A Review Of The Literature On Portfolios And Electronic Portfolios

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INTRODUCTION

As part of the Tertiary Education Commission's e-Learning Collaboration Development Fund, Massey University, the Auckland University of Technology, the Open Polytechnic of New Zealand and Victoria University of Wellington have been contracted to develop an electronic portfolio application for the New Zealand tertiary sector. To provide a context for the development of the electronic portfolio application and guidelines for its use, a review of the literature on electronic portfolios and more traditional paper-based portfolios has been conducted.

This literature review focuses on portfolio use in tertiary education institutions in general. However, as teacher education is the field most advanced in thinking about portfolios (as acknowledged by other disciplines (e.g. Davies, Khera, & Stroobant, 2005; Grant, Kinnersley, Metcalf, Pill, & Houston, 2006)), most of the general statements about portfolios are drawn from the education literature. Pinsky and Fryer-Edwards (2004, p. 585) go so far as to say that medicine "must learn from the field of teacher education where teachers in training have adapted the portfolio approach to make the activity of teaching visible". Research on electronic portfolios in particular is fairly new, though, again, most studies so far have focused on their uses for the learning and development of preservice teachers (Milman & Kilbane, 2005; Sherry & Bartlett, 2005).

Barrett and Knezek (2003) make the argument that electronic portfolios *should* be electronic versions of paper portfolios. The same thinking about purpose, pedagogy and assessment lies behind both kinds of portfolio. With this in mind, the discussion will begin with portfolios in general: the different types of portfolio; their uses; their benefits; problems, issues and tensions that arise relating to their use; and the essential elements that need to be present in their design to ensure their success as learning, development and assessment tools. This section concludes with a discussion of their uses in a variety of disciplines. Following this, electronic portfolios will be discussed in depth: how they differ from traditional portfolios, their benefits, and issues relating to their use. In adopting electronic portfolios as a medium for student learning, certain criteria ensure success and several barriers to implementation exist. In addition, several educational and technical considerations are inherent when adopting an electronic portfolio system.

METHOD

Two search engines were used to gather the articles used for this literature review. The first, the Educational Resource Information Clearinghouse (ERIC), was searched for the term 'electronic portfolio', yielding 155 results. The second, Web of Science, was searched for journal articles from 2000 to the present using the term 'electronic portfolio', yielding 38 results. An additional search of Web of Science for 'portfolio', excluding the fields of business and finance (to eliminate reference to investment portfolios), applied mathematics and applied science, generated several thousand results. Once further limited to the period 2003-2006, the results were scanned for useful articles.

Articles were chosen for inclusion in this review on the basis of their relevance to portfolio use, especially electronic portfolio use, in tertiary education, and, for reasons of expediency, their availability in electronic form via the Massey University Library website. Peer-reviewed articles from reputable journals were given precedence. Once retrieved, the bibliographies of several articles were scanned for common reference to seminal articles on portfolio use, and these too were retrieved where possible. In total, 145 articles were gathered for this literature review, although some, on closer examination, proved to be of little use and were not included.

PORTFOLIOS

Very simply put, a portfolio is a collection of evidence that is gathered together to show a person's learning journey over time and to demonstrate their abilities. Portfolios can be specific to a particular discipline, or very broadly encompass a person's lifelong learning. Many different kinds of evidence can be used in a portfolio: samples of writing, both finished and unfinished; photographs; videos; research projects; observations and evaluations of supervisors, mentors and peers; and reflective thinking about all of these. In fact, it is the reflections on the pieces of evidence, the reasons they were chosen and what the portfolio creator learned from them, that are the key aspect to a portfolio (Abrami & Barrett, 2005; Klenowski, Askew, & Carnell, 2006; Loughran & Corrigan, 1995; Smith & Tillema, 2003; Wade & Yarbrough, 1996). In that way, those compiling portfolios are active participants in their own learning (Wade, Abrami, & Sclater, 2005). Kimball (2005, p. 451) goes further, arguing that "neither collection nor selection [of pieces to be incorporated into a portfolio] are worthwhile learning tasks without a basis in reflection. Reflection undergirds the entire pedagogy of portfolios". Two other key elements to portfolios are that they measure learning and development over time (Barrett, 2000; Challis, 2005), and that it is the process of constructing a portfolio, rather than the end product, that is where the learning takes place (Smith & Tillema, 2003).

