



Steps towards using an enquiry-based blended learning design for curriculum change in Health Sciences

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A learning design based on the enquiry-based learning (EBL) pedagogical model is being used for course unit design in a curriculum change within a faculty of health sciences. The learning design is scalable to support large student cohorts spread across multiple campuses. The EBL model is used to promote high levels of student engagement and active self-directed learning with the aim of enhancing academic performance and making teaching and learning time-efficient for academic staff.

The large project described in this paper uses a design-based research method and is currently in its first phase. Details of the enquiry-based blended learning design, its application across the common first year units, and processes used to achieve inclusive dialogue and orient academic staff to its use are reported.

Keywords: pedagogical models, learning designs, enquiry-based learning, curriculum change

Introduction

The use of learning designs for course enhancement is a major development in elearning. A learning design can be thought of as a pedagogical model for a course, focused on learning activities that will support teachers and designers to develop particular kinds of learning experiences (Bennett, Lockyer, & Agostinho, 2004). One of the aims of a learning design is to enable the features of a successful course unit to be applied to other units so these may also promote successful outcomes for students and staff. When a learning design is applied to course development the design forms a structure of interrelated pedagogical processes, devoid of any course content. The original application of the design forms a template for further applications in other course units. Templates have been developed in software form to enable and support rapid transition to a new course unit development (Bennett et al., 2004; Heathcote, 2006; McAlpine & Allen, 2007). The applications of pedagogical models that promote student-centred constructivist approaches can be seen as a paradigm-shift in the tertiary sector – a change from a focus on teaching to a focus on learning (Barr & Tagg, 1995; Biggs, 2003). Many developments in learning design and learning design templates are aimed at promoting and enabling this paradigm shift (Dalziel, 2003; Heathcote, 2006; McAlpine & Allen, 2007; Oliver, Harper, Hedberg, Wills, & Agostinho, 2002)

While learning designs have been applied in a wide range of course unit developments, their application to changing a complete curriculum is rare. This paper outlines the first stage of a design-based research project on curriculum change in the Faculty of Health Sciences at La Trobe University. Applying a learning design that promotes active learning and skill development in one course unit is beneficial in the context of that unit, but the benefits could be lost if subsequent units do not build on the active learning skills. By applying a learning design using the EBL model to a whole curriculum the development of learning skills and graduate attributes associated with this pedagogical model can be continually developed and enhanced through successive years of study. The use of learning designs can be challenging for many academic staff who are accustomed to thinking of a course unit in terms of the content that needs to be communicated and assessed, rather than thinking about pedagogical models to guide the design of learning activities. In this first phase of the project staff development and educational design were required to introduce academic staff to the conceptual framework of EBL as a learning design, and to use of a generic LMS template in WebCT/ Blackboard CE 6 that structures the blended learning aspects to appropriately support the EBL experience for students.

Project aims

In 2006 the Faculty of Health Sciences (FHS) at La Trobe University decided to make their course delivery more efficient and educationally effective. A key decision was to create a common first year (CFY) that would rationalise the ten separate first year programs offered across the faculty. The FHS offers courses on several regional campuses, at Bendigo, Albury-Wodonga, Shepparton and Mildura. Some of these campuses run their own first year programs. It was decided that the CFY rationalisation would occur across campuses as well as courses. This reduces the total number of first year units from 80 to seven, and an elective. Enrolment in each core unit could be approximately 1700 students, distributed across five campuses. These large, cross-campus units must be educationally effective and scalable by design so that they may provide equivalent educational experiences for students on all campuses. Some schools are also offering their course at a College in Malaysia. This represents a huge educational and logistical challenge.

Research questions

The project focuses on the application of an EBL focused blended learning design to a full curriculum reform across a faculty. The curriculum reform involves integrating 10 separate degree programs into a more integrated structure, starting with the CFY, and changing the emphasis from content to learning activities to suit the wide range of students who enrol in Health Science courses. A design that was successful with a small number of course units is now being tested across a wide range of units. Key questions for this research are:

1. Does the enquiry-based blended learning design provide a suitable basis for developing all course units in a curriculum?
2. What support processes are needed to enable the learning design to be applied to curriculum change?
3. What effects did the curriculum change have on student learning?
4. What factors impact on the effectiveness of a curriculum change?

