Learning to Lead Change: SaMnet's action-learning projects

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Abstract

Eight project teams at universities across Australia are attempting to change how chemistry is taught as part of a larger effort to improve the teaching of science and mathematics, generally. The teams are involved in what are called action-learning projects, "acting" to change the teaching in their school or faculty while "learning" to lead change. We outline here why this initiative is being pursued, describe the projects in chemistry, and explain the nature of support provided by the Science and Mathematics Network of Australian University Educators (SaMnet). We then enumerate the key principles involved in this effort to transform a range of individual initiatives to improve teaching into a sector-wide movement for change.

Introduction

Eight action-learning projects are under way in the discipline of chemistry supported by the Science and Mathematics network Australian of university science educators (SaMnet). They range from improving laboratory practices in biochemistry to implementing student-response systems in first-year lectures in a service subject. Some projects are developing new teaching approaches, while others are adapting what has worked in one context to a new setting. More than a dozen other action-learning projects are being pursued across disciplines in science and mathematics. Some projects will have implications for university chemistry teaching, such as intensive mode delivery of a semester-long subject.

These activities are more than just clever experiments in how to improve one's teaching. They are labelled "action-learning" projects in that members of each project team are meant to be developing the capability to influence the teaching of colleagues, both locally and at other institutions. They are to evaluate not only the potential advantages of what they are doing but how it fits with traditional modes of operating, embedded values of colleagues, and key performance of indicators of their heads of school, deans, and administrators up the line. These projects are meant to move beyond "the usual suspects," the 10-15 percent of academic staff who could be classified as "innovators" or "early adopters" (Rogers, 2003). These "usual suspects" tend to populate education special interest groups and attend teaching-oriented workshops or conferences. Such dissemination needs to occur beyond the bounds of the discipline of origin, as well. Fairweather's (2008) review of the literature found that, while many worthwhile teaching approaches that were developed in one discipline could be readily adapted to other disciplinary contexts, there was little of this cross-discipline uptake.

Improvements in university science teaching have been supported through approximately forty projects funded by the Australian Learning and Teaching Council and its predecessors (e.g., Carrick, 2007). Despite such developments as inquiry-based laboratory exercises, science teaching retains a reputation for being content-heavy and didactic with assessment based predominantly on exams. Efforts to share newly developed or adapted approaches usually fail to continue when a project's funding ceases (D-Cubed Newsletter, 2011) or when the innovative teachers move on.

The ability for one academic to influence how others teach can be understood to represent a form of "transformational leadership", which Southwell and Morgan (2009) identified in a review of the leadership literature that they saw as relevant to higher education in Australia. Southwell and Morgan (2009) explain, "Transformational leadership engages the needs, aims and abilities of individual followers so that they are drawn up into the vision and goals of the organisation and effect significant improvements through common interests and cooperative actions" (p. 29). That relevant "organisation" in our case is embodied in the national network, SaMnet, which in turn intends to represent the enterprise of university teaching in science and mathematics in Australia beyond the time of its current seed funding.

In taking this angle, the SaMnet effort follows in the footsteps of the project: *Active Learning in University Science (ALIUS) – Leading Change in Australian Science Teaching*, pursued by chemistry and physics academics Bedgood, Bridgeman, Buntine, Gardiner,

Lim, Mocerino, Morris, Pyke, Southam, Yates, and Zadnik (2012). That project's final report underlines the value that project team members gave to leadership development workshops and to insight provided into their roles as "early adopters" in the diffusion of good teaching practices (Bedgood *et al*, 2012: p.6). They also articulated greater awareness for their own setting of key concepts in spurring organisation, such as instilling in colleagues a "sense of urgency" to change how they teach and developing a "guiding coalition" in their school or department (*Ibid*., p.6). To support ongoing change, they conclude that, "Three domains have been identified as the architecture upon which sustainable L&T innovation will be built. These domains include Learning and Teaching innovation in project leaders' and colleagues' classrooms, development of project leaders as *Science Learning Leaders*, and creation of a Science Learning Hub to serve as a locus and catalyst for the development of a science teaching community of practice" (Bedgood *et al*, 2012: p.5).

SaMnet is also following cues from the "leadership academies" formed in science in the US via Project Kaleidoscope (2011) as well as from the cross-disciplinary Change Academy run by the UK Higher Education Academy (2011).

