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Enhancing Relevant Curriculum Engagement in the Applied and Analytical Chemistry Course

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Abstract

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Enhancing Relevant Curriculum Engagement in the Applied and Analytical Chemistry Course

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Abstract: At ECU, Curriculum Engagement and Workplace Integrated Learning (WIL) are key elements in the University's strategic direction and significant features of many undergraduate courses. There are several forms of Engagement in course design and units that deepen students' skills and knowledge of practice in realistic workplace and community contexts; develop their employability and generic skills; and contribute to graduate work and career readiness. This partnership project between two academics, one in Centre of Learning Development (CLD) and one teaching in the School of Natural Sciences, aims to increase Curriculum Engagement in the Bachelor of Science (Applied and Analytical Chemistry). Reflecting on current programs and teaching practices while focusing on these strategic priorities reveal potential key actions to embed Engaged teaching and learning. Stories of success from other courses and units serve to illustrate the definitions and practices, providing a snapshot of progress. An overview of enabling and impeding factors in the tactical implementation of Engaged teaching and learning is provided. Discussion will enable audience members to comment on their experiences in developing and measuring effectiveness of sustainable Curriculum Engagement. We expect that this session will generate useful ideas to be applied in other courses, particularly Natural Sciences courses.

Introduction

ECU is working to increase the scope and extent of Engagement in its learning and teaching programs. ECU seeks to be known for the productive ways in which it engages with its communities and stakeholders, characterised by partnerships with our community. Our community includes the businesses, industries, government agencies, non-government organisations, professional bodies, schools, Alumni, Indigenous and ethnic communities, local community groups around our campuses and at state, national and international levels (Edith Cowan University, Centre for Learning and Teaching, n.d.).

Curriculum Engagement refers to mutually beneficial partnerships with ECU's communities for community and student learning as part of each course. Our community can engage with ECU in many ways. When external partners are involved in course design, teaching, marking, designing assessments and offering placements, the process helps to

ECULTURE

develop and provide programs that are relevant, contemporary and valued by the community and industry. Students then enrol in a course that is industry relevant, with excellent prospects for employment. Industry colleagues help ECU colleagues to ensure that courses are relevant and appropriate to community needs.

Measuring Curriculum Engagement

The Curriculum Engagement Mapping activity undertaken in December 2008 sought to quantify the levels of several forms of Engagement in the undergraduate curriculum at ECU (Oliver, 2009). This measurement yielded a total score for each course for current instances of Engaged teaching and learning. Similar Engagement Mapping was undertaken in November 2009 and again in June/July 2010 aiming to compare survey data annually and inform operational planning as part of School and course review process.

To quantify Engagement in the curriculum, a points system considers the scope and extent of learning derived from each activity and the scope and nature of the industry/community involvement in the learning (Oliver, 2008). Each course is scored for Engagement in Course Design for a maximum of 15 points. Each course is also scored for the Engagement in 12 units and in four forms: Unit Delivery, Course Products and Services, Workplace/Community Activity and Workplace Integrated Learning (WIL). Units with multiple forms of Engagement score the highest form with a maximum of 10 points per unit.

Engagement in Course Design aligns with the ECU policy for Course Consultative Committees (CCC) (Edith Cowan University, 2009) describing the roles, structure and conduct of the committee. Points are allocated for the number of meetings held, demonstrable feedback from industry/community and whether this Engagement activity led to course revisions and improvement.

Engagement in Unit Delivery (UD, 1 point) includes external industry partners acting as collaborating teachers presenting lectures in person or via video, facilitating workshops or tutorials on or off campus, and participating in on-line discussion with students. Students may be taught and learn off-campus during a site visit, a field trip, a workshop or seminar, a TAFE course or unit, practicum, a performance, competitions or an activity day in a school or the community.

