

Using e-portfolios to support trainee Design and Technology teachers in developing their subject knowledge

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Key Words: e-portfolios, web 2.0 technology, constructing knowledge, assessment, knowledge organisation and congruent teaching

Abstract

Stefani, Mason & Pegler (2007) reflect that the underlying pedagogy with e-portfolios is based on 'constructivist educational principles'. Our emphasis in this research was for the e-portfolio to be a student led development process rather than teacher/lecturer led, with the student creating their own resource of their knowledge and understanding, reflecting on their progress and identifying their own learning needs and understanding. Online technologies, sometimes referred to as 'web 2.0' tools, such as blogs, e-portfolios and wikis allow learners and educators to learn more, create more and communicate better (Richardson, 2010).

Students in the second year of an undergraduate teacher training programme are beginning to think of their future careers as design and technology teachers, developing their awareness of what sort of teacher they want to be and what skills they want to develop. To support the students they are asked to evidence their growing range of skills, knowledge and understanding in particular areas of Design and Technology education through the use of an e-portfolio.

As future design and technology teachers, the students were encouraged to make a start at building up their own online learning resources. This will hopefully lead to a growing body of knowledge that they can draw on in their subsequent careers. At the same time, and for purposes of assessment, it provides evidence of their learning. A significant reason for using e-portfolios is to enable the students to share information outside the constraints of time and place, i.e. asynchronous learning (Garrison, 2003).

Asking students to develop an e-portfolio presented them with an alternative way of recording their learning. Learning was gained from their experiences even if their experiences were regarded as failures, such as ruining a sand-cast aluminium part (the process, background information and the student's reflections were recorded). The expectation was that students would find this an easier medium to evidence their learning rather than through a folder with notes and diagrams.

It is hoped that students will continue to use their e-portfolios long after the end of the assignment period or learn from their experiences to create new and better personal e-portfolios. It is anticipated that these e-portfolios will accompany the students well into their teaching careers continuous education (Attwell, 2007) allowing them to build up useful resources and ideas.

This case study gives some direction towards improving the effectiveness of using e-portfolios in developing trainee teachers' subject skills and their use of online learning resources.

Introduction

The purpose of this study is to explore design and technology education students' activity and their use of e-portfolios as a device for developing their own subject knowledge and understanding and how they use it to reflect on their progress and identify their own learning needs and understanding.

This paper consists of four parts. After the introduction, the second section outlines the context of the study, which highlights the authors' common philosophical perspectives and views on how e-portfolios are to be used in Initial Teacher Education. Thirdly, the paper will present an analysed case study, chosen to enable the authors to allow 'new lines of thinking to emerge' (Eisenhardt, 1989) during the exploration of collected data. The paper concludes by presenting identified implications from the analysis.

Context of the study

Department Philosophy

The case study focusses on students in the second year of a three-year undergraduate BA (Hons) Secondary Design and Technology Education course in a post-1992 University based in the East Midlands, UK.

The authors ascribe to the view of teachers, including trainee teachers, who construct their own knowledge and determine their own priorities for learning. Within a design and technology setting the authors believe that this can be done through solving problems in design situations: 'what do I need to know/find out to solve this problem?'

Combining self-constructed learning and the use of emerging technologies, e-portfolios can be a powerful tool in supporting the students' ability to construct knowledge (Tam, 2000). The portfolio enables students 'to record information for future reflection and objective analysis'.

Students in the second year of the undergraduate Technology Education course are beginning to think of their future careers as design and technology teachers, developing their awareness of what sort of teacher they want to be and what skills they want to develop. Subject knowledge is determined by the Design and Technology Association (D&TA) minimum competencies for design and technology teachers (Design and Technology Association, 2010). To support the students they are asked to evidence their growing range of skills, knowledge and understanding in particular areas of Design and Technology education through the use of an e-portfolio.

