Promoting creativity in computing via portfolio assessment

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One of the challenges in teaching Computing is balancing the need to have students carry out well defined programming tasks with a desire to encourage exploration and creativity. To try to address this issue, a portfolio assessment task has been developed that allows students to develop their own work over the semester and present it for assessment. The portfolio task is structured to allow formative feedback to students throughout the semester and to encourage students to reflect on the work they are producing as it develops. In the first version of this task there were problems both for the students and the staff; students were a little confused about what they were supposed to do and staff spent a lot of time providing feedback due to the need to unpack and run each individual assignment. For the 2008 version, we implemented a server based software system that tried to address both of these issues by providing a framework for the students to work within and a smoother work-flow for staff providing feedback. This paper will provide an overview of the assessment task from the point of view of the student and the staff providing feedback.

Introduction

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. 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. In 2007 we moved to address this problem by introducing a new kind of assignment based around a portfolio: a collection of work developed by the students over the course of the semester (Cassidy & Schwitter, 2007). This proved very successful and was generally well received by the students, but there were significant issues that needed to be addressed, both from the point of view of the students and of the staff on the unit. This paper outlines the changes that were implemented for 2008 and provides some reflection on the task and its use in a technology unit like COMP249.

Portfolio Assessment

The portfolio is widely used as an assessment method and as a way of encouraging students to reflect on their own work. It has the advantage of being a long term assessment task and one that provides opportunities for students to both present their work and reflect on their learning experiences. Portfolios have been used in whole-of-program evaluation where students are encouraged to collect examples of their work throughout their degree as evidence of their learning (eg. Lorenzo & Ittelson, 2005). Even broader in scope than this are examples such as eFolio Minnesota[1] which is available to all residents of Minnesota to 'create a living showcase of your education, career and personal achievements'. Many people have discussed the advantages of the portfolio as an assessment item. Diller and Phelps (2008) see it as an authentic assessment task in the context of an information literacy unit as it allows students to collect together examples of real work that they have completed during their studies rather

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[1] http://www.efoliomn.com/

than the artificial constructs of set assignments. Others, such as Kuisma (2007), point out the advantages of the portfolio as a reflective device; in their context it is used to help assess the individual experience within a group project unit. In fact, reflection is one of the major motivations for using portfolios and they find many supporters in teacher education (Klenowski, 2001) where educators are trying to encourage reflective teaching practices. The emphasis on reflection can backfire however, with comments that students manufacture their reflections on cue to fulfil the requirements of an assessment task, especially where the reflection is of a personal nature (Hobbs, 2007). Hence one must be cautious in what kind of reflection is expected of students and how it is interpreted as part of the assessment of the overall portfolio.

The Portfolio in COMP249

Our implementation of portfolio assessment was presented in the context of the practical part of COMP249 where students are asked to learn about the different technologies that make the Web work. The portfolio was introduced to address two main problems that we saw with the assessment methods we had been using:

- Feedback: students were not getting feedback that helped them get better grades, all of the feedback was intended to help them learn (perhaps from their mistakes) but this didn't often translate into any opportunity for improving their grade in the unit.

- Creativity: we found that the rigid requirements that we had to place on the programs the student wrote meant that creativity in the students was actually suppressed. We wanted to find a way to encourage students to show off what they could do, rather than just jump through hoops.

At the same time, we were also looking for ways to reduce the weight of the final exam in the unit which is traditionally high due to the perception that plagiarism is a major factor in in-term assessment in Computing: it is very hard to tell who wrote a program submitted by a student and so putting too much weight on this kind of assessment is risky. The portfolio, as a very individual and longitudinal assessment method was seen as one way to put more emphasis on in-term work in such a way that copying some or all of the work would be difficult and obvious to the marker.

Reflection by the students was not one of the original goals of the portfolio task except to the extent that it addressed the plagiarism issue – having students developing personal comments on their work to help ensure that the work is indeed their own. The commentary was also seen as a way of encouraging the students to plan their work ahead with earlier versions of the portfolio including details of proposed work as well as comments on what had already been achieved. The reflective comments were found to be most useful in assessing the work but quite difficult for the students to complete.

The portfolio assessment task was run first in 2007 in addition to the three other web programming assignments. It was worth 10% of the overall mark for the course and students were asked to complete three items of work and provide comments on each item. The portfolio was submitted three times through the semester; the first two submissions received formative feedback only while the last submission was graded. The goal here was that the feedback given on the first two submissions would be directly useful in improving the portfolio and hence the grade for the final submission. Students were given some guidance as to what they might include in the portfolio with part of each week's practical devoted to a suggested open ended task that students could include. It was suggested that at a minimum, students could include solutions to some of the practical problems set each week but that to get better than a pass grade, some kind of extension would be required.

In an earlier paper (Cassidy & Schwitter, 2007) we described the outcomes of this first experience with the portfolio task. It was generally well received by the students and resulted in a significant improvement in the rating for feedback in the unit evaluation questionnaire compared with the previous year. Students generally improved their scores over the three submissions and tended to use the feedback they were given to improve the work they presented. The task was seen as very strange by the students and there was a lot of misunderstanding as to what they were meant to do; many, including students aiming at high grades, said they would have preferred to have been told exactly what to do rather than having all of this freedom to be creative. The task did encourage the students to do some amazing work, exploring well beyond the material covered in lectures and tutorials.

Grading and providing feedback on the portfolios turned out to be very time consuming given the need to unpack submissions (we asked students to submit zip files), browse their web pages and run the programs they had written. We also wanted to compare the second submission with the first which required more juggling of files and manual switching between versions of their work.