Engagement through Course Products and Services (PS, 5 points) in which students develop a product for external use or provide a service to the community as a strategic part of their learning and assessment activities. There is relevance and authenticity in the learning experience. The student does not usually need to go to the workplace and ideally, the assessment (product or service) is of tangible benefit and should be delivered to the external partner as the potential end-user. Students practise and develop their skills in relevant and meaningful applications increasing their employability. Industry practitioners may act as assessors and their feedback is received by the student. Ideally the feedback from the industry partner contributes to the assessment of the work. For example, students in some Business units may write a business or marketing plan for a specific company as an authentic learning experience. Their business or marketing plan would be authentic to a real company. Personnel within that company may assess the plan and provide feedback from an industry point of view.

Workplace/Community Activity (WCA, 5 points) may be similar to Course Products and Services excepting that the students would actually go to the workplace. Also known as service learning, this teaching and learning strategy integrates meaningful community service with instruction and reflection and teaches civic responsibility. Through these activities, students may learn planning skills, organisation skills and other life skills that will be useful

ECULTURE

for employment but these activities may not be directly targeted towards work or work skills and/or specific discipline knowledge. Unlike Workplace Integrated Learning (WIL), this is not practicum. Also these activities are not Volunteering in that they are a required part of the unit.

Workplace Integrated Learning (WIL, 10 points) is a distinctive form of learning experience that incorporates students being in a workplace setting as a component of learning providing many learning opportunities denied in classroom settings. Students apply generic and specific knowledge and practical skills from on-campus learning to a workplace setting. Then they apply generic and specific knowledge and practical skills from the workplace setting to on-campus learning. Some courses have WIL as a designated unit; others have WIL as a component of a unit. WIL may be over distributed days and/or continuous days and can be for a full semester. WIL helps students develop their capacity to apply their knowledge and skills and to streamline the transition from university to the workplace. ECU aims to create sustainable WIL programs by ensuring that the community partner is advantaged by the student placement so that the relationship is mutually beneficial.

Reviewing Curriculum Engagement Scores for the Chemistry Course

The Applied and Analytical Chemistry degree is a two year program in which students with an appropriate diploma from TAFE are awarded 120 credit points on entry. Therefore, there is a total of 16 ECU units in this degree. The Applied and Analytical Chemistry degree scored a total of 30 points from the Engagement Mapping survey for the period 1st July 2009 to 30th June 2010 and is, therefore, in the low band. The distribution of points is outlined in Table 1.

The course scored 3 points for having had one Course Consultative Committee (CCC) meeting. The degree has had a Consultative Committee associated with it for over 10 years. Following a restructure of Course Consultative Committees in the School of Natural Sciences last year, a CCC dedicated to the Chemistry Course was established. At this time the membership was reviewed with several new members joining and non active members no longer listed as involved. Two meetings per year have been planned for the future. At the meeting in February 2010, the committee recommended the replacement of two core units (both Business units) with electives. This recommendation has been endorsed by the chemistry staff and CMS has been updated. This industry feedback and subsequent action taken is a clear example of relevant industry input into course development and so the degree scored a further 3 points for Engagement in Course Design. This course is accredited by the Royal Australian Chemical Institute and, therefore, 5 points were awarded for industry/community involvement in course design). This benchmarking found that the course was comparable and of equal status of other accredited chemistry degrees in Australia and the course will be benchmarked again in 2012. In total, the Bachelor of Science (Applied and Analytical Chemistry) (G60) scored 11/15 points for Engagement in Course Design. There is no reason why the course cannot gain 13/15 points next year as the CCC are committed to meeting at least twice a year. The School is fortunate to have a very committed committee who want to value add and be involved in both curriculum development and in supporting our students and graduates. At the last meeting the committee specifically discussed the need to maintain regular meetings and agreed that two was the minimum required to remain engaged.

