

CUBEnet - Collaborating for Innovation in Biomedical Science Education

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Changes and Challenges Facing Higher Education

There have been enormous changes in higher education in recent years in terms of increased student numbers increasing the pressures on academics, the structure of the programs available for students and the imperative to improve the student learning experience and outcomes.

Within the biomedical science disciplines, we have traditionally taught within Science degrees and often within the silos of our discipline-specific majors. However, developments in the sector have impacted on many teaching programs. These include the changing face of research – our biomedical science disciplines now overlap, with the boundaries often hard to define and hence the boundaries between subjects continue to blur. This has a positive impact in that it pushes us to adopt more interdisciplinary approaches to subject development and student learning. On the other hand, the ‘pedagogy’ for interdisciplinary teaching remains relatively poorly developed and is often rooted in the disciplinary silos. The fact that many universities now offer specialised Biomedical Science degrees in addition to Science degrees creates further tensions in the curriculum. As a point of difference, Biomedical Science programs typically feature integrated and interlinked subjects designed to help students to see the connections and interrelationships between the specific biomedical science disciplines. The success of these initiatives depends largely on the capacity of the existing academic staff to cross the disciplinary boundaries and embrace more ‘open’ and collaborative modes of teaching. The sector is also increasing student numbers and diversity. This is a challenge that needs to be accommodated.

To add to the confusion, the increasing questioning of the efficacy of the emphasis on the traditional didactic lecture, as well as the emergence of massive open online courses (MOOCs) and other online resources creates further challenges to conventional teaching. How one can reconcile these new trends with existing ingrained approaches to teaching is an ongoing challenge for those academics whose brief or goal is to innovate in the ways that university teaching in the 21st century may require.

These pressures and drivers of change are not isolated to a specific discipline or institution. Working collaboratively to address these common challenges is the most efficient and productive approach. Within our specific biomedical science discipline, societies such as ASBMB, ASPS, AUPS and ASCEPT, there are education special interest groups in which engaged academics do work towards addressing some of these issues. However, it is clear that a broader

and combined interdisciplinary approach with colleagues from across the biomedical sciences and other relevant disciplines such as Education has the potential for greater co-ordination, communication, impact and leverage.

The 2010 report ‘*Vision and Change in Undergraduate Biology Education: a Call to Action*’ from the American Association for the Advancement of Science (1) presented a clearly articulated direction for the life sciences curricula into the 21st century. Four action items were identified as part of the agenda for change: (i) integrate core concepts and competencies throughout the curriculum, (ii) focus on student-centered learning, (iii) promote a commitment to change and (iv) engage the biology community in the implementation of change. This is echoed in the report from the Australian Council of Deans of Science (2) that specifically identified the need for new approaches for teaching generic skills and the delivery of laboratory classes, something that required leadership at the national level. Similarly, a report on learning and teaching of biotechnology in Australia (3) identified two themes contributing to success (i) recognition that biotechnology is interdisciplinary and (ii) the need for strong leadership in the design, development and administration of programs, given the rapidly changing technological environment facing the field. In the context of the biomedical sciences, these reports clearly articulate and reinforce the need to convene a discipline-based, yet outwardly looking collaborative network for learning and teaching in the biomedical sciences and related areas.

Hence the establishment of the **Collaborative Universities Biomedical Education Network – CUBEnet**.

The Establishment of CUBEnet

In 2011 the Australian Learning and Teaching Council (ALTC) recognised the need for a collaborative approach to Higher education by supporting a number of Special Initiatives grants to form discipline networks. The stated aims in establishing the networks included “... embed good practice in learning and teaching in higher education. The network funding aims to consolidate existing connections in the sector and help foster new collegial and cross-institutional links to generate high-level collaborative approaches to teaching and learning issues.” (<http://www.olt.gov.au/networks>)

The application to establish CUBEnet was led by Professor Philip Poronnik (Sydney), with team members Professor Ian Dawes (UNSW, AAS), Associate Professor Yvonne Hodgson (Monash), Associate Professor Susan Howitt (ANU), Associate Professor Janet Macaulay

(Monash), Associate Professor Cathy Abbott (Flinders), Associate Professor David Saint (Adelaide) and Associate Professor Louise Lutze-Mann (UNSW). In addition to being funded by the ALTC (now replaced by the Office for Learning and Teaching (OLT)) the initial establishment of CUBenet had the support of the National Committee for Biomedical Sciences (part of the Australian Academy of Science), discipline societies including ASBMB and 17 universities, indicating the breadth of support and the perceived need for an interdisciplinary approach to the challenges facing higher education.

