

# An Evaluation of Portfolio Assessment in an Undergraduate Web Technology Unit

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## Introduction

One of the perennial issues that is raised in student surveys is that of effective feedback. As part of our ongoing review of teaching, we identified feedback on assessment as a target area for 2007; this paper describes the evaluation of one strategy for improving this feedback that was implemented as part of an undergraduate unit.

COMP249, *Web Technology*, is a second year undergraduate unit in the Computing program at Macquarie University. It assumes some knowledge of programming and provides a basic introduction to the various technologies that make up the World Wide Web with a focus on server side programming. Assessment in COMP249 has traditionally been based on three programming/design assignments, weekly submission of tutorial questions and a final exam. Student feedback on the unit from previous offerings has been generally good with the exception of the score for *feedback* which was markedly lower than other ratings.

The questions that relate to feedback in the standard Macquarie student survey are as follows:

- *I received timely feedback that assisted my learning*
- *The feedback given in this unit helped me address my weaknesses*

The main thrust of these questions is whether the feedback that we give the students, enabled them to do better than they might otherwise have done.

Like most lecturers, we are used to providing some feedback on students' work as comments on assignments etc. and some in lectures and tutorials as general points and discussions of issues. There are two possible interpretations of our poor scores on these feedback questions: either the students don't understand what feedback is, or the feedback we are giving them is not effective. While it's tempting to accept the first interpretation and complain about our students, it is perhaps more effective to think about what we might do to make the feedback we give more useful.

To address this issue, we chose to implement an assessment task that made the provision and use of feedback very explicit to the students. This has the twin goals of making them more aware that what we are giving them is feedback and giving them time to put the advice to good use and improve their work. We chose a portfolio assessment task as the means to achieve this.

This paper describes the implementation and evaluation of the portfolio assessment task with a particular reference to the effect on student's perception of the feedback they received in the unit. Our primary question is whether portfolio assessment provides better opportunities for feedback to students and whether this improves their learning experience as a result. In evaluating this new assessment method, we are also aware of the potential for generating excessive load on teaching staff; hence a secondary question is whether this mode of assessment can be managed within reasonable workload for the teaching staff.

## Portfolio Assessment

In a portfolio assessment task, students are asked to collect together the work that they do over the semester for submission. While this would be common in arts based courses it is less common in Computing. One example is described by Plimmer (2000) in an introductory programming unit; the experience here was very positive with students reported as welcoming the opportunity to develop their work in this way. Plimmer required a set number of programs to be submitted on three occasions through the course with the work being marked in consultation with a tutor who could give feedback directly to the student. Another implementation of portfolio assessment is described by Estell (2000) in the context of a Java programming course; in this case the focus is on the technology that is used to allow the programs to be run online in a web browser and less on the assessment and evaluation of this form of work. Ross (2007) describes the use of portfolios in a Biology laboratory class where students are required to compile a portfolio over the semester; this is presented as a manageable way of assessing laboratory notes which would otherwise require staff to either mark every week's notebook or take a random sample of notes to mark.

While feedback evaluation is the focus of this paper, the choice of portfolio assessment is motivated by other factors as well. One of the other issues raised in previous offerings of the unit was that students were too constrained by the requirements of our assignments and that creativity wasn't being rewarded. Another issue was the concern that students did not work through the regular practical problems that we set each week since there were no marks associated with them; they were then ill prepared when it came to the assignment work. The portfolio was seen as a way of encouraging regular work on the practicals while allowing for creativity in its open format.

## Methodology

The portfolio assessment task was integrated into the 2007 offering of COMP249 which had 105 students enrolled. Three submissions of the portfolio were required with the first two being for feedback only and the last for assessment counting towards the final grade. Notes were kept by the authors during the marking of each submission to assist in the evaluation of staff workload. At the end of the unit, students were asked to complete a survey with questions selected to allow comparison with earlier surveys on the issue of feedback and to gain some insight into the effectiveness of the task as a learning tool. Since the decision to put this new assessment task in place and carry out this evaluation was made quite late, no Human Ethics approval had been obtained prior to the evaluation. Hence, only summary results from the student surveys can be presented here.

