"Do red apples differ from green apples?": Using research-based learning to facilitate learning and engagement in a large first year course

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Research-based activities were developed in a large first-year psychology course that includes students from a wide variety of backgrounds and programs of study in order to enhance student engagement in disciplinary learning and facilitate development of important generic and discipline skills. Student feedback data showed that these new aspects of the course were enjoyable and effective for helping students achieve the espoused learning outcomes. Student assessment results also indicated improvement in the targeted areas, and compared to the previous year there was a reversal of predicted trends in performance, where, typically as student numbers increase, proportions of higher level grades decrease and lower level grades increase. These results, coupled with substantial decreases in OP entry cut-offs (e.g., from 7 to 12) from the previous year, and thus likely differences in students level of ability, indicate that the project has been successful, and will likely have a longer-term impact on students' future semesters of study.

Introduction

Research has shown that large classes are often a negative experience for students, and are perceived as being quite impersonal and rigid. Students often report feeling confused and overwhelmed, and isolated from staff and fellow students (Herbert, Chalmers & Hannam, 2003). Given the importance of the first-year experience in supporting student retention in later years, these are concerns that should be addressed in any large class context. Moreover, large and/or diverse student cohorts also impact on the teacher. Along with the obvious issues of administration and management, it is often perceived that there is a limited range of options for teaching and assessment, and that the group is overwhelmingly heterogeneous in background, abilities and motivations, making it impossible to cater to all students' needs. Also, it is typically reported that there is neither time nor resources to give adequate feedback to support students in their learning, and particularly in developing academic skills (Herbert et al., 2003).

These issues are particularly relevant to the teaching of first-year psychology, however, I would add one further issue – engagement in the discipline. For many first-year psychology students, psychology is seen as something of a mystery, or at best, a discipline that deals with mental illness, forensics, and other such popularised topics. The rigorous scientific basis of the discipline and the broad scope of topics covering all of human behaviour are often not understood by students; "…but when do we get to study *real* psychology?" is an oft-heard question!

Undergraduate, particularly first year, psychology courses often service a variety of programs (e.g., business, nursing, allied health, education, arts and social science) and have very large enrolments. Whilst this situation poses many challenges, the positive impact of "getting it right" can be far-reaching. For example, on the Gold Coast campus of Griffith University, the two core first-year psychology courses had 550 and 460 enrolments in 2005, increasing to 650 and 480 in 2006, respectively. In both of these courses, less than half of the students were enrolled in a specified psychology program, with the majority of students studying other programs including business, marketing, management, law, education, nursing, exercise science, arts and information technology.

A curriculum design project was developed to specifically address these key large-class concerns in a core first-year psychology course at Griffith University. In doing so, it was clear that strategies needed to be adopted that, (1) facilitate the engagement of students in the teaching and learning environment, particular student-student interaction, (2) facilitate and scaffold the development of academic skills (those particular to psychology such as lab report writing) and (3) promote engagement in, and appreciation of, the discipline of psychology. The guidelines for large-class teaching developed for the Australian Universities Teaching Committee (2003) formed the principles underpinning this project; in particular, (1) provision of early and targeted support for students likely to experience engagement difficulties, (2) offering activities and resources that promote early engagement, (3) regularly monitoring students' learning, and (4) using technology to support learning.

Whilst teaching about research and getting students involved in research-based activities is a traditional element in the psychology curriculum at university, focus is often placed on learning content and students are not always explicitly guided and supported in developing the skills integral to these tasks (Lipp et al., 2007) such as academic writing, independent and critical thinking. The enhancement of existing course requirements related to research activities (i.e., reporting an experiment) was the focus of this project as they provided the best opportunity to achieve the objectives discussed above - facilitating student-student interaction, scaffolding the development of academic skills, and promoting engagement in, and appreciation of, the discipline of psychology.

The following sections will provide background information about the course and the project strategies developed. This is followed by an evaluation of the design.

Introductory Cognitive and Biological Psychology (1001PSY)

This course is one of the first semester, first year courses undertaken by psychology students in their program of study, and also students of some other related disciplines. As such, it provides the opportunity for students to develop the important foundational knowledge and skills required for the study of psychology, and in particular, it provides a basic grounding in topics in cognitive and biological psychology. In addition to weekly lectures, it is aimed to provide students with practical opportunities in the lab (tutorial) classes to develop an understanding of, and skills in, basic research in the key topic areas, as well as skills in critically evaluating and reporting psychological research.