The specific aims of establishing CUBenet as stated in the original grant application were: "The network aims to generate a critical mass of active tertiary biomedical academics at the national level to create a sustainable framework for a program-wide approach to the biomedical curriculum that can harvest expertise across the university sector at the local, national and international levels. This network will serve to (i) provide the critical mass needed to identify, address and solve the central challenges that face us in delivering a forward looking and sustainable curriculum and (ii) maximize the efficiency of development, dissemination and adoption of innovative curriculum. In a complex tertiary environment, such a network is critical to aggregate, filter and connect ideas and information with the appropriate teams of people to achieve effective, transferable and sustainable solutions."

The network was launched in December 2011 by the Australian Chief Scientist, Professor Ian Chubb, at the inaugural CUBenet forum 'Ahead of the Game - Biomedical Science Education into the 21st Century' held at the Shine Dome, Australian Academy of Science, Canberra.



What CUBenet has Achieved

Since December 2011, CUBenet has achieved the formation of a national community of engaged and active tertiary educators in the biomedical sciences. The 'face' of CUBenet and the initial points of interaction are the website (<http://www.cubenet.org.au>) and the annual conference. CUBenet now has over 200 members from over 20 tertiary institutions across Australia. The membership is diverse, coming from a broad range of disciplines (including many Biochemists and Molecular Biologists) and inclusive of senior management, research intensive, teaching/research and education-focused academics. The network has made significant contributions to learning and teaching in higher education at the discipline, institutional and national levels including those described below.

Interest Groups

CUBenet members have an extensive range of expertise

and interests in diverse aspects of higher education. To foster collaborations, at the first CUBenet forum, work (interest) groups were established based on shared expertise and interests and a willingness and recognised need to work collaboratively. A number of the groups have been very active - and all groups would welcome new members and can be contacted through the CUBenet website.

Output from the groups included a dedicated issue of the *International Journal of Innovation in Science and Mathematics Education* (4) in 2013 - a significant achievement produced by the Allied Health Group (<http://www.cubenet.org.au/cubenet-groups/bioscience-teaching-in-allied-health>). CUBenet has supported a number of conferences and workshops, including one organised by the Science Communication Group led by Susan Rowland.

The Assessment Group (Co-Leaders: Janet Macaulay and Kathy Tangalakis, Advisor: Philip MacKinnon) surveyed attendees at the December 2013 CUBenet conference on their assessment practices and needs. The results provided strong evidence of the need for improvements in assessment in the biomedical sciences and additionally, when asked if they would participate in the development of shared assessment material, there was an overwhelming positive response, indicating a willingness to work collaboratively. This confirmed the need for improvement in assessment in the biomedical sciences and importantly, the willingness of CUBenet members to engage in a collaborative approach to improving assessment practices and quality. In addition, the assessment group ran a pilot study using psychometric analysis of examinations from three universities, which further demonstrated a need for improvement in assessment. Members of the assessment group have since submitted an OLT grant application to address some of the identified issues.

Other groups have surveyed members on their needs and interests and arrived at similar conclusions, showing that biomedical science academics would like more support to develop curriculum resources and greater access to existing resources. This suggests that there is an ongoing role for CUBenet in sharing of resources and enabling collaborative projects.

