

Dissertation by Portfolio - A Break from Traditional Approaches

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Abstract—Much has been written about the difficulties students have with producing traditional dissertations. This includes both native English speakers (L1) and students with English as a second language (L2). The main emphasis of these papers has been on the structure of the dissertation, but in all cases, even when electronic versions are discussed, the dissertation is still in what most would regard as a traditional written form.

Master of Science Degrees in computing disciplines require students to gain technical proficiency and apply their knowledge to a range of scenarios. The basis of this paper is that if a dissertation is a means of showing that such a student has met the criteria for a pass, which should be based on the learning outcomes of the dissertation module, does meeting those outcomes require a student to demonstrate their skills in a solely text based form, particularly in a highly technical research project? Could it be possible for a student to produce a series of related artifacts which form a cohesive package that meets the learning out comes of the dissertation?

Keywords—Computing, Masters dissertation, thesis, portfolio

I. INTRODUCTION

THE traditional taught MSc degree in computing disciplines requires a student to write a thesis based on a piece of research. At Sheffield Hallam University, depending on the structure of a 180 credit degree, this is normally either a 45 or a 30 credit module. The resultant thesis is approximately 10,000 words (30 credit) to 15,000 words (45 credit).

Since 2000, the composition of the student cohort has changed with a large increase in the proportion of international students who have English as a second language. In the Faculty of Arts, Computing, Engineering and Sciences at Sheffield Hallam University, there were, in 2009/10 498 new full time enrolments of which 413 were international students. The equivalent figures for 2002/3 were a total new enrolment of 320 or which 158 were international.

The total numbers of students has increased by 55% and the number of international students has increased by 161%. Home and EU student numbers actually declined by 47%. This was even more marked in the Department of Computing which saw one of the greatest increases in international numbers.

Writing a traditional thesis is one of the hardest things a student will have to do during their postgraduate studies. The difficulty is compounded where English is either their second (L2) or even third language. Marking schemes used at Sheffield Hallam University and other higher education institutions assign weight to English usage (for example,

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Seymour [11] discusses new approaches to assessment criteria at masters level, but still retains a component mark for English usage). The traditional thesis is not an end in itself for a postgraduate taught degree. It is an instrument to assess how well the student has met the learning outcomes for major project (called dissertation) in their degree. We will argue that the written thesis is not always the most effective instrument for demonstrating attainment of learning outcomes and we will present the concept of a portfolio made up of related artifacts which present evidence of meeting the learning outcomes of a research based study at taught masters' level in computing.

II. THEORETICAL BACKGROUND OF PORTFOLIO DISSERTATIONS

There is a lot of literature concerning writing of dissertations in L2. This has concentrated mainly on traditional writing and includes debate of such things as the importance of grammar and correcting it. Truscott [10], for example, claims that grammatical error correction has at best a negligible effect and at worst can be detrimental. Bruton [4] takes a different view, but makes the point that the debate is really about the last P in the PPP (Present-Practice-Produce) sequence. In both cases the artifact from the produce phase is regarded as being written evidence. What we are arguing here is that Present-Practice may be better evidenced by an artifact that is not in a traditional academic writing form.

This theme is continued by Bitchener and Basturkmen [3] who concentrate on the 'discussion of results' section of a thesis and the understanding of its function. Difficulties are acknowledged, but alternatives to written evidence of understanding are not considered, despite the acknowledged benefits of a viva voce examination.

Warshauer [12] considers the role of 'new' technologies and their place in academic discourse. The consideration here is of the "speech-writing hybrid of computer mediated discussion". In our argument, this recorded artifact could be evidence of meeting a learning outcome, particularly if a student was defending a position in their dissertation. Warshauer also raises the issue of L1 formalism and its relation to students who are L2.