As would be found in the majority of first-year psychology courses across the country (Lipp et al., 2007), a textbook and accompanying study guide are set as the required texts for the course, and the assessment program for this course typically has involved the following tasks:

- *Mid-semester exam* (15%) and *Final exam* (45%) – including multiple-choice questions and short answer questions, mostly relating to the lecture content but a small number relating to the lab program.

- *Lab report* (25%; 1700 words; Due approx. week 11 of semester) – a written research report based on an in-class experiment where students in lab classes are the participants in a short experiment.
- *Research participation* (5%) – students choose from a wide variety of research projects in the School, and participate for 3 hours in total (or part thereof, marks are granted proportionally).
- *Class participation* (5%) – students gain marks for attendance at lab class throughout the semester (marks granted proportionally – full attendance gains 5%).
- *Library Research Tutorial (LRT)* (5%) - a web based set of 6 modules designed to help students gain generic skills in finding information and using Griffith University Library. Completion of the modules takes approximately 3 hours.

Student characteristics

The 2006 student cohort is described in the table below. Similar proportions of students were previously enrolled in the course in 2005. In both 2005 and 2006, 68% of students were female and 32% were male. Given that the two largest program groups, psychology and exercise science students, are required to complete this course in the first year of study, students are primarily first-years. There are, however, a small proportion of students taking the course as a general elective and are often in the later years of their program.

Table 1
Student enrolment numbers by program and year of study.

Program of Study	N	***%***	***Year at university***	***N***	***%***
Psychology	187	30	International	24	4
Psychology double degrees	43	7	GUEST (high-school)	18	3
Exercise Science	211	34	First year	220	83
Arts	116	19	Second year	17	6.5
Business	14	2.3	Third year	13	5
Science	10	1.6	Fourth year	3	1

The OP cut-off levels for the main programs of study involved in 1001PSY have changed quite substantially in recent times. Although figures remained relatively stable for the double degree programs offered in Psychology (e.g., Psychology/Law between OP5 and OP7), there was a significant drop for the Bachelor of Arts in Psychology (the program with greatest enrolments for psychology) from OP7 in 2005 to OP12 in 2006. This was also the case with the Bachelor of Exercise Science, which dropped from OP7 to OP11 during this time.

Research-based learning for engagement

Although research-based learning (RBL) may seem like another recent catch-cry for teaching and learning in higher education, there are well-founded reasons for endeavouring to include this instructional method in the curriculum. Not only can research-based learning facilitate learning of the content of a course, but such activities can help students develop many of the key graduate attributes and skills that are important aspects of higher education (Smith, 2008). For example, a study of undergraduate science students across several liberal arts colleges in North America found that students who participated in research projects during vacation time not only gained confidence in their abilities as learners and future professionals, but also developed skills in communication, critical thinking and problem-solving (Seymour, Hunter, Laursen, & Deantoni, 2004). Some students also felt that the experience had helped to clarify

their career goals. Moreover, they also showed a more sophisticated understanding of the discipline, the nature of science and the nature of knowledge.

There were two main components to this curriculum design using research-based learning, and each is described below.

Lab Exercises

First, the writing skills required for reporting psychological research are quite specific, and even typically high-achieving students struggle with this the first time. For psychology students this skill is paramount for the rest of their degree and their early experiences can impact greatly on future performance. Therefore, a number of lab exercises were developed to facilitate and scaffold the development of these skills as well as student confidence in their ability to undertake these tasks. These exercises were integrated into the first half of the lab program for the course, and so students are provided with early feedback on their writing skills. Thus, the exercises serve to prepare students for the lab report assignment, and also provide students with a guide they can utilise in future lab report writing tasks. The exercises and associated materials were trialled in a pencil-and-paper version in 2006, and were then developed for online use.

The first exercise requires students to write a one-page summary of a journal article discussed in week 3 of the lab program. The second exercise includes two referencing tasks (using the standard conventions for the discipline - APA style). First, students are required to make corrections to the in-text citations in a paragraph of text. Second, students are required to correctly construct a reference list from the details of 6 resources (including books, book chapters, journal articles and online documents). The third exercise requires students to write a 2-page mini lab report of a short experiment conducted in week 5 of the lab program. Students are provided with a sample template of a lab report for this exercise, with each section heading included and annotations giving tips regarding what to include, any formatting issues, and how to approach each section. A writing guide for psychology (Burton, 2002) was also adopted as part of the set textbook package for the course, and utilised throughout this part of the lab program.