Uses of portfolios

Portfolios can be developed for many different purposes: for learning, for professional development, for assessment, or for job applications and promotions; and many different audiences: for lecturers, for mentors, for employers, or for the creator him or herself. In tertiary education, portfolios provide an alternative form of assessment (Chang, 2001; Smith & Tillema, 2003; Smits et al., 2005; Wade et al., 2005) that moves away from summative assessments to charting the development of students' thinking over their course of study. Such assessments are seen by some (Abrami & Barrett, 2005; Chang, 2001; Kimball, 2005; Loughran & Corrigan, 1995; Ma & Rada, 2005) as more 'authentic' as they rely on more than one piece of evidence, show development of thinking, and more accurately represent student ability.

Different types of portfolio

Zeichner and Wray (2001) emphasise three different types of portfolio as discussed in the literature. These are a 'learning portfolio', which documents a student's learning over time; a 'credential portfolio', which is used for registration or certification purposes; and a 'showcase

portfolio', which students can use when applying for employment positions. While a learning or a credential portfolio contains examples of 'less than perfect' work as well as the finished product, a showcase portfolio serves only to display a student's best pieces of work. Similarly, Abrami and Barrett (2005) catalogue three different types of portfolio, though the purposes of each are slightly different from those described by Zeichner and Wray. For Abrami and Barrett, the portfolio types are a 'process portfolio', or a collection of work showing a learning journey; a 'showcase portfolio', which is used to show achievements either at study or in the workplace; and an 'assessment portfolio' prepared specifically for assessment or evaluative purposes.

In comparing the purpose of a portfolio with the setting of its use, Smith and Tillema (2003) come up with four different types of portfolio. A portfolio used for job selection or promotion purposes and for which the content is mandated is a 'dossier portfolio'. A mandated portfolio used for learning and development is a 'training portfolio'. A selection or promotion portfolio that leaves the choice of content up to the portfolio creator (or is 'self-directed') is a 'reflective portfolio'. Finally, a self-directed learning and development portfolio is a 'personal development portfolio'.

The varying ways of typifying a portfolio all serve to emphasise the importance of deciding upon the purpose and audience of the portfolio. A portfolio developed to show change and progress in a student's learning will not be appropriate for use when applying for a job, just as a portfolio displaying only exemplary pieces of work will not be useful for assessing reflective learning.

Benefits of portfolios

If used to their full potential, portfolios have a number of benefits for students. Portfolios help to focus student thinking (Wade & Yarbrough, 1996), provide a means to translate theory into practice (Hauge, 2006), and, most importantly, document a learner's progress over time (Abrami & Barrett, 2005; Challis, 2005; Smith & Tillema, 2003). They can enhance students' communication and organisational skills, are a way of identifying and recognising prior learning, and lead to new learning outcomes (Brown, 2002).

Through the process of portfolio construction, students gain a broader sense of what they are learning (Young, 2002). They can see their learning unfolding (Darling, 2001), acquire an awareness of their accomplishments and come to understand how their learning takes place (Brown, 2002). Darling (2001) highlights one important point however: that while students view portfolios as the creation process, evaluators see portfolios as the end product.

Decisions

Several decisions need to be made about why to construct a portfolio, how to go about it, what to include, and what happens after it is completed (Zeichner & Wray, 2001). Following Zeichner and Wray's argument, several important questions for those considering implementing a portfolio in a tertiary education setting emerge:
- What is the purpose of the portfolio: for learning, for assessment, for professional development, or for employment reasons?
- Who decides what should be included in a portfolio: the student compiling the portfolio, or the people for whom it is being created? How prescriptive should guidelines for creating a portfolio be?
- How should the pieces of evidence in the portfolio be organised: around themes chosen by the student, around programme goals, or around achievement standards?
- What kinds of artefacts are acceptable as pieces of evidence? What should, and should not, be included in the portfolio?
- What kind of input should tutors, lecturers and peers have throughout the process of constructing the portfolio? Should there be a lot of involvement, or just a little? How frequently should students be expecting feedback on their progress?

- How should the portfolio be assessed: through very specific evaluation criteria and grading rubrics, or a more general pass-fail system?
- What should happen to the portfolio after it is finished: should there be some kind of public acknowledgement or presentation of students' work?