This paper addresses all questions to the extent that current progress in the first phase of the project allows. Although questions 3 and 4 are beyond the current research scope as outcomes cannot be determined until implementation and evaluation begin in 2009, a discussion in terms of how the evaluation may occur is presented.

Research on learning design and templates

The use of learning designs emerged from research on student learning supported by applications of technology. While much of the promotion of educational technology has an emphasis on technical features, such as anytime access to online material, use of quizzes, online discussions and wikis, research on student learning examined ways in which the affordances of technology could support effective pedagogical models, such as conversation theory (Laurillard, 2002). Oliver (2001) reported that most examples of high quality online learning designs were discipline-specific, and difficult to use as generic exemplars. However, in working with a framework that emphasised activity-centred learning designs, such as problem-based, case-based and enquiry-based learning, some innovative approaches to online learning were developed as generic frameworks where activities were separated from resources, allowing subject matter to easily be removed and replaced. Early examples of activity-centred design approaches are the use of situated learning as a design model for a 'constructivist shell' (Herrington & Standen, 2000), and application of problem-based learning (Oliver & Omari, 1999) and collaborative learning approaches (McAlpine & Ashcroft, 2002) to online course units.

The identified change in emphasis in undergraduate education from teaching and course delivery to engagement and learning outcomes (Barr & Tagg, 1995) is reflected in the development of research on learning designs. Nicol (2003) suggests that the learning design is a shell that can be inhabited by learning objects and, as such, may support a transmission view rather than 'a social constructivist view in which students construct their own interpretations of subject content in dialogue with others'. He questioned whether a learning design template can really capture the essence of a pedagogical approach. Knight et al (2005) propose that a vocabulary shared within the education community is needed to make a learning design, decontextualised from course content, comprehensible to academic staff. They suggest the use of pedagogical models, such as collaborative and problem-based learning, that are based on learning activities and processes and can be described in a way that academic staff may relate to, even if they are unfamiliar with the model.

An Australian University Teaching Committee (AUTC) project involving the University of Wollongong (UOW) (Bennett et al., 2004; Oliver et al., 2002) created a website presenting a range of generic ICT-based learning designs and tools; these were developed through extrapolation of existing exemplars and are described in terms of the student activity encapsulated. As group learning activities are an important aspect of many learning designs a significant development was the inclusion of software supported student self and peer review processes in one collaborative design (Luca, 2002). A Queensland University of Technology (QUT) project is extending these designs to develop learning design templates for use with an LMS (Heathcote, 2006). These include course unit designs such as 'Group Problem-Solving' and 'Work Integrated Learning', and shorter creative thinking activities.

Of interest also is the wide range of generic learning designs gathered for sharing through the Learning Activity Management System (LAMS) (Lucas, Masterman, Lee, & Gulch, 2006; McAndrew et al., 2004) and the current exploration of the use of LAMS for Inquiry-Based Learning, defined as

... a form of active learning in which open-ended, student-directed inquiry or research drives the learning experience. It includes both relatively-structured forms of learning activity – e.g. based on problem-solving and case scenarios – and less structured forms based on small- or large-scale investigations and projects (JISC, 2006 p. 1).

As enquiry-based learning is a broad framework that includes PBL, it is broadly consistent with the constructivist approach while providing an additional range of pedagogical models such as case-based learning. This should provide a framework for a broader range of learning design models and LMS templates based on constructivist pedagogical models.

A design-based research method

A design-based research method is used in this large curriculum change project. This method is applied to designing learning environments based on theories of learning, developing the research through cycles of design, enactment, analysis and redesign, developing sharable theories that are applicable to practitioners, accounting for how the designs function in complex settings, and relating processes of enactment to outcomes of interest (Design_Based_Research_Collective, 2003).

