



Navigating a pathway to
outcomes-focused thinking
in higher education

A case study in engineering



Final report

Professor Wageeh Boles



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Navigating a pathway to outcomes-focused thinking in higher education: A case study in engineering

Final report 2013

Navigating a pathway between the academic standards and a framework for authentic, collaborative, outcomes-focused thinking in engineering education

ALTC National Teaching Fellowship

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<www.nationalteachingfellowshipboles.com>

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Executive summary

The purpose of this report is to provide an overview of the objectives, activities and outcomes of the ALTC National Teaching Fellowship titled ‘Navigating a pathway between the academic standards and a framework for authentic, collaborative, outcomes-focused thinking in engineering education’. The fellowship was awarded in 2011—by the then Australian Learning and Teaching Council Ltd (ALTC)—to Professor Wageeh Boles of the Electrical Engineering and Computer Science School, Science and Engineering Faculty, Queensland University of Technology.

The report is designed to be, in itself, a useful resource for practising academics, university leaders at various levels, and future applicants and nominees for grants and national teaching fellowships.

The main objectives of the fellowship were to work with the five participating universities (The University of Adelaide, Edith Cowan University, James Cook University, La Trobe University, and Queensland University of Technology) to incorporate authentic, collaborative, outcomes-focused thinking for curriculum design, pedagogy and assessment; and to provide support for engineering academics through direct engagement at the coalface, and indirectly through university, faculty and school leaders.

These objectives were driven by two factors. The first is the national imperatives created by the revision of the Australian Qualifications Framework (AQF), the Learning and Teaching Academic Standards (LTAS) project, which was established to facilitate and coordinate the definition and implementation of academic standards by discipline communities, and the establishment of the Tertiary Education Quality and Standards Agency (TEQSA). The second driver came from the changes in the demographics of the academic workforce and the increased demands on, and expectations of, early- and mid-career academics for enhanced performance in not only research (where they are highly trained and qualified) but also teaching (where they are less likely to be so).

The fellowship activities consisted of two major components: an overseas study program, and a Fellow-In-Residence Engagement (FIRE) program. The study program was carried out over two visits to the United States where the fellow conducted talks and discussions with 37 academics. Interviews were conducted not only with established scholars and internationally recognised leaders (some holding senior national and university positions), but also with those at the early stages of their academic careers. The experience gained from this first component of the program was used to enhance the outcomes and strengthen the impact of the second. This was achieved by sharing that experience, and the identified relevant resources, through workshops and individual consultations.

The second component, the FIRE program, involved the fellow residing at each of the participating Australian universities for two periods, each of one to two weeks. During these residencies, the fellow worked with university and faculty leaders, and more closely with heads of schools and academic staff, individually and in small groups. At each location, the fellow presented seminars, round-table discussions and workshops, some of which were co-facilitated by scholars invited from the US.

Ample evidence is provided to substantiate the positive impact of the fellowship on individual participants, whole schools and faculties, and, to some extent, at the university level. This is supported by written comments from early- and mid-career academics as well as those in key roles such as assistant deans and heads of schools.

The FIRE program provided a great opportunity to get close to the day-to-day issues facing academics. The majority of participants were from the engineering discipline, but because the FIRE program activities and seminars were made available university wide at the participating institutions, academics from other disciplines such as mathematics, pharmacy, business and law also participated in groups or as individuals, albeit in smaller numbers. As a result, valuable insights were gained in a wide spectrum of areas including:

- *Team teaching:* There is little evidence of academics working together in teaching teams, little discussion of teaching among academics and an apparent lack of ease in seeking support to improve teaching, despite such aspirations. Academics still do not work together as teams perhaps due to the diminished value of the 'return on investment' in regard to recognition and career advancement.
- *Student evaluation of teaching:* The actions taken by the leadership, especially at the school level, can critically affect how academics respond to the 'real' issues identified in student evaluations of teaching.
- *Assessment practices:* There is potential and scope to restructure the learning and assessment practices in ways that enhance student learning while saving academics considerable time.
- *Resources and expertise utilisation:* Ways of facilitating teaching, including the preparation of student learning resources and creating better assessment tasks, could be better managed by using local expertise to assist with identifying existing quality resources that meet particular needs. This is especially important given the huge amount of available but often under-utilised resources.

The report highlights the fellowship's outcomes and deliverables as well as its extensive program of engagement through seminars, round-table discussions, meetings with individuals and small groups of academics, discussions with university leaders at the levels of deputy vice-chancellor (academic) or equivalent, director of academic staff development department or equivalent, faculty leadership at the levels of executive dean and assistant dean (learning and teaching) or equivalent. Further, it emphasises the critical importance of working closely with the heads of schools, based on the recognition that their role is the most influential in supporting academics and effecting change.

Finally, the report concludes with some reflective remarks on how the outcomes of an extensive engagement program can be greatly influenced by the characteristics of those involved, including personality, attitude, disposition, shared goals and objectives, and willingness to change or make changes. It also emphasises the importance of strategic alignment of the program's objectives with those of the university, faculty and school, within the broad lines of the national and international imperatives.

Fellowship website: <www.nationalteachingfellowshipboles.com>

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1. Overview

1.1. Motivation

Australian universities are currently engaging with new government policies and regulations that require them to demonstrate enhanced quality and accountability in teaching and research. The development of national academic standards for learning outcomes in higher education is one instance of this drive for excellence. These discipline-specific standards articulate the minimum, or threshold learning outcomes, to be addressed by higher education institutions so that graduating students can demonstrate their achievement to their institutions, accreditation agencies and industry recruiters.

Further, the revision of the Australian Qualifications Framework (AQF), and the strengthening of the regulation through the establishment of the Tertiary Education Quality and Standards Agency (TEQSA) are two of the most influential factors affecting higher education in Australia. The AQF is the national policy for regulated qualifications in Australian education and training. It incorporates the qualifications from each education and training sector into a single comprehensive national qualifications framework. It provides the standards for Australian qualifications, and ensures that qualification outcomes remain relevant and nationally consistent, continue to support flexible qualifications linkages and pathways, and enable national and international portability and comparability of qualifications. TEQSA is Australia's regulatory and quality agency for higher education and its primary aim is to ensure that students receive a high quality education at any Australian higher education provider. TEQSA regulates and assures the quality of Australia's large, diverse and complex higher education sector.

These developments impact the design of engineering courses (with particular emphasis on pedagogy and assessment) and influence the preparedness of academics to engage with these standards and implement them in their day-to-day teaching practice on a micro level.

The imperative for enhanced quality and accountability in teaching is also significant at a meso level, for according to the Australian Bureau of Statistics, about 25 per cent of teachers in Australian universities are aged 55 and above and more than 54 per cent are aged 45 and above (Australian Bureau of Statistics, 2006). A number of institutions have undertaken recruitment drives to regenerate and enrich their academic workforce by appointing capacity-building research professors and increasing the numbers of early- and mid-career academics.

This nationally driven agenda for quality and accountability in teaching permeates also the micro level of engineering education, since the demand for enhanced academic standards and learning outcomes requires both a strong advocacy for a shift to an authentic, collaborative, outcomes-focused education and the mechanisms to support academics in transforming their professional thinking and practice.

Furthermore, the international trend in undergraduate engineering course accreditation towards the demonstration of attainment of graduate attributes poses new challenges in addressing academic staff development needs and the assessment of learning.

The school or departmental levels of universities are the most effective loci of changes in approaches to learning and teaching practices in higher education (Knight & Trowler, 2000). Heads of schools are being increasingly entrusted with more responsibilities—in addition to setting strategic directions and managing the operational and sometimes financial aspects of their school, they are also expected to lead the development and delivery of the teaching, research and other academic activities. Guiding and mentoring individuals and groups of academics is one critical aspect of the head of school's role. Yet they do not always have the resources or support to help them mentor staff, especially the more junior academics.

1.2. Objectives

The fellowship program had a substantive focus (the incorporation of authentic, collaborative, outcomes-focused thinking for curriculum design, pedagogy and assessment) and a procedural focus (support mechanisms for engineering academics provided by heads of schools). This two-fold approach derives from the levels of context described above.

It was envisaged that fostering an outcomes-focused education that gives greater attention to the ways in which the curriculum design, pedagogy, assessment approaches and teaching activities can most effectively make a positive, verifiable difference to students' learning. Such education is authentic when it is couched firmly in the realities of learning environments, student and academic staff characteristics, and trustworthy educational research. That education will be richer and more efficient when staff work collaboratively, contributing their knowledge, experience and skills to achieve learning outcomes based on agreed objectives. This led to the following specific objectives:

1. Assist the higher education sector in moving to the next stage of academic standards development, with a focus on mapping program outcomes onto appropriately aligned assessment tasks.
2. Identify and evaluate relevant international and Australian initiatives for effective teacher engagement and curriculum reform, in the light of research findings and in the context described above.
3. Establish a developmental model for identifying, trialling and evaluating assessment tasks capable of providing evidence of students' achievement of program outcomes.
4. Facilitate the development of academics in teaching as well as research, with attention to the needs of early- and mid-career academics in general and those of women academics in particular.
5. Build a framework for establishing authentic, collaborative, outcomes-focused thinking through advocacy and support mechanisms, working as a shadow mentor with heads of schools as they mentor their academic staff. Shadow mentoring is the process by which the fellow assists both the mentor (heads of school), and their mentees (academic staff), to achieve mutually identified development outcomes.
6. Provide an enhanced means of engaging academic staff in target schools through a fellow-in-residence program.

The fellowship program encouraged engineering academics, both those directly engaged with the program and those beyond it, by demonstrating how strategic teaching and assessment can enhance student learning outcomes in the context of implementing academic standards.

The intended major outcomes of the program were to achieve a shift to an authentic outcomes-focused approach to teaching demonstrated in the design and evaluation of assessment tasks, and a set of guides and resources for mentoring, with an emphasis on supporting early- and mid-career academics.

This was carried out by working with five Australian universities, building on understandings gained from a study program in the United States, and an extensive literature review. The US study program not only provided useful and valuable resources to share, but also presented the opportunity to bring international experts to Australia to work with the fellow at these universities.

An overview of the fellowship program is given diagrammatically in Figure 1.

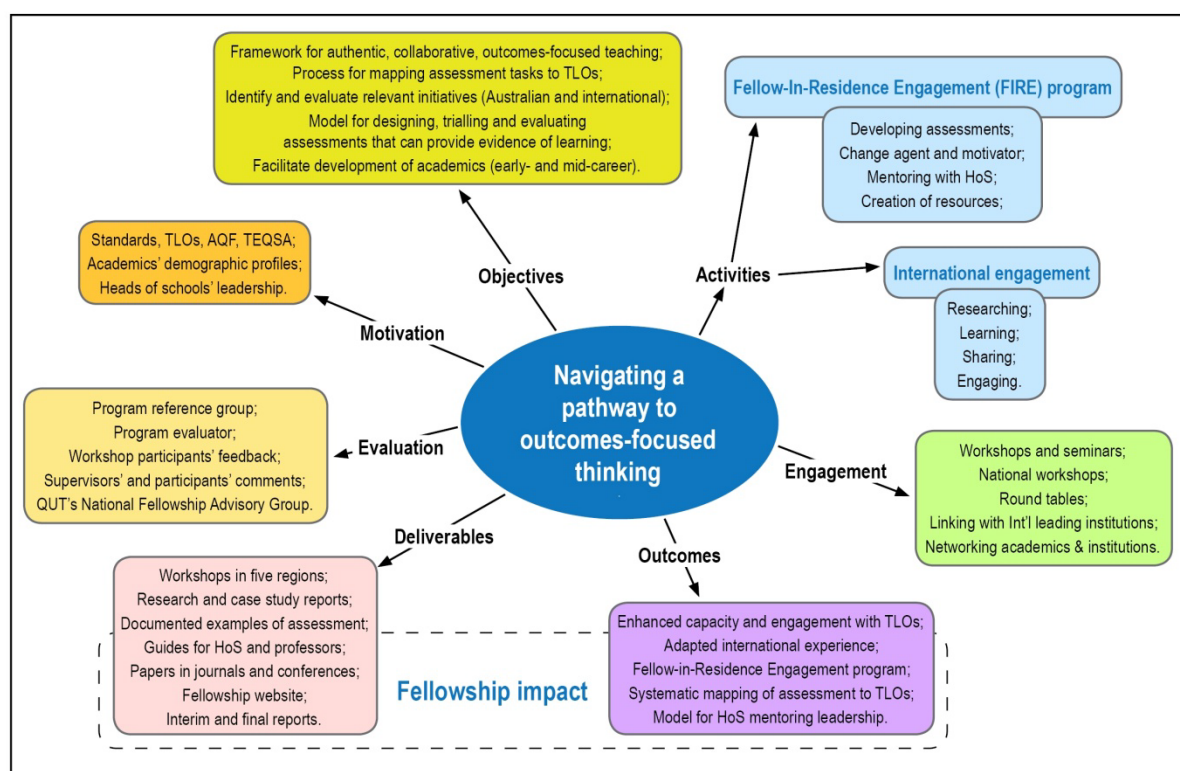


Figure 1: Overview of the fellowship program

1.3. Fellowship team and roles

1.3.1. The team

The fellowship team consisted of the fellow, the project officer, the project researchers and the program evaluators.

The fellow was greatly assisted by the project officer, Mrs Hilary Beck, and the project researchers, Dr Bhuva Lakshminarayanan (July–June 2011), Dr Carol Quadrelli (June–September 2012), and Dr Martin Murray (July–December 2012), who were appointed on a part-time basis. The fellow also worked under the guidance and support of the program evaluators, Dr Southwell then Dr McDonald, and benefitted from the feedback and comments provided by the fellowship reference group.

Project officer: The project officer's role was absolutely critical for the successful implementation of the extensive activities of the fellowship in Australia and overseas.

The project officer's work had a strong focus on managing the fellowship program's various aspects including: obtaining ethics approval; overseeing the budget and monitoring expenditure; completing the administrative paperwork required for appointing the project researchers and fellowship program evaluators; carrying out phone, electronic and written communications with the various participants in Australia and the US; and scheduling the travel itineraries and meetings during the US study program and the Fellow-In-Residence Engagement (FIRE) program in Australia. In addition, the project officer organised the venues for the workshops in all five participating Australian universities, and completed the extensive paperwork required for obtaining the visas and managing the itineraries and accommodations of the invited US scholars.

