Project title

The Implementation of Digital Wet Practical Laboratories in the School of Applied Science

Project leader

Dr Danilla Grando
Senior Lecturer
School of Applied Science
danilla.grando@rmit.edu.au
99267135

Team members

Dr Danilla Grando, Project leader and manager
Senior lecturer and Program leader for Biotechnology (BP226) and Biological Sciences (BP227), recipient 2007 LTIF funding for development of tools for the new digital laboratories. Currently SAS coordinator of development of the city site, accepted invitation to lead project development for School Applied Sciences.

Dr Garry Allan, Academic advisor and project facilitator
Senior lecturer and Academic Project Manager ICT Integration, Office of DVC

Project participants

Ms. Anne-marie Christensen, Heamatology module developer, School of Medical Sciences
Dr Greg Nugent, BIOL2146 Cell Structure and Function, School Applied Sciences (SAS)
Dr Bert Collard, BIOL2146 Cell Structure and Function, SAS
Prof. Dayanthi Nugegoda, BIOL2258 Animal Structure and Function, SAS
Dr Belinda Kennedy, BIOL2156 Plant structure and Function, BIOL2258 Animal structure and Function, SAS
Mr Jim Holbeche, BIOL2158 Microbiology 1, SAS
Ms. Christine Paras, BIOL2158 Microbiology 1, SAS
Ms. Christine Chow, Manager SAS, administration facilitator
ITS training:
Mr Chris Hugo
Mr Michael Fedyk
Mr Joe Lambe

Funds Approved
$29483

Funds acquitted
$28447 (See Appendix 1: Budget expenditure)
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Introduction
This project addressed the category “New Ways of Learning – E-learning”. It also addressed “Teaching and Assessment of Large Classes”. It was a continuation of a 2007 LTIF project that explored ways of blending digital learning objects into the classroom setting (in particular wet laboratories).

A new area of innovation at RMIT is the blended learning enabled digital wet laboratory. This innovation has been successfully implemented in the School of Medical Sciences in the Haematology and Pathology practical laboratories on the Bundoora campus. In the 2007 LTIF round, the School of Applied Sciences developed curriculum for four courses that would run in the new digitally enabled practical laboratories on the city campus, commission in March 2008. In the 2007 phase of the LTIF project, courses had their digital learning modules integrated into Blackboard and were evaluated in terms of pedagogy. These materials would be blended into actual classes running in the digitally enabled laboratories during 2008. Central to the 2008 phase of implementation was the installation of NetOp software and training in the use of this software to capture student work output and the dissemination of classroom activity materials to workstations. Two new digitally enabled laboratories were commissioned for the commencement of 2008 teaching period, 14.13.7 (56 student stations) and 14.13.8 (60 student stations). These labs can be configured to operate as one class as is the case in the large 1st year classes in the biological sciences through split/integrated AMX controllers and teaching stations. It was decided by the school's management to call these teaching spaces Digital Wet Laboratory 1 and Digital Wet Laboratory 2.

Project Outline
The aim of obtaining funding for this LTIF project was to enable:
1. An investigation and evaluation into how training can best be designed and delivered for academics using the digital wet laboratory and NetOp software
2. Delivery and dissemination of training in NetOp to school academics
3. The monitoring of the blended learning implementation and evaluation of modules created in 2007
4. Development of new materials for two courses that have been identified at need and not previously the subject of course refurbishment
5. Investigation of integration of microscopes and other instruments into the digital environment, building on the experiences of Medical Sciences
6. A review of video modules supporting laboratory practice currently available and pilot project in video production
7. Dissemination of the digital wet lab innovation to other schools at RMIT, industry, and other universities in Australia through showcase events

Project Outcomes
1. An investigation and evaluation into how training can best be designed and delivered for academics using the digital wet laboratory and NetOp software.

In March of 2008, upon the commissioning of the school's digital wet laboratory, two major hurdles were faced
1. The NetOp (software for class management) operating manual was large (150 pages) and complex. Initial attempts to understand the software using this manual frustrated project participants and did not result in user competency.
2. Although the software was in use in the School of Medical Sciences, only two staff members in that school had become competent through the support of the software provider. Since the software was low cost, the software providers were not expected to provide ongoing staff training.

A meeting was then facilitated by Dr Gary Allan between the project leader, Dr Danilla Grando and the head of ITS training, Mr Chris Hugo. The training project was scoped and a plan to produce a training module formulated. This was followed by a series of 2 hour meetings held at both the city campus laboratory and the Bundoora laboratory (facilitated by Anne-marie Christensen). From the consultations obtained at those meetings, Joe Lambe from ITS training developed a comprehensive training manual. This manual is attached as Appendix 2.

2. Delivery and dissemination of training in NetOp to school academics
An initial meeting was arranged with Medical Sciences to explore whether training would be required to use the NetOp software. Ralph Green and Anne-marie Christensen were of the opinion that it would be an excellent idea to produce training sessions for staff.
A call for participants in the planned NetOp training sessions resulted in 4 fully booked sessions (maximum of 15 staff per session). On average around 12 participants attended each session, and these were held before the beginning of semester 2, 2008. The sessions were all run by the team from ITS training.

