Integrating tertiary literacy into the curriculum: effects on performance and retention

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Abstract: Tertiary literacy instruction and assessment were introduced into two first year biology subjects as part of a collaboration between Biological Sciences and Learning Development staff at the University of Wollongong. In both subjects, the project focussed on scientific report assessment items based on aspects of the practical curriculum. The project involved production and use of a web site giving instruction in report writing and general guidance on scientific writing, marking schemes using explicit criteria including literacy based criteria, a peer marking tutorial, and marking and feedback using the schemes. The results from assessments in the second subject, which included the biology cohort but also a new cohort from another faculty, indicated improved literacy in those students who had received instruction in the first subject. Moreover, longitudinal data suggests that this benefit was translated into higher pass rates and greater retention rates for the students in these classes compared to others in the Faculty. While it is impossible to make a causal link between these pass and retention rates and the literacy instruction, the quantitative results and qualitative observations indicate the value of such an approach.

Introduction

There is a focus in universities in Australia on graduate skills or competencies and most universities consider that their students *will* graduate with certain desirable skills, including written communication. This is a crucial skill, not just for graduates in the hunt for a job, but for students throughout their years of study. Good writing skills can ensure that students are able to effectively convey the results of their learning in written assignments, using the conventions and text types of the specific disciplines they belong to, in a way that ensures they 'sound' like a biologist or an engineer. While this talk about graduate skills, particularly tertiary literacy or communication skills, is common across universities and reflected in policy, it may not always be reflected in teaching practice. The University of Wollongong, like other universities, suggests that there is a set of attributes which characterise its graduates; it also explicitly teaches and assesses these skills and attributes throughout its programs of study to ensure that students do graduate with such skills.

Background

Learning Development at the University of Wollongong implemented the University's strategy for ensuring students' development of tertiary literacy and learning skills in 1997. This is a systemic, curriculum-based and collaborative approach to skill development that has as its basic philosophy the idea that all new students entering university need to develop new writing and learning skills suitable for both the university context and, more importantly, for disciplinary contexts. To achieve this development, explicit teaching about such skills is embedded or integrated within normal content curricula so that students have the opportunity to develop skills alongside content, skills that are relevant to that context and rewarded within that context. By integrating this teaching into curricula, it becomes contextualised, relevant and discipline-specific.

Integrating such teaching into curricula requires collaboration between Learning Development and discipline staff in designing and implementing this teaching. This collaboration is meaningful and successful because of a number of factors. Firstly, discipline staff have the opportunity to 'unpack' their knowledge of the discipline for the purposes of instruction. Secondly, Learning Development

staff add their expertise to further 'unpack' discipline-specific literacy, allowing for a more sophisticated understanding of the disciplinary conventions within tertiary literacy. These two factors ensure that students are able to bypass the slow process of 'osmosis' that is the more common means of acquiring such skills and can more quickly and systematically learn the skills appropriate to their discipline and to the specific writing tasks that are part of that discipline. This is a great advantage because, as Lea and Street (1998; p.164) found, students have difficulty in… 'moving from subject to subject and knowing what [they're] meant to write in each one'. This more explicit teaching assists students in their transition into new disciplinary environments, each with its set of associated conventions.

This integrated teaching of tertiary literacy and learning skills is being vigorously implemented throughout core curricula in every faculty at the University of Wollongong. The following is a case study of an integration project in a 1st year core course in the Faculty of Science that will outline the curriculum development, teaching and assessment strategies commonly adopted in our integrated teaching. It will also detail the learning outcomes that were achieved in this particular project in terms of generic and discipline-specific literacy skills and in terms of students' success and retention rates.

The project

The project was a collaborative effort between Learning Development and Biological Sciences aimed at improved tertiary literacy in Biology. We were dealing with large class sizes (300-400) and associated resource constraints and wanted to avoid the common responses to this: a) cutting back on the instruction and feedback the students receive in relation to literacy; b) not addressing literacy until later years (when classes are smaller); and c) assigning literacy instruction to courses or services outside the Faculty, separate from the curriculum. Our conviction was that effective instruction and assessment of literacy in first year significantly improves literacy outcomes (and more general outcomes) in later years and that literacy generally, and discipline-specific literacy in particular, are most effectively taught embedded in the curriculum.