The design of a new learning environment for use across the Faculty of Health Sciences and its implementation in the new curricula in all courses provided by the Faculty is the focus of the project. Although the planned structure and sequence of units within the new curricula across the Faculty predated this project, the following must now be provided for:

- An integrated common first year curriculum
- An approach to learning and teaching that will enable large numbers of students on multiple campuses to study with the same unit materials and achieve the same learning outcomes
- Enhanced learning outcomes using a student-centred curriculum approach
- A consistent approach to curriculum reform and implementation in all years of all programs
- Development of Faculty of Health Sciences graduate attributes throughout the new curriculum

To meet these requirements a project team was created to support the design of the new core units in the revised curriculum. In the first phase of this large project the design team focused on ways of enabling the CFY rationalisation and enhancing learning outcomes using an EBL approach where appropriate. The design team has considered and applied:

1. A course unit learning design that suits the needs of the common first year
2. A process for orienting academic staff to the learning design chosen for the units

The developments are partly finished at the time of writing (August 2008) and will be further developed this year and tested during the Phase 2 implementation in 2009.

Applying the enquiry-based blended learning design

Selection of the learning design

Within the broader framework of the Faculty's full curriculum revision the needs of a large student cohort distributed across multiple campuses with a wide range of ENTER scores, matriculation subject choices and previous experience added to the identified need for greater focus on skill development and

integration of theory and practice in the health sciences. This suggested that a learning design supporting student-centred learning, self-directed team work and blended learning was required.

A learning design based on problem/project-based learning (PBL) that serviced a faculty-wide unit catering for 1000+ students in the Faculty of Engineering at UNSW (McAlpine, Reidsema, & Allen, 2006) was investigated and appeared to provide a suitable model for the CFY in Health Sciences at La Trobe as it was reported to:

- Successfully engage the students
- Enable skill development and attainment of the desired learning outcomes
- Be time efficient for academic staff
- Be scalable, to cope with large student numbers.

Some approaches to PBL are highly prescriptive in the methods that must be applied (Hmelo-Silver, 2004) and could be too labour-intensive to implement on the scale required by the faculty. Therefore, the learning design was adapted to characterise it with an EBL focus as this broader concept, that includes PBL and other forms of project or research project outcomes (Kahn & O'Rourke, 2005), appears to better suit the range of needs across the faculty. Nonetheless, much of the original design is retained including a number of specific features identified from research as providing a valuable contribution to student learning processes. These include group facilitation guides so that individual students can facilitate meetings to support group projects. The guides detail activities for the group to follow, questions to ask to encourage discussion and clarification of meaning, and a whiteboard format for students in the group to document aspects of the problem and learning issues for follow-up (Hmelo-Silver, Chernobilsky, & DaCosta, 2004). The activities enable student groups to be self-directed, which is satisfying to students and relieves the time pressure on academic staff. Student peer review was included, using both the Calibrated Peer Review (CPR) system that enables students to assess each other's work and to learn more about writing to criteria and how to improve their own writing (Chapman, 2001), and the iPeer system that enables students to anonymously rate and provide feedback on individual contribution to group projects and to reflect on the effectiveness of their own contributions and how to improve this (iPeer, 2006).

Research and evaluation of the UNSW learning design (McAlpine & Allen, 2007) had revealed that its LMS template could be used to develop effective blended support for a range of course units and might be an effective tool in course unit design/redesign where the application is supported by educational designers. The features retained in the LMS learning design include:

- Information on the problem scenario
- Guidelines for working in groups
- Tasks and guides for individual preparation and group activities
- Group Facilitation Guides for individual students to facilitate group meetings
- Simple and direct access to course materials and learning resources
- Online discussions for each project group
- Online peer review and assessment of individual written reflections
- Online peer review and assessment of individual student contributions to a group during their research, development, and report writing processes.