Feedback from these training sessions was very positive and the staff were very enthusiastic about the potential for blending learning resources in the digital laboratory. These training sessions also resulted in staff from two more courses in food microbiology and environmental chemistry making changes to their curriculum in order to take advantage of these digitally enabled practical laboratories.

3. The monitoring of the blended learning implementation and evaluation of modules created in 2007

Digital Modules created in 2007 were for the large first year class, Introduction to Microbiology, Immunology and Genetics (BIOL2256 - City and BIOL2257 – Bundoora), for Plant Structure and Function (BIOL2156) and Cell Structure and Function (BIOL2146)

The 2008 phase of this project involved adapting the digital materials created in 2007 to be used in a blended learning environment. For instance, modules created for Plant Structure and Function were sent to the student work station for use during the practical classes. This meant that students could access and use these resources whilst actually performing the practical exercises. Figure 1 shows a class held in Semester 1 of 2008, using the plant module materials for reference during class. Students used this reference material to discuss with their demonstrators this reference material in relation to their microscopic findings.

Figure 1. A student is pictured discussing this reference material with their demonstrator in relation to their microscopic findings
3.1 Report on the implementation of a blended learning environment in Plant Structure and Function

In 2007, funds were allocated to create digital modules for Plant Structure and Function. In 2008 funds were committed to peer review these modules, trial the modules in class of Semester 1 and then follow up the deployment of these modules with the teaching staff of BIOL2156 through a focus group.

The initial peer review of materials was performed by Dr Belinda Kennedy with staff teaching into Plant Structure and function. There were only minor adjustments needed to the modules before they were ready for deployment in semester 1. Students accessed the digital materials during classes as pictured in Figure 1.

A focus group held with staff teaching into Plant structure and function (7 attendees) yielded the following points

- The digital modules were well constructed and an excellent aid to teaching in the classroom setting
- The demonstrators wanted a clear guide as to the type of materials that were accessible on the DLS
- Better navigation of available resources online required
- Digital images produced by the project should reside online so that they can be reused by other teaching staff
- The was a need to produce a training session for use of digital microscopes as the manufacturer supplied manual was not user friendly
- More support requested to roll out further development of additional modules for later years study of plant sciences

The success of these plant modules was then used to populate a further course in plants called Biology BIOL1010.

Dr Belinda Kennedy will continue to monitor the use of the digital materials in 2009.

3.2 Report on the implementation of a blended learning environment in Cell Structure and Function

The following report was prepared by Bertrand Collard:

**Milestone:** Embedding of modules created for Cell structure and function (BIOL2146) into practical classes. Trial ITS training program with Cell Biology Staff

**Deliverables:** Redesigned laboratory manual for students and instructor manuals for demonstrators in cell biology.

3.2.1. Summary of activities.

Current practical material for three specific practical (prac) classes in BIOL2146 (Cell Structure and Function) was revised. Revisions included:

- improved clarity (in specific sections)
- improved formatting (especially by using Document map in MS Word)
- correction of factual errors
- correction of typographical errors
- inclusion of references

All sections are now easily findable using Document Map and student questions have been indicated in red font. Demonstrators were informed to provide feedback leading to the improvement of the to the project officer

3.2.2. Review of previously developed material

All previously-developed digital learning materials including PowerPoint presentations, Excel spread sheets and video materials were critically reviewed. In the reviewer's opinion (Bert Collard), 'This material will be extremely useful for future classes for students and possibly demonstrators. The material has been carefully prepared and is directly relevant for course material. The material can be viewed by students before, during or after the prac class to consolidate what the student’s have learnt, at their own pace. Ideally, the students should use the material before the prac class.'

3.2.3. Review of prac classes.

In order to effectively evaluate current material, the three prac classes were attended by the project officer Bert Collard during the Open Universities Australia (OUA) practical week (city campus in the digital labs). This permitted the observation of how students performed during the classes. By interacting with the students, it was possible to gauge the student’s interpretation and understanding of the practical aims and clarity of existing material. Generally, the prac classes were well run and students were very well supported by the demonstrators.
It was interesting to note the diversity of student backgrounds attending the class and that many students had travelled from interstate to attend the classes (Open University Australia). Some students had relatively difficult experiences in terms of reaching the venue (e.g. after overnight road trips) and accommodation (e.g. one pair of students who travelled together had slept in their car the night before due to a problem with accommodation bookings)!

Comment by Project Manager, Danilla Grando: It is important that students be not overloaded with pre-practical preparation. The Digital laboratories should allow ample time for these resources to be accessed during class time, providing classes are well organised.

3.2.4. Development of Demonstrator’s manuals.
When work on this project began, these did not exist. The development of such manuals would be of great value to demonstrators (especially new demonstrators) and students would directly or indirectly benefit. Therefore the creation of practical manuals for demonstrators was initiated. These manuals were essentially the student prac manual version with the inclusion of answers to questions and hints for success of practical work. This will enable demonstrators to conveniently track questions from students because the format of both documents is the same. A section on common student obstacles and FAQs has also been added at the end of each practical document. Most efforts were directed at developing demonstrator’s manuals for prac #2 and #3 since these were the most challenging for students.