Capacity for transformational leadership can impact not only on colleagues but on those in higher positions, the heads of school, deans, etc., referred to above. The use of influence individually can be augmented by use of influence collectively, which is a form of "distributed leadership" (Gossling, Bolden, and Petrov, 2009; Spillane, 2004; Harris, 2004). Distributed leadership represents influence that is not based solely on rank or control of valued resources. Rather, it draws on the abilities of individuals and groups to articulate a vision, create a sense of urgency, and provide support for others who can be persuaded to change.

Leadership distributed across individuals in multiple disciplines would enable academic science in Australia to "speak with one voice" about educational issues of concern (Sharma, Rifkin, Beames, Johnson, Varsavsky, Jones, Yates, Zadnik, Crampton, Matthews, and Pyke, 2012). These issues would include establishment of teaching and learning standards to be enforced by the Tertiary Education Quality Standards Agency (TEQSA). There is also the Commonwealth government's lifting of caps on university enrolment and their agenda to raise enrolments at universities from 35-percent to 40-percent of the eligible age cohort. This initiative, coming to be known as the "inclusion" agenda, is drawing students from backgrounds that are under-represented, such as from families or communities with low socioeconomic status and those who are the first-in-family to attend a university.

Within this context, one can see that an action-learning project on implementing a student-response system in a large, first-year lecture in chemistry has implications well beyond the learning of the individual students in that one class. In this article, we will elaborate on this trail of causality from individual initiative to potential changes in the teaching of science across Australia, which is the strategy being pursued by SaMnet. First, there will be a brief listing of the eight action-learning projects in chemistry that are currently under way. This listing is meant to alert readers to projects that may be of interest and to identify examples from the "SaMnet movement" that should be visible at upcoming conferences. Second, we will outline what is involved in pursuit of these projects to suggest what to expect from the project team – from their proposed plan of action to their case study on how to implement change. Third, we will elaborate on the aspects of the SaMnet initiative that are oriented toward collective action and will introduce concepts and literature from the social sciences to rationalise this approach. We will conclude by (1) tying these threads together to underline how individual action toward creating mass change can be seen as part of an academic's "day job" and (2) suggesting how such efforts align with traditional reward structures of science – publication and leadership in the discipline.

2. Who is involved, doing what – 8 chemistry projects

The SaMnet initiative is currently supporting eight action-learning projects in chemistry. The projects are based at seven universities, which include regional universities and urban ones, teaching-intensive and research-intensive universities. Most of these eight projects focus on chemistry alone while a few address chemistry in concert with a second discipline. Some other SaMnet projects address chemistry as part of a focus that crosses undergraduate science programs, generally, but they are not listed below (though they can be viewed on the SaMnet website – http://www.samnet.edu.au).

- Williamson, Metha, Willison, and Pyke of the University of Adelaide are aiming to change the way content is delivered in Foundations of Chemistry lectures. They will implement a shift from a traditional format to a Process Oriented Guided Inquiry Learning (POGIL©, http://www.pogil.org/)-style approach in order to provide students with more opportunities to engage actively with course material. They plan to cater to – and engage – increasing numbers of students who have no chemistry background.
- Brown, Southam, Sneesby, and Zadnik of Curtin University are employing a constructive alignment process (Biggs and Tang, 2007) to map subjects. They are developing diagnostic measures and assessment tasks to engage and motivate students as well as to assess their competence in core laboratory skills.
- Schultz, Tasker, Beames, and Savage of the Queensland University of Technology (QUT) are aiming to improve lecture delivery in first-year chemistry by enabling instant feedback to polls and open-ended questions. They are employing Student Response Systems (SRS), which have been shown to improve student engagement and performance, while, they argue, helping academics avoid burnout.