Issues relating to the use of portfolios

A variety of problems and issues arise with the use of portfolios as an assessment exercise in academic settings, some of which are mitigated by the shift to an electronic environment, and some of which are exacerbated. A lack of well-defined guidelines and a clear structure (Smith & Tillema, 2003) and a lack of examples of past portfolios (Darling, 2001), can lead to student confusion and anxiety about the scope, nature and value of the task (Darling, 2001; Wade & Yarbrough, 1996). Finding a balance between student-driven construction that can lead to superficial reflections and limited evidence, and over-prescribed guidelines that can lead to students lacking ownership and therefore resenting their portfolios, is difficult (Zeichner & Wray, 2001). Students need a lot of guidance and support throughout the portfolio process (Smith & Tillema, 2003), which involves a lot of time on the part of tutors or supervisors (Wade & Yarbrough, 1996). As Darling (2001) points out, students often have little academic experience with writing reflective pieces, so that again needs to be nurtured by their supervisors. The ways in which such feedback is given, and how that (sometimes critical) feedback becomes acceptable to students, are also problematic (Smith & Tillema, 2003).

There is an inherent conflict between the goals of students and the goals of their supervisors in constructing portfolios. Students "are understandably most concerned about the uses of their portfolios as aids in gaining employment while…educators are most concerned about using portfolios to promote professional development and to make assessments" (Zeichner & Wray, 2001, p. 618). Zeichner and Wray's solution is that different portfolios be used for each different purpose.

Concerns are also expressed over the difficulty of assessing portfolios. Smith and Tillema (2003) see a lack of match between assessment criteria and the goals of the programme of study, or what competencies students are expected to develop. They also see a tension between the measurement of standards and capturing development and reflection. The danger is that learning and reflection will get lost in the drive to measure competency. In addition, students in Darling's (2001) study were concerned with the subjectivity of evaluation.

Success criteria

From consideration of the above problems and issues, a number of criteria for the successful use of portfolios have been put forward (e.g. Loughran & Corrigan, 1995; Smith & Tillema, 2003; Wade & Yarbrough, 1996). In summary, the success criteria are:
- Familiarity with the portfolio concept, including an understanding of both the process and the product of portfolio construction;
- Clear framework and guidelines;
- Structure tempered with freedom for creativity;
- Feedback during the evidence collection process;
- Understanding of the value of reflection;
- Understanding of the value of the portfolio for future use, such as employment;
- Motivation to learn and achieve good marks;
- Student ownership of the portfolio;
- Making connections between the portfolio content and the outside life of the student;
- Consideration of the target audience; and a
- Sense of achievement at overcoming initial struggles to understand the portfolio concept.

Portfolios in different disciplines

While the above discussion is intended to give a broad overview of portfolios, especially as used in tertiary education, some differences in focus are seen between different academic disciplines. As such, portfolio use in teacher education, medical education, nursing, and other disciplines, are examined in more depth.

Teacher education
Specific to a teacher education setting, portfolios have a variety of purposes: to teach prospective teachers how to be reflective, to assess their readiness to graduate, as part of the process of registering beginning teachers, and as part of teacher education programme accreditation (Zeichner & Wray, 2001). Portfolios can serve to measure achievement for practicum work and to foster reflection on teaching (Smith & Tillema, 2003). As McNair and Galanouli (2002) argue, a reflective portfolio is a way of embedding theoretical principles, skills and knowledge in classroom practice, of making meaningful connections between university-based learning and the classroom context, and of helping to improve performance and develop competence.

Portfolios "encourage student teachers and teachers to think more deeply about their teaching and about subject matter content, to become more conscious of the theories and assumptions that guide their practices, and to develop a greater desire to engage in collaborative dialogues about teaching" (Zeichner & Wray, 2001, p. 614) with a goal to developing confident and capable teachers. Portfolios document the shift "from seeing oneself as student to recognizing oneself as teacher" (Darling, 2001, p. 107), and allow students of teacher education to develop their teaching philosophy and dispositions (Ma & Rada, 2005). In order to facilitate the more specific focus of portfolios in teacher education, additional pieces of evidence that might be included are: "narrative statements of teaching goals and philosophies, lesson and unit plans, pupil work samples…excerpts from student teaching journals, communications with parents…video taped teaching samples, action research projects, and sample pupil assessments" (Zeichner & Wray, 2001, p. 617).