Swennen, Lunenberd & Korthagen (2008) call 'congruent teaching' when 'teacher educators should not confine themselves to (1) modelling, but should also (2) explain the choices they make while teaching (meta-commentary), and (3) link those choices to relevant theory' (pp. 531); The teacher educators/ lecturers of this course ascribe to this philosophy and the use of web 2.0 technologies in departmental assessment and teaching is one example of the authors' congruent teaching. Web 2.0 tools, such as blogs, e-portfolios and wikis, allow learners and educators to learn more, create more and communicate better through collaboration online (Richardson, 2010)

The lecturers use web 2.0 technologies as part of their planning and departmental activity, for example a wiki and Twitter was used to coordinate our research, plan the structure of the paper and edit. In their classroom practice the authors use web 2.0 technologies, such as wikis, discussion forums, blogs and screencasts as part of their teaching. Explicit links (meta-commentary) are made between the student learning and teaching strategies. Finally, links are made to relevant theory related to web 2.0 technologies in the classroom.

The department's philosophical viewpoint of congruent teaching is to also model the use of our classroom practices to influence the students' future practices as a teacher in design and technology; the hope is that use of e-learning technologies with university classes will positively influence

their use when teaching design and technology in schools. E-portfolios are primarily used in design and technology assessment, for example for GCSEs (General Certificate of Secondary Education) at the age of 16 (OCR, 2009: 49). The authors see their use as more than an assessment tool, as an online scrap book and sketch book which can be referred back to when designing and making in design and technology.

Stefani, Mason & Pegler (2007) reflect that the underlying pedagogy with e-portfolios is based on 'constructivist educational principles'. Within one of the course modules the use of e-portfolios was formalised as a reflective and developmental tool as well as a method of assessment. This meant that students had to compile an e-portfolio of their own developing work. The emphasis was for the e-portfolio to be a student led development process rather than teacher/lecturer led, with the student creating their own resource, gathered from their knowledge and understanding, reflecting on their progress and identifying their own learning needs and understanding.

In summary, the authors' position with regard to the work to be carried out for this taught module and subsequent research:

- Student/ designers develop the needed knowledge as part of problem solving a design situation
- Congruent teaching: the tutors for the module are demonstrating a method of learning which our trainee teachers can use with pupils in schools
- Students construct their own knowledge through open tasks and personal engagement with the e-portfolio
- Producing work helps students to construct and build on their own learning

E-portfolio

The e-portfolio tool used by the students is held within the university's virtual learning environment (VLE); it has a number of areas within it (Figure 1).

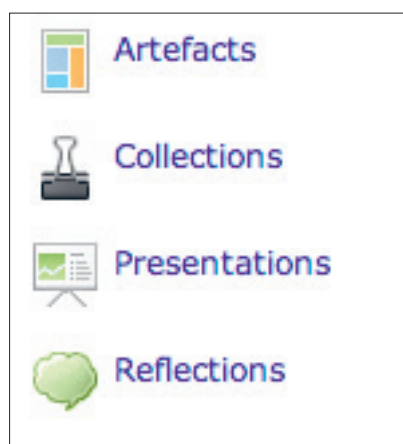


Figure 1: screenshot of areas within the e-portfolio

The three areas used by students, and referred to in this paper, are:

1. Artefacts are files or forms that students add to their e-portfolio. They can be reflected on, shared with others and displayed in presentations.
2. Presentations enable students to showcase work by selecting artefacts, reflections, and comments to present through one or more web pages.
3. Reflections are a way for students to record thoughts. Students can reflect on existing artefacts and presentations, or can create independent reflections that aren't associated with other items in the portfolio.

(Desire2Learn, 2012)

Other users of the VLE can be invited to view, review or comment on any of the artefacts, presentations or reflections within a student's e-portfolio. The two researchers who assessed the module were invited by students to review and comment on their presentations as part of the assessment process.