Characteristics of the course unit learning design

A learning design in an LMS needs to provide a support structure for the learning process associated with the design, and provide the tools and resources the students need to follow the process. In EBL the students are given an enquiry task and an output requirement such as a report or presentation. In most cases students work in teams on enquiries, although the students must be able to demonstrate through assessment that they have individually attained the unit learning outcomes. The task and the output requirements provide a basic structure for the enquiry. Unit materials, lectures and support processes need to fit within this framework, so that the unit is structured around the enquiries and the students see the enquiry and their own efforts to resolve it as the drivers of their attention and the focus for feelings of achievement and reward.

The learning design and online learning environment need to support and enable the processes associated with the enquiry. Table 1 outlines some student learning processes and the online support that is needed to enable them. As EBL is a flexible approach, the schematic presented in this table may vary

considerably depending on the nature of the actual enquiry, and it is not intended as a rigid formula that will act as a constraint to enquiry design.

Table 1: Schematic of student learning activities during an enquiry and identified online support

Student activity	Online support materials
First meeting Consider the enquiry and determine its scope <ul style="list-style-type: none"> • Decide on roles • Identify what is known and what is needed 	<ul style="list-style-type: none"> • Details of enquiry • Group activity guide • Group facilitation guide with ‘whiteboard’* layout • Resources such as texts, lecture notes or lectopia, articles, videos.
Individual follow-up Reading, finding sources	<ul style="list-style-type: none"> • Guide to individual tasks • Resources • Online discussions
Second meeting <ul style="list-style-type: none"> • Reconsider the enquiry and what is known <ul style="list-style-type: none"> ○ Group members ‘teach’ what they have found ○ Group discussion • Generate ideas or hypothesis • Decide on test, data source and follow-up tasks 	<ul style="list-style-type: none"> • Group activity guide • Group facilitation guide with ‘whiteboard’* layout • Resources
Individual follow-up Such as reading, finding sources or data	<ul style="list-style-type: none"> • Guide to individual tasks • Resources • Online discussions
Third meeting <ul style="list-style-type: none"> • Reconsider the enquiry <ul style="list-style-type: none"> ○ Individuals feed back findings to group ○ Group discussion • Test/evaluate what has been found • Consider additional/related tasks • Analyse information and data and apply this to the requirements of the enquiry <ul style="list-style-type: none"> ○ Are the findings effective? ○ What more is needed? • Plan presentation/report <ul style="list-style-type: none"> ○ Consider roles • Decide on follow-up tasks 	Group activity guide Group facilitation guide Analytical tools Resources
Individual follow-up	<ul style="list-style-type: none"> • Guide to individual tasks • Resources • Wiki • Online discussions
Fourth meeting - Finalise and present <ul style="list-style-type: none"> • Review information, data, and recommendations for action • Make a presentation if required • Define final report 	Group activity guide Group facilitation guide Analytical tools? Resources
Individual follow up – finalise report	Resources; Wiki; Online discussion Student Peer review

* The whiteboard may take a variety of forms depending on the resources. It could be a whiteboard, a sheet of paper, or a Word file on computer.

The enquiry-based blended learning design has enquiry tasks and processes supported by tools and resources in the LMS. The LMS template ensures that the online learning environment is structured to support the enquiry process. Figure 1 shows a section of the LMS template that provides student online access to the enquiry, support materials, assessment tasks and guides. It provides a self-contained structure for each enquiry. The example is taken from a trial version of one of the new first year units. Further refinement of the template is anticipated as the process of creating new units within the learning design framework continues, to provide a valuable design tool for future unit development.