3.2.5 Future recommendations.
- Further development of practical demonstrator’s manual
- Development of supplementary material for other practical classes.

Ideally, the further development of demonstrator’s manuals should focus on incorporating suggestions made by the senior practical demonstrator and other demonstrators based on their actual experiences. This information could be effectively acquired during student and demonstrator focus groups scheduled for later in the year. Additional notes should focus on answers to questions and common obstacles encountered by students. An adequate level of detail will ensure that new demonstrators are confident of practical content.

The project was then continued by Dr. Belinda McKenzie. The complete demonstrator and student versions of the digital prac manuals and the digital answer sheets were then completed in time for the mid-year study period 2 practical classes run for Open University Australia. The following feedback was received from Dr McKenzie before she left RMIT ‘Thankyou for the opportunity to contribute to this project, and I wish you all the best with your endeavours to get more digital materials up and running. It was a huge success.’

3.3 Report on the implementation of a blended learning environment in Introduction to Microbiology

This section of the project commenced by taking the results of student and tutor evaluations of digital modules (Figure 2) created in 2007 and redesigning them to be more user friendly. The 2007 versions used macros to enable students to interact with the modules and monitor their understanding of concepts in the digital modules. These macros caused problems as students needed to reset their security settings on computers in order to start the modules. In order to address this issue, the macros were removed from the modules and replaced by links to answer slides were students could navigate to in order to check their answers. These modules were then deployed as pre-practical preparation assignments that were required to be completed by all students before coming to practical class. Student performance of this task was assessed through online quiz.
The implementation of the modules for this large cohort of first year students raised an interesting situation. This class had previously been delivered identically on two sites (city and Bundoora). The laboratories in the city had been refurbished to enable the digital blending. Digital modules available online to both cohorts, could only be used by Bundoora students for pre-practical preparation, whereas city students would have access to materials whilst doing their practicals. This afforded the unique situation that we could compare the effect of the blended learning environment by using the results of the student experience survey.

The pre-practical preparation modules were then adapted into Resource PowerPoints. City students were able to access a different resource PowerPoint for each practical class (Figure 3).
In planning for the blended learning environment, consultation with Anne-marie Christensen raised the opportunity for introducing lesson plans into the courseware. For each class a brief lesson plan was developed and displayed on the plasma screens (Figure 4)

**Lesson Plan Session 1**

- Introduction by Danilla 15 min
- Demonstrate 30 min
  - Safety
  - Using the microscope
  - How to prepare slide and stain by Gram
- 1.1 S1 – practice setting up mic with prepared smear 15 min
- 1.2 S2 – stains smear (after fixing) and practices pronunciation with demonstrator 15 min
- Then swap roles S1 and S2 15 min
- Discuss with your partner page 10 10 min
- View case study smear 10 min

Figure 4. Having trouble keeping the class running to a schedule? A lesson plan is displayed on the main plasma monitors for each class. It has the effect of focusing the students’ activity and it is now uncommon to see students sitting around wasting time. The development of a lesson plan also helps focus the planning and logistics of the class whilst keeping an eye on lesson objectives.

A focus group session was held with the city demonstrating staff (7 attendees) to gather information on perceptions of this new blended class environment. The following issues were raised

- Staff were unanimous in their views that the blended learning environment was an improvement on previous delivery of practical classes
- Staff were impressed with the pre-practical learning modules and wanted access to them as they felt it also helped them prepare for the practical classes
- Staff found that the Resources PowerPoints provided during class gave students a valuable insight into the expected results and a point of reference to directly compare to their own results.
- Staff found that the in lab resources helped improve student observational and interpretation skills
- Students showed a more mature approach to their work as they were focused constantly on activity and had online resources that supported them if the demonstrator was busy
- Staff wanted to see the lesson plans written into the practical manuals as well as being presented digitally
- Staff wanted to see more application of exercise to real world issues and have this reflected as an imbedded story line in the practical manual
- Staff were concerned that they may be made redundant by the technology, they were assured that the technology was an aid to their activity rather than a replacement
Students attending the digital wet laboratory practical classes in study period 3, 2008, were surveyed using a questionnaire designed during the 2007 phase of the project. They rated their responses to the following questions on a scale of 1 for strongly disagree to 5 strongly agree on the following questions. 32 surveys were completed.

1. The role of the digital learning support of my practical classes has been clearly communicated to me 4
2. I have been provided with constructive feedback in my digital learning support of practical classes 3.9
3. Digital learning made my practicals more interesting 4
4. Digital learning helped me with my understanding of my practical classes 4
5. Digital learning enabled me to prepare for the practical class 4
6. I have sufficient support to enable me to use the Digital learning materials 4
7. Digital learning helped me identify areas in my learning that required further attention 4
8. Digital learning demonstrated that I was making progress in my understanding of the practicals 4
9. Digital learning demonstrated that I was making progress in my understanding of the overall course 4.2
10. Working with Digital learning support enhanced my IT skills 3.5
11. Digital learning combines well with the learning in the practical laboratory 4.2
12. The whole digital learning experience was positive 4.5

When reading the comments supplied by students it became clear that their interpretation of digital learning was not limited to the blending learning environment of the practical laboratory. Comments on improvements seem to centre on problems with accessing lecture audio files, viewing grades, downloading interruptions, remote access, and unavailability of Blackboard at times as well as “too much to print out”. One student commented ‘Not enough bench space to keep things aside. Digital is really great, however bench space could be maximised’. One student commented that they did not realise that they would need to have access to software that would open PowerPoint files.