The 'traditional' written dissertation of approximately 10,000 words is generally recognized as an opportunity for a learner to demonstrate a variety of M-level characteristics such as:

- higher-order problem solving;
- the use of analytical skills for complex problems;
- the selection of rigorous approaches and the presentation of data, leading to substantiated inferences;
- an ability to ground new work in the context of existing, peer-reviewed research;

- deep evaluation of both product *and* process;
- written communication.

In the case of a viva voce examination, oral communication, presentation and inter-personal skills are also tested.

Arguably these characteristics can be demonstrated in other ways, and in fact the written format of the dissertation may serve to constrain the learner unduly, particularly L2 students as noted by Truscott [11]. Related to this is the increased demand from employers for potential employees to demonstrate 'real-world' skills, which may in fact, be masked by the production of a written document. Although employers also want graduates who can communicate in writing, L2 learners from outside the European Union must return to their home countries, therefore are unlikely to be writing in English when they gain employment.

Also recognizing that the Postgraduate learner population in computing at Sheffield Hallam has changed radically in favor of L2 learners, there is a compelling argument to be critical about what the MSc Dissertation stage should achieve. This is also an opportunity to explore whether the Dissertation process can be enhanced to improve the flexibility of contributions that might be demonstrated as being M-level.

III. WHAT IS A PORTFOLIO?

A separate theme from written dissertations in the literature is the use of portfolios in the assessment of students. The majority of the literature here concentrates on undergraduate teaching and assessment. In these cases the portfolio often consisted of unrelated pieces of work, rather than artifacts relating to an integrated project. Woodward and Nanlohy [13] for example, looked on portfolios as a resource to be used after graduation by students on a teacher education course. Barrett [1] considering e-portfolios in a business school context saw them as more integrated and a resource to help graduates gain employment. He also saw them created as a collaborative effort with the academic tutor. This approach does not fit the assessment model being considered here, but does demonstrate the value of a portfolio on graduation. Klenowski, Askew and Carnell [8] did consider portfolios in postgraduate programmes (but not as an alternative to a dissertation or thesis). They raised the issues of what a portfolio is and the problems of student perceptions. Clarity of purpose was raised as an issue with a tension between gathering evidence (artifacts) and analysis and integration. Analysis and integration is key to the concept of dissertation by portfolio if the portfolio is not to become a collection of unconnected artifacts. Although not explicitly discussing portfolios, Edminster and Moxley [6] presented the idea of Electronic Theses and Dissertations (ETDs). Although these could be in the form of a portable document file (pdf), they are 'increasingly in more sophisticated formats such as HTML and XML and include color images, streaming multimedia, animation and interactive features' (p. 90). Pullman [9] put forward a similar argument and did explicitly mention portfolios, but saw the portfolio as a single artifact rather than a collection of artifacts.

Barrett [2], looked at the development of portfolios and her work goes some way to resolving the clarity of process issue. Also working in the context of teachers developing electronic portfolios, she defined the development of a portfolio as consisting of the following stages:

- Define the context and goals
- The working Portfolio - collect, interject
- The reflective portfolio - select, reflect, direct
- Connected Portfolio - inspect, correct, connect
- Presentation portfolio - celebrate.

In Barrett's terms, these portfolios had the objectives of being a method of professional development resulting in a teaching resource. It therefore was a different context to masters level information technology dissertations, but the development stages provide a useful roadmap to portfolio development in general.

In the case of dissertations, the portfolio is seen as a means of supplementing the traditional dissertation format so as to enable a wider range of relevant skills and characteristics to be presented. There are also potential benefits in terms of how the process of building a portfolio can further improve learners' abilities, especially for employment and life-long learning, a primary concern of Barrett [1].

Therefore, a portfolio at M-level must be more than just a collection of pieces of work. There needs to be an integrated theme which links the artifacts in the portfolio (and at least one artifact should be used to evidence this). The learner must demonstrate that they are able to produce evidence of their work, but also be able to appraise and select appropriate examples that justify their claim to be at M level. This corresponds with the views of Kimball [7] who, although looking at e-portfolio tools, discusses the central concepts of the pedagogy related to portfolios.