- Thompson, Rayner, Hughes, and Varsavsky of Monash University are redesigning laboratory exercises to offer a more open selection of tasks and to incorporate experimental design challenges, group work, opportunities for multimedia presentations and peer assessment. They are adapting approaches that the literature and experience indicate are successful. They are starting in single a large first-year subject, with similar strategies then being rolled out in second and third year for chemistry, physics, and biology.
- Huth, Potter, Yench, and Johnson of La Trobe University are developing an efficient laboratory program that mixes "traditional" laboratory activities, which they characterise as verification, with enquiry-based activities. These new activities are to be supported by tutorials/workshops and online materials and to link up to and complement the lecture program. They aim to enable students to systematically develop relevant skills and capabilities (including communication and higher-order thinking skills) and to inspire them to continue with chemistry in their studies and career.
- Hudson, Neto, Symone, Gysbers, Schmid, Bartimote-Aufflick, and Bridgeman of the University of Sydney are creating strategies for engaging students in active learning. Their focus is on visualization of chemical phenomena for large lectures. They are looking to use "clickers" (student response systems), buzz sessions, and peer instruction related to students' understandings of lecture demonstrations.
- Stewart, Kant, Baldock, Denyer, and Bridgeman of the University of Sydney are investigating whether undergraduate physics and biochemistry labs are achieving desired learning outcomes by using the tested framework, Advancing Science by Enhancing Learning in the Laboratory (ASELL; http://www.asell.org/). The aim is to identify what problems exist, why they exist, and how to change the laboratory exercises to improve outcomes. They will focus on several experiments in first-year physics and second-year biochemistry, and they will implement changes based on the results of the ASELL analysis.
- Fildes, Bedford, O'Brien, Keevers, and Carr of the University of Wollongong are aiming to increase student engagement by moving some student activity away from the currently passive, lecture situation to a more active environment. They will restructure teaching approaches as workshop activities based on the framework, Process Oriented Guided Inquiry Learning (POGIL©).

What one can see above are specific initiatives of the sort that would be on the "wish list" of many who seek to improve or rejuvenate their chemistry program. SaMnet seeks to provide a structure and external support for pursuing these initiatives.

3. Elements & process of a SaMnet project

3.1 Proposal

The projects listed above came about, and are being supported, through a multi-step process. SaMnet elicited proposals throughout the latter half of 2011 by presentations and e-mails relayed via associate deans of education/teaching and learning in science, deans of science, discipline-based groups, communities of interest formed around previous projects funded by the Australian Learning and Teaching Council (ALTC), and delegates of the Australian Conference on Science and Mathematics Education (http://sydney.edu.au/iisme/conference/2011/index.shtml).

Proposals followed a format previously developed for internal projects at Curtin University and the University of Queensland while requiring some of the information needed for a nationally competitive grant (e.g., to the ALTC). Notably, applicants were required to assemble a team of individuals with complementary skills and abilities. SaMnet specified a need to include: (1) a junior or innovative academic, someone who sees a change that is needed; (2) a senior academic who recognises the challenges faced in creating change; (3) an academic developer to provide insight from the educational literature as well as across faculties to recognise university-wide initiatives and performance indicators; and (4) the associate dean for education/teaching and learning in science in the faculty in order to assure that the project aligns with faculty-wide requirements and the key performance indicators (KPIs) of heads of school and the dean.

Proposals had to identify the scope being addressed in the project, such as what degree programs, how many students, and how many colleagues would be affected. The aims and rationale had to be articulated, of course, as well as precedents known through experience and in the educational literature. A knowledge of precedents was required in order to avoid having people reinvent the wheel, or the flat tyre, as the case may be, and to bolster the tradition of consulting the scholarship of teaching and learning (SoTL) literature as a first resort.

The proposal needed to define desired outcomes and how they would be measured. It also had to articulate why those outcomes would eventuate from the strategies being employed. There was a section of the proposal form to be completed on dissemination, with instruction that publication should be an aim so that project participants were not only providing leadership within their faculty but also intellectual leadership more broadly. The proposal included a section on capabilities that applicants felt that they needed to gain to make their project successful and types of information that they could use from others. On the latter, they were asked which of the communities of practice that SaMnet is consolidating would be the most relevant, the one on educational standards, the one on laboratories and inquiry learning, or the one on new educational technologies. Applicants needed to draft a timeline for their project. They were to identify which aspects of their project they were least sure about, and where they could use help, whether in co-opting another team member or in devising an evaluation scheme, for example.