Positive comments included
‘In this particular class the digital learning has been exceptional. Instructions clear, information easy to find and follow and assistance given quickly when assistance required’.
‘I have only experienced advantages in comparison to former lectures conducted at uni. I have accelerated learning, better explanation, tools to complete assessment’
‘Without the digital learning I probably would have failed!’

Recently a laboratory class been delivered for OUA was visited by a TAFE member of staff, Ms. Kirsten Balding. I asked for her impressions of the class and I quote from her email reply, ‘I was impressed with how focussed the students were in the class I observed in the digital wet lab (quite different to what I see in my lab classes, though I note it is a different student cohort, so that might make a difference!) I want one! I can’t wait till we can get a similar lab in my area!’.

An evaluation of the past Course experience survey results Good Teaching Scale (GTS) for the course is presented in Table 1.

Table 1. GTS scores comparing those in the digital lab (City 2008) to the Bundoora cohort (2008) and the previous year.

<table>
<thead>
<tr>
<th>Course</th>
<th>GTS 2007</th>
<th>GTS 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 2256 (City cohort, digital lab 2008)</td>
<td>53</td>
<td>75</td>
</tr>
<tr>
<td>BIOL2256 (Bundoora cohort, no digital lab)</td>
<td>57</td>
<td>53</td>
</tr>
</tbody>
</table>

It is believed that the improved GTS in BIOL2256 is attributable to the blended digital format of the practical classes as the courses are delivered by the same staff on each campus.
4. Development of new materials for two courses that have been identified at need and not previously the subject of course refurbishment

4.1 Microbiology 1

Many of the students that undertake the first year course, Introduction to Microbiology, progress to the second year course Microbiology 1. It was felt that having had the experience of a digitally enable practical environment in their first year, it would be remiss not to similarly refurbish course materials in the second year class.

The aim of this part of the project was thus to develop some learning PowerPoints for Microbiology 1 and associated quiz materials to test students learning. The images created for this project could then be redeployed for in class practical resources in semester 1, 2009.

A second aim of this project was to pilot a resource that would be useful to all students throughout the three years of undergraduate study in microbiology. An e-Glossary was proposed as a replacement for a manual of microbiology tests that students have been expected to buy in addition to a prescribed textbook and an additional practical manual. The e-Glossary would be made accessible to all year levels of students studying microbiology.

A template based on using the Blackboard Wiki function was developed by Christine Paras in consultation with Danilla Grando. The Opening web page for the template was called G.E.R.M.M (Glossary and Electronic Resources of Microbiological Methods) (Figure X).

Figure X. The new digital resource for practical classes using microbiological methods.

This template was then shown to the then course coordinator of Microbiology 1, Mr Jim Holbeche, course teaching and technical staff. Comments were unanimously positive. The next phase is planned for 2009 as part of a SET portfolio PACE grant. 20 Wiki pages have been drafted for various test used at the second year level. A list of digital asset requirements has been drawn up and photography sessions planned. Photography has been trialled and training in the use of equipment bought with a 2008 ALTC Citation award received by Danilla Grando. Equipment purchased included a Canon Digital SLR, Copy stand, Canon Ring Flash and a Canon macro zoom.
lens. It is important to have this equipment on hand as practical classes are numerous and digital materials will be produced from materials produced on the days experiments run.

The following report was produced by Christine Paras and gives an insight into the work in to prepare such a resource:

**Activities undertaken during this time:**
- Internet research as to methods of presentation of microbiology materials
- Internet research into visual formats of varied glossary layouts.
- Comparison of internet materials for microbiology with RMIT course structure.
- Book research into methods to produce copyright free material for GERMM
- Production and manipulation of copyright free images inserted into GERMM.
- Consultation with laboratory preparatory staff as to media preparation.
- Consultation with educators of primary and secondary students
- Consultation with learning psychologist and teaching coordinators of secondary students into effective learning strategies
- Interaction and consultation with RMIT ITS staff and SET staff
- Familiarization and learning of RMIT Blackboard and Wiki programs
- Set up of dummy shell of Wiki within Blackboard to practice setting up program
- Consultation with other microbiologists as to content of methods used.

**RESEARCH**
Most of the research was aimed at seeing what was available on the internet and seeing how other institutions organized the resources that are available to students, other professionals and to interested parties whether they be lay people or not.

I specifically looked at how glossaries where set up and the styles that were used. I looked at these sites and glossaries with a view to how easily they were navigable particularly for students with a basic knowledge of microbiology.

