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Four different approaches to improving the student learning experience

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Enhancing the student experience at higher educational institutions is currently considered to be one of the most challenging roles of academic staff at Australian universities. The reasons for this shift in focus are due partly to the changing nature of the students' interaction with the institution: students today have less time on campus due to their commitment to work and other extra-curricula activities; the abolition of compulsory student union fees have contributed to the 'university experience' being significantly different to that of recent years; educators are expected to produce 'work ready' graduates, from increasingly diverse student populations. In addition, the increased financial burden on students has also contributed to the change in role of educators from that of 'lecturer to student' to that of 'service provider to client'. All of these factors have driven the need to alter the traditional tertiary teaching pedagogy. In the Department of Mathematics at RMIT University, the academic staff have engaged in a number of incentives designed to address some of the issues faced by our students, both those entering and those leaving the university. These initiatives include projects funded by the University to improve course material and enhance the online presence of courses; funding for action research in teaching and learning; a peer mentoring project (Student Learning in Mathematics Education, SLIME); and courses in professional practice at both the first-year and third-year levels. This paper presents the details of some of these initiatives, with discussion of the objectives and the outcomes of each.

Keywords: student experience, action research, course enhancement, peer mentoring, professional practice

Introduction

The student experience has gone through a renaissance over the past few years, and the causes have been discussed in many papers, (van der Meer and Scott, 2008 and citations therein). Response to the changed expectations of the students has been as varied as it is controversial. In Australia, the increased proportionate cost to the students for higher educational degrees has meant that they have essentially moved from 'learners' to 'clients'. This transition has put increased pressure upon the educators to deliver a 'product', generally dictated by employers and the clients themselves. Thus the traditional methods of imparting knowledge to students, who might or might not take advantage of the opportunity, have become almost obsolete, and the onus is now on the academic to ensure that the student graduates with a pre-defined set of skills, the 'product'. Additionally, in general, students are spending less time on campus and more time in employment. This provides an enhanced need for online learning, and academics are required to provide materials, assessments and other learning tools for students who are unable or unwilling to come to the classes.

These changes have necessarily impacted both the students and the staff, and higher education must adapt if it is to continue to be effective. In this paper, I describe some of the approaches

taken by the staff of the Department of Mathematics in the School of Mathematical and Geospatial Sciences, at the Melbourne city campus of RMIT University. Four different initiatives are presented as complete sections and a general conclusion follows. These include the investigation of students' concerns with 'virtual' classrooms (the ARTL project); projects to improve the online presence and practical relevance of a third-year course (the PaCE project); the introduction of a peer mentoring program to assist the transition of students into university (the SLIME program); and the development of students' soft skills (the Professional Practice Courses).

The ARTL project: assessing the effectiveness of new teaching methods

Recently, the School of Mathematical and Geospatial Sciences was supplied with Access Grid Room (AGR) facilities. This was partly funded by the Australian Mathematical Sciences Institute (AMSI), which is a federal government initiative. The AGR is a facility which provides two-way audio and video communication, with the addition of smart boards, allowing instantaneous two-way written communication. The RMIT Mathematics Department use this facility to share honours courses with other Australian universities, which enormously increases the options for the usually relatively small number of honours students.

A project was devised to investigate the problems that the students identified in the delivery of their AGR courses. The project was initiated under the ARTL (Action Research in Teaching and Learning) scheme and is funded by the College of Science, Engineering and Technology (SET) at RMIT University.

The literature suggests that there is a shift towards a learner-centred paradigm (Moore, 2002; Chang & Smith, 2008). This shift involves moving away from a more traditional 'talk and chalk' delivery method, to a method that focuses on interaction and collaboration between students and other students, as well as students and the instructor. The literature insists that this approach is vital to the effective provision of feedback and delivery of distance education courses. Broadly speaking the findings in this study around student–student interaction and student–instructor interaction echoed literature and studies of distance education more generally (Baldarrain, 2006).

The sample size was small: four students from two different external universities and one from RMIT. This precluded any robust statistical analysis from being performed but highlights the need for encouraging interaction on any level.

The students were asked to complete questionnaires (Table 1), and their responses indicated that interaction between their peers was valued and important to their learning experience, primarily because it increased motivation. This is consistent with other studies of distance learning which recommend that interaction between students is prioritized as it is central to student levels of motivation, satisfaction and achievement (Chang & Smith, 2008).

Secondly, the student feedback identified a link between the level of interaction between the students and their understanding of the course content. Moore (2002) also made the point that social interactions and collaboration between students was necessary for effective learning of course material. The students wanted to improve the extent to which they interacted with one another.