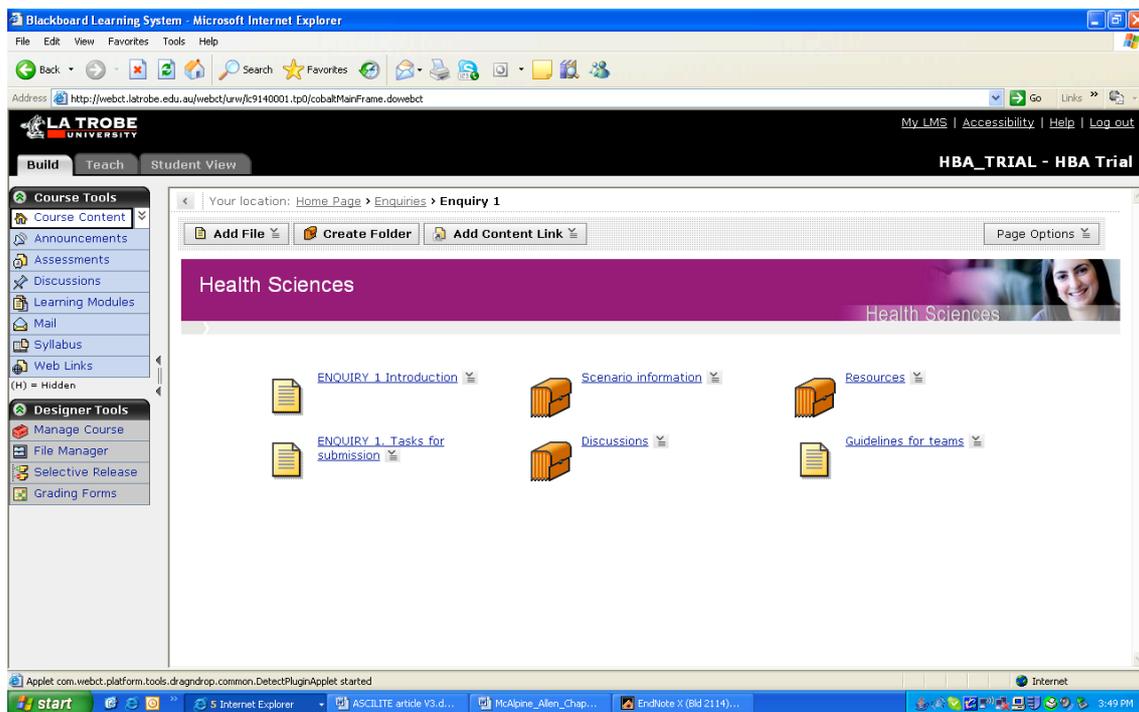


Figure 1: An enquiry in a trial unit, showing the structure for enquiries in the template

Unit scalability

Scaling the unit to cater for large numbers of students across the multiple campuses involves:

1. Building the enquiry materials, resources, guides to the enquiry and team self-facilitation guides into the LMS.
2. Providing all lectures by videoconference link to all campuses. Lectures will be recorded on Lectorpia and made available via a link in the LMS.
3. Timetabling weekly workshop times (1 – 2 hours) for groups of 25 students with a workshop facilitator. Within this larger group students will be arranged in self-directed teams of 5 to conduct enquiries and report on their findings.
4. Team work will be supported by online peer review of individual contribution to the team so that students may learn through peer feedback on their performance; this may motivate appropriate contribution to the team's enquiry and follow up report/presentation. An online system such as iPeer will be used for this purpose.
5. Tutors will undergo staff development to become workshop facilitators. As students are working in self-facilitating teams on their enquiries the facilitator's role is that of a non-directive guide.
6. Workshop facilitators manage assessment for their groups in accordance with assessment criteria. This will be subject to moderation.

In this way students on all campuses have the same access to lectures, resources and guides for the enquiry process, and have an academic staff member (workshop facilitator) to provide guidance. Workshop facilitators need to be knowledgeable about the topic and the enquiry, without needing to be experts. On a 1:25 ratio the learning design is scalable, provided students have access to a campus for lectures, workshops, team meetings, and access to online materials, library support and the Internet.

This model leads to considerable economies of scale. In 2009 only half the number of teaching hours will be needed for first year units, compared to the staff time commitment in 2008.