Some of the sites that I viewed were CDC, Wikipedia and many Universities that have “free to view” educational sites that are set up for their own students, I found these sites the most invaluable as they were set up by people with a generosity of their knowledge of practical microbiology and freely allowed non enrolled students of their institution to access this information in the name of education and obvious love of teaching their field. The most important finding from these “Free to View” sites was, what appeared to be, an immense amount of time and effort into producing such a site. These sites appeared comprehensive in the methods of teaching of practical microbiology. The structure of teaching practical courses in microbiology of many sites mainly followed our own teaching structures in practical classes, more-so for Microbiology 1 classes, and I was able to compare our own teaching elements with others across the globe.

What I looked at, during internet exploration of sites with similar conceptual approaches to an online glossary, for microbiology:-
1. How sites arranged their information i.e. format
2. How glossaries were organized and how the topics contained therein were connected for ease of use looking at specifically links and images.
3. Aspects of formatting with a view to which and how sites presented material in an effective yet simple manner.
4. Tertiary student focussed sites that had varied complexity in presentation of materials.
5. Looked at content of information within these sites as to scientific language and the audience that the site was addressing (eg students vs. others).
6. Looked at the presence of lexicons contained within sites. Note: - of the sites which did not aim at the undergraduate many did not have simple to find or easy to use lexicons/glossaries.
7. Ease of navigation within site and links used.
8. Ease of site to be updated/modified at later stage i.e. ease of insertion of new segments, media, links, images information, pages etc.
9. Ease of modifying site without destroying structure i.e. piecemeal update modifications.

**CONCLUSION**
After viewing, interacting and utilizing many license free internet sites from sources such as, educational groups, universities, private web sites, Wikipedia(s), commercial interest sites, the style of our Wiki –GERMM evolved. After this research I came to the conclusion(s) that the online glossary should be SIMPLE to NAVIGATE, EASILY UPDATED, EASILY APPENDED, use STYLIZED FORMAT and contain VISUAL QUEUES as to the content and character of the information contained.
From these conclusions the format of the GERMM, it was decided, would be an alphabetical listing with each letter linked to its own page containing a complete listing of headings which are then linked to the individual page of information.

COMMENTS ON THE USE OF BLACKBOARD TO HOUSE THE GLOSSARY
I found the Wiki easy to set up (eventually) but I do not think that the Wiki/Blackboard has enough formatting power to truly set up a glossary with a greater complexity than what I have created. I tried to import preformatted word documents to append the glossary with very little success as the formatting was scrambled when imported into the Wiki. Having to try and fix the formatting after importation from Word 2003 to no avail I gave up on the idea of having sophisticated looking pages and opted to do my best using the minimalist word processing capabilities of Wiki much to my chagrin. Wiki does not have huge word processing capabilities and does not always work as expected and sometimes produces errors in formatting after the final document has been saved (evidence of gremlins within).

I believe that the formatting and visual enhancements is key to online learning using the glossary however the adequate but rather basic capabilities of Wiki may eventually pose barriers.

4.2 Animal structure and function
PACE funding was received in the early part of 2008 to develop digital materials for BIOL2258 Animal structure and function. This initial PACE funding was used to train Belinda Kennedy in course mapping and to scope the project. Remaining funds were used to develop some digital materials. As the funds provided by PACE were insufficient to complete this project, it was decided to continue the project funded by LTIF funds into semester 2 of 2008.

The following report was submitted by Dr Belinda Kennedy:
“Tend Pre-Practical quizzes (chicken, rat and toad dissection pracs) -these were run Semester 2 2008. The students prepared for the practicals by reading their notes before the session knowing they had a quiz. Overall, the students were better prepared to start the prac after their test (because they had actually read the prac notes before coming to class).

I updated the practical manuals for the rat, toad and chicken dissection practicals. These manuals were used in Semester 2 2008. I included some pre-practical notes, learning objectives, revised instructions, animal drawing templates, and learning exercises the students could complete during the class (definitions). The feedback from the demonstrators and students was good. They felt that the practical manual had improved and it was much clearer what the students needed to complete and also easier to mark (more consistency with marks across the demonstrators).

I also organised a whole series of professional photographs of the rat, toad and chicken dissections. These will assist the students and demonstrators greatly with tissue and organ recognition. The photos can be archived and used as a teaching resource at RMIT.”

5. Investigation of integration of microscopes and other instruments into the digital environment, building on the experiences of Medical Sciences
Medical Sciences had integrated their demonstration microscope digitally to enable live presentation of materials using NetOp software. Focus groups with staff in the school of Applied Sciences determined that this set up was also desirable in the newly refurbished Digital Wet Labs. Two digitally enabled microscopes were purchased from school funds, a compound microscope and a dissecting stereomicroscope. These pieces of equipment arrived after the scope for training was determined with ITS training. It was decided to devote some of the LTIF funds towards an in-house production of training manuals for these two microscopes. These training manuals were produced by Christine Paras and designed to be user-friendly. Christine has also provided training to two technical staff in the school.