Further, as a member of the fellowship team, the project officer participated in, and contributed to, the preparations of reports, papers and workshop workbooks.

Project researcher (senior research assistant): The project researcher's role was central to linking and grounding the fellowship work in what the research has provided in the literature. This was not only valuable for better preparing the fellow to effectively carry out the fellowship activities, but was also critical in giving credibility to the ideas and approaches discussed with participants.

The project researcher worked closely with the fellow and the project officer, and indirectly with the program evaluator and the reference group, acting on their guidance and advice. The project researchers specifically assisted with development and dissemination tasks including:

- carrying out a thorough investigation of the literature
- collecting feedback and analysing expert comments from the study program
- collecting materials for the resources and the preparation of assessment exemplars
- assisting with the preparation of the required materials, and running of the seminars and workshops at the participating institutions as well as at the national workshop

- assisting with the preparation and dissemination of materials, and documenting the fellowship program progress reports.

Program evaluator: The role of the program evaluator can be carried out in a number of ways. For example, program evaluators can formally assess the fellowship program, at the conclusion of its activities. While this approach may be valuable for reporting purposes and for benefitting future fellowship programs and fellows, there would be no opportunity to modify the program's course of action, when needed, in a timely fashion. So, in order to maximise benefit from the program evaluator's expertise, it was decided to work with them as a guide, providing formative evaluations and feedback at various stages and points of the program. This arrangement has meant that advice was available along the way, thus making the program evaluator's input an important factor in maximising the outcomes and positive impact of the fellowship.

Dr Deborah Southwell was appointed as program evaluator and fulfilled this role from July 2011 until she withdrew in February 2012, after accepting a position with the Queensland Government. Following this, and after an extensive search, Dr Elizabeth McDonald was appointed as program evaluator. However, due to her prior commitments, Dr McDonald started to provide guidance to the fellow formally from July 2012.

Fellowship reference group: In addition the project officer and researchers, the fellow worked with the fellowship reference group (a list of members is given in Appendix A). Reference group members were selected from prominent academics (from Australia and overseas) and professionals in engineering education, engineering societies, professional staff development societies and industry. The reference group members were informed of progress at a number of points throughout the duration of the program. The interactions with the reference group were more intense and frequent at the early part of the fellowship program, providing direction and feedback from various perspectives. The reference group also acted as a conduit for disseminating the objectives, outcomes and resources identified or created through the fellowship.

The contributions of the fellowship team and reference group members varied in intensity and substance depending on the fellowship needs, and the roles and specific expertise of those members.

1.3.2. About the fellow

Wageeh Boles is currently a Professor at the School of Engineering Systems, Queensland University of Technology (QUT), Brisbane, Australia. Professor Boles was an Assistant Professor in the US at Penn State University, prior to joining QUT where he held the positions of Lecturer, Senior Lecturer and Associate Professor. From 1999 to 2004, Wageeh held the position of Assistant Dean (Teaching and Learning), in the Faculty of Built Environment and Engineering, QUT.

As an established researcher in the area of digital signal processing, Wageeh has been successful in obtaining numerous competitive research and teaching development grants and has more than 170 publications as journal and conference papers, book chapters, theses, and learning and teaching software packages. He conducted pioneering research for developing new image processing techniques and adapting them to various applications such as biometric human identification using iris and palm images, object recognition and texture analysis.

Wageeh is a member of the Institute of Electrical and Electronics Engineers (IEEE), the world's leading professional association for the advancement of technology. He is also a member and accreditation panellist of Engineers Australia (EA), and a member of the Australian Pattern Recognition Society (APRS).

Professor Boles has published widely in the areas of technology and education, work integrated learning, curriculum design, and the study and utilisation of learners' cognitive styles in the design and implementation of computer-based learning solutions. He was a member of the Executive Committee of Australasian Association for Engineering Education (AaeE), from 1999 to 2008 and the National President of AaeE in 2007.

Professor Boles has received numerous awards for excellence in teaching and leadership. While working at the University of Pittsburgh, Wageeh was awarded two Outstanding Teaching Assistant Medals in 1987 and 1988. At QUT, he won the Faculty of Built Environment and Engineering teaching excellence award and the University's Outstanding Academic Contribution Award in Teaching and Leadership in 1999.

In 2004, he won the National Engineers Australia and the Australasian Association for Engineering Education Award for Excellence in Teaching and Leadership. He also won the Vice-Chancellor's Performance Award and was nominated for two Vice-Chancellor's Excellence Awards in 2007. In December 2008, Wageeh won the Faculty of Built Environment and Engineering Dean's Excellence Award for outstanding contributions to student learning.

Professor Boles is the recipient of a 2007 Australian Learning and Teaching Council (ALTC) Associate Fellowship. In May 2011, Wageeh was privileged to receive the ALTC National Teaching Fellowship that is the subject of this report.

1.4. Purpose and organisation of the report

The nomination for this fellowship was prompted by the fellow's strong desire to interact and positively influence academics at the coalface. The early- and mid-career academics were of particular interest to the fellow given the demands placed on them, and the critical role they need to play in the education of future engineers. It was thought that the fellow's experience of more than 25 years in academia, through the responsibilities and leadership positions held, could be put to use serving the larger engineering education community. The fellowship was seen as an opportunity to reach the academics *in situ*, and spend extended periods of time with them and with their leaders to address the day-to-day issues they deal with.

This report will demonstrate how this personal aim has been achieved as an integral part of the overall objectives of the fellowship program, and to what extent. The report presents a case study of the experience gained from carrying out the activities of such a national teaching fellowship, especially the Fellow-In-Residence Engagement (FIRE) program model, for the benefit of future fellowship applicants, university leaders, academics at all levels, and the higher education sector.

Section 1 of this report provides an overview of the fellowship. Section 2 provides details of the fellowship activities and the participating universities. Section 3 describes how the fellowship was implemented, outlining the successes achieved and challenges faced. The impact of the fellowship on various constituencies is presented in Section 4. The dissemination of the fellowship outcomes and its deliverables are presented in Section 5, followed by conclusions in Section 6. Sections 7 and 8 contain references and appendices.

Materials and resources are available on the fellowship website:

<www.nationalteachingfellowshipboles.com> (see pp. 50–52 for more information).

2. Fellowship activities

2.1. Study program

Two major activities were conducted at the early part of the fellowship program: the literature review, and the visits to a number of US experts and institutions. The purpose of these activities was to update and enrich the fellow's knowledge base and scope, thus enhancing the quality and impact of the fellowship program.

2.1.1. Literature review

The literature review ensured that the fellowship program activities were informed by the research in engineering education, while the visits to the US provided a more expanded view of some of the most recent developments in the field, as experienced by a number of leading experts there. The interactions with those experts, their colleagues and institutions also provided a glimpse of future trends in engineering education practices.

The review broadly examined the literature on assessment as evidence of learning, attaining academic standards, as well as its pointers to teaching approaches. An important consideration was to identify methods of documenting evidence for accreditation purposes. It produced a comprehensive report covering various aspects of assessment.

One of the research questions was 'What process can be followed to systematically design assessment items capable of providing evidence of student learning?'. The investigations have resulted in producing and documenting such a process. How to develop this type of design was a main theme in almost all the workshops conducted on site at the five participating universities and at the AaeE 2012 conference.

2.1.2. US visits

There were two purposes for involving internationally recognised scholars who are identified as effective change agents. First, the aim was to analyse the teaching-related developments these scholars have achieved in their institutions, with specific attention to their coaching for effective academic cultural change. This was carried out during visits to those institutions to better understand the contexts, the situational dynamics and the factors that have contributed to their success. The second aim was to learn from any impediments they met and how these have been overcome. The investigations identified the aspects of those scholars' activities that can be taken up (with adaptation as necessary) to the Australian academic environment, and were utilised during the FIRE program.

The fellowship proposal nominated the following scholars for the US study component of the program: Dr Norman Fortenberry, Executive Director of the American Society of Engineering Education (ASEE) and Founding Director of the Center for the Advancement of Scholarship on Engineering Education (CASEE); Michael Prince, Professor of Chemical Engineering at Bucknell University; Richard Felder, Hoechst Celanese Professor Emeritus of Chemical Engineering at North Carolina State University; Dr Milton Cox, Director of the Centre for the Enhancement of Learning and Teaching, Miami University, Ohio; Professor Geoffrey Orsak, Dean of Engineering at Southern Methodist University; Professor Jeffrey Froyd, Director of Academic Development for the Dwight Look College of Engineering at Texas A&M University; and Professor Edward Crawley, Massachusetts Institute of Technology, MIT, Boston.

With the exception of Professor Crawley, who was not available due to accepting a leading academic position outside the US, the fellow met with all nominated experts. The fellow also met with 31 other experts, scholars, and early- and mid-career professors (a total of 37). The fellow was keen to gather as much knowledge and data as possible, so took the opportunity to interview this many people, to enable him to enrich those engaged with the fellowship program in Australia. The visited scholars took the initiative of treating the fellow's visit as an opportunity to exchange experience with as many of the colleagues in their institutions as possible.

The two main areas of focus for discussion during the interviews were: (a) developing assessments that can provide evidence of student learning; and (b) development and support for academics, especially early-career ones. In this context, the interview questions were meant to simply provide starting points for discussion. A list of the guiding questions used as prompts during the interviews is given in Appendix B.

The rich experience gained through the overseas study program has been extremely rewarding and will be detailed in this report. The visits also provided the opportunity to personally invite a number of those scholars to participate in planned activities at the participating Australian institutions. For example, the discussions at the University of Pittsburgh resulted in an invitation to Associate Professor Mary Besterfield-Sacre to give a keynote address at the Australasian Association for Engineering Education conference in Melbourne in December 2012.

2.2. Fellow-In-Residence Engagement (FIRE) program

The objectives and activities of the FIRE program have been developed rigorously within an established action-research approach to educational reform called professional practice research. This is defined as 'critically-informed, politically-activist and action-oriented' investigations in a range of educational settings, systemic priorities and policies and global contexts (Macpherson, Brooker, Aspland, & Cuskelly, 2004; Macpherson, Brooker, Aspland, & Cuskelly, 2010). The approach is critically informed because it situates itself within global and national trends in engineering education; politically-activist in being an agent of curriculum change; and action-oriented in involving heads of schools as key mentors of engineering education academics.

Two main areas were considered: curriculum alignment and evidence-based assessment; and academic mentoring. The program consisted of two rounds of visits by the fellow to each of the five Australian institutions, with each visit lasting for one to two weeks. The activities conducted at each of these universities were determined mainly by the objectives of the fellowship program. However, the details were discussed with each institution in order to maximise relevance and benefit.

2.2.1. Why use a FIRE program?

Engineering academics, especially early- and mid-career ones, face very high expectations in research performance and increasingly substantial responsibility for producing a workforce of competent professionals. Many of these academics have relatively little teaching experience or teaching skills, and need support. Thus, it is important not only to appropriately design the engineering courses and address the manner in which they are delivered (with particular emphasis on pedagogy and assessment), but also to address the preparedness of academics to engage with the academic standards and implement them in their day-to-day teaching practice.

With this in mind, many universities provide staff with an opportunity to participate in introductory programs on teaching (for example, Early Career Academic Recruitment and Development (ECARD) Program at QUT). These programs usually provide an overview of learning and teaching theory and practice and assist the academics to develop basic teaching strategies to deliver lectures, teach in small or large groups and assess student learning.

The types of programs and the breadth of theory and practical assistance vary between institutions. However, for many new academics, such programs have to be squeezed into a schedule that is dominated by research agendas, administration duties and the actual preparation and delivery of lectures. Some may question whether these programs are worth their time (Jacob & Goody, 2002).

Rust (1998) presented a review of the literature and conducted a study on the effectiveness of a number of workshops conducted over a period of four months, using qualitative and quantitative data. The study suggests that conducting workshops can be useful for staff development and the evaluation data collected from participants can be used to gauge impact. The author cautioned that the sample size used in the study was small, and that the characteristics of how workshops are run and the topics they cover can also influence the outcomes. Most of the studied workshops focused on practice rather than concepts and analysis. The author suggests that comparative analysis of the usefulness of workshops needs to consider workshop duration, the topics covered, whether attendance is voluntary or compulsory, and whether attendees consist of similar or different disciplines.

Jacob and Goody (2002) conducted a study for evaluating the effectiveness of some staff development programs. They reported that it appears what is missing is the provision of some form of evaluation of the transfer of learning to the participants' teaching practice. They also found that there is no follow-up in the medium to long term to check the extent to which participants have implemented strategies into their teaching, nor is there any formal opportunity for them to reflect on their progress.

Stes, Clement and Van Petegem (2007) conducted an exploratory study for evaluating the long-term individual and institutional impact of a training program for academics at the University of Antwerp in Belgium. They aimed to find out if the program resulted in changes in their teaching practice and if there were effects at the institutional level. They concluded that the data they collected suggested that the contextual elements have greatly influenced the long-term impact of the training program.

For lasting positive enhancements, a continuous quality improvement system needs to be put in place in such a way that it is owned and driven by those who can effect change at the local level (Harvey, 1996; Knight & Trowler, 2000; Newton, 2000). It is therefore important to encourage and support academics at the coalface, through various approaches.

The Higher Education Academy (HEA) in the United Kingdom sponsored a review of the impact of teaching development programs in higher education in May 2012. The outcomes of the review were published later that year by Parsons, Hill, Holland and Willis (2012). This was prompted by the adoption of a revised framework for professional standards by the HEA. Similar to drivers of this fellowship program, the review coincided with an intensified focus on enhancing teaching practices to improve learning outcomes.

As reported in Parsons et al. (2012), Postareff attempted to examine the effects of the length of training of university teachers on approaches to teaching and self-efficacy beliefs. They showed that training does enhance a shift from teacher-centred to learner-centred approaches to teaching. However, they indicated that such a shift occurs slowly and that awareness of one's own approach to teaching is essential for improving teaching practices. The FIRE program provided opportunities to participants to gain insights into their teaching approaches, suggested ways to make enhancements, and in a few cases, followed these up through practice.

The FIRE program has also helped provide feedback, without overwhelming the participants and making them more uncertain about themselves as teachers—a drawback of short-duration training programs (Postareff, 2007).

2.2.2. Participating universities

The FIRE program was implemented at five academic institutions. These have been selected to represent the diversity of university types around Australia: Edith Cowan University (new generation), James Cook University (regional), Queensland University of Technology (Australian Technology Network, ATN), The University of Adelaide (Group of Eight), and La Trobe University (Innovative Research Universities, IRU). The selected universities were distributed across Australia, from Queensland to South Australia and Western Australia, ensuring that an Australia-wide perspective was gained.