At the end of that paper we identified three areas for future work:

- **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 programs have a better chance of working for the marker without undue effort.

Revisions for 2008

We set about making changes to the portfolio task for the 2008 offering of the unit. In terms of workload, we reduced the number of assignments to two and increased the value of the portfolio to 15% - effectively rolling the first assignment into the portfolio task. We also tried to make sure that students started their portfolios early by focussing the first couple of practical sessions on the task.

Most of the changes were around the implementation of special purpose web server software to manage submission and grading of the portfolios. One of the advantages of teaching a Web Technology unit is being able to ask one of last year's excellent students to help write the software to support this year's offering. We collaborated on developing software that would improve the experience of the students by providing more guidance on what they needed to put in their portfolio and provide support for staff browsing and providing feedback on the work.

Figure 1: An example page from the portfolio website

From the student's point of view, logging into the website provides a page with slots for an overall comment about their portfolio and each of their three pieces of work. In each case there is a clear location for their comments about their work as well as a place to upload the programs and web pages that they have written. Help is integrated into the website to give guidance on the ideas behind a portfolio assessment task and the use of the website itself.

The website is a little more than a place for storing files and comments on work due to the nature of the Web Technology unit. Students are required to write server-side programs which generate web pages (CGI scripts) so the portfolio server software needs to support running these programs. This is an added complexity that wouldn't be found in most other units and was the primary reason we wanted to write our own software to support the portfolio rather than use or adapt an existing product.

We called the intermediate submissions of the portfolio snapshots, the web server software made copies of the current state of each students work at the time that the submission was due. No action was needed on the part of the student to make a submission. The snapshot could then be used to provide feedback which could be viewed by students – the example page shown in figure 1 shows two prior snapshots in the block on the right, one of which has feedback for viewing by the student.

From the marker's point of view, the website gave easy access to the 80 student portfolios that were submitted. The marker gets the same view of the portfolio as the student, augmented with a marking rubric and comment box. Switching to earlier snapshots is simple so it is easy to evaluate the progress that a student has made or whether they have acted on the feedback they were given earlier. Significant effort was put into making the work-flow of the marker as efficient as possible so that the marker can concentrate on providing good feedback rather than the complexities of student submissions. Once feedback has been provided on the snapshot in the form of a comment and the marking rubric, the student is able to view the feedback and hopefully act on it to improve the final submission.

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Reflections on the Portfolio Task

Based on informal feedback, the reaction to the portfolio task from students is mixed. Most of the better students welcome the possibility of expressing themselves creatively but are concerned that the amount of work that they could put into the portfolio could exceed the value of the task in terms of assessment. These students are clearly being *strategic* in their approach to assessment (Biggs, 1999), putting in enough effort to get the grade that they want. Especially in their first year in Computing, students are used to having quite well defined assignments involving writing a program or completing a design; in these cases a good student can usually determine when they have done enough to get a good grade – for example, if they cover all of the test cases that have been given. The portfolio task is quite different because the task is deliberately ill defined and the grading criteria are much more qualitative than most other assessment items. It was clear that the better students made good use of the feedback they were given on the earlier submissions to improve their portfolio; particularly in the area of the comments on their work which improved significantly to match the quality of the work they had put together.

Many students in the middle of the class seemed to approach the task as just another assignment with the added complexity of having to submit it three times. It was clear from their comments that they were working to the intermediate and final deadlines for submission rather than thinking about the portfolio as a collection of things they had achieved through the semester. Many did little for the second submission but put a lot of work into the final portfolio that was graded.

Poorer students tended to be most confused about the portfolio task. Many submitted just solutions to set practical tasks with no commentary and did not change their portfolio between submissions except to add more work. Some submitted only the final version of the portfolio, missing out on any chance for feedback at all. The element that was most lacking was the commentary on their work, many finding it difficult to say anything about what they had done or why it might have been interesting.

From the marker's point of view, the new web based system was a significant improvement on last year. We were able to grade 80 submissions with a turnaround of less than a week providing comments on how the students might improve their work as well as a completed marking rubric that gave them a clear idea of what areas were weak. The server allowed comparison to the student's previous submissions and largely painless running of programs that they had submitted (some of the smarter students found bugs in our software which complicated things a little but we learned a lot from the exercise).

Pedagogically, the portfolio assessment task is a net improvement in the assessment for COMP249 but we have still not struck the right balance between creative freedom and guidance or workload and assessment value. The assessment made many of the students work harder and engage in the subject and was clearly a positive factor with many students reporting really enjoying the assessment and finding it rewarding. However, it is clear that students want this kind of engagement rewarded appropriately; if they can show mastery of the subject via an outstanding portfolio, perhaps we should be happy to reward them with a good grade rather than capping their achievement at the 15% value of the assessment task. Some students, if given the freedom, would construct something well beyond the programming tasks that we set them in assignments; it would be good to give them the option of doing this rather than jumping through the hoops that we set to guide the less able students.

One possibility is raised by Lister and Leaney (2003) who set different assessment tasks for different levels of achievement in his undergraduate computing classes. All students must

complete a pass level task but students wanting a higher grade complete more challenging tasks. Only those wanting distinction grades complete the most complex task. Lister found that most students attempted the credit assessment tasks but fewer selected the distinction task. A similar arrangement might be made with the portfolio task used for credit or distinction students to show their higher level of achievement while pass level students complete an alternative, more controlled collection of practical solutions.

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