The students also expressed desire to improve the level of interaction they had with the lecturer for obtaining feedback, as this was identified as a challenge in AGR courses. Moore (2002) highlighted how the learner's satisfaction was linked to the sense that the instructor had a 'social presence'. In this study, the participants noted not only the importance of the lecturer interacting with them, but more specifically the importance of visual gesture, via visual and audio links and in digitally marking lecture material as he proceeds. This would improve the sense of the lecturer's social presence.

Table 1: Some of the questions and answers from the ARTL Project questionnaires.

Questions	Responses
Describe how interacting with students from other universities via the AGR differs to how you interact with students from your home university?	The very nature of the Access Grid environment inhibits and hinders communication and interaction between students. There is no opportunity for interaction between students in AGR courses. Problems with AGR technology, hinders interaction between students via the AGR.
In what way could the AGR technology be used to improve the level of interaction you have with other students in AGR courses?	The level of interaction between students via the AGR could be improved if the technology worked consistently The way the course is delivered could improve the level of interaction between students via the AGR.
How could the AGR technology be used to improve the way you obtain feedback and support from your lecturer?	Allocating time for live questions and feedback could improve the level of interaction between the student and the lecturer. Utilizing the smart board could improve the provision of feedback and support in AGR courses Methods of improving the provision of feedback and support from AGR lecturers to students could also increase interaction between students across different universities.
Describe how the AGR technology affects your overall learning experience?	AGR technology provides opportunity to access additional courses and quality teaching and thus generally has a positive impact on students overall learning experience The nature of the AGR technology presents a challenge to students learning experience, in terms of the level and quality of interaction in class, particularly when the technology fails
General comments	I think that AGR courses are a great idea, but in practice it will still take a few years to get things such as the systems and equipment set up so that they don't 'feel' so different from ordinary classes I think that the courses could be better improved by ensuring the performance of the technology that is already in place is perfect (e.g. video feed and smart board application being viewed and used in all locations that the course is run.) The main concern is visual. I like to be able to see the lecturer as this helps with finding what they are talking about and also builds a level of personal interaction with the lecturer and myself. Clearly the level of interaction is a key issue. Another student had the following suggested that course delivery techniques could be implemented to overcome this

There is a consensus in distance education literature, that new technologies have great potential to accommodate, if not drive, this theoretical shift (Baldarrain, 2006). The students in this study were also enthusiastic about the potential of the AGR technology to improve all of the course delivery issues that they brought up, particularly in the utilization of the smart board to supplement the visual and audio communication.

Due to the complex nature of the course material, the lectures were most effectively delivered in a more traditional style. The lecturer in this sense remained what Gallini & Barron (2001) described as the '*locus of control*' and '*the primary source of information and the director of the learning agenda*'. Although moving away from this model is central to a learner-centred approach, it is not to say that this approach was disbanded all together in this project. One of the major findings was that there was a lack of opportunity for students to engage the lecturer in class time to obtain feedback or to interact with fellow students. While it was deemed necessary to have a formal, instructor-directed lecture, the introduction of separate, supplementary, less structured sessions that were devoted to student–student interaction, student–teacher interaction and obtaining feedback and assistance with course work and assignments, was an effective solution.

The Access Grid environment offers unprecedented potential for achieving effective distance learning outcomes for students, however this potential should not be taken for granted; there needs to be a conscious effort to review and adjust conventional teaching modes. Principles of learner – centred theory are useful and should be taken into account, in the review of distance education course delivery for the improvement of student learning experience. Promoting interaction, via the full exploitation of the available technology should be of central concern in delivering distance education.

The PaCE project: adapting course materials for the twenty first century

Every year, the Program and Courseware Enhancement (PaCE) team works with academics on projects either to develop new courses, enhance existing courses by applying instructional design principles, or build flexible learning materials including web packages. Funding is provided, on a competitive basis, to assist in achieving the outcomes of the project. All projects are peer reviewed and should be contextualised to the learning outcomes of the course and program, (Nageswaran, 2007).

In the Department of Mathematics in 2008, one PaCE project concentrated on improving a third-year course to teach natural resource modelling. The course is relatively new (in its third year) and was suffering from lack of cohesion, since three lecturers were involved in delivering the course. There was also indication from the students that mathematical application to real world problems was lacking. The project allowed opportunity to streamline the course, provide online materials and develop systems of learning through industry adopted models, thereby highlighting the relevance of the mathematics they were learning to real-world problems.

The approach taken by the academics was to introduce modelling methods by examining natural physical systems such as population dynamics, spread of diseases and hydrodynamic systems. This provided the students with the necessary skills, both mathematical and computer software, while engaging them in 'real-world' problems.