As an example, Christine trained a member of the technical laboratory staff that needed to learn how to use the system so that a digital record of a rare microscope specimen could be recorded not only for archiving but for teaching purposes. The staff member explained that the specimen in question was no longer able to be supplied to students as wear and tear and accidental destruction of duplicate slides by students had diminished the resources. It was stated by the staff member that the new hardware, together with the image manipulation software, would enable images to be taken of other valuable and rare specimens. The image could be annotated to point out features of interest. Teaching would thus be easier, more efficient and make feedback to the student more assured through a digital resource. identifying features of subjects easier to identify for a student. The actual rare specimen
could still be loaded to the demonstration microscope and broadcast in real time, but students would instead work on the digital reproduction of the specimen. Previously, students had to wait to access the demonstration microscope. A digital shared experience of the resource materials would promote discussion and enable students to engage their demonstrator for points of clarification.

6. A review of video modules supporting laboratory practice currently available and pilot project in video production

During the development of the Animal diversity modules, feedback was received regarding the quality of video currently being used in the course. These videos had originally been produced to be broadcast during the class session. They tended to be long (30 minutes), lacking in annotation and the learning outcomes from spending time watching these videos were uncertain. Similarly in Microbiology, existing videos had poor audio quality and were found to be unengaging. It was decided to pilot a project that could be used to seek funding for a dedicated video project in 2009.

The steps in creating and producing the work of the pilot project included

- Investigating the minimum equipment (hardware and software) at the lowest cost that would produce quality acceptable to students (Mac computer, installed video editing software, Sony Handicam, tripod, tripod dolley, number of microphones, backup hard drive)
- Purchasing the equipment (Teaching award monies received from an ALTC citation for Danilla Grando in 2008 were used to purchase) and self training
- Recruitment of students. Two students were subsequently selected based on their previous experience with creating YouTube videos.
- Video week. This began with a half day workshop on examining educational videos currently on the web. An analysis of strengths and weaknesses was used to determine the types of video segments that would be produced over the next four days. The afternoon workshop was devoted to learning how to use the camera equipment and some experimentation of styles. The remaining four days were used to produce around 100 short video segments. Each days video segments were rendered into film at the end of the day by Danilla Grando and made available for student review the next day.
- Editing process. All video segments were catalogued. Segments pertaining to safety were assembled into 5 short films and presented to students studying in the February 2009 cohort of Open University Australia SCB140 Introduction to Microbiology, Immunology and Genetics. These videos can be found at:
  - [http://www.youtube.com/watch?v=xPWMo8d5g4A](http://www.youtube.com/watch?v=xPWMo8d5g4A)
  - [http://www.youtube.com/watch?v=MIWBSUSH3JU](http://www.youtube.com/watch?v=MIWBSUSH3JU)
  - [http://www.youtube.com/watch?v=7LgNrCc7Kx8&feature=related](http://www.youtube.com/watch?v=7LgNrCc7Kx8&feature=related)
  - [http://www.youtube.com/watch?v=wk58mN1cDCs&feature=related](http://www.youtube.com/watch?v=wk58mN1cDCs&feature=related)
  - [http://www.youtube.com/watch?v=E90qO2OGHzU](http://www.youtube.com/watch?v=E90qO2OGHzU)

The feedback on these videos from staff and students has been very positive. Comments include; just the right length, learnt a lot from these videos, fun to watch because humour is used, it is good that you can annotate the videos. There have been around 200 views of the videos to date.

A 2009 LTIF project grant proposal was devised with Dr Neale Jackson (who also has extensive experience with video production) and submitted. Unfortunately the project was not chosen for funding in 2009.
Project Outcomes aligned to LTIF grant guiding principles

**Improved student learning experiences, outcomes and employment opportunities**

- Improved student learning experience through timely access to learning support and feedback mechanisms. Provides a stimulating active learning environment that is student-centred. Evidence of improved CES results through comparison of a parallel course run at the Bundoora campus that does not have digitally enabled wet laboratories.
- Increases the efficiency of staff and student time. A blended learning environment means that academics are no longer tied to the lecture format of delivering material. Academics were able to re-prioritise their teaching so that active learning can take place within the new blended learning space. The academics were able to introduce the learning session and then return to their offices. Demonstrators for the blended learning labs were able to prepare before class by accessing the same pre-learning lab materials that have been created for the students.

**Innovation**

- Transforms teaching practice through the implementation of a blended learning strategy. Traditionally practical laboratories in science do not enable the simultaneous use of digital materials. Industries use online support for access to support materials. Simulating this in practical classes more closely resembles real-world laboratory environments.
- The creation of new teaching resources e.g. Learning PowerPoints, In-lab Resource PowerPoints, eGlossary

**Strategic alignment**

- Extends the Minimum Online Presence by providing enhancements to access. Students are able to engage with materials before coming to practical class in preparatory mode, then access the materials in class to support their active learning.
- Strengthens support services for learning and teaching. Staff development workshops have been run in the Digital Wet Labs.

**University wide application**

- Model of blended learning can be applied to a diverse area of discipline areas. In the 2008 ALTC grant proposal, discipline areas from across two schools were included. In the proposed 2009 application it is proposed to include other schools including a TAFE engineering program.
- Through the use of repository sites, digital tools can be made available to other schools. Currently videos created in this project have been made available to TAFE through publishing on ‘You Tube’.