It is by reflecting on the evidence collected in their portfolios that student teachers are able to uncover their strengths and weaknesses, develop an awareness of their teaching and learning achievements, assume responsibility for their own learning, and begin to anticipate their learning needs (Orland-Barak, 2005). One research study, on the use of portfolios in teacher education in Israel, is primarily concerned with "moving beyond the obvious conclusion that portfolios promote greater reflection, towards providing teacher educators with a clearer sense of the specific quality of reflection associated with portfolio use" (Orland-Barak, 2005, p. 25). Orland-Barak concludes that documenting reflection is problematic; merely constructing a portfolio does not mean reflection is occurring. In order to be successful, reflection must move beyond simple description.

In teacher education, the use of portfolios, and electronic portfolios in particular, has gained momentum in the United States recently, due in part to standards-based reforms of education. Teachers are being required to demonstrate that they meet certain standards, before they can gain a teaching license (Delandshere & Arens, 2003; Ma & Rada, 2005). Many institutions offering preservice teacher education are using these nationally mandated standards as part of the graduating requirements of their students (Kimball, 2005; Strudler & Wetzel, 2005). Portfolios are seen as a way of assessing the learning and abilities of student teachers and beginning teachers, to see whether they meet these teaching standards. Parallels can easily be drawn to the New Zealand context, where the New Zealand Teachers Council's *Satisfactory Teacher Dimensions* are being used as indicators of readiness for registration. As they emphasise on their website, "learning centres may use these dimensions in a variety of ways to help them reflect the special character of their centre and the standards they desire from teachers" (NZTC, n.d.). Many teacher education providers are indeed adopting the dimensions as part of their graduate profiles (Kane et al., 2005).

Medicine

Similar to teacher education, medical education in the United States of America (Carraccio & Englander, 2004; Jarvis, O'Sullivan, McClain, & Clardy, 2004; Pinsky & Fryer-Edwards, 2004) and the United Kingdom (Davies et al., 2005) is shifting its assessment focus to the achievement and maintenance of competencies. This provides the context for their use for medical students and for practicing doctors. Competency-based evaluation needs an authentic means of assessment; a way of measuring progress against a threshold, rather than against other people; formative feedback; and assessment tools that are adequate to the task (Carraccio & Englander, 2004). Both Carraccio and Englander (2004) and Jarvis et al. (2004) conclude that portfolio assessment shows the greatest promise for meeting these needs.

Within medical education, a portfolio is defined as an evaluation tool that can be used to assess performance in authentic contexts (Driessen, van der Vleuten, Schuwirth, van Tartwijk, & Vermunt, 2005), or as a collection of evidence over time that demonstrates education and practice achievements (Davies et al., 2005). A portfolio's ability to both foster discussion with tutors (Amsellem-Ouazana, van Pee, & Godin, 2006) and to encourage reflection (Driessen, van der Vleuten et al., 2005) are emphasised. Portfolios also have their place in aiding the professional development of medical educators. They can be "a record of activity and accomplishment as an educator" (Wood & May, 2006, p. 255).

Authors agree that reflection on learning is a critical aspect of portfolios (Carraccio & Englander, 2004; Driessen, van Tartwijk, Overeem, Vermunt, & van der Vleuten, 2005; Grant et al., 2006; Rees, 2005), and that the process of creating a portfolio promotes reflection (Pinsky & Fryer-Edwards, 2004). However, it cannot be assumed that medical students and practicing doctors know how to reflect on their work. The skills to reflect need to be developed and fostered in a favourable environment (Driessen, van Tartwijk et al., 2005). In order for portfolios to be used reflectively, those compiling them need a good introduction to the portfolio and its intended use, a clear structure to follow, discussions with tutors or mentors, and to feel ownership of the portfolio. (Driessen, van Tartwijk et al., 2005). By reflecting on their work, students are able to formulate their own learning objectives, focus on what they need to learn, gain an awareness of their learning styles, learn how to integrate information from different sources, gain confidence in what they are learning, and obtain a sense of achievement (Grant et al., 2006).