There was no section of the proposal on a budget because SaMnet does not provide direct financial

support. Some projects were already funded internally, and others would potentially employ the imprimatur of SaMnet to leverage internal support. Still others were being pursued as part of the normal duties of the applicant team or the desired direction for their school or faculty. The orientation was toward what the noted organisational theorist, Karl Weick, calls "small wins" (1984), positive though incremental and repeated progress toward desired goals. This strategy aligns with research findings of Tobias (1992) and Gibbs (2006), both of whom recognise that significant improvements in teaching can be traced to cultural change within a department, a unit that can support and reward modest initiatives.

So, the proposals followed the format of many research proposals, albeit in abbreviated form (4-6 pages in a *pro forma*). However, there was perhaps more attention to human and organisational capabilities and challenges. These latter areas would align with the action-learning aspect of the projects, in that the projects are meant to serve as practice and to build capabilities.

Proposals were due for submission in early December 2011. They were vetted in December 2011 and January 2012, and formal feedback was provided by at least two expert reviewers by March of 2012. Formal acceptance letters were sent to team members and their dean of science. Project participants were invited to day-long workshops scheduled to accommodate their teaching commitments, *i.e.*, in February before session began and in April during the Easter break.

3.2 Critical friend

Each SaMnet project has been "adopted" by a critical friend from SaMnet's steering committee. The role of critical friend has been described as a kind of mentor who offers compelling questions and provides guidance with a light hand (see, for example, Miller, Vandome, and McBrewster, 2011; Conole, Brown, Papaefthimiou, Alberts, and Howell, 2010; and Costa and Kallick, 1993). In the case of SaMnet, the critical friend is to contact each team every four to eight weeks to find out what is occurring and to hear about challenges, successes, and failures. They are to offer advice but not prescriptions and ask questions and point to factors that project team members may not have considered. They are also to clarify what SaMnet hopes the project will deliver, such as workshop attendance or a conference paper.

If a project does not seem to be progressing, they are to ask questions that can reveal why and to remind participants that the project is about developing team members' capabilities. One such capability is the ability to focus on an effort that may be a little outside one's normal scope of duties and potentially outside one's immediate comfort zone. Critical friends are to use any roadblock as a potential "teachable/learnable moment."

Critical friends record a few bullet points from their conversations with team members onto the SaMnet website in a "members only" area. These points are not meant to publicise success or failure in order to compel compliance. Rather, they are to let teams clustered by region (e.g., Queensland and the Northern Territory) know how each other are going, to highlight what may be common challenges, and to share useful strategies for engaging with colleagues and for being persuasive.

In summary, the critical friend role involves being supportive but not directive. They are to ask hard questions but in a developmental way.

3.3 Workshops

Each workshop has focused on building capability in both intellectual leadership and organisational leadership. It also provided time for project teams to develop their plans and specify next steps, as it was realised that team members can have difficulty in drawing themselves away from ongoing duties to pursue a voluntary, additional project, particularly a project that required alignment of timetables across people with four disparate areas of responsibility.

For each workshop, the focus in the morning has been on getting project team members to talk with one another about their projects both within teams and across teams. The notion is that participants would initially be more interested in the practical aspects of their project and less interested in the conceptual aspects of leading change. University-based, leadership workshops have all too often been reported to be a stream of PowerPoint slides and management jargon that is unrelated to academic science and its teaching. We sought to avoid that.

A key element in each workshop has been a focus on the scholarship of teaching and learning. A range of research methodologies have been outlined and discussed, from more structured, survey-based approaches to more emergent, ethnographic approaches. SoTL in science was characterised as tending toward the more controlled, quantitative approaches that typify the rest of science but with increasing acceptance of more qualitative approaches that lend an air of authenticity, that capture the experiences of students and/or staff. Team members discussed how to approach their project's SoTL effort by selecting approaches representing a combination of the research strategies discussed. Teams were also walked through the sequence of steps in SoTL research, from selecting a research question and object of study through ethics clearance, data gathering and analysis, and on to synthesis and publication.

In the afternoon, attention shifted from project specifics and educational research toward organisational leadership. Senior academic administrators, such former pro vice-chancellors, have been invited to serve as "patrons" to discuss how they learned to lead change. These accounts of experiences of leadership were conceived as a gradual introduction to concepts of leading change. It was suspected that this topic would not be seen as particularly relevant to science and mathematics academics unless it was couched in familiar examples and experiences of respected academics.

The workshop segment on leadership concepts has begun with participants discussing their experiences of change and factors that they felt helped to make such an experience a positive one for them.

