of the Chemistry Discipline Network. Guest Editorial. *Australian Journal of Education in Chemistry*, 72, 5.

Mitchell Crow, J., O'Brien, G., & Schultz, M. (2012). The Chemistry Discipline Network: One Year on. *Australian Journal of Education in Chemistry*, 72, 6-8.

Lim, Kieran F. (2013). Threshold Learning Outcomes. *Chemistry in Australia*, Mar, 35.

Schultz, M. (2013). The chemistry discipline networks: background, benefits and challenges. *HERDSA News*, 35, 4-5.

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Schultz, M., Mitchell Crow, J., & O'Brien, G. (2013). Outcomes of the Chemistry Discipline Network Mapping Exercises: Are the Threshold Learning Outcomes met? *International Journal of Innovation in Science and Mathematics Education*, 21, 81-91.

6.2 Outputs by category

Enter the number of outputs in each category, as appropriate. Include published and 'in press work', but exclude 'forthcoming' and 'submitted' work.

A1	Book—authored research	
A2	Book—authored other	
A3	Book—edited	
A4	Book—revision/new edition	
A4	Book—translation	
B	Book chapter	
C1	Journal article—articles in scholarly refereed journal	2

C2	Journal article—other contribution to refereed journal	1
C3	Journal article—non-refereed article	4
C4	Journal articles—letter or note	
D	Major reviews	
E1	Conference—full written paper—refereed proceedings	
E2	Conference—full written paper—non-refereed proceedings	
E3	Conference—extract of paper	
E4	Conference—edited volume of conference proceedings	
E4	Conference—unpublished presentation	3
F	Audio-visual recording	
G	Computer software	
H	Designs	
I	Patents	
J1	Major creative works	
J2	Creative work included in group exhibition, performance, recording or anthology	
J3	Exhibition curatorship	
K	Other academic outputs e.g. websites other than those listed above	3

6.3 Has the Network or team members won prizes, or awards as a result of the Network?

If yes, give details.

7 Additional feedback

As this report is for the internal purposes of the OLT only, Network holders may have comments, additional to those in the final report for publication.

7.1 Factors critical to the success of the approach

Having an energetic and committed champion was crucial to the success of our Network.

7.2 Factors that impeded its success

The website was envisioned as the heart of the Network but was never adopted by the majority of members. Online discussion fora lack the immediacy of a skype meeting, and reports posted to a website are not accessed frequently compared with email attachments.

7.3 General lessons learnt, including a reflection on the challenges and unexpected successes

It is always a challenge to get something out of busy academics and our Network work was no different. A pleasant surprise was how willing members were to take time to attend face-to-face and virtual meetings, and how openly people shared their teaching challenges and resources. The series of TLO to standards meetings were particularly rewarding because they put a diverse group of members together to tackle the nitty gritty of the TLOs, which people did with great heart and commitment.

8 Summary of completed Network

The Chemistry Discipline Network was formed to improve the teaching of chemistry at Australian Universities through the creation of a community of practice among chemistry academic staff. In addition, we were tasked with overseeing the implementation of the Threshold Learning Outcomes (TLOs) for Chemistry, which were published at the time of our formation (late 2011). The outcomes of our Network include a snapshot map of the chemistry taught across 12 institutions around Australia and a map of three chemistry degrees against the chemistry TLOs. We have also worked to clarify the nature and extent of the chemistry-specific TLOs, TLO 2.1 (principles and concepts of chemistry) and TLO 3.3 (laboratory practice). Using the Network as an organiser has allowed the process of elucidating the TLOs to be inclusive and representative.

The Network achieved an unprecedented level of inclusiveness, with a total of 130 Network members, almost all of whom hold chemistry academic positions around Australia, from all institutions at which chemistry is taught. The Network has linked academics who are new to the Scholarship of Teaching and Learning with those who have extensive experience in the field. The Network has been recognised both by the Royal Australian Chemical Institute and the Australian Council of Deans of Science as the key player in establishing standards and assessment of threshold learning outcomes, and helping develop new accreditation standards.

9 ATTACHMENT 1

9.1 Independent evaluation report

Not undertaken

10 ATTACHMENT 2

Pro forma or other material produced for or used during the Network.

Please send report via email to: learningandteaching@deewr.gov.au

Not for publication

Office for Learning and Teaching Networks

Certification of Final Report Submission

Parts 1 & 2

Certification by Network Leader

I certify that Part 1 the Final Report:

- includes a network summary containing a clear explanation of the network's outcomes
- the report is of publishable quality
- the report has been edited
- the project template provided has been used.

I certify that Parts 1 & 2 of the Final Report provide an accurate representation of the implementation and findings of the project.

Network leader: Madeleine Schultz
Signature: M Schultz Date: 2.10.13

Certification by DVC/PVC (Academic), or equivalent, or their official delegate

I acknowledge submission of Parts 1 & 2 of this report and that Part 1 is of publishable quality.

Full name: STEPHEN TOWER
Position: Acting DVC Learning & Teaching
Signature: STB Date: 4/10/13

Please submit report via the [Grants online portal](#).

Please refer to the document, *Project Management Information*, available on the OLT webpage *Managing your Project* for information on completing and submitting reports.