Portfolios as used in medical education are unique in two ways. In medicine, the focus of reflection is on actions, whereas in teacher education reflection is on student teachers' individual identities and beliefs (Driessen, van Tartwijk et al., 2005). Second, the focus is on teaching medical students how to continually learn so they can keep abreast of changes and advancements in medicine (Amsellem-Ouazana et al., 2006; Grant et al., 2006; Wood & May, 2006). Medical schools are seeing the value of portfolios in helping to teach and assess both of these aspects.

A misunderstanding of portfolio pedagogy is also apparent in some of the medical literature. The 'portfolio' described by Hays (2004) does not specifically ask for or require reflective pieces on the evidence gathered. Reflection is only included in an oblique manner: "in discussing their portfolio, students are demonstrating reflection, although perhaps in a disguised way" (Hays, 2004, p. 802). Likewise, the 'portfolio' used by Melville, Rees, Brookfield and Anderson (2004) is just a collection of evidence with no reflection or overall structural focus. This particular application is strenuously critiqued in a letter to the editor by Charlotte Rees (2005) as being just a 'dossier of evidence', rather than a true portfolio, as it doesn't include reflection.

A major concern of the medical literature is the reliability and validity of portfolio assessment. Questions are raised over their appropriateness as a tool to evaluate the summation of a student's course work (Davies et al., 2005). Driessen, van der Vleuten et al. (2005) raise concerns over ensuring inter-rater reliability when assessing portfolios, although they also point out that "subjective judgements can be reliable provided an adequate number of different judgements are collected and collated" (Driessen, van der Vleuten et al., 2005, p. 215). Rees

and Sheard (2004a, p. 142) concur, suggesting that "discussion and negotiation between independent assessors can enhance the reliability of assessment criteria for portfolios". Duque (2003, p. 512), however, sees the problem in a positive light, arguing that:

> *Portfolios are effective as evaluation tools for skills and attitudes but are weak in assessing knowledge. In fact, skills and attitudes are more difficult to evaluate and to provide effective feedback on, making this method extremely useful to obviate the limitations of traditional methods.*

Davis and Ponnamperuma (2005, p. 279) agree, arguing that portfolios compiled by healthcare professionals have the potential "to assess outcomes, such as attitudes and professionalism, that are difficult to assess using traditional instruments".

A number of benefits of portfolio use that are specific to medicine are noted: portfolios show reflection on practice and learning from experience, which leads to improved patient care (Davies et al., 2005; Pearson & Heywood, 2004); they support the personal and professional development of medical students and help to clarify learning goals and monitor progress (Duque, 2003); they encourage self-directed learning (Dornan, Carroll, & Parboosingh, 2002; Lynch, Swing, Horowitz, Holt, & Messer, 2004; Rees & Sheard, 2004a); show progress over time (Davies et al., 2005; Pinsky & Fryer-Edwards, 2004; Rees & Sheard, 2004a); and teach lifelong learning skills (Rees & Sheard, 2004a). As Pinsky and Fryer-Edwards (2004, p. 583) point out, "each of these skills and capacities is crucial to physicians' development". There are also barriers to their use: predominantly that portfolio construction is time-consuming and reliant on a lot of support (Carraccio & Englander, 2004; Dornan et al., 2002; Duque, 2003; Pearson & Heywood, 2004; Pinsky & Fryer-Edwards, 2004; Rees & Sheard, 2004b). Pearson and Heywood (2004) add that portfolios may promote the recording of events over reflection, and that they may discourage reflection on difficult cases.

To ensure the success of portfolios in a medical setting, a number of strategies are suggested: student involvement in the decision-making process (Driessen, van der Vleuten et al., 2005); good supervision (Pearson & Heywood, 2004; Pinsky & Fryer-Edwards, 2004); and a supportive educational climate where students feel comfortable revealing their weaknesses or mistakes (Pinsky & Fryer-Edwards, 2004).

Nursing
Similar to medical education, the use of portfolios in nursing education is part of a broader move towards assessing practice competencies (Coffey, 2005; Farrand, McMullan, Jowett, & Humphreys, 2006; Jasper & Fulton, 2005; Joyce, 2005; Scholes et al., 2004). Portfolios are used in an attempt to assess both the learning that takes place in hospitals whilst at work, and learning in an academic setting (Farrand et al., 2006). Spence and El-Ansari (2004, p. 389), however, warn that "although portfolios have been considered central to nurse education at all levels…there is no unified understanding of the term in the literature or among practitioners".