All these universities have provided support and strong endorsement for the fellowship program, before its commencement and during its implementation. This support was granted at the senior university leadership level (deputy vice-chancellors [academic or equivalent], executive deans, and assistant deans [learning and teaching]), and heads of schools also provided very strong support.

An action-research approach was used to support engineering academics in designing and implementing assessment tasks that provide evidence of students' attainment of learning outcomes. This was informed by the outcomes of the overseas study component to identify and evaluate relevant international initiatives for effective teacher engagement and curriculum reform. It was also informed by an extensive literature review conducted at the early stages of the fellowship program.

The fellow worked as a collaborator and change agent with heads of schools and academic leaders, including course coordinators, at the participating universities, with some activities involving other institutions as well. There was a focus on supporting academics' effective teaching and assessment practices. Wherever possible, the director of the learning and teaching development unit and senior university leaders at each institution were informed of the fellow-in-residence program and were included in the dissemination and feedback cycle as a conduit to the broader institution. The Council of Australian Directors of Academic Development (CADAD) was informed through membership of its president in the fellowship program reference group.

2.2.3. Outline of a typical FIRE program

A major focus of the FIRE program was on engaging the academics and discussing their own individual issues. Interactions were meant to be informative about the national level issues, reflecting on their implications for the academics' day-to-day activities, and ensure that students' learning outcomes meet the academic standards.

Discussion meetings were available, by appointment or as drop-in sessions. Possible issues to explore were:

- How can assessment be used for learning?
- Designing specific assessment tasks.
- How can classroom activities encourage student learning?
- What or where are possible resources (websites, papers, books, packages, etc.)?

- What are teaching for learning needs and possible ways to meet them?
- Networking opportunities, being part of a learning community.
- How to achieve steady enhancement without too much overhead.
- Ideas on balancing teaching and research, etc.

The general outline of the activities, meetings and actions carried out with various leaders and staff during the two visits to the participating universities is given below.

University and faculty leadership:

- Meetings with the deputy vice-chancellor (academic) or equivalent; the executive dean; the assistant dean (learning and teaching) or equivalent; and the head of school.
- An open seminar (university-wide offering) on the issues of assessment and mentoring.
- A workshop (co-facilitated by an international scholar, when possible).

Head of school:

- Explore available mentoring programs and how they are achieving their objectives.
- Work as a shadow mentor with the head of school for academic staff.
- Discuss relevant issues, as may be determined during the visit.

All academic staff:

Discussion meetings were available by appointment or as drop-in sessions. Possible issues to explore were:

- How can assessment be used for learning?
- Designing specific assessment tasks.
- How can classroom activities encourage student learning?
- What or where are possible resources (websites, papers, books, packages, etc.)?
- What are teaching for learning needs and possible ways to meet them?
- Networking opportunities, being part of a learning community.
- How to achieve steady enhancement without too much overhead.
- Ideas on balancing teaching and research, etc.

Small teams:

Topical workshops and discussions were held with the assistant dean/program coordinator, a representative from the university's staff development unit or equivalent, and a small number of academics (with one from the professoriate). Possible areas were:

- selecting certain course objectives, linked to the Engineers Australia Stage 1 competency standards
- designing assessment tasks capable of providing evidence of student learning
- other relevant areas as determined by the school/faculty.

A sample FIRE program schedule of activities is given in Appendix C. As can be seen, more engagements were actually achieved with a wider range of participants.

2.2.4. How the study program was used

As mentioned earlier, the purpose of the overseas study program was to update and enrich the fellow's experience, thus enhancing the quality and impact of the fellowship program. The following provides some highlights of what was learnt and how it was utilised during the implementation of the fellowship, but specifically during the FIRE program.

Utilising the literature review

Apart from the actual research results obtained, this activity has emphasised that there is no shortage of ideas, theories and practical implementations of the often thoroughly evaluated initiatives. While there is always a need for innovations, exploring new ideas and adapting old ones, one focus of this fellowship program was on bringing what the literature offers to the practising academics, facilitating its accessibility, relevance and usability.

It is recognised that assessment plays a critical role in influencing student approaches to learning. James, McInnis and Devlin (2002) suggest that recognising the potent effects of assessment requirements on student study habits and capitalising on the capacity of assessment for creating preferred patterns of study, is a powerful means of re-conceptualising the use of assessment.

Although this seems logical or well established, the FIRE program used the support of the literature to convey these ideas to those who did not reflect on their own approaches and how effectively they are using them to purposefully influence their students' learning.

In Australia, a 2010 study by David Boud and Associates (2010) confirmed that assessment plays a key role in both fostering learning and the certification of students. However, unless it first satisfies the *educational* purpose of ensuring that students can identify high quality work and can relate this knowledge to their own work, the likelihood that they will reach high standards themselves is much reduced.

During the FIRE program, it was observed that assessment tasks did not cater for providing opportunities for students' self-assessment as a means of learning. This led to making suggestions to some about how they might attempt to address this.

Based on their study, Boud and Associates put forward seven propositions for assessment reform in higher education, by stating that assessments have the most effect when:

- assessment is used to engage students in learning that is productive
- feedback is used to actively improve student learning
- students and teachers become responsible partners in learning and assessment
- students are inducted into the assessment practices and cultures of higher education
- assessment for learning is placed at the centre of subject and program design
- assessment for learning is a focus for staff and institutional development
- assessment provides inclusive and trustworthy representation of student achievement.

They go on to say that the above cannot be achieved with new techniques or assessment methods but by ensuring that what we do in assessment is always subordinated to the main goal of higher education, which is to develop educated citizens who can face the many challenges of a complex and changing society.

Once again, workshops and meetings with individuals were used as opportunities to prompt lecturers' self-questioning about the links between course and subject objectives and the ultimate purpose of university learning, and then to take practical steps in addressing those in teaching and assessment. This is directly connected to the findings of McAlpine (2010), who states that assessment must be understood, first of all, as a form of communication primarily between student and teacher but also by employers, curriculum designers and policymakers. Assessment is thus a social function, a communications link between the education system and wider society. Taking communication as her model, McAlpine then breaks assessment down into five main points or criteria that ensure that this dialogue is worthwhile:

- clarity of purpose
- validity/reliability
- referencing (establishing a common measure across all candidates)
- the quality of assessment items/instruments
- grading, a process that relates directly to referencing.

Palmer (2004) also suggests a tension between traditional forms of assessment that are simple and easy to administer (examinations, standard problem solving, etc.) and newer forms of assessment that offer a more authentic representation of practice, but could be more complex and expensive to administer. Hence, the issues around assessment cannot be examined on their own without also examining the issues around academics engaged in the learning and teaching activities.

The many discussions held at various locations during the FIRE program provided renewed opportunities for such engagement with the learning and teaching issues.

Utilising the US experience

The visits and interviews conducted in the US have been very informative about the various practices, in the US and Australia, of how to document student performance against accreditation criteria and standards. Many initiatives, approaches, strategies and resources have been identified and utilised during the FIRE program. Specific examples of how experience gained has been utilised will now be presented under the three headings:

1. Initiatives for enhancing learning and supporting academics
2. The importance of and strategy for individual consultations
3. Learning and teaching approaches gaining momentum

These examples will be followed by details of:

4. Direct engagement of the US expertise into the fellowship program.

1. Initiatives for enhancing learning and supporting academics

During the visits to the US, a number of initiatives have been identified and their resources made available to participants, as part of the FIRE program activities. Some of the resources were put together as a concise list, with brief descriptions and a copy of the associated documents, extracts and/or internet links. Some the identified initiatives were described in a paper presented at the CDIO international conference, held in Brisbane in July 2012. See www.cdio.org/knowledge-library/documents/faculty-mentoring-evidence-based-assessment-and-student-learning-austral

Below are brief descriptions of two initiatives undertaken by US universities to enhance student learning and support academics. These are selected for presentation here since their leaders have been invited to Australia to co-facilitate workshops with the fellow, thus disseminating their outcomes and resources to participants in the FIRE program. Some of the resources will be added to the fellowship website.

The Foundation Coalition

The National Science Foundation developed the Engineering Education Coalition program (1990–2005) to stimulate innovative models for systemic reform of undergraduate engineering education. This enabled groups of universities to form coalitions to champion systematic change. These groups produced significant reforms that have reinvigorated undergraduate engineering curricula to produce graduates who are better prepared to meet the demands of an increasingly and rapidly changing world. See www.foundationcoalition.org/home/keycomponents/assessment_evaluation.html

The goals of these coalitions included increased retention of students, especially under-represented groups, and improved learning experiences in engineering as well as active experiential learning experiences.

The Foundation Coalition was one of eight engineering coalitions in the US, and was established as an agent of systemic renewal for the engineering educational community. With its partner campuses, the Foundation Coalition has restructured its curricula (Foundation Coalition, n.d.), renovated or built new classrooms, and created faculty

development projects guided by core competencies that are informed by a number of theoretical frameworks, such as social learning and constructivist learning theories that address learning and change (Froyd & Frair, 2000). This was relevant to the fellowship program through its extensive resources, which were produced to address many areas such as active and cooperative learning, student teams, technology, and assessment and evaluation. Valuable and productive discussions with the Foundation Coalition's director, Professor Jeff Froyd, were prompted by its particular relevance to the objectives of the fellowship program. Professor Froyd was invited to Australia and co-presented workshops with the fellow.

Faculty learning communities

Another initiative of direct relevance and importance is the faculty learning communities (FLCs). A faculty learning community is a faculty group engaging in activities that provide learning, development and community. Therefore, the fellow had extensive and very informative discussions with Dr Milton Cox at Miami University, Ohio, who pioneered and continues to lead this approach, to learn firsthand about the details of establishing and maintaining these communities. Dr Cox was invited to Australia and facilitated workshops with the fellow. FLCs refer to the faculty—the academic staff; and were renamed academic learning communities (ALCs) in order to accommodate the differences between the American and Australian systems of nomenclature of academic staff titles. In the remainder of this report, FLCs and ALCs should be taken to mean the same thing.

As described by Cox and Richlin (2004), the faculty learning community focuses on future, new, junior, mid-career and senior faculty's desire for community, and support for investigation and implementation of new learning and teaching approaches and opportunities. These communities do not focus extensively on negotiated timing or other formal structures at meetings. However, while including the efficiency of getting things done, the FLCs have more focus on the social aspects of building community. They include more emphasis on the team aspect (while still consulting about and developing each individual's project) and on the ultimate beneficiaries of the program: the students in the participants' courses and those participating as student associates of the FLC (Cox & Sorenson, 1999). Every FLC must have clear goals and objectives. Accomplishment of these goals is usually the focus of evaluation outcomes at mid- and end-of-year reports.

Participating universities, especially those visited by Dr Cox, have gained valuable insights into the details and benefits of the ALCs, at QUT, the fellow's own institution, processes are underway by the Head of School to establish ALCs in the School of Electrical Engineering and Computer Science.

2. The importance of and strategy for individual consultations

With individual academics, discussions should start with where they are coming from, using questions such as: 'What is the innovation they wanted to institute in their course?'; 'What is it they were coming to seek support on, and what did they think was going to happen as a result?'; 'Why are they considering a certain innovation?'; 'What are they hoping to see as a result?'; 'And then how would we get at that?'; and 'How would we know that that is happening?'.

One of the lessons gained and communicated by one of the US experts while working with others at the Schreyer Institute for Teaching Excellence <www.schreyer institute.psu.edu> was the importance of demonstrating the effects of our teaching on student learning, thus providing credibility and evidence for others to use similar techniques. This is an approach that was encouraged during the FIRE program activities.

It was also learnt that it is important that individual academics are assisted to articulate their objectives and operationalise what they were hoping to achieve. It might be good to advise them that things are not always going to work as planned, but it is important that they continue to persist and improve.

3. Learning and teaching approaches gaining momentum

Through the visits and interviews conducted in the US, a number of teaching and assessment approaches seemed to have gathered increased attention and adoption. These have been communicated and their associated resources provided to participants in the FIRE program. Three examples briefly described here are:

Concept inventories

Student misconceptions are thought to be generally the result of a deficiency in their understanding of fundamental principles. In order to create a new conceptual framework and to displace the existing one that has been ingrained over many years, new teaching methodologies have to be established. Concept inventories are promoted (see <www.esm.psu.edu/dci>) as an excellent instrument with which to validate the effectiveness of these new methodologies.

In-class lab reports

Students often attend lab sessions where they conduct experiments or validate theoretical ideas, and find out the relationship between ideal and practical situations. This is a valuable contribution to student learning that can be burdened by complicated or inefficient reporting requirements. The in-class reports approach aims to aid the reporting process, but, more importantly, emphasise the learning. Student groups prepare short (usually one page) reports during the lab class time, which are then displayed on the walls around the lab. Each report is then briefly critiqued by other groups. These comments are recorded, also during class time. Students can then use this as foundation to prepare more formal reports, with the added benefit of the feedback received from, and provided to, the other groups.

Flip teaching or inverted classroom

In the inverted classroom, lecture and homework switch places, with lectures taking place outside of class through pre-recorded video and class time being spent on active work. Subject materials are delivered as video recordings that are made available for access from computers and mobile devices, and students are to study them ahead of class time. And in class, students can focus on internalising the material with the direct help of their peers and their instructor.

Since instructors do not present a one-size-fits-all lecture to an entire class, instruction can be personalised to each student, and the instructor can take the role of 'guide on the side' rather than 'sage on the stage'. The end result can be a classroom that is more inclusive, more active, and more learner-centred than the traditional classroom (Talbert, 2012). This is an approach that some lecturers have tried with success, and has been offered to FIRE program participants as an option to explore.

4. Direct engagement of the US expertise into the fellowship program

In addition to the indirect utilisation of what has been learnt from the overseas study program, three experts (Dr Milton Cox, Professor Geoff Froyd and Associate Professor Mary Besterfield-Sacre) were invited to participate in the FIRE workshops and meetings. Dr Cox and Professor Froyd co-facilitated workshops and were engaged in discussions with academics, heads of schools and other leaders at four of the participating Australian universities. Dr Sacre gave a keynote speech and conducted a workshop with the fellow, as well as other workshops and master classes at the Australasian Association for Engineering Education (AaeE 2012) conference held in Melbourne. The contributions were well received, as confirmed by written feedback. The keynote speech created much interest from attending academics, especially national engineering education leaders: see www.aeee.com.au/conferences/2012/documents/AEE-2012-%20keynote-Besterfield-Sacre.pdf

Some of the experts interviewed in the US led many successful workshops on academic staff development, academic learning communities, active and flexible learning, and assessment. Many of their ideas on how to run successful workshops were incorporated in the workshops run by the fellow as part of the FIRE program. Direct input from the US experts who were invited to Australia has also been incorporated in the workshops that were co-facilitated with the fellow.