These exercises replace the previous "participation" tasks for the course (see description of assessment above) - the Library Research Tutorial (LRT) and class participation. Previous records show that engagement in, and completion of, the LRT was reasonably low at 85% overall, with some program of study cohorts as low as 65%. Class participation rates were much higher, with at least 85% of students attending half of the lab classes or more. However, together, these aspects of the assessment program were considered to be in need of improvement both in terms of the nature of task and the rate of engagement and completion (Research participation rates were similarly low like the LRT, however this task was deemed important to the course objectives in providing opportunities for experiencing psychological research, so instead of changing this task it was hoped to encourage increased engagement).

In order to balance the assessment program and weighting of tasks, the lab report was reduced from 25% to 20% (and the required length also reduced) acknowledging the work involved in the lab exercises. The lab exercises thus constitute 15% of the final grade - replacing 5% LRT and 5% Class participation, and including the 5% reduction to the lab report.

Lab Report Experiments

The second component of this design targeted the issues of engagement in the discipline and the heterogeneous nature of the student cohort. Because this course involves students from a wide variety of disciplines, it is often difficult for some students to see the relevance of psychology (and in particular, research in psychology) to their degree. Previously the lab report assessment has involved the running of one particular experiment in lab classes where students were the participants and the tutor was the researcher. The collected data are then combined for all classes, and overall results are then fed back to students by the tutor along with guidelines as to how to write the lab report. Students in the past have complained that they don't see the relevance of the experiment to their study, or the meaningfulness of the experiment to the discipline. Ideally, students would be given the opportunity to undertake an experiment that is particularly relevant for them, in order to support their engagement in, and understanding of, the discipline and for those in other degree programs, the development of an appreciation of the role of psychological research in their own discipline. Allowing students to take ownership and some control over their own learning is an important guideline for quality teaching and learning, regardless of class size (Biggs, 1999; Gibbs, 1992; Knowles, 1984).

A variety of small-scale or "mini" experiments were developed that to be carried out by students, and then written up as their lab report assignment. These experiments cover a variety of topics that have application to some of the common discipline areas of students typically enrolled in the course (e.g., including psychology, exercise science, business, etc). The resources and materials are available online, and students work together in small groups to conduct their chosen experiment. Each student can choose 1 of 3 experiments, is required to collect data from 5 people, and then the data from each student in the small group is combined. Groups consist of at least 4 students, so that an adequate sample size can be obtained. In their groups, students share their data, plan and discuss the experiment and results and how to write the report. This exercise not only impacts on assessment (e.g., making assessment more authentic), but offers activities and resources that promote early engagement and the development of student interaction, integrates content with learning processes and varies the students' learning experiences.

Evaluation

In order to evaluate the success of these strategies, it was deemed important to include different perspectives as this can provide a stronger basis for inferences. For example, student achievement as well as their own opinions and assessment of their learning experiences, and the opinions and reflections of teachers themselves can together serve to provide rich and informative data, much like the idea of triangulation in research (Jason, 2003; Smith, in press). Therefore, evaluation included two main components: (1) feedback from students was obtained via a course evaluation questionnaire completed at the end of semester; and (2) student assessment results for the course were analysed, in order to compare performance in assessment tasks between the previous 2005 cohort and the 2006 cohort who experienced the new design. These latter analyses allow for examination of any possible impact on student learning and achievement in addition to how students experienced and perceived the strategies.

Student Feedback

The sample of students who returned evaluation surveys was representative of the overall cohort (as in Table 1 above). There was a 43% response rate (N = 251).

The lab exercises were designed to provide students with focussed learning of the academic skills required, in particular, to write a lab report in psychology. Students were asked to consider these exercises as well as other associated activities and resources, in terms of how useful each was in helping them learn, and gain these skills. Results are presented below.

Table 2
Student evaluation of learning activities in relation to Lab report.

	Mean*[#] *(SD)	***% Not used***
Exercise 1 – summarising literature	5.59 (1.28)	1.5
Exercise 2 – referencing	5.89 (1.08)	1
Exercise 3 – mini lab report	**6.24** (0.88)	1
Sample template for lab report	**6.32** (0.82)	1.5
Feedback on lab exercises	5.82 (1.19)	-
Lab classes	5.68 (1.21)	-
Writing guide	**6.12** (1.24)	8
Discussion with group	5.07 (1.47)	3.5

Rating scale where 1 = not at all; 4 = moderately; 7 = extremely

Student usage of all elements was very high, with very few students indicating they had not used any particular activity or resource. As can be seen in the table, although all elements were rated on average as more than moderately helpful, there were significant differences in these ratings, $F(7, 1582) = 42.42$, $p<.0001$. Students rated the sample template as the most helpful resource in preparing their lab report assignment, although this was not rated significantly higher than the 3rd lab exercise (mini report) and the writing guide. These three elements were rated as significantly more helpful than all others, except for the writing guide which was not rated significantly higher than the 2nd lab exercise or feedback on lab exercises (analyses using simple comparisons with bonferonni adjustment).