The literature found for this review did not show such a division of understanding, perhaps because definitions have become more uniform over the past two or three years. One oft-quoted definition is that "a portfolio is a collection of evidence, usually in written form, of both the products and processes of learning. It attests to achievement and personal professional development, by providing critical analysis of its contents" (McMullan et al., 2003, p. 288). Coffey (2005, p. 75) calls a nursing portfolio "a number of snapshots of student clinical learning…assembled and combined to reveal a more holistic impression of the learning experience", that show evidence of reflection and are a catalyst to the development of practice. Elsewhere, nursing portfolios are described as a means of demonstrating personal and professional growth and change over time (Joyce, 2005; Scholes et al., 2004); as a way of accrediting prior learning, showing evidence for registration, and facilitating lifelong learning (Scholes et al., 2004); and as a way of showing that learning has taken place within the framework of the particular course objectives (Tiwari & Tang, 2003).

Definitions of nursing portfolios all contain reference to reflection, something that the literature arising out of education calls a key aspect of portfolio pedagogy (e.g. Wade & Yarbrough, 1996). Coffey (2005, p. 79) offers an explanation of reflection within a specific nursing context: "as a way of making sense of a situation and key to the ability of nurses to…understand their contribution to therapeutic working". However, McMullan (2006) points out that students can be reluctant to engage in self-reflection for two reasons: it may be threatening for students to write about their weaknesses as well as their strengths, and those students without the requisite writing skills may find the task daunting.

Nursing education as a discipline is also concerned with how best to assess portfolios. Jasper and Fulton (2005) raise a number of questions: how assessors ensure consistency and reliability in their marking, what constitutes good evidence, how reflective pieces should be evaluated, and how marking criteria should be used. McMullan et al. (2003, p. 284) are concerned with the validity of portfolio assessment, whether it assesses "students' ability to write about their practice rather than the standard of the actual practice itself". Webb et al. (2003) believe that the relationship between the student and their assessor, usually the student's supervisor while on practice placement, is fundamental. The assessor's knowledge of the student helps to guarantee the authenticity of the pieces of evidence in the portfolio, and helps to circumvent issues of subjectivity:

> *Portfolios usually contain qualitative rather than quantitative evidence and assessors make qualitative judgements about this evidence, taking into account what they have learned about the student in a more or less extensive relationship throughout the placement* (Webb et al., 2003, p. 608).

In order to maintain the rigour of assessment in an environment where personal knowledge of students is a factor in evaluating their work, Webb et al. (2003) suggest that there be explicit marking and grading criteria, that evidence be drawn from a variety of sources, and that internal and external quality assurance processes be put in place.

Again, a number of benefits and barriers to portfolio use are noted in the nursing literature. Portfolios are student centred and emphasise student autonomy over, and responsibility for, their own learning (Coffey, 2005; Joyce, 2005; McMullan, 2006; McMullan et al., 2003). They are a way of demonstrating professional ability, especially against pre-determined competencies, and showing the development of learning over time (Coffey, 2005; Jasper & Fulton, 2005). Portfolios enable the development of skills in critical thinking, reflective practice, and writing as learning (Jasper & Fulton, 2005), help students to increase their competence and self-awareness (Spence & El-Ansari, 2004), and promote creativity, in-depth understanding of subject matter, and meaningful learning (Tiwari & Tang, 2003). Portfolios serve to integrate theory and practice, and thereby help students to see the links between the two (Jasper & Fulton, 2005; McMullan, 2006; McMullan et al., 2003). The benefits of portfolio use are realised not just through the finished product, but through the actual process of constructing the portfolio (Coffey, 2005; McMullan et al., 2003).

Barriers to portfolio use include: the time needed to complete and to assess the portfolio, uncertainty over the nature and amount of evidence that should be included, the need for effective support and guidance for students (McMullan, 2006), how students' privacy and confidentiality be maintained, especially when they are reflecting on difficult cases (Joyce, 2005), students' lack of confidence and experience at compiling portfolios, and the level of preparation necessary (Scholes et al., 2004). McMullan et al. (2003) also raise concerns over the conflict inherent between assessment use and learning use of portfolios. Knowing that their work will be assessed may impact on what evidence students choose to include, and "may also affect the experiences and perceptions of the benefits to themselves of portfolio use" (McMullan et al., 2003, p. 291).