They were asked analyse a particular management conceptualisation of leading change – Kotter's 8 steps for change (1995) and Rogers's factors that indicate whether something new will be adopted quickly or slowly (2003). Both these frameworks were well received in the ALIUS project. Also introduced were notions of transitions, the emotional stages involved in taking on new approach and giving up something old, which is attributed to Bridges (1991), and distinctions between organisational challenges and emotional challenges described by Wilber (2001). These latter two frameworks were recommended by professional staff development officers, the university staff who are responsible for enabling heads of research units and deans to lead more effectively. Participants were asked to identify which elements in a change strategy would be easy to implement and which elements hard. The aim here was to have participants evaluate the relevance, usefulness, and difficulty in using these frameworks on their own projects, rather than asking them to accept their value without scrutiny.

Workshop participants were asked to explain the relevance of the framework for implementing change that they had discussed to (1) their own experiences, (2) the experiences and insights related by the "patron", and (3) their project. Team members then each had to identify a key stakeholder in their project initiative (e.g., students or tutors or the head of school) and determine the pros and cons of their SaMnet project from the perspective of each one. This discussion emphasised that strategic leadership of change involves seeing worthy initiatives from the perspectives of others. In other words, one needs to frame or re-frame one's aims in terms of what others value.

That was a key take-home message, the idea that one needs to be strategic about how to approach each stakeholder in a subject, laboratory, or other aspect of teaching. Furthermore, being strategic means acknowledging others' views and values and responding to them. The leadership concepts introduced provide frameworks for doing that analysis and strategising. They are also meant to assist in selecting what sort of approach to take in what phase of a project.

3.4 Reporting & Publishing

Project teams are to provide an account of their experiences and progress to their respective critical friends every month or two. They are to summarise these matters on a more frequent basis on the project website or in some other common record-keeping document (such as a shared Google Doc). They are expected to discuss their progress at two SaMnet workshops each year as well as at opportunistic meetings, such as at conferences where it is evident that members of several project teams are attending, such as the national Chemistry Education conference in Adelaide in June 2012.

Teams are meant to produce refereed publications in order to earn credit for their efforts in a mode that research scientists recognise, *i.e.*, journal articles. For some, SoTL publication is a new venture even if "scholarly teaching" is not new to them. Each team should include someone who has published in SoTL before, but there is also support available from the critical friend as well as from members of other project teams who share an interest in their project.

Two forms of publication are meant to emerge. One is on the educational innovation and its impact on students. That could detail improvement in students' understanding that corresponds with implementation of inquiry learning strategies in a first-year subject. Another article would be a case study of strategies employed and impacts identified when trying to get colleagues to adopt a similar approach in their teaching. For example, in what ways does successful implementation of inquiry learning in a first-year subject lead to more ready uptake in a second-year unit? What strategies aside from reporting of convincing results need to be in place to foster adoption?

Aligned with this latter effort, SaMnet steering committee member Kelly Matthews of the University of Queensland has developed a set of reflective survey questions. The questions are based on a framework offered by Timperley and Parr (2005) that ties successful change to factors of beliefs and values, knowledge and skills, and outcomes.

In summary, the reporting and publishing elements of SaMnet projects are oriented toward enabling teams to get help, to see how other teams are going, to earn credit for their efforts, and to reflect on how they could become more influential. The publication in SoTL and the one on driving change represent the two prongs of leadership that are being developed, respectively – (1) intellectual leadership and (2) organisational leadership.

Through these action-learning projects, SaMnet is attempting to provide structure, a national imprimatur, training, and support for making local initiatives to improve science teaching more successful. It is also providing a national network through which some of this support and insight can be delivered peer to peer both within disciplines, such as chemistry, as well as across disciplines.

4. Concepts behind this approach

In order to provide leadership development for both the current and the next generation of science academics who want to focus on improving teaching, the project teams are mixed, including both senior and junior academics. The individuals involved form a network for both support and dissemination, as just noted. However, the aim is to have the network evolve into a movement, an organised push in a particular direction that can engage more than just the 400 keenest of the estimated 4,000 full-time science academics in Australia.