The project focussed on scientific report writing in two consecutive first year biology classes (BIOL104 – *Evolution, Biodiversity and Environment* and BIOL103 – *Molecules, Cells and Organisms*). One of the advantages of using these two subjects for evaluation of the project was that the cohort of students in the second subject comprised the cohort from the first subject (mostly Faculty of Science students, n=167) and a second cohort from outside the Faculty (mostly students from the Faculty of Health and Behavioural Sciences, n=170). This second cohort constituted a control group because they had missed out on the tertiary literacy instruction that was provided in the first subject; they were also a group that had entered their degrees with higher Tertiary Entrance Ranks than the Science cohort and might therefore have been expected to perform at a higher level in assessments. Because the first assessment item in the second subject was not preceded by any literacy instruction, there was an opportunity to compare the results of the Science cohort who had received instruction in the first subject with the results of the Health and Behavioural Science students who had not received any instruction. This comparison enabled us to assess the effectiveness of the instruction, assessment and feedback in the first subject.

Two main features of our approach were establishing explicit criteria, and reiteration. The criteria developed were based on the Measurement of Academic Skills of University Students (MASUS) assessment procedure (Bonanno and Jones 1997), and were tailored to the requirements of the subjects' assessment tasks (see Figure 1). As well as forming the basis of marking schemes used to grade reports and provide feedback, the criteria were used as the basis for the development of web-based instructional resources. These not only gave information and explanations for each criterion, they also provided extensive examples based on excerpts from student assignment and model reports that were analysed and annotated to show good and poor examples of writing relating to each criterion. This information also provided the basis of a marking workshop for staff (particularly for

casual tutors), instructional tutorials for large classes of students and a peer marking exercise. In this exercise, which was carried out in large classes (80 students), the students exchanged drafts and used the marking scheme (the same one used ultimately in grading) to mark each others' reports. This peer marking exercise was used not to assess the reports, but to provide feedback to the students about their writing as well as instruction via the exercise of using the criteria in marking. In order to ensure ample opportunities for learning, the project involved reiteration of assessment tasks within and between the subjects, including two full reports in the first subject and two part reports (results and discussion sections) as assessment items in the second subject. In the second subject, further reiteration was achieved through the draft and peer marking exercise.

Criteria		Excellent		Poor	
C	Control of scientific language and writing style	4	3	2	1
	• language appropriately formal, impersonal and technical • appropriate use of discipline specific terminology • consistent and appropriate tense choice • logical flow of information • figures appropriately introduced/referred to				

Figure 1. Example of MASUS criteria tailored to a scientific report writing assessment exercise

The results

Improvement in literacy

An initial evaluation indicated that the 1998 cohort of biology students enrolled in the Faculty of Science in the first session subject, who had received the integrated instruction, had significantly higher assignment marks than the 1997 cohort who did not receive literacy development (Skillen Merten, Trivett and Percy 1998). Assessment of the literacy of this group of students, using the MASUS procedure, indicated a significant improvement in the standard of written reports over the period of instruction, particularly in criteria which were specifically addressed. Perhaps more compelling was a comparison conducted in the second session subject, using the MASUS criteria, between the Faculty of Science students who received instruction in first session, and the similar-sized cohort of students from the Faculty of Health and Behavioural Sciences (H&BS) who did not receive instruction. Comparison of literacy levels in the first assignment indicated a significantly higher standard ($F(1,325)=6.34$, $p<0.01$) in the Science Faculty students ($M=2.88$, $SD=0.37$) than the Health and Behavioural Sciences Faculty students ($M=2.75$, $SD=0.36$) despite the fact that the Science students had entered university with a lower average Tertiary Entrance Rank. An evaluation of further literacy teaching across the second session showed significant improvements in literacy in the second assignment ($F(1,322)=179.93$, $p<0.01$) for Science Faculty students ($M=3.21$, $SD=0.42$) and for H&BS students ($M=3.11$, $SD=0.41$).

The grades of reports and anecdotal observations by markers, especially in years in which we were most active with this project, affirmed an improvement in the quality of written work. The improved grades may in fact underestimate the improvements in quality as expectations and marking standards tend to shift when developments of this kind affect the quality of work from a majority of the cohort.