## Implementation of the Portfolio Task in COMP249

The portfolio task was described to students as an adjunct to the weekly practical tasks set in the unit. These have traditionally been small tasks set each week to give students practice on working with the material being taught in class. A weekly lab session is run to give students help with these problems as well as any assignment work that they are doing. The portfolio task would require the students choose three pieces of work that they were proud of, and submit them along with a short commentary on what they had done. Our goal was also to encourage the students to go beyond the work that had been set for them, set their own goals and document this in their submission.

The task requirements were described to the students as follows:

*As an additional assessment task this year you will create a portfolio of your work stemming from the practical classes. The portfolio is a way of assessing your work that does not require you to hand something in every week and allows you to choose the work you'd like to be assessed on. Your portfolio will consist of the following:*

- 1. Three pieces of work that you have written yourself, at least one of these should include some Python scripting (The only exception being the first submission, we won't have done any Python in time).*
- 2. One or two paragraphs of commentary on your work; what you have done, why it was challenging etc.*

*The items of work that you submit will be based on tasks set in each week's practical page. At a minimum you may submit solutions to these tasks, however this won't get you very many marks. The intention is that you develop your solution in a direction of your choosing, going beyond the original specification. For example, you might be asked to develop a personal web page; you could extend this with a CSS based design, add Javascript or develop it into a fully fledged website. This is your chance to show us what you have learned in COMP249.*

In addition, the task was discussed during Lectures and advice was given to students during practical and tutorial sessions. The three submission dates were set around one month apart starting in week 4 of semester. Students were to submit a zipped folder of html and python CGI files with a main index.html page acting as a front piece for the portfolio.

A sample portfolio, written by the first author, was provided to students to show the format and expected contents of the portfolio. The sample contained two pieces of work that had been presented to the class as screencasts and one other piece of work that was a solution to an assignment from the previous year. A commentary was provided with these items to model the kind of commentary that was expected from the students.

### Providing Feedback and Grading

Feedback on the first two submissions and the grading of the final submission was based on a rubric (Table 1) developed by the authors with reference to various published marking rubrics. The intention was to provide both an indication of how well the student had performed on the task and some information about what the characteristics of a higher grade might be. In addition to the marking rubric, students received comments from the marker focussed on what they could do to improve their submissions next time. To generate a numerical score, the columns were numbered from 1 (unsatisfactory) to 4 (excellent) and a total was calculated as the sum of the component marks.

The marking scheme was not released prior to the first submission as we were still working out the details of how the work would be marked. Our justification for this was that since the first two submissions would provide detailed feedback, there would be ample time for the students to properly understand the marking scheme before the final graded submission.

	<b>Unsatisfactory</b>	<b>Basic</b>	<b>Good</b>	<b>Excellent</b>
<b>Presentation:</b> able to present a clear exposition of work	<i>Clearly no thought gone into presentation</i>	<i>Clear but unexciting presentation</i>	<i>Has used HTML/CSS to good effect in presenting the work</i>	<i>A spark of creativity in the way the work is presented</i>
<b>Goals:</b> able to explain the personal goals for a piece of work	<i>No statement about what the work was intended to achieve</i>	<i>Goals only expressed in terms of the problem being solved</i>	<i>Clear expression of what the student wants to learn from each exercise</i>	<i>A clear theme of exploration is expressed</i>
<b>Problem:</b> able to state the problem and place it in context	<i>No description of the problem</i>	<i>Simple problem statement</i>	<i>Problems clearly defined and explained</i>	<i>N/A</i>
<b>Issues:</b> discusses issues raised/lessons learned from the work	<i>No discussion</i>	<i>Some discussion of things that went wrong or new knowledge acquired</i>	<i>Lessons linked to the goals for the work</i>	<i>Goals modified in the light of experience with the task</i>
<b>Creativity:</b> work shows some degree of creativity	<i>Very mechanical examples</i>	<i>Some evidence of exploration within the technology</i>	<i>Work shows creative elements</i>	<i>Clearly original work expressing the student's personal goals</i>

