**Project title**  
Problem based learning in a technology enriched pre service teacher education course (Education Mysteries)

**Project leader**  
Nicky Carr  
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**Team members**  
Dr Gloria Latham, Senior Lecturer, School of Education  
Education Media Group – Jody Fenn, Bill Lane, Zennie McLaughlin (Plus others occasionally)

**Funds approved**  
$20,561

**Funds acquitted (attach financial statement)**  
$20,561

**Introduction**
This project grew out of a strong desire to provide students with an innovative and technology enriched learning environment that supported collaborative knowledge building in a problem-based learning scenario. The objective of this LTIF project was to develop a bank of original, professional and interactive web-based learning objects and associated information architecture that supported the delivery of problem-based learning. The information architecture was intended to form a model for online delivery of problem-based learning for other areas of this university and beyond. The online resources, or learning objects, were also intended to have potential application in other Schools within RMIT.

**Detailed project description and outline of what was done**
The learning objects and associated online environment were intended to be used in a pre-service teacher education course that integrated curriculum across disciplines and that integrates information and communications technologies (ICT). Students in this course were immersed in an investigation of a fictitious problem, whilst at the same time interrogating the pedagogical strategies used by the teaching staff which they might adapt to their own teaching practices upon graduation.

The LTIF project centred on developing the online environment that supported the course in question and developing the multimedia learning objects. The online environment had to allow for the publication and flexible distribution of ‘evidence’ that took the form of images, video, audio and text files to specific individual or groups of students to assist them in the problem-solving aspect of the course. The online environment also had to include a wiki space where teams of students could collaborate and where teaching staff could provide input to the student teams.

During 2009 the key activities of the Project Team were:
- Consultation with other sections of the University to enlist their support as critical friends, potential sources of content and potential users of the learning objects and system architecture
- Detailed scoping of the functionality of the system architecture and learning objects for Scenario 1
- Development of three problem-based learning scenarios
- Development of associated pedagogical activities and materials to support the implementation of the scenario
- Creation of learning objects to support the implementation of Scenario 1 – in the form of videos, podcasts (Audio files), images, templates for various styles of text objects and multimedia interactive objects
- Development of the system architecture and administration system that allows academic staff to create and manage content, and distribute such content to students in flexible ways that responded to the flow of the ‘investigation.’
- Scoping of learning objects for Scenarios 2 & 3.
- Use of the architecture and learning objects in a second-year pre-service teacher education course, as intended.

The project produced an online environment that included:
- a wiki
- an online discussion forum
- a range of learning objects built in a range of media to support the implementation of one scenario
- an administration system that allowed for flexible management of the learning objects.

The project demonstrated to pre-service teaching students the potential of problem-based learning and associated student-centred pedagogical approaches as a learning and teaching approach. It also demonstrated how technology might be harnessed in meaningful and authentic ways to support learning.

Although not all the intended outcomes of this project were met within the 2008 calendar year, EMG has agreed to complete the outstanding deliverables during 2009 at no further cost. These include further refinement of the administration system associated with the information architecture, re-development of the administration system interface and learning objects for Scenarios 2 & 3.

A number of unintended outcomes emerged from this project including:
- The need to spend more time scoping a set of realistic outputs for such a complex project prior to project commencement, with the intent to phase completion of the deliverables over a more realistic time frame
- The recognition that content development of the type characterised in this project requires significant research in order to ensure authenticity even in the face of a fictitious scenario
- The difficulty of engaging other sections of the university in such projects, given time constraints staff deal with on a day to day basis
- The professional renewal that emerged from projects such as this and teaching approaches such as were adopted in this course that brings together teachers from different disciplines and with different skills sets
- The necessity of ensuring thorough testing of newly developed online systems before releasing them to students and staff.

Attach the full and detailed report and evaluation of your project outcomes including evidence of the impact the project has had. Also make reference to how the outcomes address the five key objectives:
- Improved student learning experiences, outcomes and employment opportunities
- Innovation
- Strategic alignment
- University wide application

See attached report.
| Dissemination of project outcomes both completed and planned. This should include both within RMIT and externally. | Presentation at iCampus Symposium, University of Melbourne, July 2008  
Presentation to Learning Management and Academic Staff at the University of Melbourne, August 2008  
Project used as input to RMIT Learning and Teaching Website |

