Portfolios in Design and Technology Education: Investigating Differing Views

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Abstract
In many professions, portfolios constitute a primary method of documenting proficiency, skill, style and talent by showing examples of actual work. However, the multiple purposes of portfolios in design and technology education have given rise to problems. The conversion of a portfolio into a product has become a significant problem, as have the constraints imposed by examining bodies.

This paper will describe a research study that investigated the use of portfolios in professional practice, initial teacher education and secondary design and technology education. Separate focus group interviews were conducted with professional designers, teacher educators and secondary school teachers of design and technology education in both England and Canada. Questions asked of participants focused on definitions and the advantages and disadvantages of using a portfolio, as well as the particular purposes of portfolios in the context of the professional work of each group. Audiotapes of the interviews were transcribed verbatim. Analysis of the data involved thematic analysis and concept analysis.

Preliminary analysis of the data has identified that professionals use four types of folio, each for a quite different purpose. These findings have given rise to questions about how these four types of folio could be used to enhance teaching, learning and assessment in design and technology education, and to what extent the adoption of these four types of folio could resolve the conflict between the portfolio as a teaching and learning tool and the portfolio as an assessment instrument.

Key words: design and technology (D&T) education, authentic assessment, portfolios, constructivist learning.

Introduction
The multiple purposes of portfolios in D&T education have given rise to problems. For example, in England the Office for Standards in Education (2000) noted that attainment in D&T education is often limited because students spend too much time on superficial work associated with the presentation of their portfolios at the expense of the main core of designing and making activities. According to McCormick & Davidson (1996), the ritualization of designing, the conversion of a portfolio into a product and the constraints imposed by examining bodies have become significant problems in design and technology education.

This paper is in four parts. First, it will review the literature describing portfolios as a teaching, learning and assessment tool and some implications of constructivist views of learning for using portfolios in design and technology education. Second, the paper will describe a research study that investigated the use of portfolios in professional practice, initial teacher education and secondary design and technology education. Four research questions drove the study:

(a) How do professional designers use portfolios to enhance creative product design?
(b) How do secondary school teachers use portfolios to enhance creative product design with students in design and technology education?
(c) How do secondary school teachers use portfolios to assess creative product design with students in design and technology education?
(d) How are portfolios used with teacher candidates in design and technology education?

The third section will report results from a preliminary analysis of the data that identify four types of folio and their uses. Finally the paper will offer suggestions for using these four types of folio for teaching, learning and assessment in design and technology education.

Review of literature

In many professions including art, architecture, and photography, portfolios constitute a primary method of documenting proficiency, skill, style and talent by showcasing examples of actual work. In an educational context, a student's portfolio has several essential characteristics:

> First, it is purposeful. There is a clear reason why certain works would be included and how the portfolio is to be used. Second … the portfolio represents a systematic and well-organized collection of materials that make up a sample … of student work. Third, pre-established guidelines are set up so that it is clear what materials should be included. Fourth, students are engaged in the process of selecting some of the materials and … continually evaluating and reflecting on their work. Fifth, based on clear and well-specified scoring criteria, progress is documented with … evaluations. Finally, conferences are held between teacher and student to review progress, identify areas that need further improvement, and facilitate student reflection. (McMillan, 2004:235)

Constructivist views of learning

In contrast to past, mechanistic theories of knowledge acquisition, learning is now understood as an active process of mental construction and sense making (Shepard, 2000). Intelligent thought involves self-monitoring and awareness about when and how to use skills, and expertise develops as a principled and coherent way of thinking and representing problems, not just as an accumulation of knowledge. Effective instruction does much more than present information to students: it provides an environment that engages the student in active learning that connects new information with existing knowledge (McMillan, 2004).

Authentic assessment examines a student's ability to use knowledge to perform a task that is similar or reflects those encountered in life outside school (Herman, Aschbacher and Winter, 1992). Portfolios are one authentic assessment tool requiring the active construction of meaning rather than the passive regurgitation of isolated facts. Burke and Rainbow (1998) describe how a portfolio can be used to provide an evolving picture of students' learning and progress in a variety of areas, including technical skills, self-learning, metacognition, improvement over time, and establishing next targets.

Method

The research method employed in this study used a case study design (McMillan & Schumacher, 2001). Purposefully sampled, that is 'information-rich cases for study in-depth' (Patton, 1990:169) groups of professional designers, teacher educators and secondary school teachers were invited to attend separate focus group interviews. Following Morgan (1998) ten participants were invited to each interview. The response rate to these invitations was low. In England, two professional designers, six teacher educators and five teachers responded to the invitation and subsequently participated. In Canada, five professional designers attended a focus group interview. Because of the travel distances involved, it was decided to send written questionnaires to Canadian teacher educators and teachers. Two teacher educators and four teachers responded to the questionnaires.