Orienting academic staff to the learning design

One of the difficulties in promoting the use of learning designs is that many academic staff think about the content of a unit more than the method of learning and teaching. Student-centred constructivist pedagogical models such as EBL focus on method rather than content. This means that educational developers and academic staff have a different orientation and language. A 'bridge' is needed between the orientation towards content and the orientation towards an approach embedded in a learning design.

Bridge building is primarily achieved through workshops and formation of unit development teams. Workshop focus has varied according to need. The aim for some development embedded workshops was to enable academic staff to apply the pedagogical principles of EBL, helping them to make sense of any aspect of EBL that may be counter-intuitive to some. To ensure that the focus is on application, explanation of the rationale and discussion are followed by activities focused on planning and developing EBL activities and units. A staged development process is used so that, for example, an initial focus on rationale, needs and outcomes is followed by a consideration of constraints and possibilities, before planning an enquiry that will work within the constraints and meet the needs. Considering how to resolve typical student misconceptions and common difficulties in applying theory to practice may lead to finding the focus of an enquiry. Small trials of various aspects of the learning design provide in-house evidence of their suitability and not only allow refinement of the developed materials but increase staff familiarity with the pedagogical theories underpinning the learning design as they present the findings of these trials to their colleagues. Further inclusive dialogue and orientation towards the learning design are derived through workshops and presentations by targeted external experts in, for example, effective use of EBL and blended learning.

For the common first year units, development teams have been formed that include educational designers. The teams followed a staged process of development, with the product of each stage being circulated for feedback within the faculty. Unit materials circulated included learning outcomes, unit details, the complete first draft of student materials for the first enquiry, and drafts of the complete unit materials. The feedback received prompted revisions to ensure that the needs of all schools were met.

This process is feasible for the seven units of the common first year. It is necessary as all schools and courses use these units for their first year students. Ongoing development will have the advantage of the complete CFY units as exemplars. Development of many more units (approximately 80 in the second year) cannot proceed on the assumption that an educational designer can regularly participate in detailed design and development. Staff orientation and support will be provided by:

- Workshops providing detailed discussion of the EBL rationale and a method of systematically applying design and pedagogical principles.
- Mentoring by staff who have already participated in the EBL unit design process, such as those who developed the first year units.
- Sharing and celebration of effective and innovative educational practice at Faculty forums.
- Discussion with educational designers when necessary.

Word document templates have been developed for the design of an enquiry, a unit showing details of the rationale, learning outcomes, enquiries and assessment, and a template in Word for a complete enquiry. The latter Word template matches the structure of the LMS template illustrated in Figure 1, and aids in the production of the online enquiry support materials.

These approaches have enabled staff to move from a discussion of the rationale through a staged development process, leading to each unit's online materials being available on the LMS. The LMS template itself, with exemplars, may be a valuable tool for orienting staff to EBL and to support the development of later year units. This may shorten the unit design and development process.

Outcomes

In this first project phase a learning design based on the EBL pedagogical model has been applied to the design/redesign of a wide range of units in the revised Faculty of Health Sciences curriculum. The seven units in the common first year are nearing completion. Common modules that will be accessed by all of the first year units and remain as a resource for latter year units, and students, are under development. These address topics such as Information Literacy, Team Work, Academic Writing, and Introduction to Evidence-Based Practice in Health Sciences. Design and development is proceeding with the critical early stages for second year units, in preparation for 2010. Learning outcomes and unit outlines that indicate the enquiry structure and assessment are under development for these units.

As in all design-based research, the project will proceed over subsequent phases of implementation and redesign/additional design following evaluation and analysis of data. The first implementation phase will begin in 2009. Data gathering during that phase will provide preliminary evidence of outcomes and identify any needs for improvement in the design. These outcomes will be reported in subsequent papers.

Reflection on research questions

While the research questions cannot be addressed conclusively at this time, the outcomes so far enable a preliminary consideration.

1. Does the enquiry-based blended learning design provide a suitable basis for developing all course units in a curriculum?