| Summary of the project, outcomes, impacts and dissemination | The objective of this LTIF project was to develop a bank of original, professional and interactive web-based learning objects and associated information architecture that supported the delivery of problem-based learning. The information architecture was intended to form a model for online delivery of problem-based learning for other areas of this university and beyond. The online resources, or learning objects, were also intended to have potential application in other Schools within RMIT. This project grew out of a strong desire to provide students with an innovative and technology enriched learning environment that supported collaborative knowledge building in a problem-based learning scenario. The learning objects and associated online environment were used in a pre-service teacher education course that integrated curriculum across disciplines and that used information and communications technologies in authentic and meaningful ways. Students in this course were immersed in an investigation of a fictitious problem, whilst at the same time interrogating the pedagogical strategies used by the teaching staff which they might adapt to their own teaching practices upon graduation.  
The LTIF project centred on developing the online environment that supported the course in question and developing the multimedia learning objects. The online environment supported the publication and flexible distribution of ‘evidence’ that took the form of images, video, audio and text files as well as interactive multimedia objects to specific individual or groups of students to assist them in the problem-solving aspect of the course. The online environment also included a wiki space where teams of students could collaborate and where teaching staff could provide input to the student teams.  
The project demonstrated to pre-service teaching students the potential of problem-based learning and associated student-centred pedagogical approaches as a learning and teaching approach. It also demonstrated how technology might be harnessed in meaningful and authentic ways to support learning and that technology can be used to engage students in learning in new ways. The project was clearly designed to enhance the learning experience of our pre-service teacher education students and to expose them to different ways of learning and teaching. Reflections from students about the approaches taken to the course and the various aspects of the online environment were, by the end of the course, largely positive. However, CES results, which were gathered relatively early in the course, did not reflect the types of comments that students made on completion of the course.  
The project also provided invaluable learning for university staff in developing and managing large, complex content development and delivery projects. Specifically these were in the areas of project scoping to reflect more realistic and achievable outcomes, and the need to ensure rigorous user testing of systems and learning objects prior to release to students.  
Aspects of the project have been disseminated to audiences within RMIT, Australia and the international academic community in the form of presentations to groups of staff, symposia and international academic conferences. |
LTIF Grant 2008

Problem based learning in a technology enriched pre service teacher education course (Education Mysteries)

Full Report

Project Category – eLearning

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Position Title: Lecturer, RMIT School of Education
1. Introduction

This project aimed to develop a bank of original, professional and interactive web-based learning objects and associated information architecture that supported the delivery of problem-based learning in a blended learning model. These learning objects and associated online environment were intended for use in a pre-service teacher education course that integrated curriculum across disciplines and that integrated information and communications technologies (ICT). The information architecture was to form a model for online delivery of problem-based learning for other areas of this university and beyond. The online resources, or learning objects, would also have potential application in other Schools within RMIT.

2. Background

The Education Mysteries Project was devised because of a perceived need for a learning environment that would engage second year pre-service teacher education (Primary) students in important ideas about learning and teaching. Specifically, students needed to develop skills in designing curriculum for students to develop critical literacy skills across a range of disciplines using technology in authentic ways. Previous incarnations of the course were not cohesive, were heavily theoretical and did not engage students as intended. A multidisciplinary lecturing team reflected on anecdotal feedback from students and lecturers about lack of motivation in the second year of a four year pre-service teacher education university program. Lecturers were drawn from literacy, numeracy, science and ICT backgrounds. The response was to develop a collection of problem based learning scenarios that could be delivered in a blended learning environment (a combination of face-to-face and online environments) and multimedia elements of the environment.

The LTIF Education Mysteries project builds on a successful pilot in 2007, where, as part of the University trial of the Campus LX implementation, use was made of Blackboard and the Campus LX Wiki to create an authentic, problem-based learning environment for students. Over 150 second year pre-service teaching students were asked to complete various web-based tasks that focused on developing their numeracy, literacy and ICT skills and understandings in the course TCHE2124 Designing Multiliteracies. Students accessed online materials or clues/evidence via the course shell in Blackboard to help solve a problem-based scenario. Wikis were used extensively to communicate within and across groups to collaborate on their findings, as well as to communicate with teaching staff and to collaboratively build knowledge to solve the problem and develop communication skills. This resulted in significant use of the online environment with an average of 41 hits per student to the course shell on Blackboard during the period 27/7/07 to 15/10/07, extending the use of this shell well beyond the minimum online presence.

However, there were evident weaknesses with the approach taken during the pilot. The online environment was limited to flat html pages, thus offering no opportunities for the students to engage or interact with the online environment. Further, the flexibility and the management of the online system were limited and restricted the opportunities to maximise learning potential from the problem-based learning experience. Finally, it was felt that more skilled media designers would be able to produce a more professional set of learning objects. Thus the LTIF project was developed to address some of the issues that emerged from the pilot project.

2.1 Underlying Learning and Teaching principles

The approach to teaching and learning that underpins this LTIF project represents a significant transformation from the traditional lecture/tutorial model and provides an innovative educational opportunity for students. A deliberate attempt to disrupt the students existing ideas about learning, teaching and schooling was undertaken with this course.

The following learning and teaching principles underpin the project:

- Teaching needs to shift away from an information transmission model of learning towards problem-based or inquiry based learning in the belief that such an approach allows students to belong to the learning, because the learning is more student-centred.
Learning must be more active – where students are involved in creating knowledge rather than passively receiving information. The teaching team strongly believe in placing much greater emphasis on creating a learning environment where the student is at the centre of the learning, requiring them to think for themselves, to problem-solve, to hypothesise and to create. In doing so, our students are required to engage with the types of higher order thinking skills that they are expected to be able to teach when they graduate.

Learning needs to be more authentic, drawing on real world issues rather than dealing only in abstract contexts; attempts to model making connections to the lives of the students beyond the school. Teaching should foster students’ ability to see situations from multiple perspectives.

Existing notions of school should be constantly challenged – the course uses a pedagogy of disruption; this course is not what most of our students would think of as school learning, but is a deliberate attempt to challenge their notions of what school learning might look like and to encourage them to question what school learning is or could be; to imagine alternative approaches that they might take in their own classrooms upon graduation to engage their own students in deep rather than superficial learning.