This notion of a movement has been articulated by Parker Palmer (1992), a respected US-based sociologist of higher education. He describes a movement as a

bottom-up approach, like the "free-speech movement" in the 1960s or the women's movement initiated soon thereafter. Parker explains that inventions of isolated individuals need to become the work of groups that provide mutual support. We see that in Australian science in the growth of education special interest groups within disciplines. This stage should be followed, Palmer explains, by widespread public discussion of issues and opportunities. Such conversations have been fuelled in recent years by increases in the volume of the scholarship of teaching and learning and attention to establishing teaching and learning standards to be enforced by the TEQSA. Another log on the fire has been the Commonwealth government's lifting of caps on university enrolment, mentioned earlier. One can conclude that Palmer's "widespread public discussion" is growing in Australia.

Parker argues that an additional stage is crucial, the establishment of reward structures to sustain a movement for change. In science, that currently means enabling academics who teach well to achieve by standards employed to assess the research of their colleagues, *i.e.*, refereed publications and exercise of leadership in the field. SaMnet is aiming to provide avenues for achievement and acknowledgement in these areas. In so doing, SaMnet is working across science disciplines attempting to do what the respected sociologists Snow and Lessor (2010) represent as aligning frames of reference of various interest groups so that a movement coalesces.

Also addressing collective action is the work of Michael Fullan, a Canadian specialist in the leadership of change in educational systems whose work has guided projects for change in Australian school systems. Fullan calls for an alignment among the efforts of individuals and organisations (Fullan, Cuttress, and Kilcher, 2005) as well as fostering of "system thinkers in action" (Fullan, 2005). These prescriptions can be understood to support (1) a coherent effort across academic staff in science, (2) regulation and incentive structures from government that reflect effective classroom practice, and (3) complementary support by university administration, *e.g.*, deputy vice-chancellors, deans, and heads of schools. This alignment would mean that an individual academic's initiative should satisfy key performance indicators (KPIs) for their head of school and dean, which are in turn designed to satisfy the government mandates to which Deputy Vice-Chancellors and Vice-Chancellors need to respond. Achieving this sort of productive alignment among academics, administrators, and government suggests a need for academic staff in science to "speak with one voice", as we noted earlier, as science academics need to represent classroom needs effectively to government. They also need to frame their efforts to satisfy KPIs of those higher in the hierarchy at their own universities, a strategy that we framed above.

This alignment is being pursued through the range of activities being undertaken by members of the teams undertaking SaMnet's action-learning projects. In addition, members of the steering committee for SaMnet are participating in, or liaising with, leaders of discipline-based networks funded by the ALTC. They have also presented at educational conferences organised by the Australian Council of Deans of Science (ACDS) and have presented to the annual general meeting of the ACDS. Responses to date from deans of science have been encouraging.

5. Conclusion

We are hoping that SaMnet supports a growing buzz of activity toward improving teaching in chemistry and across science and mathematics in lectures, tutorials, and laboratory settings. SaMnet is intended to build on growing interest and capability in SoTL and increasing accountability to government for quality of teaching in universities. At the same time, we are trying to turn the current generation of informal leaders, such as former and current ALTC grant holders, into mentors for the next generation, junior staff in the growing number of teaching-intensive appointments for example.

By collecting these players into action-learning teams, we are aiming to have more than just a network of comforting and informative conversations. We are providing structure and frameworks to foster rigour in the pursuit of worthwhile changes in teaching and curriculum in science and mathematics. Toward this end, we have outlined above how we are drawing on experience of senior level academics (*e.g.*, former PV-Cs) as well as on experience captured in the literature on leadership of change in organisations.

SaMnet is aiming to create leadership that is distributed in the sense that numerous academics in different roles are pulling in a similar direction. This leadership is meant to be transformational in nature in that it is intended to alter the culture of teaching in science. Such an impact requires what Parker called a "movement", a bottom up effort, but it also necessitates alignment up and down university hierarchy, as Fullan argues, as well as across disciplines.

In this sense, it is hoped that chemistry academics will recognise a greater context when listening to a presentation on a SaMnet project on POGIL-style lectures in second-year chemistry or an ASELL analysis of biochemistry lab sessions. That project should be seen as more than just the experiment of a single academic or a small group of colleagues. It is part of a greater initiative to boost the quality of teaching by improving the scholarly rigour, peer support, and organisational rewards for experimentation and dissemination.

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