	Unsatisfactory	Basic	Good	Excellent
<b>Technology:</b> student has shown good understanding of the technologies used	<i>Things don't work, syntax errors, cut and pasted</i>	<i>Working code, examples clearly authored toward student's goals</i>	<i>Designs examples around the use of interesting technologies</i>	<i>Integrates technologies to good effect, shows off mastery of the area</i>
<b>Range:</b> presents a range of technologies	<i>Really just one example given</i>	<i>Includes different technologies to cover the bases</i>	<i>Designs problems to bring a range of technologies into play</i>	<i>Work shows an understanding of the interrelations between technologies</i>

**Table 1: Marking rubric used in the portfolio task**

### Experience of Teaching Staff

The first draft of the portfolio was submitted by 94 out of around 105 students enrolled in the class. The work was graded using the marking rubric described above; each submission took 5-10 minutes to mark with a lot of that time being taken in writing comments on how the work could be improved.

Many of the first submissions were very similar to each other in that they included solutions to the first three weeks practical problems with varying degrees of commentary included. Most of the written feedback provided to students was aimed at improving the amount of reflective commentary included on their work; for example:

*“The start of a good example, try to work towards a specific goal with each piece of work. The website is good for working with HTML/CSS, try working the Javascript demo into a separate page. Discuss the goals/problems/issues as you have done (just a little more) alongside each piece of work.”*

Submission	Presentation	Goals	Problem	Issues	Creative	Technology	Range
<b>Draft 1</b>	2.02	1.88	1.83	1.54	1.78	2.06	1.77
<b>Final</b>	2.65	2.63	2.44	2.48	2.52	2.63	2.6

**Table 2: Mean results for three submissions of the portfolio. Columns correspond to the rows of the marking rubric. Scores ranged between 1 and 4 for each range except Problem (1-3)**

Scores on the different scales in the marking rubric were generally low with most students sitting around the 'basic' column. The mean results for the first and subsequent submissions are shown in Table 2.

The second draft submission was unfortunately close to the due date of the second assignment and a major assignment in another second year unit, hence only 69 students submitted updated versions of their draft portfolio, the remainder submitted an unchanged draft. In marking the second submission we compared the first and second submissions for each student and tried to provide some feedback on whether the work had improved. Written comments were again provided along with the filled in marking rubric. Since this submission included some Python code for the first time we also took time to run some of the submissions although in most cases we just looked at the code and the commentary provided by the students. Grading this submission took around 10 minutes per student on average. One promising feature of these submissions was that many students included plans for future development of the portfolio – outlining their goals for the final submission even if they hadn't actually done the work yet. As can be seen from Table 2, the scores improved overall with many students being given the 'good' rating for some factors and almost everyone achieving 'basic'

performance.

There were 84 submissions for the final grading of the portfolio, these took a little less time to grade as detailed comments were not being provided to students. A complication with grading this submission was that many students had included Python CGI applications which required setting up some machinery to run the scripts for each application. We had provided the students with a simple webserver written in Python which can be run to serve files and CGI scripts, we used a modified version of this to view each student's submission. The results for the final submission were much improved in many cases with a lot of students getting 'excellent' grades in some categories and a large number of 'good' grades. The means again increased over the second submission as can be seen from the table.

### Results of Student Evaluation Survey

A survey was carried out in the final week of classes, there were 47 responses which was the majority of the class present at the lecture. The questions are listed below along with a factor name in parentheses that will be used to refer to the question in the following analysis.