The development of the questions for the focus group interview and questionnaires and the analysis of data were informed by the work of Morgan (1998). General questions focused on definitions and the advantages and disadvantages of using a portfolio. Specific questions focused on the particular purposes of portfolios in the context of the professional work of each group. Each focus group lasted a maximum of two hours. A facilitator's guide was used to moderate the interviews (Munby et al., 1999). Each focus group was audio taped. Tapes were transcribed verbatim. Analysis of the data required thematic analysis and concept analysis (Miles & Huberman, 1994; Silverman, 1993).

Results

Definitions of the phrase "design portfolio"
Professional designers were unanimous in defining a portfolio as a showcase (McMillan, 2004) of their work:

> When I talk about portfolios I mean normally the traditional black folder that contains your best pieces of finished work that you take along when you're trying to get a job. (PD1)

> A portfolio to me is either something somebody's presenting to me as a collection of their best work or I'm presenting to somebody else a collection of our best work.… For [me] the design portfolio is us marketing and selling our business to other people. (PD2)

Teacher educators defined a portfolio in two ways. First, it was a product that could contain a variety of media and be in a variety of formats:

> When I hear the word … portfolio the immediate image that screams to mind is the … pupils' production of … 22 pages of A3 sheets of their … examination coursework. (TE3)
>
> Generally speaking … a pile of A3 papers most of which have writing and sketching on them. (TE6)
>
> It is two-dimensional, three-dimensional, it's electronic. (TE4)

Second, the portfolio was a record of students' thinking as they progress from design brief to prototype:

> A portfolio is a combination of two-dimensional, three-dimensional entities and artifacts which tell a story … of the thinking that's going on. (TE1)
>
> The portfolio isn't just a way of developing an end product, it's a way of capturing the unfolding story … [a place for] the student to tell the story of the project through a whole variety of media … the kind of intellectual trail that's left behind once you've got the final object. (TE6)

Teachers viewed a student's portfolios as a tool for developing and recording ideas, to tell a story, and to celebrate his or her work:

> It's the paperwork that goes with what they're doing…. Sometimes it just amounts to some pieces of paper that they cut up and organize to try and actually help them clarify an idea … to help get their ideas down. (T4)
>
> It's … a place … to actually store thinking processes, research, ideas. I … think it's almost a diary of a student's work … a story … behind the production of a solution to a design scenario situation. (T1)
>
> The portfolio … [is] a summary of what you've achieved so that … you can celebrate what you've done. (T2)

Professional designers were, as reported above, quite clear that a portfolio is a showcase. They were equally clear that it is not used while generating and developing ideas. For these tasks the professional designers used three other types of folio: a sketchbook, a job bag and an ideas box.

A sketchbook was described by one designer as 'a collection of … generic research not focused towards any particular end product … going through … life looking at things and soaking up information … almost like a diary recording a journey' (PD1). A second designer noted that 'the sketchbook is a very personal thing …where I keep all of my personal sketches and notes, ideas, and that's what I carry around with me on trains, and when I go to exhibitions … a comment on the radio, a bit of news, a really neat quote in a lecture, an idea, my shopping list' (PD2).

Two of the teacher educators encouraged teacher candidates to maintain a sketchbook: one described how he encourages 'sketchbooks, which can contain information for a lot of different projects which might be going on at the same time … a book in which they write, scribble and draw anything at any time. It isn't part of any assessment, it is used as a communication tool between tutors and students and between students and students … as they are developing ideas' (TE4).

A job bag, as described by professional designers, 'contains everything to do with a specific project … every scrap of paper … sketches, and drawings, and things like that, simple rigs, models, photographs … models themselves, photographs of models, [and] digital images of models'(PD2). Another professional designer commented that his job bag 'contains letters from the client, my letters back to the client, quotes that I've got from suppliers' (PD1).

Professional designers also described the importance of creating an 'ideas box' (PD1) or 'inspiration box' (PD2). As one designer described:

> I've got a cardboard box … and it's actually got a label on, it says 'ideas box' and anything I see I think wow that's a nice colour or that's nice … that's a good paper I haven't seen before, or I haven't seen something folded up in that way, I'll dump it my ideas box. And … at the beginning of a project I'll just go through that as a way of stimulating my [thinking]. (PD1)

The purposes of a portfolio

As reported earlier, professional designers use a portfolio to showcase their work to a client. Teacher educators, on the other hand, viewed a portfolio as a way for teacher candidates to tell the story of their designing: 'the portfolio isn't just a way of developing an end product, it's [also] a way of capturing the unfolding story' (TE6).

Teachers identified four purposes of the portfolio:
(a) 'to help [students] to develop their ideas … traditionally through sketching' (T4);
(b) 'as a collection of ideas' (T2);
(c) as 'a record of what they're doing' (T2); and
(d) 'to evidence some of our assessment' (T1).