3. Fellowship program implementation

3.1. Timeline

Considering the logistics of the fellowship activities, as dictated by the timetables and availability of personnel involved at several Australian and overseas institutions and the restructuring of the fellow's faculty with the associated changes to staff responsibilities and relocations, it was quickly realised that the original duration of one year would not be sufficient. An application to extend the duration to 18 months was submitted and subsequently accepted.

3.2. Activities

The fellowship activities were completed over the period from July 2011 to February 2013.

Table 1: Fellowship activities

Time intervals	Activities
Program set-up July–September 2011	• Appointment of program evaluator, senior research assistant and project officer. • Confirmation of reference group members. • Initial set-up of communications, project timelines and scheduling with participating Australian universities. • Continued communication with international scholars and setting up international travel schedule. • Set preliminary specifications of web interface and electronic communications.
Learning from international experience 2–18 October 2011 and 2–20 February 2012	• Consolidated relevant national and international research outcomes and developments. • Prepared program briefings for profile building with national and international entities and prepared presentation materials for overseas visits. • Conducted visits and discussions with overseas recognised scholars and institutions. • Conducted literature review. • Began dissemination of results of analysis. • Began preparation for the FIRE program.
Progress report February 2012	• Mid-term evaluation, teleconferences and meetings with the reference group. • Prepared and submitted the six-month report to OLT. • Discussions with members of AaeE and Engineers Australia.

FIRE schedule March 2012	• Identified the important issues and related them to the Australian environment. • Organisation of the FIRE program at each institution. • Began preparation of presentation materials.
FIRE activities round 1 (April–August 2012)	• Worked with the heads of schools (HoS) to identify participating academics, program leaders, course coordinators, members of the professoriate, and staff developers. • Held preliminary discussions on program objectives, tailoring to the particular institution, development and trialling of assessment exemplars. • Developed exemplars of assessment tasks that map to measurable learning outcomes. • Continued the development of the fellowship website. • Prepared and submit annual report to OLT (August 2012).
FIRE activities round 2 (July–October 2012)	• Presented a paper at CDIO 2012 conference. • Continued to engage with academics and work as shadow mentor with HoS and professoriate. • Conducted regional workshops for academics in the vicinity of each institution (some with invited international scholars). • Presented to all schools in the Science and Engineering Faculty at QUT. • Invited speaker at ABEC Biomedical Conference.
Reporting/dissemination November 2012 February 2013	• Developed and prepared mentoring guides for HoS and professoriate. • Prepared and presented a paper and workshops at AaeE 2012. • Continued to work with the program evaluator in preparing the final report. • Launched website.

3.3. Lessons learnt

Through the examination of the literature and the interviews conducted in the US, as well as the various engagement activities of the fellowship program, a number of lessons have emerged. Some of the lessons learnt will now be presented under the three headings:

1. Teaching and research
2. University- and faculty-wide (that is, organisational unit) approaches
3. Institution's context and individual needs.

1. Teaching and research

The assumption that research-minded engineering academics are not interested in issues of learning and teaching and outcomes-related assessment is not necessarily true in many cases. They are interested in issues related to their own teaching and to student learning, but since the learning and teaching literature works within a different paradigm of evidence (more qualitative and empirical) from the engineering literature (quantitative and experimental), the challenge lies in framing the engineering education research in such a way that it can be comprehended and used in practice more easily by engineering academics. This was considered during the workshops and seminars conducted during the Fellow-In-Residence Engagement (FIRE) program.

In regard to the issues related to assessments and the broader picture of the learning and teaching environment in higher education, research evidence need not be confined to engineering. Although some issues in engineering education may be unique, there are several ideas and innovations from other disciplines that can bring value to engineering education.

2. University- and faculty-wide approaches

While there are several successful individual approaches to assessments to improve student learning outcomes, some that have the most impact are those that are faculty- and university-wide approaches, as well as involve industry.

The most successful efforts for mentoring academics in learning, teaching and assessment are those that are strongly encouraged or mandated from the top down. Therefore, it is extremely important to engage senior university administration in the mentoring process by showing them evidence of the long-term benefits to the institution of incorporating a structured and methodical process of mentoring early-career academics in learning and teaching, not just in research.

3. Institution's context and individual need

There is need and appreciation of assistance to individual academics to deal with their specific learning and teaching issues. This was highlighted during the fellow-in-residence program. Many academics had several sessions of discussions with the fellow and had an opportunity to develop and trial new teaching/assessment approaches during the visit. Feedback and communication continued by email and phone with colleagues met at the participating institutions.

In spite of the careful preparation of the agendas and resource materials for the workshops, ongoing improvements to workshop presentation and format and the workbooks have been necessary to ensure relevance to the specific audience. This was particularly important when workshops were co-facilitated with the invited international experts. Consideration of the specific needs of those institutions, presentations and workshop programs were modified accordingly to maximise benefit.

It is important to note here that these lessons are complementary to those learnt through the literature review and the US study program (please see Section 2.1, 'Study program').

3.4. Challenges faced

Given the magnitude of the fellowship program and the number of institutions and participants it engaged in Australia and the US, its implementation was not without challenges. Some of these were unexpected, but those that were anticipated turned out to be much more intense and involved. However, it is pleasing to report that the challenges have been largely met without negative impact on the fellowship program or its outcomes, save some intense demands on the fellowship team at times.

Obtaining the ethics clearance presented a challenge, but after some initial setbacks, ethics clearance was obtained just in time for the first overseas visits. With the cooperation of QUT staff and the experience of the project officer, the main challenge was the completion of the demanding paperwork in a timely fashion.

The creation and hosting of the fellowship website on a QUT server has been a continuing challenge. In spite of the willingness of web services personnel to assist, many difficulties were hidden in the regulations of web hosting and the necessity of conformance to templates, requirements for access to servers, and content management and formatting. An external domain name was deemed necessary and it was finally possible to build and publish the website.

It has been challenging operating in an environment of change at QUT, which has impacted on activities such as the website development. In order to ensure that the fellowship program continued to progress as closely as possible to its scheduled activities, administrative matters needed to be dealt with, in a timely fashion, at the faculty level. However, in spite of strong support from the leadership, the faculty restructure has absorbed time and effort in identifying different people in different roles to seek their assistance with those administrative matters.

Although the principal focus of the fellowship is engineering, many of the engineering schools are now merged with other schools in the science and engineering faculty. This has meant spending more time reaching out to additional disciplines in an effort to ensure that the whole faculty had an opportunity to engage with the fellowship program.

The invitations to the US workshop presenters caused some administrative headaches. At the time of introducing some changes to the Australian taxation laws, the question of visas was preceded by a lengthy deliberation on whether or not there would be fringe benefit taxes accruing to the project and this considerably delayed the processing of paperwork. Further, it was difficult to get definitive advice on the best way to remunerate and reimburse guest presenters for travel expenses.

One enormous challenge has been the scheduling of appointments, workshops, meetings, and fellow-in-residence activities, taking into consideration teaching periods, public and academic holidays, exam periods and different time zones. It was also a challenge to accommodate the most convenient time for visits and workshops at five Australian universities and several US institutions. Appointments had to be made to visit a number of key academic colleagues over two visits to the US in October 2011 and February 2012.

Concurrently, scheduling of two weeks of Fellow-In-Residence Engagement programs at each of the five Australian universities plus follow-up workshops with invited speakers from the US to co-present workshops demanded juggling, refinement and attention to detail. Through the project officer's skilful management, none of the finalised dates for all activities needed to be changed; all went according to plan.

Managing the extensive travel undertaken by the fellow was challenging and required some fine tuning. This was necessary to ensure he did not become overwhelmed by the travel and the voluminous amount of data collected through interviews with a wide range of academic staff, and to maintain focus on achieving the fellowship objectives.

It was planned to invite Professor Michael Prince to Australia to co-present workshops at the participating Australian universities and also at the AaeE Conference in Melbourne, but he was not available within our timeframe. His unavailability has meant that Edith Cowan University, Perth, did not enjoy a follow up workshop with an international presenter. However, Associate Professor Mary Besterfield-Sacre, of the University of Pittsburgh, was invited to give a keynote presentation and to co-facilitate national-level workshops at the AaeE conference. Dr Sacre's acceptance was an excellent outcome and her presentations were very well received. Dr Sacre received a number of requests to return to Australia for a longer period of time to better make use of her experience in engineering education research.

The loss to the fellowship of the appointed evaluator, Dr Deborah Southwell, due to her full-time appointment elsewhere, was a setback to the program. However, after much searching, the appointment of Dr Elizabeth McDonald to take over that role has been a great outcome given her experience and standing in the higher education sector. Dr McDonald's prior commitments meant that her engagement with the fellowship in this capacity could not formally commence until the third week of July 2012, although phone discussions started earlier.

The loss of project researcher, Dr Bhuva Lakshminarayanan, to a full-time position at a Sydney university created another challenge, given her acquired knowledge of the project. However, Dr Carol Quadrelli, who had been briefed on the project, was appointed to take on the task of data analysis. This meant additional time was needed in briefing Dr Quadrelli to ensure she was fully informed about the fellowship program and its intended outcomes. Dr Martin Murray was also appointed to assist with some aspects of academic standards and assessment resources.

4. Impact of the fellowship

Parallel to the said objectives of the fellowship, a personal objective of the fellow was to have positive effects on individual academics, as fundamental building blocks for wider ranging effects within schools, faculties and universities. Passionate teachers, equipped with research results and knowledge of the practical aspects of pedagogy, can function as beacons in their institutions. In every institution, there are those who derive great satisfaction from positively influencing others. They are perfect agents of change and a source of enormous bursts of positive energy. They need to be recognised, supported and allowed to bring out the best in today's students—tomorrow's professionals who can transform the future.

Every teacher has the power to positively change students' lives every time they step into a classroom, or have any interaction, face-to-face or virtually, with them. With this in mind, the fellow endeavoured to act as a change agent, quietly but persistently, and it has been very satisfying to observe the fellowship program's positive impact. Some of the highlights are described in this section.

4.1. Impact on participating Australian universities

The feedback received during the two FIRE rounds of visits to the participating Australian universities provided very valuable insights into what participants valued. At the senior leadership level, the FIRE program was very well received at university, faculty and school levels.

Whenever possible, the fellow met with deputy vice-chancellors (academic) and/or the assistant deputy vice-chancellors. In fact, at some universities, such meetings were requested ahead of the fellow's visit. Meetings were organised with every executive dean or equivalent and also with assistant deans.

The fellow's meetings with these leaders were conducted with two main aims in mind. First, these were opportunities for informing them of what the fellowship program objectives were. Second, and more importantly, meetings were opportunities to see how the fellowship program could be adapted to the individual university and faculty's context and priorities.

From their perspective, the educational issues considered by the fellowship program were applauded as being relevant and timely. At this level of university leadership, the heightened importance of ensuring the quality and standards of learning and teaching has meant that efforts that contributed to enhancing their responses and boosted the rate of progress towards achieving them were indeed welcomed.

There has been real movement in the course design and recognition of it [course design] as a valuable activity rather than a response to University or Faculty directives. I would say the interest in the curriculum design for the [specific] Engineering program has been driven largely by the presence of Wageeh Boles.

Assistant dean

It was useful that the Engineering staff heard from a fellow engineer even though it was much the same message as the Faculty has been attempting to disseminate. I personally found the comparison and discussion around the University standards and the professional accreditation standards illuminating.

Assistant dean

Thank you so much for coming [to university] as a fellow-in-residence. I know the value of your discussions with our staff will be felt for a considerable time as you have re-invigorated discussion of the curriculum.

Assistant dean

At the school level, it was vital to work closely with the heads of school. As iterated elsewhere in this report, this is the leadership position that can directly influence what academics will or will not do. Again, the educational issues of quality and standards were at the forefront of what they wanted to address.

Working with the head of school as a shadow mentor to early- and mid-career academics was especially appreciated. Since the FIRE program provided ample time and opportunities to work—on an individual basis—with many academics, both the individuals and their heads of school recognised and appreciated its value. This signals the value the model of visiting fellows could have in positively influencing the academic environment.

We highly recommend the continuation of the Fellow in Residence Engagement program. The excellent outcomes achieved could not have been delivered through a shorter visit. This program has provided invaluable guidance and support to the School of Engineering at [university] and we hope that by expanding this program more universities (and their schools) can benefit from it.

Head of school

The individuals felt comfortable to talk to the fellow as ‘an external’ to the institution, whose guidance and advice were free from the influence of the institutional agenda or other local dynamics. Individuals also valued being informed about, and having access to, available resources beyond their own institution. One implicit value here is the trust in the integrity of the fellow, which ensured that any matter the participants wished to keep confidential remained, and will continue to remain, confidential.

Many thanks for your time and input over the last few days both on a faculty level and on a personal level regarding my career. Nice to receive feedback from someone external about prospects and general career advice.

Early-career academic

One other value expressed by participants was the opportunity to discuss practical learning and teaching ideas, especially assessment and evidence of learning, and taking actions directly to the classroom. Some implemented changes in teaching and assessment practices, and had an opportunity to report back to the fellow and then proceed to the next steps. This is where the second round of FIRE program visits proved valuable. A range of academics expressed their views on how the FIRE program was valuable to them.

It was great leaning from you several ideas and techniques to keep developing my teaching skill and thank you for your advice.

Early-career academic

The meeting yesterday was very positive and I was thrilled at the discussions and didn't notice how 90 minutes just flew past! ... The assessment development process that you kindly shared with us will be useful going forward.

Mid-career academic

Thank you for your encouragement. I have a lot to learn from you as you are a nationally respected university teacher ... I look forward to having many collaborations and exchanging views with you in future.

Member of the professoriate

The fellow, being external to the universities visited, provided a safe and neutral environment for frank and open discussions. This had a profound effect, demonstrated by how academics and administrators took on board the fellow's ideas and suggestions, with immediate action in some cases.

