Designing an e-portfolio environment for assessment of a collaborative technology project

Richard Edwards

University of Waikato
Faculty of Education
University of Waikato
Private Bag 3105
Hamilton 3240
New Zealand
Phone: +64 7 838 4584
richarde@waikato.ac.nz

Abstract

E-portfolios can be used to record both the development process and the outcomes of technology design projects. Preparation of an appropriate e-portfolio environment, including the choice and set-up of the software, provision of both formal and informal support, and alignment with the assessment task, all require deliberate attention to design principles. This paper draws from the literature to identify important design considerations for an e-portfolio environment being used in an investigation of the feasibility of using e-portfolios for assessing individual performance in a collaborative technology project. It explores similar e-portfolio development projects and theoretical positions to develop a set of specifications and key considerations as a framework for the current project and as a contribution to ongoing discussions in this area.

Keywords

E-portfolio design, collaboration, assessment

Introduction

An investigation into the assessment of individual performance in a group technology project required the development of an appropriately configured e-portfolio environment. The term e-portfolio refers to an electronic portfolio in which the artefacts presented are in digital form. The concept of an e-portfolio environment allows consideration of the e-portfolio itself, the context in which it is to be used, and the support materials provided. In identifying the important considerations and specifications for the design of the e-portfolio environment, it seemed likely that such information may also be useful to other people working with e-portfolios, hence this paper.

Background

The context for the e-portfolio environment design discussed here is a group design project in a compulsory first-year technology education paper taught as part of a primary undergraduate initial teacher education degree. Students work in self-selected small groups (3-4 people) to develop a response to a design problem that they have identified. The project continues through the first 6 weeks of the 12-week paper and allows students to demonstrate their growing understanding of technology and technological practice which is the learning focus of the first part of the paper. Each group submits a record of their project in the form of a portfolio. The portfolio has previously been submitted in paper form but recent developments in available software have prompted an investigation into moving from paper to digital portfolios.

Methodology

Presented here is a brief review of the relevant literature leading to a proposed set of guidelines for e-portfolio environment design. The literature is primarily from the technology education and Computer Supported Collaborative Learning (CSCL) communities. The inherently contextualised nature of the design task and of the setting mean that while some aspects of the specifications will apply across a broad range of e-portfolio environments, much of what is discussed is specific to the situation described above.

Literature review

Effective use of e-portfolios depends on resolving a number of specific issues related to the portfolio concept and to the digital nature of the environment. This section explores theoretical issues before describing two examples from the literature.

Philosophically, this research is informed by a socio-cultural view of learning which suggests that learning involves interaction with other people and their ideas through mediating tools such as language, and that it is influenced by the cultural setting within which it takes place (Wertsch, 1998). This is particularly useful in making sense of a group learning situation since the effective functioning of a group requires social interaction and takes place within a particular cultural setting. A socio-cultural view has important implications for e-portfolio design as it suggests an emphasis on supporting social interaction, joint contribution, and flexibility to allow the group to make decisions about how best to present their performance on the task.

Capability and performance

Assessment of capability in technology education requires attention to aspects of student performance that are not well captured in traditional paper and pen based assessment events (Kimbell & Stables, 2009). Portfolios have been used as a way of better capturing a broad range of elements of performance. E-portfolios extend the portfolio concept by enabling the inclusion of a broader range of forms of digital evidence including images, video and sound files, weblinks, and files from specific software packages in a range of formats (Williams & Newhouse, 2013).

In technology education an e-portfolio needs to support the presentation of evidence that clearly demonstrates what is regarded as capability. Kimbell and Stables (2008) view capability as "the power to produce change and improvement in the made world" and see imaging and modelling as central to its development. Capability requires competence, skill, and knowledge but these are not sufficient. It also requires the ability to make good decisions and to bring these together in a purposeful way.

Digital technologies

Digital technologies include any means of generating, collecting, storing, or presenting information in a digital form. They are now readily available to most people through mobile devices such as smartphones, tablets and laptop computers, and through the internet. They offer a much wider range of ways of representing technological practice with respect to both process and outcome (Williams & Newhouse, 2013). They also allow much more scope for the learner to take responsibility for the collection and presentation of evidence of their learning.

The e-portfolio is a way of collecting, selecting, reflecting and presenting digital information and takes advantage of the greater range of formats offered. Because it places an emphasis on the selection of appropriate material and on reflective commentary, the learner becomes more actively involved in the assessment process when e-portfolios are used for assessment (Barrett, 2007).

Assessment

Assessment involves the collection and evaluation of evidence generated by learners and is used both to inform further teaching and learning and to indicate current levels of performance or competence (Brown, 2008). Where it allows comparison between two instances, it can be used to comment on learning. The primary focus of assessment is the student and their learning and there is increasing recognition of the benefits of involving the student in assessment decision-making (Bain, 2012; Boud, 2007).