**Value for money**

- Uses the existing infrastructure of Blackboard.
- Classes designed for RMIT have been reused for delivery to OUA students.
- The developed Digital Wet Lab has acted as a showcase for the University.
- Online Glossary (GERMM) is able to be distributed to all undergraduate microbiology based courses.
- Existing expensive class materials e.g., limited number of sets and rare resources can now be used more effectively as teaching resources, (e.g. microscopic specimens or slides), through the use of NetOp software.

**Dissemination of project outcomes both completed and planned**

The School of Applied Science’s digital wet laboratory was showcased to a large group (around 50 participants) from around the University on April 21st, 2008. Anne-marie Christensen gave an inspiring presentation on how Medical Sciences have used their space and the many gains to be made by switching to a blended learning environment. The workshop was organised by the School of Applied Sciences by Christine Chow, Garry Allan and Danilla Grando and the set up assisted by Belinda Kennedy and Christine Paras.
In May, the Digital Wet Laboratories were visited by Danware, the developers of the software integral to our model of blended learning delivery NetOps. They had not fully appreciated the potential for the use of the software in University L&T environments as the software was developed for use in secondary schools and for business consultancies. RMIT is the first University in the world to apply their software to the new generation of learning spaces. To this end Danware has invited us to work with them in renaming the software to reflect use in Universities and to make suggestions for changes to the software to better meet the needs of the University learning environment. This meeting was organised and facilitated by Garry Allan.

The School of Applied Sciences hosted the Australian Society for Microbiology National meeting workshops on Sunday 6th July. The laboratory space was showcased to 20 microbiology educators from around Australia whilst another wet laboratory workshop for the conference was also held in the split space. The workshop was organised and delivered by Danilla Grando with assistance from Christine Paras and Ruby Biezen.

The first of planned industry showcases was held for visiting Food scientists later in the month of July. Scientists from industry were enthusiastic about the potential teaching opportunities using this space. The event fostered a perception that RMIT is innovative in the ways it produces work ready graduates. The event was organised through the School of Applied Sciences by Christine Chow and the presentations delivered by Danilla Grando and Prue Bramwell.

In December a workshop was delivered for participants in the RMIT Learning and Teaching Expo. Attendance was very good (20+) participants and the workshop was received with enthusiasm. Questions fielded from the workshop included how could we make the support materials created for the digital laboratory accessible to teachers outside of the school. Several options have been proposed

- Create a list of the microbiology assets in a ‘PebblePad’ gateway
- Place assets in an RMIT asset register. This register is still under development
- Make the pilot videos more accessible by publishing to ‘YouTube’. This was achieved in January 2009.

After the RMIT Learning and Teaching Expo, we were approached by TAFE school of Physical sciences on the matter of whether the learning materials produced for this project could be shared. It is planned to place the final report for the project and associated learning materials on the University’s ePortfolio, PebblePad. We have also recently been approached by TAFE to enquire whether the space could be used for special activities and a number of bookings have been made for TAFE to use this laboratory space.

After the first year of this LTIF project in 2007, a full grant proposal was prepared and submitted to the Carrick Institute (now called Australian Learning and Teaching Council (ALTC)). This proposal was reviewed and narrowly missed out on funding as it was scored at an average of 4/5 on the criteria used to assess grants. Grants scoring 4/5 average had a high chance of being funded. One of the areas were it was difficult to show a concrete plan was on project dissemination. After the dissemination activities of 2008 and especially those involving the Australian Society for Microbiology conference in July of 2008, we have been able to create further interest in this model of teaching. It is planned to write a new grant application to the ALTC in early 2009, the focus this time will be more on models of practice rather than teaching spaces. This is because of the perception that the model is one of simply extending the use of a computer lab rather than how teaching practice and its outcomes actually changes when this type of space is used to its full potential.

Further Considerations for the Use of Digital Wet Laboratories

1. Safety
   There was considerable concern expressed by staff that the configuration of student work stations may lead to equipment damage. This is due to the proximity of
   - Bunsen burners and monitor screens
   - Liquid splashes of chemicals and monitor screens

Bunsen burners and chemicals are used throughout classes in microbiology. The measures taken to help prevent melting of and disfigurement of monitor screens included

- Induction in safe work practices at the start of the practical class
- A focus on students reporting possible unsafe work practices and an emphasis on the professionalism of students that alerted each other to unsafe work practices
- Spot checks of work practices in the laboratory
- A series of videos produced on safety in the laboratory

In 2008 there were no incidents involving heat damage to monitors, one incident was recorded of chemical splash to monitor screen, damage minor and monitor screen is still in use.

2. Space allocation
In informal interviews with students during 2008, the concern was raised that space allocation per student was too small. This space restriction has come about due to the refurbishment of a laboratory that was narrow to begin with. We have found that four students per side of a bench is optimal for the types of learning activities that have been designed for the biological sciences. If further spaces are developed, space considerations should be given high priority and consultations undertaken with current users to determine that limitations faced by over commitment to space available.
Summary of the project, outcomes, impacts and dissemination (500 words for web)

This project enabled the replacement of traditional laboratory classes with a blended learning environment of teacher-directed instruction, student collaboration, online learning and the wet-laboratory experience. It targeted the large first year biology classes and addressed the challenges of designing curriculum that enhances the learning experience in large classes, via use of online technologies. This blended learning approach created the opportunity to design innovative courseware that imbedded digital instruction and tutor-directed assessment strategies linked to capability development. These assessment strategies were designed to provide continuous feedback and enhance student learning.