The online courseware was also improved so that, if necessary, a student could participate in the course with minimal attendance at the university. Some of the comments received in recent student questionnaires are shown in Table 2, with the number of students expressing similar comments in parentheses.

Table 2: Some of the student responses to the course in both 2007 and 2008.

Year	Comment
2007	More examples are needed (4)
2007	Need more real life applications in modelling (2)
2007	The best aspect is we get to know real world uses for what we learn (3)
2008	Best aspects are the practical assignments and real world applications (1)
2008	More explanation regarding what is expected on the project is required (1)

- Of the seven students who responded to the questionnaire in 2008, only one felt the need to add text response on best/worst aspects of the course. The general anecdotal evidence indicated that the students were very happy with the course.
- In contrast, of the seven students who responded in 2007, six added text responses mainly expressing their concerns.

The student response to the course this year shows that the changes improved their appreciation of the course, their ability to recognise its worth in the real world and the improved cohesion of the content. The overall course satisfaction for the three years the course has been running is: 40%, 41% and 61%, respectively. Further improvements will be made for future years based upon the students' comments.

The SLIME program: peer mentoring

It is well known and documented that students are more prepared to listen to their peers than to authority figures. In addition, transition from high school to university can be difficult and sometimes traumatic for some students: it is important to ensure that the new students enjoy a positive initial encounter with HE, and that they feel comfortable in the new environment and know their way around. There is also pressure on the academic staff to reduce the attrition rate of first-year students, although this is rarely attributed to the students' initial experience.

These concerns have been addressed by the introduction of a peer mentoring program known affectionately as SLIME (Student Learning in Mathematics Education). Second- and sometimes third-year students, are trained as mentors to the first-year students. The incentives for the mentors include a certificate in leadership, recognition on their transcript and training in leadership skills. The benefits to the new students include smoother transition, provision of a conduit to the staff, information about the university facilities and introduction to other students. The mentors have also indicated that their experience was well worth the time invested.

The SLIME mentors are required to meet with their group of students for a minimum of 15 hours as well as attend five hour of training. All new students are assigned mentors and we attempt to link two mentors with a group of 5 or 6 new students; this seems to be the best combination, and ensures that there is a mix of personalities. The mentors are introduced to the mentees, through the first-year professional practice course. We provide class time, approximately 10 hours, for interaction, and allow the mentors to assist with the creation of

the first group project that the new students need to prepare. The remaining time required for the mentors to achieve their certificates is left up to the individuals to arrange.

One of the problems that identified by the mentors is finding sufficient time, especially towards the end of the semester, to meet with the mentees. Providing a more structured program for contact time is a possible solution.

The mentors develop leadership skills and their confidence and communication skills have also been known to improve. In addition, assistance in the classroom has improved their understanding of the mathematics that they discuss with the first-year students. The mentees are able to confide their concerns to their peers, and feel much more comfortable doing this. In addition, it is not usually the role of the lecturer to advise the students on orientation issues. The mentors are happy to inform the first-year students of arrangements such as lodging assignments, the location and availability of services and other important amenities. Having access to mentors has improved the initial experience of the first-year students and with careful management has the ability to reduce attrition, although this is almost impossible to measure.

This program has run for one year, and, based upon the anecdotal evidence from the mentors and mentees, and the level of interest that the new second-year students have shown to be mentors this year, the program will continue this year.

The Professional Practice courses: work-ready graduates

First-year students enter university generally with little idea of the set of skills that employers demand of graduates. The Professional Practice course that we deliver at first-year level provides the students with information about these skill sets. They include, naturally, the technical skills in which we are expert and the soft skills, which are increasingly recognised as essential, as well as communication and teamwork skills, (Stacey & McArthur, 2008).

At third-year level, we endeavour to provide the graduands with the ability to work both independently and in groups, produce professional curriculum vitae, effective job applications, scientific reports, and verbal presentations; conduct successful job interviews and generally prepare them for the professional workforce.

Employers today expect graduates to be work-ready professionals. A report to the 'Business, Industry and Higher Education Collaboration Council of Australia' (DEST, 2002) identified eight employability skills: communication, teamwork, problem solving, self-management, planning and organising, technology, life-long learning, and initiative and enterprise. Recent evidence however from the Longitudinal Survey of Australian Youth (Precision Consultancy, 2007), indicates that graduates do not feel that enough emphasis is placed on the development of these skills during their undergraduate studies. These soft skills are now considered essential in industry by both graduates and employers.