Assessment of performance in technology is characterised by its focus on process as well as outcome, and by its highly contextual nature. There are some significant features of learning in technology education that affect its assessment. According to Kimbell and Stables (2008) these include:

- a focus on learning in issues-rich, task-centred activities in which the learner is an active participant;
- recognising that learners will not necessarily each be learning the same things and may achieve the same result in different ways;
- viewing knowledge and skills as best learnt when the learner needs to know them and to the level needed to address the problem rather than as a defined corpus that can be generically associated with any given activity.

Procedural learning is an important part of technology education and evidence of this needs to be collected over time. Such evidence is often collated in the form of a portfolio (Newhouse, 2013). This enables the learner to take a more active role in the selection and presentation of appropriate evidence and supports a greater focus on the individual. Recent research into the use of digital portfolios (e.g. Kimbell, 2012; Williams, 2012) has highlighted the potential to broaden the forms of evidence that can be used to demonstrate developing capability.

Collaboration

Collaboration has been identified as a key skill in research into what people need for 21st century living and employment (Binkley et al., 2012; Ministry of Education, 2007). The Programme for International Student Assessment (PISA) framework for collaborative problem-solving (OECD, 2013) defines collaboration as "*the capacity of an individual to effectively engage in a process whereby two or more agents attempt to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills, and efforts to reach that solution*." Any consideration of collaboration therefore needs to explore the nature of the group, the nature of the activity in which they are engaged, and the nature of the interactions that contribute to completion of the activity (Dillenbourg, 1999). The concept of collaboration is process oriented even though the purpose is to achieve the agreed outcome.

In recent years a growing interest in the ways in which information technologies can support collaboration has developed. Several themes emerge from this including recognition of the diversity of skills and background of participants and the need for people to develop collaborative skills as well as those needed to achieve intended cognitive outcomes (Dawes & Sams, 2004; Fransen, Weinberger, & Kirschner, 2013; Montequín, Fernández, Balsera, & Nieto, 2013; Napier & Johnson, 2007). Some of this has come from analysis of failure of collaborative projects in education (Baker, Bernard, & Dumez-Féroc, 2012; Kapur & Kinzer, 2009; Pathak, Kim, Jacobson, & Zhang, 2011). There has also been a focus on the role of design of the environment, task, and supporting tools in regulating both the process and outcomes of collaboration (Fischer, Kollar, Stegmann, & Wecker, 2013; Strijbos, Martens, & Jochems, 2004).

Technological practice is commonly collaborative. McCormick (2004) noted a lack of research in technology education into collaborative work on joint products and suggested that the use of digital technologies offers potential for both collaborating to learn and learning to collaborate in the context of design problems. Since then, there have been significant developments in digital technologies, particularly associated with mobile devices. However,

few studies e.g. (Hong, Yu, & Chen, 2011) have focused on collaborative work. Most research into the use of digital technologies in design problems tends to focus on individual activity rather than collaborative activity e.g. (Kimbell, 2012; Williams, 2012). Although possibilities for collaboration in technology education have been identified (Hennessy & Murphy, 1999), they haven't been explored with respect to the use of digital technologies.

Examples

Project e-scape

e-scape is an exam management system designed to support the assessment of performance in design capability in the United Kingdom (Kimbell, 2012). It is essentially an e-portfolio that facilitates the collection and presentation of diverse forms of digital evidence in a limited timeframe. The collection of evidence is to some extent scripted through the use of specified templates. The software was aimed at supporting assessment of individual performance in a high stakes examination setting.

While there is considerable scope for inclusion of a broader range of evidence of process, student performance is constrained through use of templates and e-portfolio structure, and through time limitations. The assessment process uses the comparative pairs approach which has been shown to support more holistic judgements and to be reliable (Pollitt, 2011).

Digital representations project

This project in Western Australia (Williams & Newhouse, 2013) explored the use of digital technologies to support more authentic forms of assessment in high-stakes qualifications assessment in four areas of the curriculum that have a strong practical performance component. In the Engineering Studies example, the e-scape system developed in the United Kingdom (Kimbell, 2012) was used.

Implications for e-portfolio design

Drawing on the points raised above, the following would need to be consdiered in developing an appropriate e-portfolio environment for a group design task:

- The way collaboration is supported needs to reflect both how the e-portfolio is used and what it is able to represent
- The potential benefits offered by digital technologies should be integrated into the system
- Technological capability should be evident through both process and product
- Students should have input into assessment with respect to what is represented and how.
- Assessment needs to be authentic, reliable and valid

The e-portfolio environment

The development of a digital environment for a specific purpose can usefully be regarded as a design problem, enabling the resources and approaches of innovative design to be applied as demonstrated in a number of recent studies (An, 2013; Chen & Teng, 2011; Kirschner, Strijbos, Kreijns, & Beers, 2004; So, Seah, & Toh-Heng, 2010; Wang, 2009; Zhang, Olfman, & Ractham, 2007). The design required is complex as it needs to address a broad range of intersecting areas including the technical aspects of the technologies involved, the nature of the task(s) students are to be engaged in, and the support materials and processes that guide students in their involvement. Where engagement in the task itself requires knowledge and skills other than those the task seeks to develop or assess, then these need to also be explicitly addressed in the supporting materials and processes.