ECULTURE

| Unit Code | Unit Name | Unit Delivery | Products & Services | Workplace/Community Activity | WIL |
|-----------|------------------------------------|---------------|---------------------|------------------------------|------------|
| SCC1111 | General Chemistry | (1) | | | |
| SCC1201 | Chemistry: Structure & Reactions | (1) | | | |
| SCC2211 | Organic Chemistry | (1) | | | |
| SCC2301 | Forensic & Analytical Chemistry | 1 (1) | (5) | | |
| SCC3201 | Analytical Chemistry | | 5 (5) | | |
| SCC3304 | Chemistry Project | | | | 10 |
| SCC3202 | Environmental Chemistry & Analysis | 1 (1) | (5) | | |
| SCI1186 | Understanding Pollution | 1 (1) | | | |
| SCI3309 | Biological Chemical Hazards | 1 (1) | | | |
| MAT1114 | Introductory Statistics | | | | |
| MAT1137 | Introductory Applied Maths | | | | |
| SCP1132 | Introductory Physics | | | | |
| | Choice of two Business units | | | | |
| Total | | 4 (7) | 5 (15) | | 10 (10) |

Table 1: Engagement Mapping scores for Bachelor of Science (Applied & Analytical Chemistry) for the period 1st July 2009 to 30th June 2010 and potential scores for the next reporting period in brackets

For Engagement in 12 selected units, the course scored 19 points. In the first year students complete four chemistry units, 2 maths units, a physics unit and an environmental science unit. In the second year, students take three chemistry units, one natural sciences unit, two electives and two business units (which are being replaced by another two electives) The chemistry course coordinator has some influence over the chemistry units (SCC coded units in Table 1) but cannot require any changes to the other units. Hence, the chemistry course coordinator intends working closely with the unit coordinators of SCC1111, SCC1201, SCC2211, SCC3202 as well as working on her own units SCC2301, SCC3201 and SCC3304 to determine if and where an increase in their Engagement is a reasonable goal, and worthwhile for student learning.

The 19 points were achieved: SCC3304 scored the maximum 10 points for its WIL component. SCC3201 scored 5 points for its service to a local truffle company and student product as a result of their laboratory learning – students analysed the carbohydrate content of truffles and the data was supplied to the external partner. Four of the 12 units (SCC2301, SCC3202, SCI3309 and SCI1186) scored a point for unit delivery (UD) for industry practitioners presenting lectures in person, facilitating workshops or giving tutorials on campus and students being taught off campus during a site visit.

Increasing Curriculum Engagement over the next 12 months.

The score of 30 implies that the Bachelor of Science (Applied & Analytical Chemistry) is not engaging strongly with industry (given that it is in the low band). However, the degree is marketed as being applied, industry focused and “hands on”. These claims are in

ECULTURE

part validated by the fact that graduates are in demand and get jobs on graduation. Furthermore, at the recent CCC meeting, members were keen to offer more placements than there are students. Students completing a major in chemistry as part of another degree are also offered and take up placements, although it is not a requirement of their degree, as they see the value in having the experience. Industry is also supportive of these students and they get chemistry jobs based on their studies. It is vital that a degree that markets itself as being industry relevant and that has such a strong practical component be able to demonstrate Curriculum Engagement using the University instrument. The course coordinator is very keen to have this apparent mismatch resolved and is, therefore, committed to working with a member of the Academic Excellence team in ECU's CLD to move the chemistry degree into the medium band for the next data collection round. In working together on this course, the course coordinator has been inspired by ideas on how to capture, increase and introduce new forms of Engagement and the member of the Academic Excellence team in the CLD has gained further insights into what Curriculum Engagement might look like in the sciences.

The following process is being adopted in an effort to actively increase meaningful and relevant Curriculum Engagement in the Bachelor of Science (Applied & Analytical Chemistry) (G60):

1. Review of the current Engagement in the chemistry course;
2. The authors have begun discussions about what constitutes Curriculum Engagement in the sciences; and hence
3. Identify strategies to increase Engagement in chemistry units in ways that benefit students and also extend current learning activities that engage external partners rather than simply adding more of the same learning activities.

Review of the current Engagement in the chemistry course

A review of the 16 units in the degree (Table 1) showed that changing the selection of the units would not increase the score. It is also apparent that several of the chemistry units, which the course coordinator has control over, have no measurable Curriculum Engagement and that some units, specifically SCC3201, SCC3202 and SCC3304, could be expected to engage with industry for learning and assessment activities as Course Products and Services bringing workplace and further employability relevance to the current learning activities.