Table I illustrates the constituent parts of a portfolio. Each of the table elements can be regarded as evidence. This evidence then needs to be tied to the learning outcomes of the dissertation to make sure it is relevant and part of a cohesive whole.

TABLE I

DESCRIPTION OF THE VARIOUS ASPECTS OF A DISSERTATION BY PORTFOLIO

Aspect	Description
Artifact (many per DbP)	A tangible product that documents an activity or experience. This can be an audio file, video file, picture or pictures, written text (report, email, feedback, online discussion, project plan), diagram, table, model, design or anything that is produced as a result of some relevant activity.
Annotation (many per DbP)	A description that shows <i>what, by whom, when</i> and <i>why</i> the artifact was produced. It should also explain <i>'what'</i> it shows; some problem solved or learning progression. For instance a learner might select an artifact produced as part of work performed with others. <i>What</i> was the individual learner's (<i>whom</i>) contribution? <i>When</i> was it produced (at the outset as an indicator of their prior understanding; part way through; at the end as a demonstration of development)? <i>Why</i> was the artifact produced?
Critical reflection (many per DbP)	Looking at the artifact and its annotation, critique the inclusion of the artifact and state what has been learned as a result. It would be prudent to indicate how the learner's thinking has led to the production of this artifact, and how the artifact has led to changes in how they will approach future tasks as a consequence. <i>Why</i> was it included within the portfolio? <i>What</i> does it illustrate about their learning?
Overall reflective commentary (one per DbP)	A scholarly piece of writing that connects the evidence together to 'make sense' of the individual items. Essentially this aspect takes the individual pieces of evidence and tells a story about what has been achieved over the duration of the work. The 'scholarly' aspect is satisfied by an individual relating their ideas to grounded literature. The primary emphasis here is about reflecting about the processes used and experienced whilst conducting the work. This may be informed by industrial approaches (software development or project management models) and also developmental approaches (professional development frameworks, learning theories, communities of practice, etc.).
Index/contents (one per DbP)	Some form of indexing that enables the reader to navigate the portfolio. The structure of the portfolio must be made explicit and should provide at least two routes through the content: <ol style="list-style-type: none"> 1. A defined route that indicates which pieces of evidence should be looked at in which order, and 2. A table of contents that allows an assessment of individual pieces of evidence to be scrutinized in any order. Option 1 might be provided as a by-product of the 'Overall reflective summary' if the narrative itself clearly indicates which pieces of evidence are specifically referred to. However the inclusion of the reflective summary does not necessarily mean that it has been presented in a way that Option 1 above has been satisfied.
Mapping matrix of criteria to evidence (one per DbP)	A table that relates each piece of evidence to the relevant assessment criteria. If the portfolio is electronic, this can be used as a supplementary means of navigation by hyperlinking references to each piece of evidence.

A. Evidence

It is important to understand what is referred to as *evidence*. For the purposes of a portfolio a piece of evidence can be one or more artifacts and associated annotation and critical

reflection. These three aspects are identified in the grey boxes of Table I.

It is the understanding of what evidence is that serves as the key differentiator of a dissertation by portfolio from a more traditional Dissertation. If a learner chose to base the portfolio upon their own development as a professional, the learner *themselves* would be a *product* upon which a developmental *process* is applied. A dissertation by portfolio is a format that lends itself to the more flexible style of presentation that might be required to demonstrate some of the creativity that could emerge.

The basis of evidence is the artifact or artifacts that are produced by the learner or as a result of their experiences.

Examples of artifacts include:

- scholarly/technical/reflective/creative writing
- description of an experimental method/approach
- critical evaluation of an idea/method/approach
- audio recording of a structured interview
- video recording of a tutorial or a topic being explained
- screencast of an application being demonstrated
- excerpt from an online discussion/email exchange
- edited collection of singular artifacts into one artifact - a collection of annotated screen shots describing a complex topic/implementation approach/software design, etc.