Five general questions copied from the standard Course Evaluation Questionnaire:

- I received timely feedback that assisted my learning (timely)
- The feedback given in this unit helped me address my weaknesses (feedback)
- The amount of work required of me in this unit was reasonable (workload)
- The learning activities (assessment tasks, in-class activities, homework etc) were useful in building up my understanding of this unit (activities)

Six questions relating to the portfolio:

- The portfolio task was a good way to assess my understanding of this unit (assess)
- The feedback that I got on the portfolio helped me improve my final submission (improve)
- I would have preferred more guidance on what to include in my portfolio (guidance)
- I enjoyed the freedom to choose the topics that I included in the portfolio (freedom)
- I think I could have done better on the portfolio given more time (time)
- Having to submit the portfolio three times was a waste of effort (effort)

One final question was asked about the student's expected grade for the unit:

- What grade do you expect you will achieve in COMP249

Responses were given on a five point Likert scale and were coded as integers with 1 meaning Strongly Disagree and 5 meaning Strongly Agree. A total of 47 surveys were completed. The results (summarised in Table 3) show that in comparison to the previous year's offering, the feedback scores had significantly improved (all differences except 'workload' are highly significant via a t-test).

The responses for the portfolio specific questions indicate that students agreed that the portfolio was a good way to assess understanding in the unit but would like more guidance on what to include. Most students were either neutral or disagreed with the statement that three submissions were a waste of effort, but 13 out of 47 (28%) agreed or strongly agreed; this included two of the three students who thought they would get a High Distinction (HD) grade. One of these HD students agreed that the feedback had helped improve the later submission but the

	2007		2006	
	Mean	Sdev	Mean	Sdev
timely	3.72	0.88	2.54	1.02
feedback	3.84	0.74	2.63	1.05
workload	3.24	0.95	3.26	1.00
activities	4.11	0.77	3.51	0.91
assess	3.26	1.11		
improve	3.43	1.07		
guidance	3.93	0.90		
freedom	3.78	1.09		
time	4.18	0.88		

Table 3: Results of student survey compared with those from 2006, scores refer to a Likert scale 1-5

remainder of this group were neutral or disagreed on this question. Not surprisingly, most students thought they could have done better with more time and the majority (65%) agreed that they enjoyed the freedom to choose their own topics.

From informal comments and discussions with students it is clear that they saw the portfolio task as an additional burden during the semester in addition to the assignments and that they may not have spent as much time as they would have liked on the portfolio because of time constraints.

## Future Directions

The introduction of the portfolio task was intended to provide a mechanism by which we could provide more useful feedback to students in the hope that this would enable them to improve their work throughout the semester. While the implementation of portfolios in this offering has not been perfect, we are generally pleased with the way that it has worked and the response from students that we've had. We will use portfolios again, taking into account the following changes:

- **Workload:** to be effective, we need to set aside more of our own and the students' time for the portfolio task. Hence we will reduce the number of assignments or perhaps integrate them with the submission of the portfolio. The goal will be to make sure that students have sufficient time to work on the portfolio effectively throughout the semester.
- **Guidelines:** we will provide clearer guidelines about what should be included and more example portfolios to model expected performance. One possibility is to provide examples of portfolios at the different levels of the marking rubric to illustrate our interpretation of the terms used.
- **Submission:** we will investigate infrastructure for submission of portfolios such that CGI scripts have a better chance of working for the marker without undue effort.

## Bibliography

Estell, John K. (2000) Programming portfolios on the Web: an interactive approach, *Journal of Computing Sciences in Colleges*, Volume 16 Issue 1, October 2000

Marsden, Helen, Carroll, Marie and Neill, James T. (2005) Who cheats at university? A self-report study of dishonest academic behaviours in a sample of Australian university students, *Australian Journal of Psychology*, 57:1, 1 – 10 URL: <http://dx.doi.org/10.1080/00049530412331283426>

Plimmer, Beryl (2000) A Case Study of Portfolio Assessment in a Computer Programming Course, *Proceedings of the NACCCQ*, Wellington, New Zealand.

Ross, Pauline, M. (2007) Using a portfolio to assess the key learning outcomes of practical classes *University of Western Sydney* [Online] , Available: <http://www.bioassess.edu.au/bioassess/go/home/pid/131> [August, 2007]

Schleimer, S., Wilkerson, D. and Aiken, A. (2003). Winoing: Local Algorithms for Document Fingerprinting. In *Proceedings of the ACM SIGMOD International Conference on Management of Data*, pages 76-85, June 2003.

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