Discussion

The portfolio

In general terms a portfolio in an educational context contains a collection of artifacts accompanied by a reflective narrative that not only helps the learner to understand and extend learning, but also invites the teacher to gain insight into students' learning (Porter & Cleland, 1995). According to McMillan (2004:235) a portfolio can be used to 'document progress toward the attainment of learning targets or show evidence that a learning target has been achieved'. Arter and Spandel (1992) note that portfolios should involve student participation in the selection of what is included in the portfolio and evidence of student self-reflection on what has been accomplished. According to Klenowski (2002:110) an important factor in using a portfolio to support learning is the opportunity for the student to choose and reflect on which work is selected for inclusion in the portfolio: 'students demonstrate growth through appropriate selection of work samples'. Research has shown that students view successful learning activities as those experiences that offer choice and a sense of ownership (Flutter et al., 1999). However, there is often a conflict between the demand for using a portfolio as a teaching and learning tool and using a portfolio for assessment purposes. Could students use the portfolio as a showcase of their best work only? Could the teacher then use this showcase portfolio for summative assessment?

The role of a sketchbook

According to Robinson (1995:14) 'a sketchbook is an Aladdin's cave of visual ideas … a personal visual memory bank that can be used as a resource for … developing ideas'. Robinson advocates that students should be encouraged to keep a sketchbook so as to function as researchers. Ash et al. (2000:193) describe how the use of a sketchbook can help students 'to develop self-awareness and skills as independent learners and critical observers'. Students could acquire the 'sketchbook habit' early in their design and technology career and be taught to develop their sketchbooks in increasingly diverse and personalized ways as they mature and their confidence and skills grow. The sketchbook could be used for information gathering as a student searches for a creative solution to a design problem. According to Ash et al. (op. cit.) this will encourage the development of a personal response, develop investigation skills, encourage critical and analytical skills, develop self-awareness as an independent learner, promote an active and creative approach to learning, and help students develop documentation skills. A student's natural curiosity, enthusiasm and need for personal realization and expression will be reflected in his or her sketchbook as a personal vision. Would this lead to increasingly creative responses to those 'wicked' design problems? Would a combination of sketchbook and showcase portfolio provide 'an intellectual trail' of the student's designing, as well as enhance learning? The authors have provided support for teachers wanting to use a sketchbook approach by writing a set of guidelines and activities that enable teachers to enhance their own creativity as well as introduce sketchbooks to students (Welch & Barlex, 2003).

Keeping a job bag

A job bag as described by professional designers contains everything to do with a specific project. Students could be required to maintain a job bag as they generate, develop and communicate design ideas. This would include all the results of their research (with annotations explaining why particular selections were made), and all 2D and 3D models. Documentation in the job bag would include evaluations made by self, peers and the teacher. In analyzing the work from the job bag to be included in the portfolio the student is attaching meaning to that work. According to Bailey and Guskey (2001) requiring the student to verbalize and write about the work selected for a portfolio promotes metacognitive growth and self-awareness. How could a job bag be used to enhance teaching, learning and assessment?

Using an ideas or inspiration box in the classroom

An ideas box may be another generic resource, much like a sketchbook, to be used when the need arises. As one designer said, 'at the beginning of a project I'll just go through [the ideas box] as a way of stimulating [thinking]' (PD1). A second designer described how he and his team create an 'inspiration box' for each project. Teachers and students could adopt both of these approaches. When students find themselves in a 'creativity slump' and need inspiration they could 'consult' a class-owned ideas box. Additionally, individual students could develop their own inspiration boxes for personal use throughout a course or to stimulate creativity for a particular project.

Conclusion

Preliminary analysis of the data collected in this study has identified that professionals use four types of folio, each for a quite different purpose. A sketchbook is used to enhance designerly thinking and creativity. A job bag is used to record designing as it is taking place and for future reference. An ideas or inspiration box is used to stimulate thinking and as a source of inspiration. A showcase portfolio is used to present selected items of finished work.

These findings have given rise to a number of questions. How could these four types of folio be used to enhance teaching, learning and assessment in design and technology education? To what extent would the adoption of these four types of folio resolve the conflict between the portfolio as a teaching and learning tool and the portfolio as an assessment instrument? In what ways could adopting these four types of folio assist teachers in devising effective ways of encouraging students' creativity while at the same time generating assessment evidence? While the small sample size in this study may appear to be a barrier to external validity, each case study was very detailed (Yin, 1989), and analysis of the data revealed elements of practice relevant to the use of portfolios in design and technology education. Further analysis of the data is expected to provide insights into current uses of folios to teach design skills and as an assessment tool. These data and analyses will be reported at a future time. Additionally, the authors are currently conducting a follow-up study to investigate students' perspectives on the use of portfolios in design and technology education. The study will also examine issues arising from the use of electronic portfolios.

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