Of course this is not an exhaustive list. A portfolio would normally consist of many pieces of evidence.

B. An Integrated Portfolio

To tie the pieces of evidence together to create an integrated portfolio, there also needs to be:

- Overall reflective commentary;
- Index or contents;
- Mapping matrix of criteria to evidence.

The last two points can be combined. The subject of the portfolio should be a case study that will be used to generate the evidence required. This case study would be a negotiated project between the learner and the supervisor.

C. Portfolio Development

The process of developing a portfolio is shown in figure 1. This roughly follows Baret's [2] steps in the development of a portfolio and addresses the issue of clarity of process raised by Klenowski, Askew and Carnell [8].

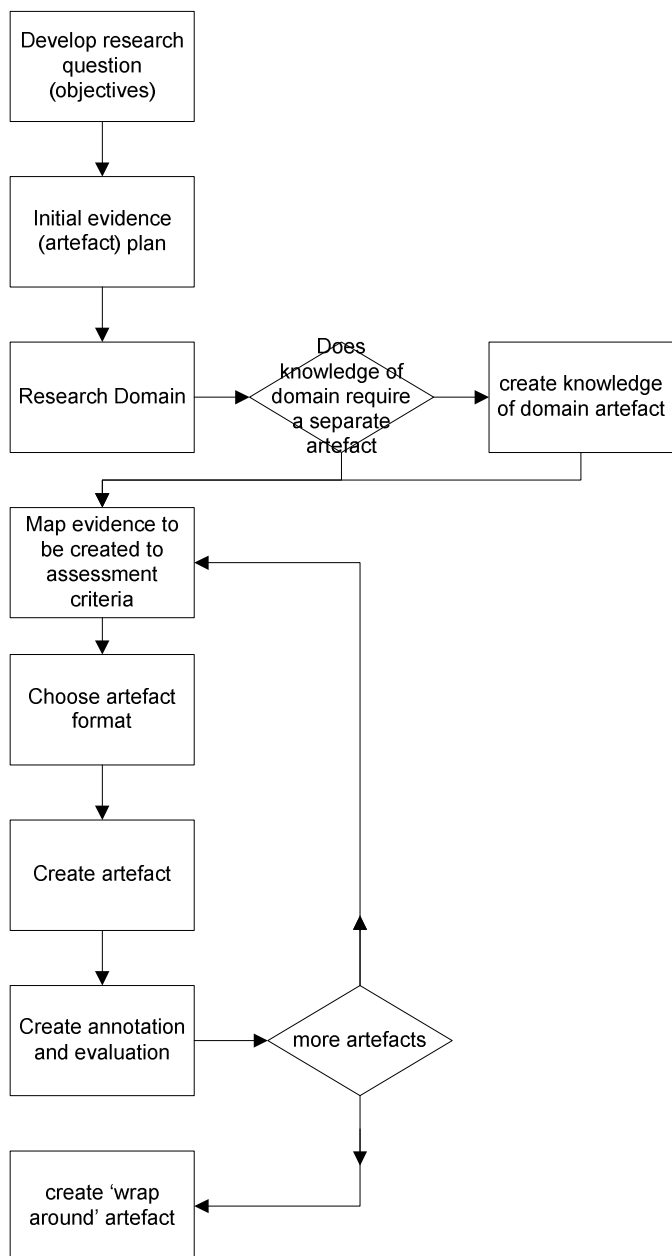


Fig. 1 A roadmap for development of a dissertation by portfolio

D. Assessment criteria

Whilst the learner may have engaged in a different learning process as a result of undertaking a dissertation by portfolio, the assessment criteria are no different from that of the traditional written dissertation which are:

- Knowledge of the domain;
- Justification of the approach;
- Description of the research and discussion of the outcomes;
- Quality of the report (portfolio in this case) and presentation of the argument.