Learning needs to be integrated - the problem to be solved, the scenario, needs to model integrated/interdisciplinary learning because the world doesn’t compartmentalise knowledge or skills. This approach will encourage students to take a more holistic view of learning, and of identifying how different domains of knowledge interconnect.

Learning needs to be collaborative - a focus on collaborative learning that moves our students beyond simple ideas of ‘group work’ towards a much greater interdependence on each other for solving the problem and for collaboratively building knowledge.

Learning needs to be multimodal. Information comes to us in many different modes, some mediated by technology, some not. Students must engage in meaningful ways of using technology to communicate, construct meaning and demonstrate understanding. Students need to develop critical skills in evaluating and ‘reading’ such multimodal texts.

Teaching needs to model effective and meaningful uses of technology that are transferable to the school classroom. Technology was not to be the main focus of this course, but was to be used in ways that facilitated collaboration and communication between students and supported learning of key concepts. The focus was therefore to be on learning through technology rather than learning about technology.

The pilot demonstrated high levels of engagement by students in a course that models rather than talks about, leading edge pedagogies that effectively integrate the use of ICT into teaching and learning. This was to be the guiding principle for the implementation of the LTIF project.

2.2 Strategic Objectives

This project was clearly aimed at the following strategic objectives:

- Improving the student learning experience and providing them with a broader range of teaching skills and a broader perspective on learning that will enhance their employability as teachers upon graduation.
- Trying an innovative approach to learning and teaching that involves effective, authentic and meaningful use of a range of technologies to support and enhance the learning experience for students.
- Developing a resource that has University wide scope.
- Delivering all of the above in a cost effective way.

3. Intended Project Scope

Initially, the LTIF project was intended to produce the following outcomes:

- Online materials & resources to support three problem-based learning ‘investigations’ or scenarios that potentially may be used in other courses university wide.
- A system architecture that enabled the administration and delivery of a range of media types to students, including text, sound files, video, images, and interactive learning objects that would be available university-wide.
• Modelling of effective pedagogical strategies that integrate learning across discipline areas as well as use of ICT in learning and teaching.
• Innovative educational opportunities for students that involve authentic integration of ICT into pre-service teacher education courses.
• High levels of meaningful engagement in the online environment by pre-service teaching students.
• Improved student learning experience as measured by CES data and student feedback.
• Strengthened links between School of Education and other areas of the wider university.
• Model of web-based problem based learning that could inform teaching and learning in other areas of the university and beyond.

4. LTIF Project Activities 2008
• Jan-Feb 2008 – development of two new scenarios was undertaken by Project team.
• Meetings were held in Feb-Mar 2008 between School of Education Project Staff and the Educational Media Group (EMG) to scope the project in detail. Initial meetings focused on the system architecture that would be required, as well as scoping the learning objects required for the first scenario.
• A critical friends group was created comprising representatives from the School of Environment and Planning, School of Criminal Justice administration, Learning & Teaching Unit, Design & Social Contexts College. The intent of this group was to engage other sections of the university in our project, particularly those areas of RMIT who may potentially use some of the learning objects or problem-based learning approaches being developed within this LTIF project. The purpose of the meeting was to introduce these groups to the concept of the problem-based learning investigation, to explore how transferable the approach may be to their own Schools, and to enlist their assistance and expert knowledge in developing the content that would be used within each investigation.
• Ongoing meetings March - May with EMG to define the specifications of the system architecture and to agree specifications for learning objects.
• Development of system architecture March – September 2008.
• Development of learning objects April – September 2008.
• Testing of the prototype system June 2008.
• Roll out of online system July 2008.
• Trouble shooting and ongoing learning object development July – October.

5. The Scenarios
Three problem-based learning scenarios were developed. Each is positioned as a mystery or investigation that needs the assistance of our students to solve. Students were formed into Task Forces and within each Task Force, students formed multidisciplinary teams. Students accessed evidence associated with the investigation via the Education Mysteries online environment on the Blackboard course shell.
Students essentially wore two hats – one as a learner, immersed in the investigation, the other as a practitioner, reflecting on the pedagogical approaches modelled throughout the investigation. All activity related to the investigation occurred within the Education Mysteries environment. All activity related to the pedagogical approaches took place within the Blackboard environment.

Each student and staff member was allocated a character to adopt in role play throughout the course. Each student character had one of five occupations related to the content of the scenario. Information about each character and each occupation was accessed through the online environment.

Teams were made up of at least one of each occupation. Lecturers took on their role to be learners with the students in the scenario and to help sustain belief in the role play.

Each scenario had to be possible, but also highly improbable. There was a deliberate attempt to incorporate an element of whimsy and humour as a device to engage second year university students. Specific learning and teaching activities (not part of the LTIF project per se) were designed for implementation in face-to-face workshops or within the online environment between tutorials that supported the students' ability to successfully complete the investigation. Students discussed that if using this approach in a primary or secondary school setting the degree of authenticity may need to be higher than in this project.