The program has been very successful for our University. It enabled staff from engineering and science disciplines across the two campuses to consult with Prof Boles, share ideas and have him advise us on developments on curriculum design, course mapping, assessment and accreditation issues.

Head of school

The voice of the external expert help[s] make the issues more 'real', and introduces examples from beyond our institutional boundary, adding to the sense that these are issues that everyone is grappling with. Finally, the fact that the expert was from a cognate discipline rather than an educationalist or policy maker probably influenced how willing some staff were to engage in the conversations.

Assistant dean

... particularly highlighted opportunities for the creation of teaching teams and dissemination of accrued experience across various areas of teaching and assessment amongst academics.

Head of school

One other value of the FIRE program was the feedback meetings held with the heads of schools and assistant deans (individually or combined). These meetings provided opportunities for leaders to hear from an 'external' about areas of strengths and others needing further attention. The fellow, through group and individual interactions, identified these areas. However, as indicated above, such feedback ensured the confidentiality of individuals.

In the short term, some very useful strategies for more effective assessment were passed along to academic staff, which should help to increase the quality of assessments, and particularly of authentic assessment.

Head of school

Additional focus on the importance of Universities providing effective mentorship of academics (especially at early career level) both in their teaching and research.

Early career academic

You have inspired me and many of my colleagues ... I have certainly learned a lot from you and you have set an excellent example for us to look up to. We will be privileged to have your continued input and support as we try to improve our teaching and learning environment for our students and staff.

Head of school

Bringing national and international perspectives of quality assurance and accreditation were among the contributions valued by the leadership and individual academics. In fact, when the fellow reiterated institutional messages (without prompting from the universities), participants more readily embraced them. As expected, such outcomes were greatly valued by the leadership. Also, individual academics valued their investment of time and effort to address those issues, realising their intrinsic importance.

Action plans involving curriculum mapping (Standards, TEQSA, AQF) and re-focussing on assessment design (constructive alignment and "for learning") have got some traction with most staff – they have a stronger appreciation of the drivers and the need to respond effectively, and are more open to engage with the challenges of changing practice appropriately.

Assistant dean

In regards to the academic standards—TEQSA and AQF—universities and individual academics are at different stages of engagement with these national initiatives. However, the fellow-in-residence program helped bring these matters to the fore, and therefore enhanced both awareness and engagement.

The [FIRE] program assisted in sensitising academic staff to the importance of AQF, Standards, and TEQSA, and having a reasonable proportion of the staff engage in initial conversations about how these might impact on practice.

Assistant dean

The active discussions we had at different levels during your stay have helped the school and the academics in many ways.

Assistant dean

An indirect indicator of the value of the second round of visits of the FIRE program was expressed in the way participants interacted with the fellow. This time, personal connections were already in place, and even those who did not have much interaction during the first visit felt they could easily do so during the second visit. Although the fellow was external to the participating universities (except for QUT, the fellow's home institution), there was a welcoming atmosphere and the fellow received various expressions of appreciation and the desire for the fellow to spend with them a subsequent period of time dedicated to their own specific needs.

A further piece of evidence of the impact of the fellowship program had on participants can be found in independent, unsolicited blog reports posted on 12 and 13 October 2012 at <<http://nickfalkner.wordpress.com/tag/wageeh-boles>>. The blog posts provide comprehensive commentary and reflections on the topics discussed at one of the workshops conducted at The University of Adelaide, and the importance and contributions of those topics to engineering education and practising academics.

The nature and levels of engagement of academic staff at the participating universities have been different from those of academic staff development practitioners. The latter were interested in the global issues of assessment and standards, and participated with a view to mobilise these national imperatives to engage academics beyond the fellowship program.

At QUT, the levels of participation in the fellowship activities (seminars, briefings, workshops, and individual consultations) have been higher than is typically expected in one's own institution. This strong level of engagement is clearly reflected in the participation data provided in Appendix D. The university, faculty and school leadership have certainly supported the fellowship program, starting from the nomination process, through to its completion. The fellow continues to draw much satisfaction from being engaged in mentoring and supporting QUT's award and fellowship nominees.

4.2. Impact on US participants

The international study component was designed to gain hands-on experience of the innovations, initiatives, and learning and teaching approaches with evidenced positive impact on student learning. It was also an opportunity to strengthen and/or establish personal links with overseas experts to exchange ideas, as well as invite some of them to Australia to participate in the FIRE program. However, this was by no means a one-way learning exercise. Discussions often involved addressing topics of mutual interest, and the fellow shared his own personal experience and also provided an Australian perspective. This is where explicit requests to share this experience and perspective came as a very welcome sign of the value the fellowship program had to offer.

For example, in a meeting organised with heads of departments, the discussions were very vibrant and participants were enthusiastically involved. The meeting was attended by other academic leaders and at its conclusion, attendees confided that it was a unique meeting that was completely dedicated to learning and teaching. They continued to express their appreciation of the ideas shared by the fellow on creating a culture of valuing learning and teaching and openness in discussing challenges, at individual and departmental levels. This was seen as one of the critical roles heads of department needed to play in order to better promote quality in learning and teaching, alongside research.

As another example, the fellow was invited to share the outcomes of the US study and the fellowship activities at the conclusion of the program, an unintended but very pleasantly received indicator of value and impact.

4.3. Impact through the reference group

Reference group members also recognised the importance and relevance of the fellowship program and the educational issues it addressed. An industry representative expressed this in the form of an invitation to the fellow to make a presentation at a national engineering conference. Another indicator of value came from the international member who expressed interest in possibly sharing the assessment resources and expertise developed through this program with their institution in the US.

4.4. Insights gained

The FIRE program provided a great opportunity to get close to the day-to-day issues facing academics. The majority of participants were from the engineering discipline, but because the FIRE program activities and seminars had university-wide availability at the participating institutions, academics from other disciplines such as mathematics, pharmacy, business and law also participated in groups or as individuals, albeit in relatively smaller numbers. Some valuable insights follow.

4.4.1. The teaching team

In engineering and also in other discipline areas, learning and teaching matters remain largely a private affair to many academics. Unlike research, where identifying a problem is an important and critical part of the whole process, teaching problems are not talked about openly, even in small groups who teach in the same program. Academics are motivated to seek support to enhance research performance, but in spite of their aspiration to become excellent scholarly teachers, many do not feel comfortable to readily seek the needed support.

It is more common than not—as observed at the institutions participating in the FIRE program, as well as elsewhere—that those teaching in the one program do not function as a team. This has drawbacks in terms of enhancing students' learning experience and outcomes, and it also negatively affects students' views of teaching performance. Issues such as the lack of coordination between subjects, and the timing and types of assessment (possibly leaving gaps of knowledge unaddressed or revealing the unjustified presentation of the same materials) all take away from quality learning and teaching.

The reason that academics still do not work together as teams perhaps stems from the diminished value of the 'return on investment' in such activities. This is especially highlighted with regard to their effects on recognition and career advancement.

4.4.2. Student evaluations of teaching

Student evaluations of teaching are among the valuable mechanisms used to enhance teaching, learning and the learning environment. However, while many academics see value in obtaining student feedback, it was observed that sometimes the wording of survey questions in student evaluations of teaching can cause a great deal of angst among academics. The tension between having students satisfied with the teaching of an individual academic on the one hand, and commenting on the quality of teaching as measured by clearly articulated and measurable criteria on the other, cannot be underestimated.

If it is thought that students give excellent teaching performance scores to those teachers who give them 'easy' assessment tasks, then there is a risk of equating good teaching scores with lowering academic standards. Student evaluations of teaching might be dismissed as just a popularity contest, and this becomes even more critical if academics' teaching performance relies solely on this form of evaluation. Variables such as the year level of the subject, the number of enrolled students, and actual or perceived difference of level of difficulty of some subjects are concerns for those who are negatively affected in student evaluations of teaching.

Many of these concerns can be addressed, at least in part, through encouraging participation in development opportunities, with clear recognition of such. The actions taken by the leadership, especially at the school level, can critically affect how academics respond to the 'real' issues identified in student evaluations.

4.4.3. Teaching and research

The majority of academics who met with the fellow individually and in small groups during the FIRE program have raised concerns about balancing the demands on their time between teaching and research.

There is a greater emphasis on raising research performance in terms of publications and successful grant applications; the expectations are raised in terms of quality (which is always welcome), but also in quantity. There are limited funds available from the Australian Research Council (ARC) to fund the spectrum of new initiatives and innovative research projects. Building a track record is vital for enhancing the chances of success of grant applications, especially from the ARC, which is seen as one of the most prestigious funding sources affecting university rankings. Engineering and technology are especially expected to keep performing to increasingly higher thresholds.

Coupled with the (perceived or real) differential value of performance and achievements between teaching and research, academics, especially early- and mid-career ones, continue to look for strategies to fast-track their research performance while trying to improve teaching performance. The FIRE program focused attention on designing assessment tasks capable of providing evidence of achieved learning outcomes.

There appears to be a real need to better appreciate and utilise local expertise to support the endeavours of new academics in learning and teaching.

A great number of early-career academics are very keen to excel in scholarly teaching, but have not been formally trained. In spite of this, some are actually introducing innovative teaching approaches, mostly utilising technology, and causing established academics to reflect on their own teaching. This is great news, but supporting academics to carefully balance their work–life obligations is necessary for sustaining their performance and wellbeing.

4.4.4. Assessment practices

During the FIRE sessions there was an emphasis on selecting certain course objectives, linked to the Engineers Australia accreditation criteria, and the design of assessment tasks capable of providing evidence of student learning. Among the points suggested for discussions were:

- How can assessment be used for learning?
- Designing specific assessment tasks.
- How can classroom activities encourage student learning?
- What are teaching for learning needs and possible ways to meet them?
- How can steady enhancement without too much overhead be achieved?

In some of the meetings discussing learning objectives and outcomes of a certain subject, it was observed that there is a tendency to have a large number of assessment tasks, each worth just a few marks. This means that students are almost always doing assignments, and academics are frequently doing marking. This is making academics so busy that they have no time to innovate, reflect or ask themselves simple questions such as: What is the purpose of the assessment task?; Is it for learning?; Is it assessment as learning?; Is it assessment of learning?

There is potential to restructure the learning and assessment so that it enhances learning while saving the academic a great deal of time. Then, if the academic is interested in doing so, where would they go to get some answers? The FIRE program meetings and workshops assisted in initiating this process, but local follow up is needed for the ideas to bear fruit in a sustainable way.

4.4.5. Discipline-specific and graduate capabilities

At least for some academics and institutions, discipline-specific and graduate capabilities have been the source of tension and regarded as a waste of time and energy. Each university has its own set of graduate capabilities. These are the skills and attributes each student is expected to have attained by the conclusion of their program. However, for engineering programs, there is the Engineers Australia accreditation criteria that must be demonstrated in order to maintain ‘accreditation status’.

Although these two sets of capabilities and criteria have much in common, it was observed that engineering academics seem to focus almost entirely on discipline knowledge: ‘the content’. In discussions, it became apparent that there are two main factors contributing to this. First, there is the impression that graduate capabilities are displacing discipline content, and those who believe this to be the case are not willing to participate in what they see as a threat to upholding discipline standards and maintaining accreditation status. Second, the emphasis on graduate capabilities and the way this is presented to academics meant, for at least some, that they have to ‘teach’ material they are not as competent in (compared with their discipline knowledge).

For example, when official university documentation lists their graduates’ skills and abilities, graduate capabilities are listed first, followed by one last item labelled ‘discipline-specific capabilities’. This, although logically justifiable from the perspective of a university-wide document, unintentionally reduces all that academics value most (their discipline content and knowledge) to one item appearing at the bottom of the list.

In many cases, this has been the source of some heated discussions that took people away from the intended outcome: producing graduates who are not only competent and capable in their discipline area, but also in the overall graduate attributes and qualities (that is, graduates who are better equipped to function more effectively and responsibly in society).

4.4.6. Resources and expertise utilisation

In an environment of greater expectations of enhanced research performance, ways of facilitating the teaching—including the preparation of student learning resources and creating better assessment tasks—need to be carefully considered.

The fellowship program has established that there are many great learning and teaching resources available. However, the utilisation of the majority of these resources remains extremely low, and limited to those who created them. One wonders why this is the case. The FIRE program was a conduit for the fellow to provide participants, especially those who had one-to-one meetings, with pointers to available resources and how can they be used. These have varied from one person to the other, depending on their needs. In these cases, the fellow identified the resources, saving the academics time in trying to look for them. The fellow also facilitated their actual use, saving the individuals the time of having to find this out for themselves. Simply, the fellow played a facilitator’s role, and was available for follow-up questions. More details about these and other resources, made available through this fellowship for academics’ use, will be discussed in Section 5, ‘Dissemination and deliverables’.

Many institutions have local expertise that can play similar roles. Will they be given the opportunity? Will they be recognised for having such capability, and then for sharing their experience with others? The fellow had the advantage of being external to the visited university system, backed by national recognition, and was available for a limited time (thus creating some urgency to seize the opportunity).

At the Australasian Association for Engineering Education (AaeE 2012) conference in December 2012, the fellow presented—with Robin King and Roger Hadgraft—a symposium entitled ‘The “not invented here” syndrome: Breaking the resources re-use barrier’. It was intended to find out from participants what the obstacles are and how they might be overcome. Here are some of the points raised:

- Having too many choices and how to organise all this material
- The need to trust the correctness of the resources
- The need to learn other materials
- Issue of privacy of student data when using resources on remote sites
- Lack of availability of development (technology) staff with specific expertise
- How the academic identity is tied up with the teaching role
- The reputational issues—some re-badging details might be necessary
- Difficulty in adapting or making changes to available resources
- Academics being time-poor, given the research versus teaching demands.

The utilisation of available resources makes sense in many respects, including building on others’ intellectual (and financial) investment and insights to enhance the student experience and learning outcomes. It is meant to support academics whose time is in great demand for research as well as teaching.

Considering the last of the barriers listed above, it is interesting to note that the symposium participants thought that the utilisation of available resources requires more of their time, thus running opposite to the very purpose of saving academics’ time (and increasing effectiveness) by using those resources. So, where do we start?

This is a very important issue and the points raised at the symposium can be seen as bases for further exploration and wider discussions.

4.4.7. Supporting teachers

Often little investments can bring about quick improvements. While these may not produce large-scale, transformative outcomes, they could be the encouraging starting points, or the hooks, that propel academics into becoming more scholarly teachers. Some academics may even use these to go deeper and move into the scholarship of teaching.