Williams and Newhouse (2013) identified a framework of four specific dimensions that would need to be satisfied in order for the use of digital technologies to be effective in assessment. This was based on the proof of concept criteria used by Kimbell (2012) in his initial exploration of the feasibility of project e-scape (described above). The four dimensions identified were manageability, technical, functional, and pedagogical. They are used here as a way of framing the development of an e-portfolio environment.

A set of guidelines has been developed as a series of key questions using the four dimensions as an organising framework. They are underpinned by the theoretical framework discussed earlier and derive from examples presented in the literature, discussions with colleagues, and consideration of my context at the time. They are not definitive but are intended as a basis for ongoing discussion and refinement.

Technical dimension

The technical dimension deals with issues about the practical implementation of the software. It addresses how the software works, where it is based, and how it is supported. It also considers the administration of student accounts and access.

Aspect	**Questions**
Server location	Will the server be located internally or externally?
	How many accounts can the system cope with?
	How secure is the system?
Accounts	How are accounts set up? How are group accounts set up?
Access	Who controls access? Will the software be continuously accessible? Is it web-based or PC-based? Does the system allow several people from the same group to access the group page simultaneously? How do students access each other's files? Can the site be accessed on multiple devices?
Storage	Is there enough storage space for what we need? How is file quality maintained?
Support	How good is the technical support within the institution?
Flexibility	How much scope is there to adapt the software to suit our needs? How much scope is there for student creativity in designing their group portfolio?

Table 1. Design questions for the technical dimension

Functional dimension

The functional dimension relates to the way the e-portfolio environment supports the intended purpose for which it is being used and so is primarily concerned with how the task itself is facilitated by the software and supporting materials.

Aspect	Questions
Nature of evidence	What evidence needs to be able to be provided?
Source of evidence	Where can evidence come from?
Task clarity	How will students know what is expected of them?
Authenticity	How will authenticity be assured?
Content decisions	How will content decisions be made and who will make them?

Table 2. Design questions for the functional dimension

Pedagogical dimension

The pedagogical dimension provides a way of considering they way in which the e-portfolio environment enacts the theoretical ideas about teaching, learning, and assessment, particularly in technology education, that underpin the task and its intended purpose.

Aspect	Questions
Socio-cultural view of learning	How does the e-portfolio environment support a socio-cultural view of learning?
Peer feedback	Are peer and teacher feedback supported?
Reflection supported	How is reflection supported?
Necessary learning supported	How will the necessary learning be supported?

Table 3. Design questions for the pedagogical dimension

Manageability dimension

Manageability addresses issues of how people might use the environment to complete the task. It considers such things as workload, timing, ease of use, and fitness for purpose.

Aspect	Questions
Student workload	Will this make more demands on student time than the current task?
Learning to use my portfolio	How long will it take students to learn to use myportfolio? What support will be provided for students to learn to work with myportfolio?
Staff workload	Will the marking take longer than it currently does? How long will it take for staff to learn to work with myportfolio?
Ease of marking	Does the group e-portfolio provide all the necessary evidence for marking?

Table 4. Design questions for the manageability dimension

Conclusions

The design of an effective e-portfolio environment is clearly complex and involves a number of interacting decisions. It is not sufficient to simply adopt a piece of software and expect it to work. The design process is context dependent as the constraints and affordances are unique to each situation. It is also iterative. Decisions about e-portfolio software and supporting materials depend on the answers to key questions but also influence some of the answers to those questions. Choices are governed by what best meets specified needs but is also moderated by considering how what is available can be tailored to what is required.

One of the main decisions is the choice of e-portfolio software which will be guided by institutional availability, how well it offers satisfactory answers to the questions, and the degree of customisation it affords. It is virtually impossible for one solution, even when custom built, to satisfy all requirements and so there will be an element of compromise. Consideration therefore needs to be given to the extent to which such compromise could be accepted before accepting or rejecting the software solution.

The tension between characteristics that are at times complementary and at times conflicting makes the design of effective e-portfolio environments challenging. The approach presented here using a series of questions is intended to provide a way to engage with the complex array of issues by highlighting key concerns and allowing them to be considered collectively. It is hoped that they will provide a basis for further discussion.

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