The scenario outlines are as follows:

**Environmental Mystery** – Local media are carrying announcements about a large number of young children being struck down with a mysterious life-threatening illness. Members of the medical staff at the Royal Children’s hospital are baffled at the symptoms, which include allergic reactions, rashes on their skin, irritated eyes, diarrhoea, muscle tremors and breathing difficulties. Over the last two weeks, 100 children from the northern suburbs have been hospitalised, and ten of the children are in a critical condition, remaining on ventilators to ensure they can breathe. Lacking faith in the public sector bureaucracy, the Premier’s Office has called on the Task Force to assist in the investigation of this public health and environmental crisis. Multidisciplinary investigative teams with strong problem solving skills are needed to assist authorities uncover the causes of these events and to determine the extent of the damage to the environment and what actions might be needed to prevent a recurrence. What is the cause of the children’s’ illness? Are the two events related? Will more children be affected? How else will this event impact on the natural and human
environment? What might be the implications if the contamination gets into Melbourne’s main water storage reservoirs? How can we locate the source of the contamination?

The Jade Rabbit - There has been a break in at the NGV in St Kilda Road. Police had feared that art thieves might have targeted some of the precious artworks currently on loan to the Gallery from (insert latest special exhibition??) but it appears that no works of art have been stolen. However, the offices of Yin Chang, Senior Curator of Asian Art, NGV, appear to have been ransacked. Fortunately Ms Pang was not in her office at the time. After checking the contents of her office Ms Chang informed police that an item of her personal possession is now missing. The item was a broken segment of an old Chinese artefact that had been handed to Ms Chang by her great grandmother. The Chinese Embassy has called in the Educational Task Force to investigate given our expertise in Asian cultural issues and mythology as well as collaborative, multi-disciplinary problem solving. The Chinese Embassy is also aware of reports of similar break-ins at three other galleries around the world where similar pieces have been removed from their collections. The Chinese Embassy, on behalf of the Chinese Government, has sought assistance from the Task Force to discover who has stolen these artefacts? Are the crimes related? What is the significance of the artefacts? How can the artefacts be recovered.

Hunt for the Extra Terrestrial Biological Entity - The Australian Army has just reported the discovery of an alien spaceship that has crashed in the remote Pilbara region of outback Australia. Members of the Armed Forces were on a training mission in the area when a platoon of soldiers came across the space craft. The spaceship appears to have been occupied by some form of extraterrestrial biological entity (EBE) but looks to have been abandoned. Australian Defence Forces have secured the site and have called on the services of international scientists as well as local scientists to uncover the mystery of where the craft is from, whether it contained any life forms prior to its crash landing and whether these life forms, if they existed, pose any threat to human life.

In 2008 the focus of the LTIF project was on the development of the system architecture as well as multimedia content for the Environmental Mystery scenario.

Throughout the investigation evidence was allocated to students according to their occupation. Our intent in providing initial evidence to each occupation is to create opportunities for collaboration rather than competition amongst the teams of students. Each occupation had to collectively study, synthesise and report their findings to the other members of the Task Force in order to collectively hypothesise the potential solution.
The evidence came in a variety of media that needed to be read/viewed in different ways.

The range of media types developed and which the system architecture can support include:
- Multimedia interactives (example shown is a water sample test that all environmental scientists received)

Podcasts/audio (example shown is a talkback radio segment)
Video (example shown is a TV news report to the journalists)

Text reports (Example shown is a report to the ethicists)
Images (example shown is an aerial images of the area under investigation for the town planners)

Subsequent evidence may have been provided to all members of the investigation via their PDA on their desk. Face to face classes would focus on providing students with specific skills need to interpret the evidence.

Students were allocated into teams by lecturers. Each team was provided with its own private wiki space where they were asked to post and modify their hypotheses and findings after each task.

The intent was to provide a space where students could collaboratively build knowledge.

Students used the wikis to share the knowledge they were building, and to support each other through giving informal feedback.

The wiki also provided a space where students who were geographically dispersed had the opportunity to communicate with each other about their tasks and their findings, using the space to organise and allocate responsibilities within the team. For many students this overcame difficulties with arranging mutually convenient face-to-face meetings on campus.
Lecturers, in role, used the wiki throughout the semester to comment on the progress being made by each team with the investigation, providing teams with feedback and suggestions to move each team forward.

Another feature of the Education Mysteries online environment is an asynchronous, text based discussion board, called the Conference Room. The intent of this space was to act as a place where students in the investigation could enter into discussions with external experts (either external to the School of Education, or external to RMIT) to gain insights and assistance with their investigations.

5.1 Scenarios 2 & 3

The initial LTIF project scope aimed to produce similar content for the remaining two scenarios during 2008. However, it was found that the initial lead times for both the content development and the system architecture that would deliver the content were significantly under-estimated. This was due mainly to an expansion of the original scope of the online environment generated by a deeper understanding of what such an environment might deliver, in terms of interactive items, video and other forms of media. The scope of content produced for Scenario 1 was much broader in terms of media type and more sophisticated level of design. Hence, only content for one of the scenarios was completed during 2008, with EMG undertaking to include content development for the remaining two scenarios in their normal work program in 2009 and 2010, when the scenarios will be delivered to the students.

Experience in implementing this LTIF project has generated a clearer understanding of the need to more clearly scope the project prior to development of grant applications. Had more time been spent planning
and scoping the project in greater detail with staff of the EMG prior to the grant process then a more accurate budget and timeline would have been generated with more realistic output targets.

Another factor that was not sufficiently considered in the grant application process was the time demands on teaching staff to develop content ideas. Much more research and development time was required of teaching staff to ensure the evidence developed had a high level of authenticity. Teaching staff found it difficult to juggle demands of teaching with this additional role of content developer, particularly when the content required fell outside their area of expertise. Consultation with other RMIT staff with the required expertise was undertaken however, they too were often teaching staff with existing commitments to students and research of their own (see discussion of Other Outcomes below).