The following are some ideas and actions schools can use to achieve quick gains:

- I have noticed that creating a positive and supportive culture is a very effective way of building a strong school or department. This is a long-term, cultural-change endeavour, but with persistence and sincere commitment and enthusiasm from the leadership, it can reap its benefits. If academics are asked about what drives and motivates them to excel, and the paths they choose to achieve success, there would not be a unique answer. A clear commitment to excellence in teaching may not be among those answers. However, if we include, as part of staff development, critical

elements such as care, and putting back into society what society has invested in us, we might be able to persuade more academics to be positively engaged in this exciting process of creating the next generation of professionals. One way of creating and encouraging a 'culture of care' is to establish and support mentoring programs and use academic learning communities, such as <www.foundationcoalition.org>, as a part of the academic environment. The effectiveness of these approaches has been established in the literature, and therefore has the credibility that would encourage research-focused academics to become more involved in scholarly teaching.

- Create a forum for sharing 'ideas that worked' with colleagues. For this to work, presenters need to: (a) give a description of the issue or problem the initiative addressed; (b) describe what action has been taken, how well it worked, and what measures were used; (c) provide an accurate estimate of the time required for implementing the ideas or action; (d) list the prior knowledge or resources required (for example any software or internet resources used) and their availability; and (e) indicate the presenter's willingness to assist. For some, this last point can be crucial for them to get started.
- Present learning and teaching initiatives in forums attended by all academics. It is almost always observed that the 'same' people participate in learning and teaching functions, with presenters feeling that they are 'preaching to the converted'. A key to reaching academics who do not normally attend learning and teaching forums or functions is to present them with practical examples of the integration of learning and teaching initiatives.
- Identify and recognise local experts and encourage academic colleagues to seek their help, advice or guidance. At least, these local experts can point fellow academics in the right direction, or to the right people (including university staff development unit staff) who can specifically help with the issue at hand.
- Encourage academics to form 'teaching triangles'. These are simply groups of three academics who teach in similar disciplines or even a sequence of subjects, and have been used with success among colleagues. The groups are self-selecting and can meet informally at the end of each semester. Discussions at such meetings may include the feedback they each received from student evaluations and how to address it.
- Students' comments on an academic's teaching performance can be very confusing. It is common for the same academic to receive both extremely negative and positive comments from the one cohort of students attending the same subject. Teaching triangles can be used as a supportive means for dealing with this wide spectrum of responses. Members of the triangle can together think of ways to respond to students' concerns, decide on an intervention or an innovation that they would try next time and then re-assess.
- Peer observation of teaching can be a powerful way of enhancing teaching performance for face-to-face classes. However, academics' concern about the 'correctness' of the content they teach, and the dread of making a mistake under the watch of a colleague from the same school or discipline or department can be a strong barrier to actually using this approach.

- Separating 'what' is being taught from 'how' it is taught can help resolve this problem; that is, peer observation can focus, for example, on the 'how.' In this case, the peer observer can come from a totally different discipline and work with the academic, without the concern about the 'content'. This approach was used successfully during a previous fellowship program <www.olt.gov.au/resource-matching-students-staff-self-evaluation-qut-2009>, where the observer was an anthropology academic from a different university. However, for this to work, one should not ignore the personal aspects such as trust in the observer as a person, and confidence in their ability to provide credible feedback.

While the above actions will need the recognition at the faculty and school levels, the head of school's support will be the one that makes all the difference.

4.5. Impact on the fellow

The following paragraphs may be seen more like reflections than specific impact. However, these are provided here because I believe that we develop much, personally and professionally, by engaging in reflective practice.

Mentoring of junior academics and working as a shadow mentor with the heads of school at the participating institutions has been very rewarding for me, as was seeing how it was received and acted upon. While the visits to the participating institutions in the FIRE program provided an opportunity for the academics at these institutions to get frank feedback on their issues, free from institutional dynamics, the insights gained from the discussions have contributed to enhancing my understanding of the common challenges facing today's academics.

Dissemination through engagement both in the US and Australia is an area where the fellowship has provided much more than what has been anticipated and proposed in the nomination. The wealth of knowledge gained from discussions held with 37 academics in a range of roles and responsibilities has been invaluable to me and, through dissemination, to the participants at the Australian universities as well.

The fellowship was also an opportunity for me to go deeper into the literature and discover many excellent resources (including printed books), to share with others, and to also use in my own teaching. This was a practical way of realising, deep inside, that I still have much to learn.

Meeting such a large number of senior leaders at the US and Australian universities has also provided me with a better understanding of how policy and national initiatives are received and acted upon at this level. The often varied perspectives of those leaders and how they go about implementing national agendas is not separate from their personal goals and objectives.

It is a humbling experience to have had the opportunity to go around the country and meet and work with colleagues at many universities and from disciplines other than my own. To be able to assist others was very rewarding, as I believe that it is an obligation to put back into society at least part of what it has invested in me.

It was also humbling and rewarding to be able to run several workshops at my own institution. This emphasised my conviction of the relevance and timeliness of the educational issues addressed in this fellowship: academic standards, assessment and assuring the quality of the learning outcomes, and accreditation by both TEQSA and Engineers Australia. But I see it also as evidence of the credibility associated with the privilege of receiving such a national fellowship.

4.6. Evidence of change

The fellowship program had at its heart the aim of effecting change at the faculty, school and individual academic levels. While long-term change cannot be ascertained at the conclusion of any program, pointers to such change may be able to be indicated.

During the FIRE program visits to the participating Australian universities, assistant deans and heads of schools provided specific feedback, of which the following are relevant to this section:

Prof. Boles seminar gave a platform for the academics in the School (and also outside the school) to discuss on various issues related to teaching and learning which included designing of assessment to achieve learning outcomes; structure and strategies of implementing academic learning communities and mentoring.

The discussions we had with Prof. Boles are very helpful in curriculum mapping that we are doing right now in the School.

It is also very helpful for formulating a structure and strategies for peer mentoring of teaching.

Assistant dean

In the long term, the program has contributed to how easily we will be able to engage staff in establishing (and using) QA systems addressing the AQF and TEQSA evidentiary requirements, and gone some way to making all academic staff more reflective in their practice. Of course, realisation of critical reflective practice across the board will take a lot more exposure to conversations about learning and teaching, but the program has assisted by giving staff a productive experience of engaging in this type of thinking and dialogue.

Assistant dean

In the longer term, assuming the School can effectively establish a set of teaching teams and a culture of scholarship of learning and teaching and collaboration between staff then the quality standards of our programs can only improve.

Head of school

... There is a very high value in establishing community dialogue about teaching and learning issues in general, and staff need to be exposed to knowledge and experiences from beyond their own institution ... not many staff currently engaging in T&L [focused] scholarship or conferences, but repeated engagement with productive workshops of this type will support the evolution of the engineering education community.

Assistant dean

Workshops were conducted at the participating universities as well as at the national and international conferences. At the participating Australian universities, workshops were held during the second round of visits with some being co-facilitated with US invited scholars. At the end of each workshop, participants were asked to provide their feedback. The aim was to not only gauge the impact of the workshops on their future actions, but to also seek their comments on how future workshops can be improved to further enhance their intended outcomes.

The vast majority of participants acknowledged that the workshops prompted them to think more systematically about assessment and evidence of learning. A moderate percentage in the first workshop (at the CDIO international conference held in Brisbane in July 2012) commented that the workshop timing did not provide ample opportunity for group discussion and hands-on application, but the materials and resources were helpful and well received.

These comments were taken on board and subsequent workshops were structured to reduce the less essential content material so that there was time available to complete activities. This proved more effective, with the majority of participants in subsequent workshops expressing satisfaction with the amount of time allowed.

General comments from all workshops related to the realisation of the importance of assessment and how this should link to the measurable course objectives through an improved, systematic design of assessment instruments that provide evidence of learning. This has led a number of academics to think about teaching goals, course design (particularly learning outcomes), how assessment is structured, and the review of current assessment practices and how best to plan for assessment.

Several comments related to an improved understanding of the roles of assessment and rubrics and the need to take a more program-focused approach to assessment to ensure the student competency requirements are met. Participants appreciated direction to useful websites/resources. For others, the workshops highlighted work that needs to be undertaken within their own course, school or discipline area.

5. Dissemination and deliverables

This fellowship had the engagement of academics at the coalface at its heart, and has thus endeavoured to disseminate its outcomes through these engagements much more than the creation of resources, that often times have to wait until the conclusion of a project or a program for those to become available. There is also the greater uncertainty of the utilisation of these resources beyond the duration of a fellowship or project.

The Fellow-In-Residence Engagement (FIRE) program was conceived, designed and implemented as a model for staff development through extended engagements. This is to be contrasted with workshops (lasting between a few hours to a full day) that are often delivered with little chance for real engagement between the facilitators and participants beyond the duration of the workshops. This is a particularly important point to make, as the literature now supports the view that such workshops, although they still have their place as an approach for staff development, do not deliver strong lasting effects (see www.aeee.com.au/conferences/2012/documents/abstracts/aeee2012-submission-181.pdf)

Speaking at the US National Symposium on 'Student success at college and university' in November 2006, Vincent Tinto (Professor at Syracuse University and former Chair of the Higher Education Program) said, 'One might argue that we already have sufficient research on student success (at university) ... What is missing in our view is the ability to transform the knowledge that we have into practical knowledge'. It was therefore important to find ways of bring this wealth to the academics in ways that would allow them to use it more readily or easily.

Coupled with this was the realisation that the literature is full of publications that address the theory and application of educational research, with a very significant amount of resources available, with little use. From this emerges a greater need for contextualised engagement, and the creation of opportunities for mentoring and guidance.

To maximise the benefits from this engagement-focused approach, it was necessary to also work with the leadership at the participating universities, with a greater emphasis on heads of schools as key players for effecting change.

With these considerations in mind, the following sections will briefly describe the various outcomes and deliverables, including references to where readers can find the identified or created resources, as applicable.

5.1. Seminars, presentations, workshops and papers

The formal engagements detailed in this section attracted approximately 671 participants (see Appendix D for details). These do not include the critically important and uniquely designed FIRE program activities incorporating focused individual and small group discussions, small-scale workshops and round tables. These targeted engineering and non-engineering academics, as well as staff from university administration and staff development departments. The impact of these engagement opportunities is described elsewhere in this report.

The fellow presented **five seminars**, one at each of the participating universities. Although aimed at addressing academic standards and evidence-based assessment for engineering, these were open university-wide, and in a few locations, there were video-conference links to other universities or campuses.

Seven short presentations were delivered: one at a meeting with the engineering education leaders and assistant deans (learning and teaching) prior to the AaeE conference in 2011, one at each of the five schools of the Science and Engineering Faculty QUT, and one at Edith Cowan University, in response to an invitation by the School of Nursing and Midwifery.

A total of **14 workshops** were presented throughout the duration of the fellowship program. *Four* workshops were presented, one at each of the participating institutions (other than QUT, the fellow's own institution). At QUT, *five* workshops were presented, including one co-facilitated with a US scholar, and one mainly aimed at early- and mid-career academics and presented by the visiting scholar for a university-wide audience. In addition, *one* workshop was presented at the CDIO International Conference and *four* at the annual Australasian Association for Engineering Education Conferences (one in 2011, and three in 2012). Some of those were co-facilitated by US visiting scholars and Australian leaders and scholars.

Workshop participants received **workbooks** containing a brief overview of the fellowship, an outline of the activities, and a set of resource materials for use during the workshops and beyond. Examples of these workshop workbooks are available from

<<http://www.nationalteachingfellowshipboles.com/resources/workshop-materials.shtml>>

Two refereed papers were presented at CDIO and AaeE conferences:

- Faculty mentoring, evidence-based assessment, and student learning: An Australian exploration of American initiatives.

<<http://www.cdio.org/knowledge-library/documents/faculty-mentoring-evidence-based-assessment-and-student-learning-austral>>

- A model for enhancing assessment and teaching practice at the coalface: Insights from a Fellow-In-Residence Engagement program.

<<http://www.aae.com.au/conferences/2012/documents/abstracts/aaee2012-submission-181.pdf>>

There was also an invited conference presentation at the Australian Biomedical Engineering Conference, ABEC 2012 <<http://abec2012.iamevents.com.au>>

These presentations were opportunities to disseminate the outcomes of the program, and to also publicise the work of the Office for Learning and Teaching both in Australia and internationally.

5.2. Assessment design process and exemplars

Based on and heavily influenced by the literature, **two assessment design processes** have been designed and compiled using selected references. One of these consists of a table that describes a systematic approach, with the table items intended to bring the academic's attention to the various aspects they need to consider when designing their assessments.

The other design process comes via the experience gained from preparing and running the workshops. A set of simplified questions that can assist the assessment designer to clarify, at least for themselves, what the purpose of the assessment task is and how they might best go about addressing that.

It is this latter process that has been employed to prepare **three exemplars**. The exemplars have been designed to sample the broad civil, electrical and mechanical engineering disciplines. There are also **three** documents prepared as **critiques of assessment** items identified at some overseas institutions. Together, these cover the process need to start the design process or to review one's proper assessment tasks, with a view to improving them. The design processes and exemplars are available at <<http://www.nationalteachingfellowshipboles.com/assessment/index.shtml>>

5.3. Assessment resources

Through the fellowship program, many assessment resources have been identified and made available to academics at the participating universities, and the national and international conferences where the fellow made presentations and facilitated workshops.

The realisation that a plethora of resources are available and now accessible via the internet directed the efforts towards finding and sharing them, rather than creating new ones (other than the assessment exemplars mentioned above). The authors of those resources, in the majority of cases, are more than happy for others to use them; the normal academic acknowledgement applies.

These identified resources have been shared through individual consultations and discussions during the FIRE program. A small sample of relevant resources was given in the workshop workbooks for use during the workshops and beyond. Other resources were collected as a small bundle of printed materials for quick reference.

In addition to the assessment exemplars discussed above, information about and links to many resources are available at <<http://www.nationalteachingfellowshipboles.com/resources/useful-links.shtml>>

5.4. Mentoring guides

With the realisation that heads of schools are increasingly entrusted with various responsibilities, there is a risk that they may not be able to attend to supporting the academics in their schools, as much as they want and should do.