Associations between literacy and academic progress

To assess the impact of the project on academic progress generally, an analysis was undertaken by comparing the two groups of students who received literacy instruction with students in the commencing cohort within the Faculty of Science who had not undertaken these biology subjects (n=189). Academic progress was measured for each student using the DEST institutional success indicator of the proportion of EFTSU passed to EFTSU enrolled and a mean success rate was calculated for the three groups in the three years including and following the literacy instruction (i.e. 1998, 1999 and 2000). Analysis of Variance indicated that the students who had received literacy instruction had significantly higher success rates than science students who did not receive this

integrated literacy instruction ($F(2,388)=30.91$, $p<0.00$) (see Table 1 and Figure 2, below). In the subsequent year, the H&BS students had significantly higher pass rates than the biology and other science students ($F(2,310)=2.76$, $p<0.06$), while in 2000 there were no significant differences between the groups ($F(2,204)=1.381$, $p<0.254$).

	Year of study		
Student group	1998	1999	2000
Biology students	0.93	0.88	0.90
H&BS students	0.96	0.94	0.93
Other Science students	0.75	0.87	0.87

Table 1. Mean academic progress scores

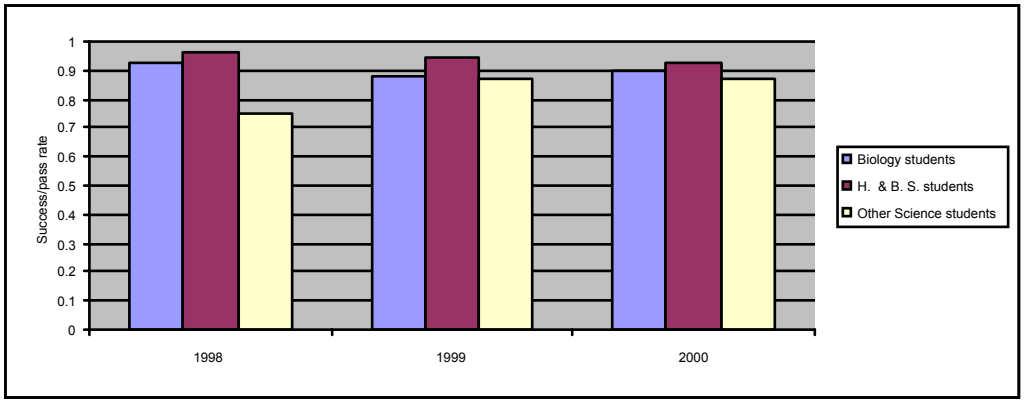

Figure 2. Mean success scores for Biology and H&BS students who received the literacy instruction in 1998, and Other Science students, who did not

Prior academic performance such as a university admissions index is a good predictor of tertiary performance, although it is less valid over time (Evans 2000), so this was assessed to determine whether the higher rate of academic progress associated with integrated literacy instruction could be more effectively explained by university entrance score data. Using Analysis of Covariance, significant differences in the mean entrance scores of the three groups of students were found: the H&BS students had a significantly higher entrance score than both of the other groups ($F(2,312)=3.16$, $p<0.04$). As a covariate, entrance score was a significant predictor of variation in pass rates ($F(1,295)=20.96$, $p<0.00$); however, after adjusting for the variance explained by entrance score, the integrated literacy development factor still accounted for a significant amount of variation in the pass rates ($F(2,295)= 25.01$, $p<0.00$). This indicates that the association between integrated literacy development and academic progress was independent of university entrance score.

Associations between literacy development and retention

Students who were provided with integrated literacy development also had higher retention rates than other students. Biology students in the Science Faculty and H&BS Faculty students who received integrated literacy had higher retention rates ($\chi^2=9.09$, df=4, $p<0.05$) from first to second year and second to third year than science students who did not receive integrated literacy development (see Table 2 and Figure 3).