Assessment method for the module

The e-portfolio was used by students for two modules: Product Design and Advanced Manufacturing; for this case study we are only considering the e-portfolios produced in Advanced Manufacturing. The module is assessed through:

1. Manufacture a reasonably complex apparel (textiles) product from supplied drawings.
2. Manufacture a reasonably complex product from supplied drawings.
3. E-Portfolio of evidence: Place artefacts into the e-portfolio area of NOW and create a presentation for the Resistant and Textile Materials skills audited from the Design and Technology Association's Minimum Competencies for Trainees to Teach Design and Technology in Secondary Schools (Design and Technology Association, 2010)

Learning outcomes (assessment criteria) and the minimum competencies for becoming a design and technology teacher were shared. It was routinely suggested that students might explicitly link the e-portfolio to these structures.

Analysed case study

Research method and question

The research is an exploratory, single within-unit case study (Baxter & Jack, 2008; Gerring, 2004); the unit was the sixteen students studying the advanced manufacturing module, the case is the students' e-portfolio work relating to this module. The case study method was chosen due to the cohort size been small ($N=16$) and the researchers wanted at this stage to only explore the use of the e-portfolio. The case study method allowed us to 'illuminate features' (Gerring, 2004:343) which may 'pertain to a broader' unit (Gerring, 2004:344). As a team we want to continue using e-portfolios and through this exploration hoped to identify features which would develop our personal use and students' use of web 2.0 technologies, specifically e-portfolios.

The study was structured to collect data from three different sources:

- Semi-structured reflections by the students
- Module evaluations and
- Evidence from the students' presentations submitted for assessment.

This data was discussed and analysed by the researchers after the completion and assessment of the module.

The authors had two main reasons for retrospective analysis, ethics and distance between completion and reflection. Two of the researchers (Researchers A & B) were module tutors and assessed the work of the students, the third researcher (Researcher C) is the students' course leader therefore to avoid compromising the students' assessment the students' reflections were completed after work had been returned. Secondly, a proposition of the research was the students' value of the e-portfolio beyond its use for assessment and so by asking students to reflect on their use of the e-portfolio after a period of not using it the researchers were hoping the students would look back with a more objective view, in order to consider how they might use their e-portfolio in their teaching careers.

Researcher C administered the student reflections several weeks after the students had received their assessment marks and feedback. The reflections were completed online in an elec-

tronic form, which once saved, became an artefact within the students' e-portfolio. Of the sixteen students, fifteen completed the electronic form.

The research question was: how effective is using e-portfolios for developing trainee design and technology teachers' subject knowledge?

Findings and analysis

The authors thought students would use the e-portfolio initially to collect evidence of their subject knowledge that they would reflect on as part of their process for constructing knowledge. Analysis of their reflections and evaluations contradicts this, ten of the students reflected that collecting evidence within the e-portfolio was a method for recording evidence and others for organising work:

'... it was a tool used to record the practical activities...' Student C (line 5)

'I added pictures and videos to my e-portfolio to show what I had done through the unit' Student P (line 20)

'...helped me to organise my work....' Student K (line 5)

A variety of approaches were taken for organising the presentations, three different approaches are evidenced in figures 2-4:

- Individual pages representing each learning outcome (Figure 2)
- one or several minimum competencies presented on a page (Figure 3) and
- each page focussing on an activity or process (Figure 4).



Figure 2: Organised using the learning outcomes (student Q)

Stool

Dressing table Stool

Linking to the Audit

M.M.3.1 - using the properties and working characteristics of wood, metal and plastic to meet design requirements.

M.M.3.2 - accurately mark out, using appropriate hand tools and taking into account of critical dimensions and tolerances when using wood, metal and thermoplastics.

M.M.3.3 - accurately cut and waste, by hand and basic machines, wood, metal and plastics to efficiently achieve appropriate fit and finish.

M.M.3.4 - accurately deform, form and fabricate by hand and using basic machines.