At the same time, the critical role of the head of school as a leader and a source of support for academics, not only to enhance their performance in teaching and research, but also to assist with their professional development and career progression. This all comes with the need for genuine care for the academics' wellbeing and the necessity of assisting them in creating a balance between their professional and social lives.

To assist, **two mentoring guides** have been prepared: one for heads of schools and the other for the professoriate. These were designed to be very practical and easy to read and use. They include checklists, flow charts and diagrams, and have relevant references dotted sparingly in order not to overwhelm readers. However, the academic rigour was not ignored and readers will find pointers for further readings, in addition to the carefully selected set of references at the end.

The booklets have been produced in PDF format and are downloadable from <http://www.nationalteachingfellowshipboles.com/resources/guides.shtml>. A limited number of printed copies are available from the fellow at QUT.

5.5. Literature review

The literature review broadly examined the literature on assessment as evidence of learning, attaining academic standards, as well as its pointers to teaching approaches. An important consideration was to identify methods of documenting evidence for accreditation purposes (see Section 2.1.2). It produced a comprehensive report covering various aspects of assessment. A copy of the report can be found at <http://www.nationalteachingfellowshipboles.com/resources/useful-links.shtml>

5.6. Data from the US interviews

The rich experience gained through the overseas study program has been extremely rewarding. The fellow's interviews with a total of 37 academic leaders and members of the professoriate as well as early- and mid-career academics in the US have been transcribed, with the data de-identified. Initial analysis of the broad areas covered through these interviews has been conducted using NVIVO 09. A summary and an outline of the compiled report is available from <http://www.nationalteachingfellowshipboles.com/resources/useful-links.shtml>

5.7. Website

The home page of fellowship website is shown in Figure 2 and is now available at <www.nationalteachingfellowshipboles.com>

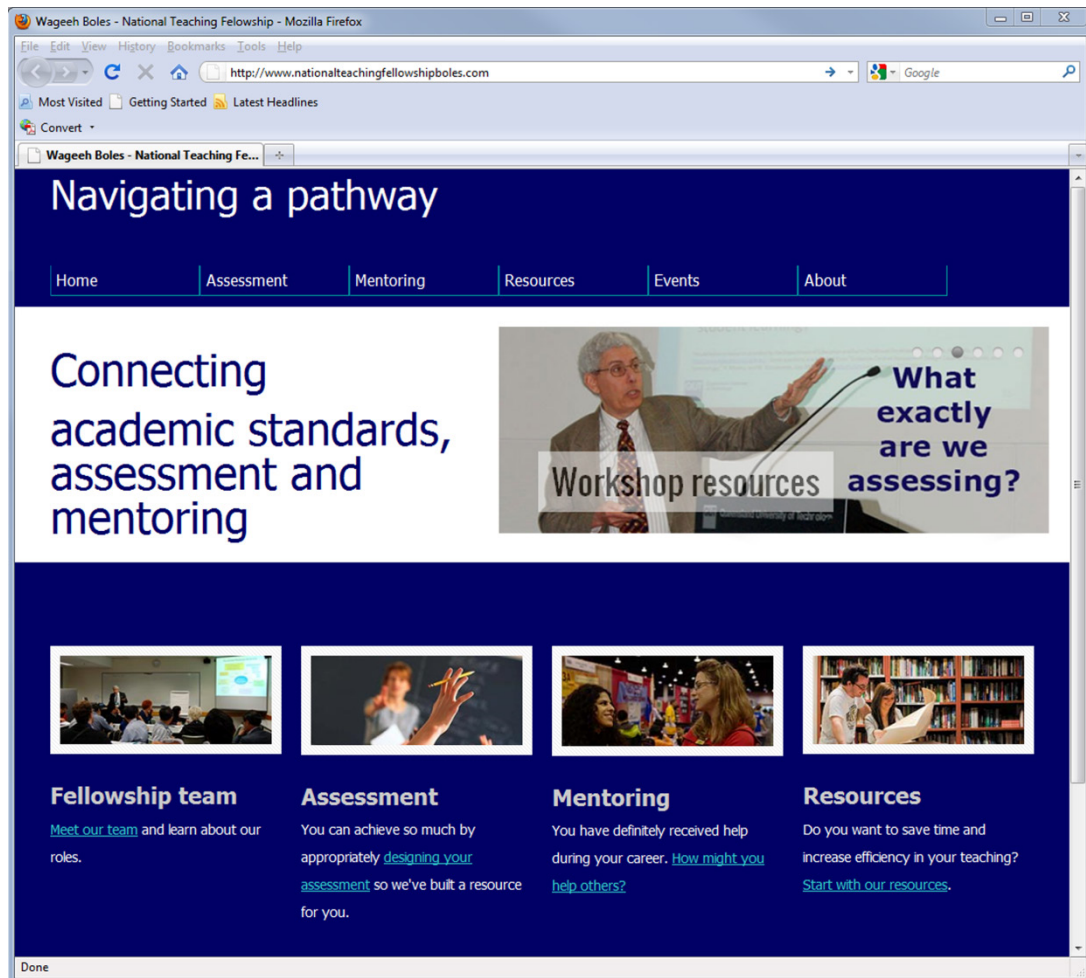


Figure 2: Home page of the fellowship website

The website contains the following main and sub-menu items:

Assessment

- *Academic standards*—ALTC/Engineers Australia Accreditation Stage 1 Competency Standards.
- *Concept inventories*—Definitions and useful links.
- *Assessment design*—Sample assessment design process and useful links.
- *Exemplars*—Example assessment tasks following a simplified design process.

Mentoring

- *Definitions*—What is mentoring?
- *Purpose*—Why use mentoring?
- *Modalities*—Various mentoring systems, including formal and informal approaches.
- *Guidelines*—Guiding questions for mentoring program designers.

Resources

- *Guides*—Mentoring guide for heads of schools; mentoring guide for the professoriate.
- *Useful links*—Links to various assessment and mentoring resources.
- *Publications*—Papers, reports and workshop abstracts.
- *Workshop materials*—Workshop workbooks at the conferences and FIRE program.

Events

- Seminars, workshops, FIRE program activities and presentations.

About

- *Fellowship team*—The fellow, project officer, project researchers, program evaluators.
- *Reference group*—Reference group members' names and affiliations.
- *Australian collaborators*—Heads of school at the five participating universities.
- *Overseas collaborators*—Names and affiliations of the 37 academics interviewed in the US.

The website is expected to continue to grow and link with other national level resource portals such as those of:

- Australasian Association for Engineering Education (AaeE):
<<https://www.engineersaustralia.org.au/australasian-association-engineering-education>>
- Academic Resource Network for Engineering and ICT Australia (ARNEIA):
<<http://arneia.edu.au>>

6. Conclusions

This document has been prepared, not just as a final report to the funding body, enabling the assessment of the fellowship program against its said objectives, but more importantly, as a resource for engineering educators and the higher education sector.

Dotted around this report's sections and subsections, are reflections, ideas and views the fellow holds dear to his heart. They stem from a feeling of gratitude and a burning desire to propel others into higher levels of performance, achievement and satisfaction, saving them the time and effort of starting from scratch.

Parallel to the said objectives of the fellowship, a personal objective of the fellow was to have positive effects on individual academics, as fundamental building blocks for wider ranging effects within schools, faculties and universities. Passionate teachers, equipped with research results and knowledge of the practical aspects of pedagogy, can function as beacons in their institutions. In every institution, there are those who derive great satisfaction from positively influencing others. They are perfect agents of change and a source of enormous bursts of positive energy. They need to be recognised, supported and allowed to bring out the best in today's students—tomorrow's professionals who can transform the future.

Every teacher has the power to positively change students' lives every time they step into a classroom, or have any interaction, face-face or virtually, with them. With this in mind, the fellow endeavoured to act as a change agent, quietly, but persistently, and it has been very satisfying to observe the fellowship program's positive impact.

The report has outlined details of the study program undertaken in the early stages of the fellowship and how this has been fed back into the remainder of the program. It also presented the Fellow-In-Residence Engagement (FIRE) program as a model for enhanced staff development. It attempted to provide documented evidence of the success of the FIRE program as model, in the limited context of the fellowship and the small number of participating institutions. However, it is important to note here that the participating institutions have been deliberately selected to represent a diversity of types, sizes, locations, foci, etc. in order to offset the effects of the limited number of institutions involved.

Like other endeavours dealing with people, the critical effects of those involved in a program such as FIRE cannot be underestimated. Characteristics such as personality, attitude, disposition, shared goals and objectives, and a willingness to change or make changes can all have an effect on the outcome.

The genuine participation of the university, faculty and school leaders, especially the heads of school is essential, and so is the constructive and strategic alignment of the objectives of a program such as the FIRE program, and those of the university, faculty and school. Further, it is to be expected that these objectives would also be in agreement with the broad lines of the objectives of national imperatives such as the Academic Standards, AQF, and TEQSA.

It is hoped that this fellowship has made a lasting positive impact, and that opportunities for programs modelled on the FIRE program can be supported for implementation on a wider scale.

As a final remark, this fellowship has strengthened my resolve that our role as academics is not only to help students become better learners, but to also contribute to building their character. Fellowships and programs need to be treated as opportunities to build an academic work force, which has a sense of responsibility, care, commitment and enthusiasm for learning and teaching, fuelled by a sense of gratitude and obligation.

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8. Appendices

- A Fellowship reference group*
- B Guiding questions for the interviews*
- C Sample FIRE program schedule of activities*
- D Participation at the fellowship major events*
- E Fellowship evaluation report*

Appendix A: Fellowship reference group

Professor Duncan Campbell, Queensland University of Technology, Australia

Professor Ian Cameron, The University of Queensland, Australia

Professor Denise Chalmers, The University of Western Australia, Australia

Professor Milton Cox, Miami University of Ohio, US

Professor Roger Hadgraft, RMIT University, Australia

Professor Doug Hargreaves, Queensland University of Technology, Australia

Associate Professor Anna Healey, Queensland University of Technology, Australia

Dr Peter Hoffman, Engineers Australia: Australian Engineering Accreditation Centre, Australia

Professor Robin King, University of Technology Sydney, Australia

Dr Judith Smith, Real World Learning Coordinator, Queensland University of Technology, Australia

Ms Kelly Stallman, Cook Medical, Australia

Ms Karen Whelan, Manager, Learning and Teaching Development, Queensland University of Technology, Australia

Appendix B: Guiding questions for the interviews

GUIDING QUESTIONS

The two main areas of focus for discussion were: (a) Developing assessments that can provide evidence of student learning; and (b) Development and support for academics, especially to early-career ones. In this context, the following questions were meant to simply provide some starting points for discussion.

What

What was/were the initiative/s that you would like to discuss with us? Did these respond to a need? How was this identified?

What evidence was used to decide there was a need?

What were the elements of focus (e.g. curriculum design, staff development, etc.)?

What is the effect of local contexts (e.g. specific university environment) on implementation?

What about quality systems: information management, project management, dissemination systems?

What evaluation (of the initiative/s) process was conducted?

What assessment types?

What are the rubrics and who devised them? Are these available and transferrable?

What were/are the funding sources and duration?

Who

Who participated (institutions, faculty, engineering disciplines, others)? Numbers?

Did participants volunteer or was participation mandated (top down)?

How were participants engaged?

What is the difference in outcomes between those who volunteered and those who followed the mandate?

What was the role of accreditation (ABET)?

Did industry have a role? Did the participation start at the time of application, during?

Who evaluated the effectiveness of the initiative—internal or external?

Who evaluated the effectiveness of the resources?

Outcomes

What is the evidence of student learning?

What counts as credible evidence in this area for engineers? Is there a consensus among engineers about what is credible evidence or does everyone have different ideas?

What was the impact of helps and difficulties on the initiative's timelines and outcomes?

Are the resources still in use? Who are the users (participating institutions only or at a wider scale)?

Was a SWOT or some other form of analysis conducted?

What resources have been produced?

What was/is the evaluation criteria of the initiative?

If the initiative is no longer active, what are the reasons?

If it is mainstreamed (adapted institution-wide), what are the reasons?

Lessons

What difficulties have you as the leader/expert/investigator, and participants faced?

What helped and what hindered progress?

How were academics encouraged and kept engaged?

How have things that helped been encouraged or spread more widely?

How have difficulties been overcome/dealt with?

What was the role of leadership at participating universities?

What are the effects of formal leadership—sponsors, champions, etc., project leadership and management and organisation, and distributed leadership by academics?

What factors would be directly applicable to the Australian environment?

Is the evaluation report, if any, available to us?

What is the current/future status of the initiative/s?

What are the follow up activities? Resources? Evaluation?

Appendix C: Typical FIRE program activities

Day 1

09:00 – 10:30	Initial meetings with the head of school/assistant dean (L&T)
11:00 – 12:00	University-wide seminar
12:00 – 13:00	Lunch and informal discussions with seminar attendees
14:00 – 15:00	Meeting with a senior non-engineering academic
16:00 – 17:00	Meeting with assistant dean and program leaders

Day 2

09:00 – 09:30	Meeting with early- and mid-career academics
09:30 – 10:30	Meeting with academics in a discipline (e.g. signal processing)
13:00 – 14:00	Meeting with the executive dean
14:30 – 15:30	Meeting with senior academics
16:00 – 18:00	Follow up with the project officer (via phone)

Day 3

09:00 – 9:30	Meeting with a part-time (casual) academic
10:00 – 13:00	Assessment and standards workshop (open to non-engineering staff)
15:00 – 15:30	Afternoon tea and informal discussions with attendees
16:00 – 17:00	Open consultation time

Day 4

Visiting another university in the region

11:30 – 13:00	Meeting a small group of academics
14:30 – 15:30	Meeting with a senior member of university staff development
16:00 – 17:00	Campus tour and informal discussions

Day 5

10:00 – 10:45	Meeting with the head of school
11:00 – 12:00	Morning tea with all staff
13:00 – 17:00	Catch up, prepare resources (electronic and printed)

Day 6

09:00 – 09:45	Meeting with the DVC (academic)
12:00 – 13:00	Lunch with the head of school
13:30 – 14:30	Meeting with first year lecturers
15:30 – 16:30	Meeting with an adjunct academic

Day 7

09:00 – 15:00	Individual consultations (by appointment)
15:00 – 17:00	Available for individual consultations (drop-in)

Day 8

09:00 – 10:00	Meeting with non-engineering academics (assessment and standards)
11:00 – 12:00	Discussions with allied disciplines' academics (e.g. maths and physics)
12:00 – 13:00	Lunch with an early career academic
13:00 – 17:00	Writing own notes and reflections

Day 9

10:30 – 12:00	Meeting with a university-level committee (e.g. mentoring)
13:00 – 15:00	Small group workshop (e.g. curriculum design)
15:00 – 16:00	Available for individual consultations (drop-in)
16:00 – 17:00	Exit meeting with head of school/assistant dean

Appendix D: Participation at the fellowship major events

Workshops

Date	Location	Event	Attendees
2011			
5–7 December	AaeE Conference, Perth	Workshop with Robin King	23
2012			
2 July	QUT, Brisbane	CDIO International Conference	32
14–21 August	QUT, Brisbane	<i>Three</i> workshops	18
3 September	Edith Cowan University, Perth	Workshop	21
27 September	James Cook University, Townsville	Workshop with Milton Cox	10
2 October	QUT, Brisbane	Workshop with Milton Cox	12
2 October	QUT, Brisbane	Invited workshop: The Learning and Teaching Unit; Academic Learning Communities and the Scholarship of Teaching and Learning with Milton Cox	30
11 October	The University of Adelaide	Workshop with Jeff Froyd	10
15 October	La Trobe University, Bendigo	Workshop with Jeff Froyd Video-conference link to Bundoora Campus (numbers unknown)	12
3 December	AaeE Conference, Melbourne	<i>Three</i> workshops with Mary Besterfield-Sacre, Robin King, Roger Hadgraft, David Knight, Carl Reidsema and Ian Cameron	28
Total number of workshops: 14			196

Conferences (2012)

Date	Location	Event	Attendees
3 July	CDIO International Conference, Brisbane	Paper presentation	20 (approx.)
17 September	ABEC conference	Australian Biomedical Engineering Conference	15 (approx.)
3 December	AaeE Conference, Melbourne	Paper Presentation	35 (approx.)
Total number of conferences: 3			70 (approx.)