For the new lab report assignment activity, students were asked to consider a number of statements, and to indicate their agreement or disagreement. The data presented below in Tables 3 and 4 are in the form of mean scores, as well as the proportion of students who either "agreed" or "disagreed" with each statement, depending on the nature of the item wording. These proportions are represented as either "broadly" or "strongly" agree (or disagree).

Students perceptions of the lab report and experiment process indicate that the main objectives were achieved; that is, having a choice of experiments and collecting own data created personal interest, meaningfulness, and benefit and facilitated an understanding of the research process. More than 75% of student agreed with these statements. There was, however, some uncertainty about the relevance of the experiment to future work or study however, and only 48% of students felt that the experiment they chose was relevant in this way. This was also the only item for which there were program of study differences. Not surprisingly, psychology students were more likely to agree that they were able to choose an

experiment relevant to their future work than both Exercise Science and Arts students, $F(2, 231) = 3.40$, $p<.05$ (Means = 4.93, 4.49 and 4.33 respectively).

Table 3
Student perceptions of lab report experiment activity.

	Mean (SD)	**Broadly Agree %*	***Strongly Agree %*
Collecting my own data for the lab report experiment:			
…helped me to understand the research process	**5.67** (1.14)	86	63
…helped me in writing my lab report	**5.65** (1.12)	87	62
Having a choice of 1 out of the 3 experiments meant that I could find an experiment that was:			
…meaningful to me personally	**5.49** (1.29)	76	54
…relevant to my study or future work	4.68 (1.46)	48	30
…interesting to me personally	**5.82** (1.16)	87	68
It was good to collect the data for the experiment myself	**5.38** (1.33)	77	52

* Broadly = ratings of 5, 6 & 7 combined; **Strongly = ratings of 6 & 7 combined.

Table 4
Student preferences for lab report experiment activity.

	Mean (SD)	**Broadly Disagree %*	***Strongly Disagree %*
I would rather have been a participant in a class experiment, and have the tutors collect the data from students	3.63 (1.69)	41 (33% unsure)	29
I would rather have been given made-up experimental data which I could immediately use to write my lab report	3.20 (1.78)	60	42
I would rather have been able to design my own experiment rather than having to choose one	2.66 (1.65)	70	54
I would like to have had more than 3 choices of experiments for the lab report	3.86 (1.57)	32 (41% unsure)	23

* Broadly = ratings of 1, 2 & 3 combined; **Strongly = ratings of 1& 2 combined.

In terms of the nature of the task, results indicate that students generally prefer to have a choice in experiments and to collect data themselves rather than alternatives that did not give them the opportunity engage as "researcher" but instead they would be "participant" only; the greater proportion of students disagreed that they would prefer to have tutors collect data from students as participants. This, along with the above findings provides reasonable support for the implementation of the project strategy involving choice and individual engagement in collecting data. The large majority of students do not wish to design their own experiment, and although one-third of the students indicated that they would not like more than three experiments to choose from, more students indicated that they were unsure about this possibility. There were no program of study differences on these questions.

Student Assessment Results

As the lab exercises were designed to scaffold the development of the skills required for writing a lab report, evaluation of the lab report assignment results was conducted. Comparisons between the 2005 and 2006 student cohorts were conducted, both for the overall

cohort as well as by the major program of study cohorts. This latter set of analyses is particularly important, as given the heterogeneous nature of the group, it is of interest to ascertain the impact of the project on these different student cohorts. Overall, students in 2006 outperformed students in 2005 for this piece of assessment $F(1, 1066) = 33.45$, $p<.0001$, and differences were also significant within program of study cohorts. These data are presented in Table 5 below.

Table 5
Student performance for the lab report assignment.

	2005		*2006*	
Program of Study	**N**	**Mark (/25)**	**N**	**Mark (/25)**
Psychology	132	17.01 (3.75)	186	18.34 (2.92)
Psychology Double degree	46	17.14 (3.93)	43	18.83 (2.26
Exercise Science	168	17.47 (2.89	210	18.15 (2.69)
Arts	91	16.04 (3.25	114	17.03 (3.24)
High-School students	24	15.20 (3.84)	18	18.34 (2.91)
OVERALL	486	16.85 (3.56)	582	18.00 (2.92)

Note. All means are significantly different between year cohorts.

In terms of engagement in the assessment activities, significant gains were also made. While only 70% of students in 2005 *fully* completed the class participation and LRT assessment components, 95% of students in 2006 fully completed the replacement lab exercises. In addition, a small increase in research participation rates was evident, with 79% of students in 2005 and 83% in 2006 submitting some proportion of participation.