Strategies to increase Engagement in chemistry units

Initial discussions have focused on the areas of Unit Delivery and Products and Services. The authors have identified one meaningful way to incorporate Engagement into some of the first year chemistry units, specifically SCC1111, SCC2211 and SCC1201, which currently do not engage with industry partners. Local industry colleagues will be invited to use video as a tool to explain a chemical process or chemical reaction central to his/her industry that is directly related to the curriculum without being in person presenting a lecture on campus. In addition to being relevant to the curriculum this would also provide students with real examples of typical jobs in the field and even typical equipment being commonly used in "real" laboratories. Current staff members are keen to involve their industry partners and one staff member has already approached her industry contact to develop such a video for SCC1111.

A review of assessment items in three second year units identified several that could be modified to be examples of authentic assessment and fit the Course Products and Services criteria. For example, this semester in the course coordinator's unit SCC2301, instead of

ECULTURE

writing a review article, students will write a grant proposal using the guidelines of the Science and Innovation Studentship Award (SISA), a WA government funded student internship. Previous chemistry students have been successful in applying for these funds. Two other units, SCC3201 Analytical Chemistry and SCC3202 Environmental Chemistry and Analysis focus on strong industry application in several laboratory activities. Although these activities are not currently linked to particular authentic industries this could easily be achieved so that students more clearly see the relevance of the learning. For example, in another of the course coordinator's units, SCC3201, students spend several weeks in the laboratory developing an effective method to analyse for amino acids (Boyce & Singh, 2008). Next year, this method development work could have an additional outcome – using the methods developed to analyse amino acids in locally brewed beers for the brewing industry.

The coordinator has demonstrated through action (modification of the assessment item for SCC2301 this semester) her commitment to enhancing Curriculum Engagement. This example of Engagement and the strategies outlined above provide positive and concrete examples to other chemistry staff as to how Curriculum Engagement can be increased. This enabling approach is important in enlisting the support of other colleagues to enhance engagement by demonstration and modelling.

In summary, the primary aim is to move the Applied and Analytical Chemistry degree into the medium band for the next Engagement survey. A secondary aim is that all chemistry units have at least one item of Curriculum Engagement. These aims can be achieved firstly by increasing Engagement through Unit Delivery in the first year units and specifically SCC1111, SCC2211 and SCC1201 and secondly by increasing Engagement through modifying existing assessment items in SCC3201, SCC2301 and SCC3202 so that they truly engage with industry. This alone will increase the engagement score by 13 points. With Engagement in Course Design achieving 13/15 points next year and Engagement in the 12 units gaining 32 points, the total score will be expected to move from 30 in the low band to 45 clearly in the medium band. More importantly, these revisions of the course are expected to increase the relevance of the specific learning activities and thus enhance the course in general, employability skills and enhance the marketability of the course possibly increasing student numbers. Any increase in WIL or introduction of WCA as a result of future discussions will serve to consolidate entry into the medium band.

Conclusions

This collaboration between a course coordinator and a member of the Academic Excellence team in ECU's Centre for Learning and Development (CLD) has been a positive experience for both authors. Ultimately the shared goal of increasing Engagement in the curriculum is being achieved. For the course coordinator, it has been an opportunity to reflect on how the degree can actually demonstrate its claim of being industry relevant. The discussions between the authors gave the course coordinator a much better understanding of what constitutes Curriculum Engagement and strategies to increase meaningful Engagement. The initial discussion inspired a professional partnership and the goal of increasing the Engagement Mapping score for a course. For the Academic Excellence team member, this has been a very positive experience, productive in her role of improving teaching and learning; in this instance by enabling and supporting a course coordinator to more fully integrate their course with industry partners thus increasing their Engagement Mapping score from low to medium band. This phase is a first stage of a curriculum development model that could be used for a whole School leading next to demonstrating this exemplar to other course coordinators and at the same time working with unit coordinators to apply the descriptions of

Curriculum Engagement to their units. This one-on-one professional development activity may not seem to be the most efficient use of time but seems to have achieved a great deal so the authors conclude that it has been worth the few hours of face-to-face two-way conversation.

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