Laboratories 14.13.7 and 14.13.8 have been refurbished using the model of a digital wet laboratory, where each student has a dedicated workstation for engagement with the lecturer or tutor using NetOp® software. Support from the Teaching and Learning fund enabled the employment of a teaching assistants and time-release for academic staff to enable help with curriculum redesign and courseware enhancement. Three courses were targeted for curriculum redesign and through this process many reusable learning objects were created. In 2008 these objects were deployed as pre-laboratory preparation exercises that were designed to be interesting, interactive and instructive. These objects were then adapted as resources for use during class time. Focus groups were held with students and staff to monitor the implementation and use of the Digital Wet Laboratories.

Outcomes

In summary students identified that the improved learning support provided by the digital materials developed had the following characteristics:

- Informative
- Easy to understand
- Helped with preparation before practical classes
- Learning enabled them to be able to answer the post quiz
- Liked getting instant feedback after test: free of intimidation by lecturers
- Visually stimulating
- Fun and interesting way of learning
- Useful in identifying key learning areas during practical classes

Students made the following comments regarding digitally blended classes:

- Ability to print out the learning support
- Better induction into using the modules
- Improve feedback arising from responses to quizzes
- Learning modules should be more interactive
- More visual aids should be created
- More referencing to be provided in learning modules

Dissemination of Project Outcomes

- Invitations to deliver workshops to RMIT staff, industry partners and the Australian Society for Microbiology
- Application for Australian Learning and Teaching Grant (Average rating 4/5 – narrowly missed funding)
- New projects arising within the School of Applied Sciences focusing on learning spaces and proposed for 2009
- Showcasing to other schools and model of blended learning being now considered in other discipline areas throughout the University
### Appendix 1: Budget Expenditure

**LTIF Budget 2008 Total Funds $29,483 ($9828 in April, July, and October)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Course/Project</th>
<th>Funds</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bert Collard</td>
<td>Cell structure and Function</td>
<td>1026.46</td>
<td>Write report on current course materials √</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Write report on actions √</td>
</tr>
<tr>
<td>Belinda McKenzie</td>
<td>Cell Structure and Function</td>
<td>881</td>
<td>Plan and carry out actions from Bert’s report √</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Implementation in time for OUA July √</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Finalise online version of prac manual √</td>
</tr>
<tr>
<td>Christine Paras</td>
<td>Microbiology 1</td>
<td>1717.17</td>
<td>Write objectives for 3 pracs √</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Develop 3 learning modules √</td>
</tr>
<tr>
<td>Catering</td>
<td>Digital Lab Showcase</td>
<td>140.30</td>
<td></td>
</tr>
<tr>
<td>Catering</td>
<td>Plant focus group</td>
<td>127.54</td>
<td></td>
</tr>
<tr>
<td>Belinda Kennedy</td>
<td>Finalise PACE work in Animal Structure and Function and Plant structure and Function</td>
<td>6344</td>
<td>Adapt digital materials in Plant Structure and Function √</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>to BIOL1010 Biology</td>
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<tr>
<td>Christine Paras</td>
<td>Microbiology 1</td>
<td>5306</td>
<td>Pilot a visual glossary for microbiology √</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Write some assessment to show learning has taken place √</td>
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<tr>
<td>Alphonse</td>
<td>Teaching relief for Danilla (72 hours)</td>
<td>2653</td>
<td>(Marking 3 lots of 72 reports = 24 hours/lot)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Funding in October was contingent on making progress (√) in above</td>
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**Total for work up to October $18195**

<table>
<thead>
<tr>
<th>Name</th>
<th>Task</th>
<th>Funds</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olivia Contarin</td>
<td>Teaching relief for Danilla (28 hours)</td>
<td>889.56</td>
<td>√ (Write 7 sets of multi choice questions 20 questions per set, 4 hours per set)</td>
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<tr>
<td>Christine Paras</td>
<td>Photograph materials for digital glossary</td>
<td>6191.34</td>
<td>√ Develop 20 modules in digital glossary √</td>
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<tr>
<td></td>
<td>Develop training materials equipment digital lab</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Anne-marie</td>
<td>Retrospective payment for digital lab consultation meetings</td>
<td>1179.3</td>
<td>√ Develop a presentation for first workshop held in March √</td>
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<tr>
<td></td>
<td>Deliver presentation and be available for discussion after workshop</td>
<td></td>
<td>Consultation meeting with ITS to develop NetOp training package √</td>
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<td></td>
<td>Total 32 hours</td>
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<tr>
<td>Video project</td>
<td>2 Students employed one weeks work (35 hours each)</td>
<td>1705</td>
<td>√</td>
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<td></td>
<td>Catering and consumables for project</td>
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<tr>
<td>Microbiology focus group meeting catering</td>
<td>√</td>
<td>221.6</td>
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<tr>
<td>Final project review meeting catering</td>
<td>√</td>
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**Final expenditure: $28447**