Development of the Biomed TLOs

A major project for CUBenet was to engage in a multistage consultative process to develop the Biomed Threshold Learning Outcomes (TLOs), (**Table 1**) which are now available on the website. A major challenge was the breadth of the Biomedical Sciences, which challenged us to articulate the nature of the Biomedical Science discipline. This has led to the development of the Biomed TLOs (5) which are broad in scope but still closely aligned with the Science TLOs (6). This will enable the contextualisation and interpretation of the TLOs within a major or degree in a way which is meaningful and relevant for students and teaching staff. The consultation process involved the CUBenet community at conferences in 2012/2013 and feedback through a survey which was circulated to the wider national Biomedical Science Education community. In addition Education conferences held by groups such as the ACDS (Australian Council of Deans of

Table 1. Biomedical Science Threshold Learning Outcomes (TLOs).	
	Upon completion of a Bachelor degree in Biomedical Science, graduates will:
Understanding science	1. Demonstrate a coherent understanding of biomedical science by: 1.1 articulating the methods of science and explaining why current scientific knowledge is both contestable and testable by further inquiry. 1.2 explaining the role and relevance of biomedical science [to] society including the translation of biomedical science to clinical and medical outcomes.
Scientific knowledge	2. Exhibit depth and breadth of scientific knowledge by: 2.1 demonstrating well-developed knowledge in at least one disciplinary area in the biomedical sciences. 2.2 demonstrating knowledge in other disciplinary areas contributing to the biomedical sciences. 2.3 demonstrating integration of knowledge from across the disciplines contributing to biomedical science.
Inquiry and problem solving	3. Identify, critically analyse and solve problems in the biomedical sciences by: 3.1 gathering, synthesising and critically evaluating information from a range of sources. 3.2 defining a biomedical science problem and formulating a hypotheses 3.3 designing and planning an investigation. 3.4 selecting and applying practical and/or theoretical techniques or tools in order to conduct an investigation. 3.5 collecting, accurately recording, analysing, interpreting and drawing conclusions from scientific data. 3.6 demonstrating creative and innovative approaches to addressing scientific problems.
Communication	4. Be effective communicators of science by: 4.1 communicating scientific results, information and conveying scientifically reasoned arguments, to a range of audiences, for a range of purposes, and using a variety of modes.
Personal and professional responsibility	5. Be accountable for their own learning and scientific work by: 5.1 being independent and self-managing learners. 5.2 working effectively, responsibly and safely in an individual and collaborative context. 5.3 demonstrating knowledge of the ethical and regulatory frameworks relevant to biomedical science and personally practising academic integrity.

Science), ACSME (Australian Conference on Science and Maths Education) were critical to the development of the Biomed TLOs which form a framework for demonstrating graduate achievement.

Biomedical Core Concepts

A similar consultative approach, led by Yvonne Hodgson and Pauline Ross, incorporating face to face workshops and the use of an online survey to allow wide input from the national community, was used to define the Biomedical Core Concepts (7) which together with the TLOs allow standard setting and benchmarking of degree programs across universities.

Leadership and Mentoring

CUBEnet has played a major role in developing and furthering the skills and leadership capacity of academics within the biomedical sciences. CUBEnet, together with the Vision and Innovation in Biology Education network (VIBEnet) (<http://www.vibenet.edu.au>) commissioned the Australian Council of Educational Research (ACER) to work with the networks to run a series of network-specific assessment workshops to provide new skills, insights

and strategies to their members and to develop new, high quality assessment items.

CUBEnet together with VIBEnet also led an exciting leadership initiative in collaboration with the LH Martin Institute. A two-day workshop was designed to explore the basic principles of academic management and leadership in the context of the biomedical sciences and to develop a deeper appreciation of why institutions are continually faced with issues such as constant change, resource shortages and leadership issues. Participants were also provided with an opportunity to explore solutions to challenges faced within their own institutions. The program was developed exclusively for members of CUBEnet and VIBEnet.

Where to Now?

Over the last three years, CUBEnet has clearly identified and started to service a niche and has created a community that continues to grow in membership and reputation and is sustainable.

In addition to a range of specific outcomes, CUBEnet has led the development of a truly interdisciplinary collaboration of biomedical science educators. CUBEnet

has established its identity and taken its position in the Australian learning and teaching community and has the potential to influence the direction of higher education at both the institutional and national level. CUBenet is creating an environment that facilitates communication across the higher education sector to enable informed decisions to be made regarding the future of higher education teaching and learning.

However the same imperatives of increasing student numbers, increasing pressures on academics and the changing face of higher education are still with us and there is much work to do.

In CUBenet, we work to aggregate, filter and connect ideas and information with the right people to achieve effective, transferrable and sustainable solutions around a wide range of issues in biomedical education. **Please join us in the CUBenet community.**

References

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