M.M.3.5 - effectively join wood, metal and thermoplastics using appropriate hand techniques and basic fixing methods.



When marking out the mortise on the legs of the stool, there are the two different depths which I had to consider, the tenon depth and the haunch depth. This is marked out at the top of the legs for the cross braces and a third of the way down for the foot braces which don't need the haunch depth, also taking into account the distance of the offset cross bracing to the edge of the legs. This was all taken into account when accurately measuring.

Figure 3: Organising related to Minimum Competencies
(Design and Technology Association, 2010) (student H)

<p>Metal fabrication</p> <p>Metal forming and casting</p> <p>Plastics forming and moulding</p> <p>Timber fabrication</p>	<h2>Metal forming and casting</h2> <h3>Pewter casting</h3> <p>Once I had used the lazer cutter to form my mdf mould, I melted the metal down to a pewter using a blowtorch and poured this into my mould, which had been clamped tightly together.</p> <p>Making sure the metal didnt overflow was difficult as the hole for the metal to go down was quite small, I could solve this problem by next time making the hole for the metal to flow through a bit bigger.</p> <p>Once the metal had cooled I was able to take apart the mould and take out my metal product!</p>
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Figure 4: Organising using activities/ processes (student A)

‘By setting out the presentation pages under the headings of the LO (learning outcome) I was able to make sure that I met each of the LOs’ Student Q (line 21)

Some were quite emphatic in their response to the question, ‘To what extent did the e-portfolio affect how you developed your subject knowledge?’:

‘the time spent on the e-portfolio could have been time spent actually learning more about other areas of the assignments.’ Student A (line 5)

‘i found it time consuming to update frequently and this would mean it would get in the way of important work.’ Student M (line 5)

In their reflections, fourteen of the students said the e-portfolio did not help them develop their subject knowledge, only one student (student H) commented that the ‘amount of words’ she wrote whilst compiling her e-portfolio helped her develop her knowledge.

Analysis of the modules evaluations suggests that it was the ‘practical hands on tasks’ that helped some of them to learn new skills.

‘using new techniques to produce my stool’ Student H

‘being able (to) do what we wanted with making the stool’ Student F

Evidence from the student reflections and their e-portfolios indicated development of personal subject knowledge resulting from meeting the assessment rather than from using the e-portfolio. Student L commented ‘...the learning outcomes were something to meet on the e-portfolio, by meeting these I developed my knowledge a bit.’ (line 6).

There is a difference of perception between the tutors and the students, in some cases:

Student D: ‘ this didn’t show I could do any advanced manufacturing work – it showed I could upload pictures and write about them’ (line 18)

Looking at the description of the image (Figure 5) recorded in student D’s presentation the authors decided that this student is constructing knowledge and this would lead to the student determining their own priorities in their learning. However, it is not the e-portfolio that is determining this but the student reflecting as they are planning the making of the stool.

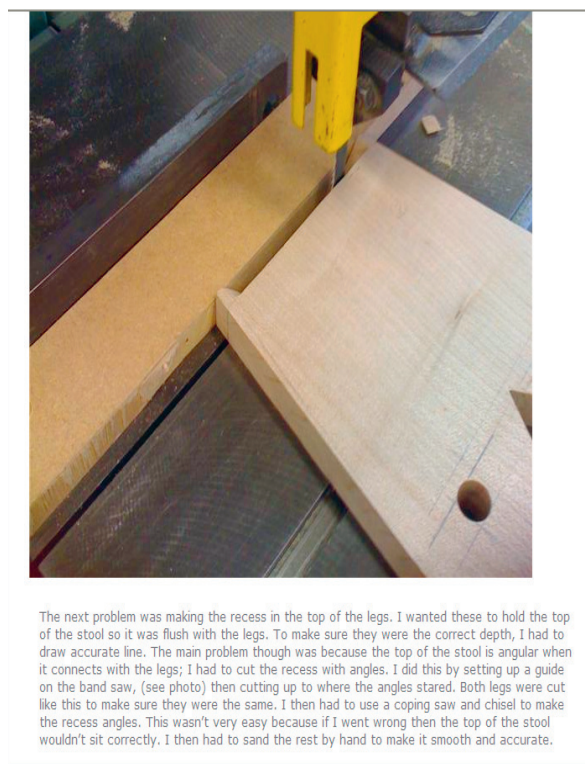


Figure 5: evidence of reflection from student D’s presentation

Some students did however identify that the e-portfolio had supported their own reflections:

‘I feel that I was able to reflect more as I could look at what I had achieved, consider the problems I overcame and consider what I would do if I were to do it again.’ Student Q (lines 11-13)

‘Reflecting on my work was useful, and certainly made me think about where my next improvements could be made.’ Student M (line 18)

Evidence of students reflecting on material choices and design decisions was seen in several presentations (see example in Figure 6 where the student discusses the decision making about material choices through modelling their stool (figure 7)).

Stool project

Material Selection

I wanted to use oak because it can be finished to a high standard, it's aesthetically pleasing and has good strength. (Albert 2005) When I was making a model of the base of the stool from pine it kept splitting, the mortise joints are quite big compared to the amount of wood left to support the weight (see back view of stool) so I needed to use a hard wood. I used a coat of sanding seal (water and PVA) and then briwax to finish the wood because I wanted the grain to be visible and natural.

I used aluminium for the legs; I had considered using stainless steel but it was much more expensive and would be considerably heavier. The aluminium I used has a good strength to weight ratio and can be easily polished to a high standard. (Hicks 1975). However the aluminium legs mark easily and although shine well when first polished they dull due to the surface oxidization.

Figure 6: screenshot of student L's reflection on material choices

Figure 7 (figures 5-6): Screen shots of student L's modelling and finished stool

The main issue for students was the actual e-portfolio tool, particularly its design and uploading limitations. Some students commented that the inflexibility of the presentation caused them frustration. The students are familiar with the instant access of websites such as Flickr and YouTube where pictures and videos can be uploaded using mobile phones and tablets; the e-portfolio tool used at the university doesn't have this facility so students could only upload one artefact at a time and had to be at a computer to do this.

Identified implications from the analysis

The research question for this case study was to evaluate the effectiveness of the e-portfolio tool in helping students develop their subject knowledge. Reflections from the students and observation by the authors do not agree that the e-portfolio has made this happen in any meaningful way. However the evidence from the reflections and the completed e-portfolios have led the authors to believe that the tool has had a positive benefit in helping students organise their knowledge and structure their work. In drawing conclusions from the analysis of the findings the authors have identified the importance of the module learning outcomes (assessment criteria) in supporting the students with their individual progress and identification of the next steps within their learning. Organisation is a big part of the students' development in knowledge construction and the authors have begun to look towards knowledge organisation, through the e-portfolio presentation tool, and as a precursor to knowledge construction.

The process of organising knowledge demands that knowledge is first acquired. Knowledge is gained by new experiences, doing and being told information. We group and categorise knowledge into concepts as we develop, and concepts themselves change as knowledge grows and is refined. In our case, the concept of how to make a stool grows by looking at different types of stools – legs, seat, joints, seat back. It leads to knowing how a stool can be made, what materials can be used and what skills need to be learned – through observation and experience.

Looking back at the research question: how effective is using e-portfolios for developing trainee design and technology teachers' subject knowledge? The authors have identified that through structured organisation, the students are being selective in promoting evidence of important knowledge they had gained and they are using the tool to record information, with the growing start of some future reflection.

It is hoped that students will continue to use their e-portfolios long after the end of the assignment period or learn from their experiences to create new and better personal e-portfolios. It is anticipated that these e-portfolios will accompany the students well into their teaching careers continuous education (Attwell, 2007) allowing them to build up useful resources and ideas.

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