The research question addressed is, 'How can we best develop employability skills in our mathematics graduates by what and how we teach them in the first year of their degree?' For many years a companion course has been taught in the final year of the course; with positive feedback from students and requests for more such courses earlier. The objective of the research was to design such a first-year course.

This view was confirmed for mathematics and statistics graduates by an industry representative committee providing input into the review of the Mathematics Degree at RMIT (Royal Melbourne Institute of Technology) (RMIT University, 2004). After consultation, industry representatives identified the need for mathematics and statistics graduates who: were also proficient in soft skills, particularly those listed in Table 3.

The LSAY study collects data on a wide range of topics, every three years, from an ongoing group of 1300 young people aged between 15–25 years. In 2006, the LSAY study asked respondents from the 1995 cohort (aged on average 2) and the 1998 cohort (aged on average 22 in 2006), if they had completed a degree in the previous twelve months, and were in full-time employment, to answer questions on employability skills.

Table 3: Aggregated responses from the LSAY 1995 Year 9 Sample Wave 12 (2006) – 126 respondents to the employability skills questions (Adapted from Precision Consultancy, 2007)

Skill area	Difference between 'how important' and 'how well'(percentage points)
Learning skills	3.6
Self-management	6.6
Problem solving	8.7
Initiative/creativity	9.4
Technology	13.3
Planning/organisation	13.4
Communication	14.5
Teamwork	18.9
Average %	11.0

Both groups were asked to rate each of the employability skills listed in Table 3 in terms of its importance (very important, important, or not important) to their current job role. They were then asked how well (very well, well or poorly) they thought their university studies had equipped them with these skills, as they were perceived to be required in their current job. The results for the 1995 group are shown in Table 3, reproduced from Precision Consultancy (2007). It is clear that in every skill area the perception was that the students felt that they could have been better prepared.

The first-year course *Elements of Professional Practice* attempts to address some of these concerns of graduates and employers, and includes: working in teams, taught by a colleague from the Psychology Department; applied ethics, taught by a philosopher from the Social Sciences Department; methods of rigorous proof; report and essay writing (centred around the life and works of famous mathematicians and statisticians); presentation skills, through group presentation of talks; and investigation of the current job market including a session taken by a professional careers advisor.

As much as possible the activities have been designed to appeal to a student interested in mathematics, and hence keep the student motivated. It is hoped that the course will also encourage students to begin to consider their future employment. As mentioned in the introduction there is a companion course taught in third year which continues the process of preparing students to be professionals, in particular developing their abilities in:

- communication
- research
- effective resourcing

- public speaking
- presentation skills
- working in teams and understanding group dynamics,
- professional ethics.

The content of this course will continue to evolve as ideas for improvement suggest themselves. The next step is to get more detailed feedback from recent RMIT mathematics and statistics graduates.

Conclusions

The success of the four methods described above to improve the student experience cannot be measured quantitatively; however, improvement in the responses to the student questionnaires is a guide to the effectiveness of various initiatives. In particular, the outcomes of the PaCE projects are not measured directly, but we know from student comments that they expect the course materials and learning tools to be available online. The PaCE team, and the funding assist the academic staff to achieve this.

The ARTL project enabled a small cohort of honours students to have a say in how their course material was delivered. The challenges of distance learning were considered and solutions proposed and tested. The most significant outcome was that the students found enormous improvement in both the teacher–student relationship and the student–student relationship with the addition of a tutorial type session. This extra session also overcame the problem of the lecturer not being available for consultation. The results of this project were conclusive and are discussed in detail in the report (Klass, McArthur, Eberhard & Stacey 2008), which will be submitted for publication in 2009.

The professional practices courses that have been developed have been recognised both by the students and by industry as vital to the success of the students' careers. The skills they are taught include written and oral communication, effective team participation and ethics in the workplace. These skills should improve the employability of the graduates as well as improving the confidence of the students in their own abilities.

The SLIME mentoring program follows a successful program in computer science at RMIT, as well as in other disciplines. The approach is slightly different in each to address the particular needs required. In maths, we believe that the strangeness of the environment can be minimised, allowing the students to concentrate on the material they are being presented with, which is strange enough. Many of our students choose the program by default and don't really understand what it means to be a mathematician. The mentors can assist them with this concept, and demonstrate the benefits of learning some mathematical techniques when the students can't really see a need for them. This in itself is of huge benefit to both students and lecturers.

The four approaches described here contribute to an improvement in the student experience to varying degrees. The only measure of the success of each program is the student questionnaires, which have a variability of their own. As academics, we have always had a responsibility to impart knowledge to our students; now we also need to ensure that they have a positive learning experience and that, when they graduate, they are employable. It is imperative that methods constantly evolve to achieve this end.

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