To date, detailed scoping of content for Scenario 2 (The Jade Rabbit) has been completed, with an initial scoping of Scenario 3 (Hunt for the EBE) completed. Detailed scoping of Scenario 3 will take place in December 2009.

6. The system architecture

A key outcome of this project was to develop an approach or system architecture that could be readily adapted for other sections of RMIT University interested in delivering scenario-based learning. The aim was to design and develop a system that could act as a repository of online, multimedia content and deliver that content to specific students or groups of students. The Education Mysteries LTIF project was therefore a vehicle through which such a system could be developed and tested. The system was developed using Drupal, an Open Source CMS (Content Management System). Use of Drupal had the added benefit of supporting tight integration between the CMS and the Flash based user interface.

6.1 User administration

The system allows the import of .csv files from other RMIT systems, ensuring that minimal administration load is added to teaching staff workload in adding student users to the system.

The system allows administrators to allocate roles, permissions and status. Drupal allows users to register, login, log out, maintain user profiles, etc. Users of the site may not use their own names to post content until they have signed up for a user account. The system allows the administrators to register new users by hand. Note that you cannot have a user where either the e-mail address or the username match another user in the system. The system allows the administrators to register new users by hand. Note that you cannot have a user where either the e-mail address or the username match another user in the system. The user administration also shows how active users have been within the system.
A Group represents a collection of individuals working on the same scenario for a specified period of time. In the Education Mysteries project, a Group represented a tutorial group or class. Groups can be allocated to a specific scenario, so theoretically different groups might work in different scenarios.

A Team represents a smaller collection of users who will be working on the same scenario over a specific period of time (i.e. 1 semester).

Groups are made up of Teams. Teams are made up of Users. Adding a User to a Team will make that User part of that Teams group.

Therefore, a typical process for a new class would be to add a new Group, import all class members, create the required teams and finally associate Users with their Teams.

6.2 Wikis

A key feature of the Education Mysteries online environment was the desire to use wikis to support communication and collaboration within and between teams. For the LTIF project it was agreed that the online environments should reflect the dual roles that each student had in this course – all activity related to their role as a learner immersed in a problem-solving investigation should occur within the Education Mysteries online environment, whereas activity related to their role as a pre-service teacher analysing and reflecting on the pedagogical approaches that were implicit in the investigation would be confined to the Blackboard environment.
Therefore, a ‘wiki’ was built within the Drupal environment. Users within a wiki can view pages, add pages, edit pages using rich text html editor (allows the addition of images, file attachments, hyperlinks, font size and colour), and view a history of revisions to pages, reverting to previous versions.

The administration system enables the management of which teams and Groups have access to which wikis. Thus wikis may be visible only to member of the team, or to members of other teams within the Group. The ‘visibility’ of the wikis can therefore be managed flexibly so that at different time in the investigation it is possible to have different levels of visibility and access to the wikis.

The system allows for detailed management of the wiki and its content ensuring that administrators within the system can delete or remove inappropriate content.

6.3 Content development and management

A key issue in the development of the Education Mysteries is that it enabled the creation and uploading of content independent of the EMG. Much of the ‘evidence’ in each scenario is text based, with content for the evidence being developed by the lecturing team. Ongoing reliance on the EMG to upload new evidence and allocate it to the appropriate teams or individual students was not desirable, and seen as inefficient for both the teaching team and the EMG. A key element of the system architecture was a content creation system. This system allows the teaching team to:
Create evidence in different formats – announcements, images, text (choosing from a variety of templates) using a rich-text html editor

Select where within the online environment the evidence will appear (lab, library, desktop)

Determine who gets to see what evidence - upload evidence in ways that allocate the evidence to individuals, teams or other groups within the course as dictated by the investigation, rather than according to any predetermined plan, thus allowing for adaptability throughout the investigation

Determine when each piece of evidence is released – the system allows administrators to set the specific dates that evidence will be visible, (both a beginning and end date)

6.4 Further Development
Due to the scope of this project growing beyond its original concept, elements of the project have yet to be completed. These will be completed in 2009 and 2010 with the assistance of the EMG.

Further refinement of some aspects of the administration still needs to occur to streamline the functionality around teams and group. The entire administration system interface was initially built in a rather crude Drupal interface. Given the experience we have had in using the administration system there will be further refinements and a more integrated Flash interface will be developed to replace the current multi-layered Drupal interface.

Learning objects for the remaining two scenarios still need to be created and built. Detailed scoping of Scenario 2 has already taken place with a schedule of completion to be finalised in February 2009, for anticipated completion in May 2009. This will enable a second scenario to be implemented to the second year Bachelor of Education cohort in second semester 2009. Initial scoping of the learning objects for the third and final scenario has already occurred but detailed scoping and building of these will take place later in 2009-2010.