Finally, inspection of overall grades also indicates some improvement in student achievement. The median overall mark increased from 66% to 68% (where 65% is the cut-off for a credit), and thus there were also some minor increases in the number of credits (31 % to 33%), distinctions (18.7% to 21.5%) and high distinctions (4.2% to 5.5%) awarded from 2005 to 2006. Failure rates remained stable at 10.5%.

Discussion

The redesign of existing research-based learning activities was aimed to provide greater opportunities for student interaction and engagement in the teaching and learning process, to facilitate the development of important academic and related skills, and to promote understanding of, and engagement in the discipline of psychology, but particularly, research in psychology.

The three lab exercises developed in place of previous "participation" only components of the assessment program were aimed at providing students with a focussed opportunity to learn and develop academic skills, particularly those required for writing in psychology. Also, by scheduling these in the first half of semester, students obtained timely feedback on their understanding and writing before submitting their lab report assignment. Evaluation results showed that students found the 2nd and 3rd exercises (referencing, mini report) most effective in helping them learn and prepare for the lab report. The 3rd exercise was associated with a sample template resource, which was rated as the most helpful. Student performance on the lab report improved significantly from 2005 to 2006, with all program of study groups showing similar gains although the high-school students showed the greatest gain, averaging

below a credit level in 2005 to above a credit level in 2006. There were also substantial increases in student completions of the lab exercises, compared to the previous LRT and class participation components.

The lab report experiment task was redesigned in order to facilitate engagement in the discipline and to acknowledge and accommodate the heterogeneous nature of the student cohort. Previously, the lab report was based on a single experiment conducted in lab classes with students as participants and tutors as researchers. Data were combined and reported back to students with guidance on how to write the report. In 2006, students were given a choice of experiments, and then collected data themselves. Small groups were formed, where students shared their data and were able to discuss their findings and approaches to the lab report. Evaluation results showed that students liked having a choice of experiments, and that collecting their own data created personal interest and meaningfulness, as well as benefit in developing an understanding of the research process and in writing the lab report. Almost half indicated that they would not prefer to have the previous assessment task, although about one-third of students were unsure - this uncertainty is probably accounted for by the fact that they had not experienced the alternative task. However, over three-quarters agreed that is was beneficial to collect the data themselves. Assessment data showed that for all student groups, significant improvement in performance on the lab report was made in the year of this redesign, compared to the previous year.

When evaluating educational programs, it is important to acknowledge the context in which these programs are conducted (Jason, 2003) – for this course, the context is a large, first-year class. Research on the impact of large classes has shown that whilst the frequency of fail grades is generally constant and independent of enrolment, the proportion of higher grades (e.g., A and B+) tends to decrease steadily as enrolment increases and the proportion of lower grades (e.g., B and C) tends to increase (Gibbs & Jenkins, 1992; Lindsay & Paton-Saltzberg, 1987). It is also important to note that the majority of this research was conducted before the large-scale massification of higher education occurred in places like the UK and Australia (Gibbs & Jenkins, 1992). Hence, it is highly likely that such trends are even more pronounced when "large" class sizes are even greater, as they typically are in the current environment. Given this characteristic of large classes, the minor increase in proportions of higher grades evident for 1001PSY in 2006 is, therefore, quite a positive outcome as it has actually reversed the predicted relationship between class size and student performance given a substantial rise in enrolments. This is even more important when the additional contextual factor of entry-level ability of students is considered. For example, the OP cut-off for students entering the Bachelor of Arts in Psychology dropped substantially from 2005 to 2006, with a similar drop for Exercise science students. This means that along with a substantial increase in enrolments (approximately 100) for this course, the entry-level achievement of the majority of students was much lower than in previous years, with only the double degree cohorts maintaining OP ranks at 2005 levels.

Conclusion

What, then, does this mean in terms of enhancing student learning? There was a minor shift in grade distribution, significant improvements in student achievement for the lab report and there was a substantial gain in student engagement when comparing the previous "participation" only tasks with the new lab exercises. Whilst it is possible that these benefits of the strategies were not experienced by all students to the same degree, together, these positive outcomes will most likely flow on beyond 1001PSY, particularly in terms of the achievements made in academic writing skills and engagement in the discipline and research

process; particularly important aspects for students continuing to study psychology. So whilst the *prima facie* impact of the strategies in terms of performance in this course may not be overwhelming, when considered in addition to the broader context (OP entry and increased class size) and future impact, these minor successes bare greater significance.

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