Presentations

Date	Location	Event	Attendees
2011			
4 December	ACED-ADTL	Workshop with Professor Robin King	25 (approx.)
2012			
1 August	QUT	Information Systems School Meeting	30
14 August	QUT	CPME School meeting	50
16 August	QUT	EECS School meeting	45
17 August	QUT	CEBE School meeting	30
21 August	QUT	Maths School meeting	20
23 August	QUT	EEBS School meeting	45
7 September	Edith Cowan University, Perth	Invited presentation to the School of Nursing and Midwifery	12
Total number of presentations: 7			257

Seminars (2012)

Date	Location	Event	Attendees
12–16 March	James Cook University, Townsville	Fellow-In-Residence Engagement Seminar	13
19–30 March	The University of Adelaide, Adelaide	Fellow-In-Residence Engagement Seminar	14
16–27 April	Edith Cowan University, Perth	Fellow-In-Residence Engagement Seminar	18
7–18 May	La Trobe University, Bendigo and Bundoora campuses	Fellow-In-Residence Engagement Seminar	25 16
9 August	QUT Gibson Room	Fellows Forum (Seminar)—Making a Real Difference + by video-link (Rockhampton 8, Mackay 1, Melbourne 3, Noosa 1)	49 13
Total number of Seminars: 5			148
GRAND TOTAL OF PARTICIPANTS AT ALL EVENTS			671

Appendix E: Fellowship evaluation report

Evaluation report on the fellowship: *Navigating a pathway between the academic standards and a framework for authentic, collaborative, outcomes-focused thinking in engineering education*

Dr Elizabeth McDonald

The contract for the evaluation of the fellowship began in May 2012, though substantive engagement with the fellowship did not begin until late July. The fellowship was well underway when I assumed the role of evaluator. The contract is due for completion in line with the submission of the fellowship final report.

Evaluation brief

Evaluations can take many forms—in this case, I was asked to provide strong formative evaluation as well as a final report.

The fellow, Professor Wageeh Boles, made it clear his particular interest was in formative evaluation; opportunities to test ideas and gain feedback during different stages of the fellowship. As such, this evaluation focused on the different stages and requirements of the fellowship as they arose. The evaluation makes no attempt to give a definitive assessment of the success of the fellowship, though it does point to indicators of success.

This evaluation report is a requirement of the Office for Learning and Teaching.

Opportunities were taken for phone calls and input to reports via email as the fellowship progressed over the months of August 2012 to mid-March 2013. There was no opportunity for a face-to-face meeting. Though he travelled extensively for the fellowship, at no time did the fellowship bring Professor Boles to Canberra. The fellow determined the agenda of our conversations. Consequently, the issues to be discussed depended on the work being undertaken at the time. Many conversations and emails were about material prepared by the fellow and were focused on the needs of the time or future planning.

What I offered in this process was a chance to test assumptions, a way to articulate thinking along with a supportive assurance that work was heading in the right direction. This approach seems particularly well suited to a fellowship, as the work is largely a self-directed activity contingent on the thinking and direction setting of one individual. The evaluator is not in the best position to judge the outcomes of the fellowship unless the main focus of the evaluation contract is to do so and the evaluator is an expert in the field covered by the fellowship. In such a case the evaluator's report would need to be submitted sometime after the closure of the fellowship. In a well-run and documented fellowship, though, it is possible to gain indications of the outcomes of the fellowship. This was one such fellowship.

About the evaluator

I was one of the initial leadership team at the Australian Learning and Teaching Council (ALTC) in 2006. Before this, I was involved for about 18 months in the preparation for the Council's establishment. From the beginning, my role encompassed responsibility for the grants programs. I drafted the guidelines for all the grants programs. Later in my time at ALTC, I was also responsible for the fellowship program.

Fellowships

Fellowships are different from projects, which involve a team of people working together. The former offer an individual—who either has expertise or is developing expertise in some aspect of university learning and teaching—the chance to spend an extended period of time in strengthening their expertise and sharing it with others. In some cases fellows also produce resources and academic papers. This fellowship in the discipline of engineering did all of these things as well as bringing other experts to Australia to share with universities additional knowledge in the important area of assessment, as well as in ways to build capacity for learning and teaching.

The final fellowship report documents Professor Wageeh Boles' activities in detail, and lists the objectives and intended outcomes. I will not repeat all those aspects of the report. In simple terms, this fellowship focused on taking steps toward the implementation of assessment standards for engineering by establishing a process to help academics to design and implement evidence-based assessment that meets the needs of students, staff, industry and accreditation bodies. One of the essential aspects was the focus on the students' learning outcomes in the context of implementing academic standards, another was building staff capacity, particularly using mentoring.

Project aims and planned outcomes from the proposal

The planned outcomes were 'a shift to an authentic outcomes-focused approach to teaching demonstrated in the design and evaluation of assessment tasks, and a set of guides and resources for mentoring, with an emphasis on supporting early- and mid-career academics' (Final report, p. 11).

The specific objectives were:

1. Assist the higher education sector in moving to the next stage of academic standards development, with a focus on mapping program outcomes onto appropriately aligned assessment tasks.
2. Identify and evaluate relevant international and Australian initiatives for effective teacher engagement and curriculum reform, in the light of research findings and in the context described above.
3. Establish a developmental model for identifying, trialling and evaluating assessment tasks capable of providing evidence of students' achievement of program outcomes.
4. Facilitate the development of academics in teaching as well as research, with attention to the needs of early- and mid-career academics in general and those of women academics in particular.

5. Build a framework for establishing authentic, collaborative, outcomes-focused thinking through advocacy and support mechanisms, working as a shadow mentor with heads of schools as they mentor their academic staff. Shadow mentoring is the process by which the fellow assists both the mentor (heads of school), and their mentees (academic staff), to achieve mutually identified development outcomes.
6. Provide an enhanced means of engaging academic staff in target schools through a fellow-in-residence program.

Actual outcomes from the fellowship

What did the fellowship achieve? This question can be explored through the question: *What did the fellowship leave behind?* Though it is always hard to document change in attitude and understanding, indicators of success can be found in looking for evidence under the following headings:

- Processes
- Outputs
- New thinking
- Expertise.

Processes

Among the processes that the fellowship supported was that of mentoring less experienced staff: 'Mentoring of junior academics ... at the participating institutions has been very rewarding for me, as was seeing how it was received and acted upon' (Final report, p. 45).

Another was the introduction, through Professor Milton Cox, of academic learning communities as an approach to sustaining discussion and reflection on learning and teaching. Other approaches and processes identified in comments from the universities are:

... particularly highlighted opportunities for the creation of teaching teams and dissemination of accrued experience across various areas of teaching and assessment amongst academics.

(Head of school [Final report, p. 35])

... some very useful strategies for more effective assessment were passed along to academic staff, which should help to increase the quality of assessments, and particularly of authentic assessment

(Head of school [Final report, p. 36])

Outputs

The **final fellowship report** is a comprehensive document containing the history and indicators of the impact of the fellowship. It is told in the voice of the fellow, which is one of conviction and passion for sharing the best ways to bring about excellent education for the coming generation of engineers.

The **literature review** provides an excellent background, one that was taken into account during the ongoing development of the fellowship. The literature review, combined with the visit to the US, enriched the fellowship, bringing a depth that might otherwise have been impossible to gain.

The two sets of **guidelines for mentoring**, one for heads of school and one for the professoriate, are simple, incisive and practical. They provide links to other resources containing more detailed information. The mentoring guidelines should be useful for those in positions of influence or responsibility who wish to strengthen the quality of teaching and learning. While written from experience in the discipline of engineering, there is no reason why the guidelines could not be used by any professor or head of school.

Website and resources: Problems associated with the website have been a continuing issue for the fellowship and a distraction. By the end of the fellowship, the website was available and contained much of the material and resources produced during the fellowship. There are also useful links to other work on the website.

New thinking

There is evidence of some new thinking among individuals who comment on more effective assessment that takes account of workload and student learning outcomes. Other comments about the faculty or university were:

There has been real movement in the course design and recognition of it as a valuable activity rather than a response to University or Faculty directives. I would say the interest in the curriculum design for the [specific] Engineering program has been driven largely by the presence of Wageeh Boles
(Assistant dean [Final report, p. 33])

... action plans involving curriculum mapping (Standards, TEQSA, AQF) and re-focussing on assessment design (constructive alignment and “for learning”) have got some traction with most staff – they have a stronger appreciation of the drivers and the need to respond effectively, and are more open to engage with the challenges of changing practice appropriately.
(Assistant dean [Final report, p. 36])

Expertise

There can be no doubt that Professor Boles has built expertise and credibility in the field. Not only did he bring new energy to the universities in which he worked, he was recognised as an expert adviser:

The program has been very successful for our University. It enabled staff from engineering and science disciplines across the two campuses to consult with Prof Boles, share ideas and have him advise us on developments on curriculum design, course mapping, assessment and accreditation issues.
(Head of school [Final report, p. 35])

Being a national fellow also gave Professor Boles credibility among his colleagues and those who he visited.

While Professor Boles brought expertise about curriculum and assessment, particularly in engineering, he also built on the lessons from the US. In this way he enriched his own experience, practice and pedagogical knowledge with international developments. He then shared this knowledge with the Australian universities.

Process and people

A number of aspects of the fellowship design were important to its success. One of these was the amount of time the fellow spent in each institution, which allowed workshops, meetings and discussions with academic leaders, as well as time with academic teachers. While this level of resourcing for change is unusual, it does bear fruit.

People took the opportunity to follow up on earlier conversations and work, and new people could be engaged who might have had reservations initially. The second visit was important, as now the fellow was known, so discussion about change and development could be undertaken without the building of trust that was an essential aspect of the first visit.

The fact that the university visitor was a professor and an engineering academic made it possible to work with all levels of the university change chain. In an institution as hierarchical as a university, it is unlikely that someone internal or an academic from either outside the discipline or of lesser academic status would have been successful regardless of their expertise. I have no doubt that a gentle and humble approach supported by knowledge and practical experience allowed Professor Boles to reach and engage with many academics who would have ignored other teaching experts.

The thorough planning, along with the integration of personal learning as a key component early in the fellowship, ensured that the fellow brought rich understandings and resources to the universities and to conference workshops as well as international experts to universities and conferences. To achieve all the aspects of the fellowship was extremely demanding. Further, the different aspects of the fellowship provided both the 'how to', with the 'why bother' for the academics themselves, along with advice on ways to work with change in a sustained manner for academic leaders. Bringing these components together provided a well-rounded approach to improving assessment in engineering. Despite the focus being engineering, the structure of many university faculties that incorporate some or all of science, maths, IT and engineering meant that the fellowship did, in reality, reach beyond engineering.

Challenges during the project

One of the risks for someone who is committed to the work of a fellowship and very conscientious is that they will exhaust themselves complying with all the aspects of the fellowship set out in the original design. This type of compliance is a particular risk given the isolated nature of fellowships compared with the way a collaborative project operates.

During the course of a fellowship or project, components of the design may become more difficult due to changes that were unforeseen during the planning stage. These challenges become both time consuming and enormously frustrating. A number of these occurred during this fellowship.

In addition to the unforeseen challenges, new aspects may be added at the request of universities visited. This occurred in the US during the study visit. New approaches may be needed as the fellow finds more information or as the result of experience.

To enable the balance to be maintained, it is important to prioritise the work. It is at these times that the role of evaluator can be important in enabling a conversation about the priorities and freeing up the fellow to reshape the remaining aspects of the work to most effectively respond to the key outcomes while retaining balance in the workload.

Lessons of value to other fellowships

- When planning, recognise that systems within your university may change, so be ready to adjust what you can achieve within the fellowship by revising priorities.
- Take account of the physical demands that your plan will demand.
- Ensure you have a 'sounding board' to help focus and find simple ways to resolve aspects of the work. A fellowship can be an isolated experience with a great deal of work and responsibility resting on one set of shoulders.
- Realise that if you plan a discipline-based fellowship that will work with academics in their own universities, you may work beyond your discipline with those in related disciplines.

Conclusion

From my point of view the type of work undertaken in this fellowship is invaluable to build the capacity needed in Australian higher education to ensure that educational change and improvement is more than compliance and paperwork. To implement change that keeps students and teachers as the focus is, I believe, the only way to build an education that will enable Australian students to be well prepared for their futures.

This fellowship worked with university teachers in their everyday world in a way that is rare. At the same time, it engaged with leaders, new ideas and practical systemic aspects of enabling change. Professor Boles should be congratulated for the systematic way he worked throughout the fellowship, building his own expertise and responding to the needs of each of the five universities he worked with during the 18 months.