7. Other outcomes
The Education Mysteries LTIF project had a range of other intended outcomes in addition to the more obvious outputs of the system architecture, the online environment and interactive learning objects. These other outcomes are restated below:
• Innovative educational opportunities for students that involve authentic integration of ICT into pre-service teacher education courses
• Modelling of effective pedagogical strategies that integrate learning across discipline areas as well as use of ICT in learning and teaching
• High levels of meaningful engagement in the online environment by pre-service teaching students
• Improved student learning experience as measured by CES data and student feedback
• Strengthened links between School of Education and other areas of the wider university
• Model of web-based problem based learning that could inform teaching and learning in other areas of the university and beyond

The following sections identify the extent to which these outcomes have been met and draw upon student feedback collected from their reflections about what they have learned from this course completed as part of their second assessment task. Further feedback about the course is still to be gathered from the 2008 cohort in a series of small student focus groups. This data will not be collected until students return to study in March 2009.

7.1 Integrating ICT
The Education Mysteries project created a unique blended learning environment in which pre-service teacher education students could be immersed. In addition to requiring students to use the online environment and the wikis, a range of other opportunities to use ICT were incorporated into tutorial activities, for example developing and analysing data in spreadsheets, using online digital learning objects as a learning and teaching resource, using digital video cameras and video editing software, recording and editing audio files. These activities were designed to assist the students in solving the mystery, with ICT being used in authentic ways as a tool to support these other learning goals, rather than using ICT as the main focus of the learning. Despite high levels of investment in ICT in schools over the last decade many school teachers do not make significant or effective use of ICT to support student learning. Many of our pre-service teaching students therefore do not see effective use of ICT whilst on their professional placement in schools. They find it difficult to extrapolate from the types of ICT we talk about university courses to how they might integrate ICT in their own practice upon graduation. It was through their hands-on experience of using the Education Mysteries environment that our students could develop their understanding of how ICT might be integrated into their own teaching practice upon graduation. Students also were given an opportunity to develop their own ICT skills in a range of applications, as exemplified in the following comments made by students.

There were a few aspects of The Source that I found to be a challenge. One of the challenges that I found was the reliance on ICT and a few programs that I was not familiar with as ICT and working with computers is not one of my strengths. I did find however that as time went on and the more I used the wikis the more comfortable I felt. It was just the initial reaction of having to communicate and operate through a wiki, something I had not used before. I found that my skill in this area only increased throughout the course.

Apart from me previous ideas of working in a group being challenged so ere my previous experiences of working with technology. I t was very difficult when we initially started the course as we had dilemmas with the technology and the wikis. My own knowledge improved in such areas as designing wiki pages, surfing the internet, interpreting excel spreadsheets, PowerPoint and filming. I feel I am now more confident teaching using technology.

However, not all students took the opportunity to use the technology enriched environment to develop their skills, suggesting that the ICT skills of our students are perhaps not as strong as is commonly assumed and their interest in using ICT as a learning tool is not always a high priority:

Personally I wasn’t interested in nor did I enjoy doing the work (save for the multimodal text assignment) for the subject as I do not have very good skills with ICT and find it very challenging to use it for means other than Facebook, MySpace, Hotmail, Youtube, Google and MSN. It is quite sad really but I enjoy doing those things because they are not exactly new to me, there wasn’t a deadline
ever on learning how to use it and I wasn’t being marked on my skills. Naturally when one is uncomfortable doing something they will not exactly jump at the chance to do it for a few hours a week unless it interests them.

A feature of the course was a reduced reliance on face-to-face lectures. No lectures were delivered in real time, although two lectures were delivered via Lectopia to supplement the online environment. Students were expected to use the time they would normally spend at a face-to-face lecture each week working within the online environment. Many students did not choose to do this, since the content within the online environment was not directly assessed. This impacted on the progression of the ‘investigation’ when in some weeks teams had not completed their tasks. This outcome highlighted to many students the need for them to develop greater self-regulation and collaborative learning skills, and highlighted to teaching staff that additional scaffolding may be required for students even at this level.

Students in the course were also encouraged to make use of the online discussion forum within the Blackboard course shell. Topics for discussion in this environment were restricted to the pedagogical approaches taken throughout the course. For some students this was an important source of information and feedback from the teaching staff:

“I found the discussion forum to be a fantastic source of knowledge and was thrilled that the lecturers put in so much time replying to our posts, It shows that they really do have an interest in what we are learning and care about their work.”

7.2 Wikis as collaborative tools for learning
Most students came to see the wiki as a potentially useful communications tool that would support learning, in particular collaborative learning.

“Through using the wiki to record my work I feel it improved my ability to stay focused and on as I had something to work for and to prove to others rather than just leaving everything until the last minute.”

“Something that surprised me was the collaborative way my team worked in class but especially through the use of ICT and our team wikis. The way the wikis played a vital role in the whole investigation. I was surprised at the way I relied on the wiki, and the reliance that my team held on the wiki for communication, organising our multimodal text, to delegate roles and even to just generally see how each member was going and their individual contributions to The Source.”

“The wiki was a great resource we used to keep in contact with each other for ideas and communication. We shared ideas and kept in contact with each other through the wiki. What really worked well with our team were our wiki pages. Everyone contributed into it at some point. We put forward our opinions and thoughts about things we had to do.”

7.3 Pedagogical strategies and student engagement
The course was intended to model a range of student-centred pedagogies aimed at developing skills in deep rather than superficial learning, higher order thinking skills, self-regulation and metacognition. A key component of the course was to encourage students to deepen their understanding of such pedagogical strategies and to think about how they might use similar strategies in their own teaching practice.

“The Source strengthened my respect for student-guided learning as it was a notable technique throughout the investigation and allowed students to take responsibility for their own learning instead of relying on the teacher.”