For each of the criteria above, a dissertation by portfolio must include 3 pieces of evidence. Therefore in total a dissertation by portfolio will normally present:

- A minimum of 3 artifacts each with an annotation and critical evaluation (9 pieces of evidence);
- One overall reflective commentary;
- An associated index or contents to enable navigation of the content (figure 2);
- A matrix that relates the criteria to each piece of evidence (which may be incorporated in the contents).

Dissertation by Portfolio	
Table of Contents	
Abstract	Abstract.AVI
Artifact name: Methodology	
Learning Outcome(s) Addressed	Justification of the approach
Format and Location:	methodology artifact cove.pptx
Annotation:	annotation for methodology artifact.docx
Critical reflection:	critical reflection of methodolgy.docx
Artifact name: Literature Review	
Learning Outcome(s) Addressed	:Knowledge of the domain
Format and Location:	word file, literature review artifact cover.docx
Annotation:	annotation for literature review artifact.docx
Critical:	critical reflection of literature review.docx

Fig. 2 Part of a table of contents with hyperlinks to evidence shown

Whilst the dissertation by portfolio must include the constituent parts above to be complete, the overall reflective commentary and the matrix should be judged within the portfolio as a whole and do not require specific assessment criteria of their own. In particular the reflective commentary will also serve to substantiate all four of the Dissertation assessment criteria.

IV. RESULTS

In the pilot, 4 students elected to submit dissertation by portfolio out of a total of 92 computing students. Of these 3 passed, but none gained more than 60%. The remaining student failed to submit. The overall average score was comparable with students submitting a traditional written dissertation, but this sample was too small to correlate with Chang's [5] study. In this it was suggested there was no significant difference in student achievement on portfolio dissertations compared with traditional dissertations.

As part of the pilot a number of templates were developed with the students to guide them in the development of their portfolios. These included:

- Artifact template (figure 3)
- Annotation template

- Critical reflection template
- Overall reflective commentary template
- Contents template (figure 1)

Dissertation by Portfolio Artifact	
Project Title:	
Student Name:	
Student ID:	
Artifact Name:	
Format (for example: web address, doc/ pdf/ wav/ ppt file....)	
Learning Outcome(s) Covered (place X in appropriate box(s)):	
Knowledge of the domain	<input type="checkbox"/>
Justification of the approach	<input type="checkbox"/>
Description of the research and discussion of the outcomes	<input type="checkbox"/>
Justification for Inclusion in Portfolio (Annotation): 	
References	

Fig. 3 template for an artifact cover

After the completion the pilot a sample dissertation by portfolio was developed by the author and put through the assessment process in the normal way. This will be used as an example of a pass level piece of work and serves as a basic benchmark for the next cohort of students.

The templates, the sample dissertation, its assessment and feedback and other resources have been made available via Sheffield Hallam University's virtual learning environment.

V. FUTURE WORK

A second pilot is being conducted over the summer of 2011 where students will be given the aids developed in the first pilot and access to the sample dissertation by portfolio. The evidence from these new portfolios will be used to refine the dissertation by portfolio process. Students completing a dissertation by portfolio will be interviewed about their experience.

Refined guidelines will be made available for those starting their dissertation in September 2011 and a comparison will be made will L2 students undertaking a traditional dissertation.

If there are sufficient numbers opting to develop a portfolio, the student achievement levels will be analyzed to validate the findings of Chang [5].

VI. CONCLUSION

Initial results suggest dissertation by portfolio is a valid alternative to the traditional written dissertation. Although it is not suggested they be a replacement for traditional dissertations, they should be considered as an alternative. The biggest initial obstacle was giving an indication of what one could look like. This has now been overcome by presenting students with a 'pass' sample complete with marking and

feedback as to how it could be improved. Students can demonstrate they meet the same learning outcomes as with a written dissertation.

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