Each unit in the common first year has used the learning design. This appears to suit some academic staff more than others. Some see the design as an opportunity to make their courses more engaging than they traditionally have been in the past, particularly in areas considering social and public health aspects of health care, or the individual motivational aspects of clients and human service staff. Informal trials of EBL activities in these units provided anecdotal evidence of high levels of student engagement and active learning, indicating enhanced interest in and outcomes from the topic. Academics involved with Biological Science units, that focus heavily on factual and conceptual content, are less certain. They have traditionally relied on frequent lectures to communicate with students. A trial in this area showed that students could enjoy the enquiry process and liked the authentic scenario but still preferred more direct support from facilitators and were less comfortable with the self-directed team process. Enquiries in this topic area have many specific questions and are less open-ended than those in other discipline areas. Academics developing interdisciplinary studies units found the EBL approach to be appealing and highly suited to their unit topics.

It appears that the model may suit staff teaching some units more than others, and that aspects of EBL may need to co-exist with other traditional approaches. The first implementation phase will reveal the full range of issues for the different unit categories.

2. What support processes are needed to enable the learning design to be applied to curriculum change?

Educational design support and workshops have been needed to enable academic staff to design/redesign their units in accordance with the learning design. When the rationale for the design is understood, development can be rapid. Detailed guidance and templates to structure ideas have been valuable supports. Ongoing support will rely more on workshops and the LMS template, with exemplars to demonstrate the learning design in its final form. This should enable more rapid design and development of units.

3. What effects did the curriculum change have on student learning?

This is a major issue for further research, as it requires implementation and evaluation to address it. A range of evaluation methods is envisaged:

- A comparison of examination scores between 2008 and 2009. This can be done for topics that will use comparable examination questions for old and new first year units.
- Focus groups in S2 2008 and S2 2009, concentrating on experiential aspects of the first year units.
- Surveys, such as AUSSE (ACER, 2008), that reveal student engagement levels. 2008 and 2009 data can be compared for the first year. This comparison can be ongoing for subsequent years.
- Focus groups and surveys of staff attitudes towards student learning and experiences of EBL.

4. What factors impact on the effectiveness of a curriculum change?

This will be the topic for later research papers on this project.

Conclusions, and further design research and development

The EBL pedagogical model has enhanced a previously researched learning design, and the resultant enquiry-based blended learning design and its supporting LMS template are being used to support unit design in the context of curriculum change in a Faculty of Health Sciences. Academic staff have been able to adopt the model to suit their needs in the new first year units. Informal trials have shown high levels of engagement and active learning by students – one of the key aims of the project. The learning design has been applied to all units in the common first year, and some elective units. The Faculty has established an organisational structure that aligns with the learning design, to provide staffing, administrative and online support to ensure the scalability of the units and to cater for large cohorts and multi-campus operations. The biggest test will be the next phase of this project, when the new common first year begins in 2009.

Further research on this project will include evaluation and ongoing design and development processes. Evaluation will reveal the effectiveness of the first implementation and redesign needs to enhance student learning. Wide ranging evaluation indicators, such as AUSSE (ACER, 2008) will provide valuable data

on student engagement, and the overall effect of the curriculum change as shown by this indicator in comparison with 2008 data. Evaluation of individual units may identify the effectiveness of the learning design for different topics, and whether some are better suited than others to the overall approach. This will test the versatility of the learning design.

Another research focus is on bridge building between academic staff perspectives and the learning design. As many academics have some difficulty in conceptualising the value of a generic learning design, this research will focus more on ways of supporting conceptual understanding and methods of enabling staff to design units in this way. Extensive educational design support and staff development activity have been used to develop the common first year units. For later years, in which the number of units is increased by a factor of 10, alternative means of supporting the process that are less labour-intensive are needed. Additional workshops are planned and currently under development to provide broad support. The learning design template may also be enhanced so that more support for a learning design can be built into the LMS, to be used as a design and development tool.

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Please cite as: McAlpine, I., Pannan, L. & Fitzmaurice, K. (2008). Steps towards using an enquiry-based blended learning design for curriculum change in Health Sciences. In *Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008*.
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