“My previous belief was that structure was needed within a primary school but having seen how much I liked not knowing what was coming next this belief is now changed. I now believe that structure needs to be taken away from students in order to breathe fresh air into a classroom and breathe life into my own teaching.”
“I believe that I have learnt much more than I had anticipated when I commenced this course. In the beginning I was a little confused and could not quite comprehend the relevance of The Source to education, but discussing the pedagogy behind it in class opened my eyes and made me realise that The Source was not just an engaging scenario for students to enjoy, but it incorporated new approaches to teaching and learning that is inquiry based and student centred. Throughout this semester I have acquired a greater understanding of these approaches along with knowledge and ideas about ways of providing our students with authentic learning experiences through integrated learning and disruptive pedagogies.”

“As I reflect on my experience undertaking The Source I realise that it has challenged my ideas about learning and teaching. The structure of the course differed immensely in comparison to the courses I have previously undertaken. This new approach to teaching created feelings of uncertainty and doubt, I felt that this was linked to a fear of the unknown. My ideas about teaching were strengthened during this course. It has allowed me to explore new ways to teach students in the 21st century. The learning requires us as students to be self-directed and have the ability to work with others.”

The approach taken with the Education Mysteries course was a deliberate attempt to disrupt our students who by the second semester of second year have become highly socialised into the lecture/tutorial model that closely follows the publication of a detailed course guide that highlights what topics will be covered each week. This is not an appropriate model for an investigation, the direction of which is determined largely by the students, and it might be argued not always an appropriate model for primary school education. It is a model that is heavily reliant on teacher direction. The intent was to challenge complacency in teaching, and to make students aware of how easily as teachers we form habits that need to be called into question periodically. Many students find it difficult to cope with this apparent lack of structure, even though they are told at the beginning of the semester about what the assignments are and when they are due and are given an overview of the approach.

“What really surprised me about the course was rather than have a course guide we were given the information on a need to know basis. This completely freaked me out. As a person I am quite disorganised and all over the shop so the structure of a course guide is perfect for me to have something to refer to when planning my days. I’m also one of those annoying people that needs to know everything and so the whole mystery and having to go onto the wiki every week to find our clues in order to close the mystery stressed me out.”

However, by the end of the course most students were able to reflect on the benefits of the approach despite their initial discomfort:

“My previous belief was that structure was needed within a primary school but having seen how much I liked not knowing what was coming next this belief is now changed. I now believe that structure needs to be taken away from students in order to breathe fresh air into a classroom and breathe life into my own teaching.”

“I like knowing everything about a course and its assessment so that can plan ahead for it, but it wasn’t like this with this mystery. Yet I realised I was able to cope just fine without knowing what was coming next.”

“The Source made me aware of my comfort zones and that as a teacher I need to be continuously stretching myself and stepping out of these zones. If I expect the students in my class to try new things, I need to lead by example.”

This course was strongly focused on ideas about integrated curriculum and it challenged many students ideas about what integrated curriculum looked like:

“Prior to taking part in this course I was unclear as to what an integrated curriculum was. My idea of integrated curriculum was basically a topic spread over a wide variety of subjects. However, as we went through The Source it became evident to me that this was not the case. I found out that it is more having something you are working towards and along the way in order to achieve this outcome you will partake in a variety of subject areas. I found this an eye opener and I believe that I will take this knowledge away with me so that I can incorporate it into my own teaching practices.”
Another aim of the course was to engage students at a deep level through the use of ICT and innovative pedagogical approaches. Whilst many students were intrigued by the idea of the mystery the level of engagement was not universal:

“*The idea that you learn best when engaged was strengthened as I was about to produce my best work because I was having fun.*”

“What surprised me most was the fact that students didn’t take to the mystery as I did. This is alarming as a lot of work obviously went into making The Source engaging and still there were some that weren’t engaged. However it confirms for me the idea that everyone has different preferences. Furthermore it alarmed me as it shows that even the best laid lessons and ideas are still not going to engage everyone.”

A key feature of the pedagogical approach taken in this course was a heavy reliance on collaborative learning. Traditionally our students dislike ‘group assignments’ but feel little hesitation in implementing group work in their own teaching practice. By asking students to reflect on their own experiences they were able to bring into view some of the issues around collaborative work and identify strategies that might assist such collaborative approaches to be more successful. Whilst these comments by students highlight some of the positive experiences, not all groups worked successfully:

“At the beginning of this course I was very excited to find out that it was going to be interactive, however, after finding out how interactive it was and how much I had to rely on others to get things done, I wasn’t so sure I liked the interactive idea so much. There were many times when team members didn’t do their part or didn’t turn up to class which impacted on the investigation. However the course engaged me as a learner and I believe it would engage students in a primary school setting.”

“I observed some classmates behaving carelessly towards their responsibilities and relying on others to do their work for them.”

“When we were placed in our groups I was a little nervous as I had never really communicated with the majority of our team members an I was secretly wishing we could have picked our own groups. However, nor I look back and see how effective it was working with these people and I am grateful I have had the opportunity to work with them, as each team member brought something different to the team. I realise that there will be children who feel this sense of apprehension working with others they are not too familiar with however I can now see the benefits of this approach and would definitely use this in my classroom.”