Student Group	Retention from 1998 to 1999	Retention from 1998 to 2000
Biology students	80%	58%
H&BS students	83%	61%
Other Science students	61%	36%

Table 2. Retention rates

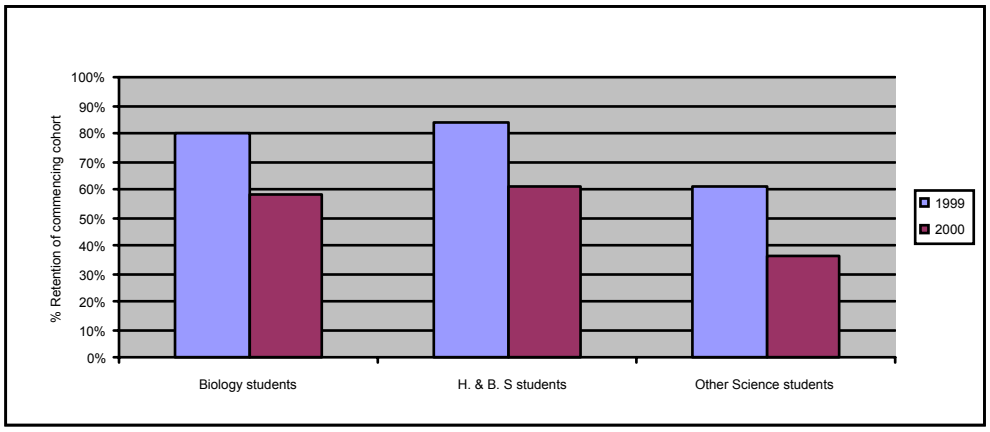

Figure 3. Retention rates into second and third year for Biology, H&BS, who received the literacy instruction in 1998, and Other Science students, who did not

The outcomes

Dealing with issues of literacy at an early stage and on a large scale is not only a more efficient and effective way of addressing literacy problems at University, but is also likely to significantly raise the standard of literacy throughout degree courses. This is essential in ensuring that students acquire the generic skills expected of university graduates. In this project, we found that despite the usual resource constraints of large first year subjects, the addition of activities such as peer-marking and small group work, web-based flexible delivery material and an integrated and iterative approach created many opportunities for learning. In addition to the development of tertiary literacy skills, this integrated teaching also provided opportunities for fostering content learning generally, and for developing computer, communication, teamwork and peer-teaching skills.

In this study, the provision of curriculum-integrated tertiary literacy and learning instruction is associated with higher levels of literacy, assignment marks, pass rates and retention rates for biology students compared to other science students who had not undertaken these integrated subjects. It is not possible to make a causal link between the literacy program and the performance and retention outcomes. The literacy level of the science students who had not received integrated literacy development was not measured so comparisons of literacy levels with the two groups who had received literacy instruction was not possible. As the program did not extend into higher years, there was no opportunity to monitor literacy as students moved through their degrees. Demonstrating links between improved literacy, performance and retention is difficult as the indirect effects of improved literacy on factors such as comprehension, communication or motivation need to be accounted for. However, a co-relationship between higher retention rates and the integrated teaching is not a surprising finding, as Evan's (2000) review of empirical research indicates that a lack of preparedness or insufficient academic skills is associated with attrition. Interestingly, there were no differences in academic progress between the treatment and control cohorts in their third year of enrolment; however, there was an attrition rate of 64% for the students who did not receive integrated literacy instruction, suggesting that only the most capable or motivated students may have been retained in this group. The reduction in progress benefits in second and third year suggests that integrated literacy instruction needs to be provided in later years of enrolment as well as in the first year. This is consistent with research on the 'sophomore slump' which indicates that students in second year regress in their learning strategies (Gardner 2000).

The project outcomes in terms of student success and retention also demonstrate the value of collaborative work of this kind that involves learning development units within universities and staff within disciplines. Such collaboration is probably the best way to integrate the teaching and learning

of generic skills with content and skills from the disciplines (see also Bowden and DiBenedetto 2002; Souchek and Meier 1997).

> It has been suggested that
> 'the success not only of retention programs, but of education programs generally, hinges on the construction of educational communities at the college, program, and classroom level which integrate students into the on-going social and intellectual life of the institution' (Tinto 1987; p.188).

Any curricular practices which help students engage in intellectual inquiry could potentially enhance education and retention. We speculate that the tertiary literacy instruction provided to biology students in this project enabled them to understand and use the genres of the discipline, become successful learners in the discipline, integrate with the intellectual life of the faculty and has thus enhanced their academic progress and retention at university.

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