“Working in teams is something which I am always nervous about. From previous experiences I have either been left with the work or what is presented is often below the standard which I would have preferred. Seeing as The Source was created predominantly around group work, from day one I wasn’t looking forward to it. I didn’t know any of the other four group members however knew of them… After some initial turbulence everyone worked well together and better than I feel as though I have made some real friends out of my group. I have observed that we now help one another with other courses too.”

### 7.4 Links across the University

An ancillary outcome of the project was to establish stronger connections with other parts of the University; to engage others in contributing to the development of the content used in the three scenarios as well as engage them in the problem-based learning scenario approach.

A group of staff drawn from across relevant areas of the University were invited to become critical friends of the project. An initial meeting was held early in 2008 at which the objectives of the project and the broad approach being taken were outlined to the group. Some helpful input in the form of expert knowledge and ideas was provided by some of the people in the group following the initial meeting, however it would be realistic to say that the Education Mysteries Project was not a high priority for these people, so their contribution was limited. It was difficult to engage other parts of a university when competing demands on their time prevent them from being as involved as they and we might desire.
7.5 Staff professional renewal

Another, unintended, outcome of the project was a strong sense of professional renewal that was generated from teachers with different skills sets and discipline backgrounds teaching together and developing content in a collaborative way. Staff shared imaginative ideas, technological skills and pedagogical strategies that informed their own and each others' teaching both within this course and beyond it. Technology skills of the staff teaching in this course improved as did their content knowledge in areas they did not normally teach.

8. Issues

8.1 Project scope

As outlined earlier in Section 5.1, the scope of the project was expanded significantly on what was originally envisaged. The team that worked on this project was highly creative and seemed to feed off each others’ creativity. Discussions with EMG staff in the early stages of the project opened up a range of previously unconsidered possibilities by the teaching staff involved in the initial scoping of the project, who were relying on limited technical knowledge of what was possible. Thus the budget and timeline stipulated in the project was significantly less than what was ultimately required for the project.

This experience suggests that before grant applications are considered that more detailed discussions between academic staff and EMG staff should be encouraged to consider more widely the possibilities that technology affords. This should result in more realistic budgets and timelines for such projects that involved the development of online learning objects and systems to manage and deliver such content to students.

8.2 Lead times and technical difficulties

The development phase of the project did not get fully underway until March 2008, although much work had been done prior to this on developing the outlines for the three scenarios. When combined with the significantly expanded scope of the range of content and the functionality of the system architecture, this meant that lead times to develop the system and the content for the scenario to be implemented in second semester 2009 were not long enough.

An issue that had not been fully considered during the application process was the time it would take academic staff to prepare inputs to the content – for example specifications for interactive water sample tests. In many cases academic staff were operating outside of their area of content expertise and it took much longer than anticipated to research the details of content objects. This was necessary since it was important pedagogically to have an authentic basis for much of the ‘evidence’ that students were asked to analyse. Future similar applications for funding should be encouraged to include a provision for a research assistant to address this issue.

The lack of lead times resulted in the release of functionality literally minutes before classes. Academic staff were frequently being shown how elements of the system worked just before making this functionality available to students, without time to test the robustness of the system. A lack of familiarity and comfort on the part of the academic staff with the administration area of the system also caused performance issues. Functionality of the system therefore needed to be prioritised with full functionality of the system not being available until the final week of the investigation phase of the course.

Poor performance of the online environment in the early stages of the semester, particularly the wikis, lead to student dissatisfaction that the technology did not allow them to do what they were asked to do. Many students disengaged from the course as the technical issues interrupted the flow of the investigation. Many did not re-engage in the investigation phase of the course.
“As the course continued I began to see the relevance to our professional learning, although it did not happen without a few technical problems. TI found that these perhaps lessened the impact of the usefulness of The Source.”

“The fact that the wiki was fussy and decided to work when it felt like it didn’t help in motivating me to do my best work.”

“I found The Source’s large dependence on ICT challenging and intimidating as I don’t believe it’s a strength of mine. I also couldn’t access The Source from my home computer. I found alternatives to accessing The Source from home such as using university computers, the local library computers and sending emails instead of wiki posts.”

“Sometimes technology was an issue, for example the wiki not working at times and did not respond well with some information you wanted to insert in the pages. Technical difficulties brought struggle and the groups' progress slowed.”

8.3 CES results

CES results for the course in 2008 were disappointing, falling below the levels achieved during the 2007 trial. As just discussed the impact of the technical difficulties was apparent in the qualitative comments provided by students on the survey instruments. Last minute staffing changes to teaching team resulted in having two relatively inexperienced teachers on the teaching team who had no ownership of the course, and with limited exposure to the pedagogical principles underlying the course delivery. They also had limited expertise in the use of the online environment so were often unable to provide the students with adequate guidance about the online environment. This also impacted adversely on the CES results. Finally, students were not required to attend classes for the last few weeks of the semester, instead using this time independently for group work on their final assignment and participating in online discussions about the pedagogies used within the course. The CES survey was therefore administered prematurely to the students prior to the completion of their second assessment task which involved much stronger and more successful group work, and considered reflection about what students had learned from the course as a whole. In future iterations of the course the timing of the administration of the course will be shifted to later in the course so that students have more of an opportunity to reflect on the understandings they are developing. Greater effort will be spent on ensuring that staff teaching in this course understand the pedagogical drivers and have more time to become familiar with and confident in the use of the technology.

9. Financial Statement

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