In order to be successful portfolio users, students need control over what is or is not included as evidence (Joyce, 2005), clear guidelines on the purposes, content and structure of portfolios (McMullan et al., 2003), training on strategies for their use, and support from their supervisors

(Tiwari & Tang, 2003). Students are aided by the recognition that portfolio assessment can have a positive impact on their learning (Tiwari & Tang, 2003).

Other
Finally, portfolios are also used in a variety of other disciplines, including: art and design, dentistry, psychology, engineering and information systems. During the literature search, only one or two articles in each area could be readily accessed, so any generalisations made should be treated with a degree of caution.

The art and design community define a portfolio as "a focused collection of pieces of visual art and design, often accompanied by reflective and explanatory written data…usually constructed for a specific purpose" (Blaikie, Schonau, & Steers, 2004, p. 303). The goal of the portfolio exercise is to foster students' ability to critically self-assess their own artistic work, and to help them to form their artistic identity (Blaikie et al., 2004). Portfolios are beneficial, in that they enhance student motivation and engagement in learning, foster constructive learning, enable dialogue and co-operation between students and their teachers, provide valid and authentic assessment tasks that are related to the art curriculum, and respect the voices and personal styles of students (Pereira de Eca, 2005). However, while students are encouraged to make their own decisions about the art or design project they conduct, and which pieces of work are included in their portfolios as evidence, the autonomy of decision-making is difficult for some students, especially where they have no previous experience of critical reflection or evaluation their own work (Pereira de Eca, 2005).

The subjectivity and potential bias of teachers when assessing their students' work is seen as problematic. This is usually mitigated by the external examination of portfolios (Blaikie et al., 2004) or by using several evaluators – a 'community of assessors' – to evaluate portfolios (Pereira de Eca, 2005). In addition, as Blaikie et al. (2004, p. 303) outline, "currently there is a move towards a 'flattening' of power relationships, where the student's opinion about his or her work is taken into account, and where assessment is negotiated between student and teacher".

Chambers (2004) recommends the used of portfolios to assess the readiness of dentistry graduates for licensure to practice, in place of the 'one-shot' practical examination currently being used in the United States. He defines a portfolio, as used in dentistry, as "a collection of authentic evaluations, including repeated measures from several sources" (2004, p. 177), and "an approach designed to reduce the risk of poor decisions being made by using multiple measures and multiple balanced sources of information" (2004, p. 180). Chambers' primary concern is that the current practical examination is prone to error, either licensing graduates who are not fit to practice as dentists or failing graduates who are competent, because of factors outside the control of students, such as variation between patients or the location of the test. He argues that portfolios provide a more valid measure of competence, as they include a wide range of evidence that encompasses many of the practical experiences of students with a variety of different patients. Nowhere does Chambers discuss the potential of portfolios to foster reflection in students, and as such, his 'portfolio' is in fact more a 'dossier of evidence'.

Egan, McCabe, Semenchuk and Butler (2003) conducted a research study on portfolios as used by graduate students in cognitive psychology. They were attempting to discover whether the use of portfolios can help to reduce the number of errors students make when scoring cognitive ability tests. By envisaging a portfolio as a reference file of correct scoring, errors and how to correct them, they conclude that portfolios are a useful tool in cognitive psychology. As for the dentistry example above, portfolios are being very narrowly defined.

The majority of the portfolios referred to in the literature discussed thus far are all paper-based portfolios. In contrast, Campbell and Schmidt (2005) outline the electronic portfolio system, Polaris, that they have been developing for engineering students at their institution. Their system aims to be fun, easy to use, and to result in something to be proud of. Using the electronic portfolio system gives students a personal website for managing their work, and a

forum for reflection on their coursework and their development as engineers. The institution itself benefits, as the system facilitates student advising, degree planning, scholarship applications, and the collection of materials for accreditation. Campbell and Schmidt (2005) also make the point that portfolios are relatively new to the discipline of engineering.

Finally, Duffy, Duffy and McKean (2004) describe their Information Systems in Organisations course, which was being restructured to incorporate the concept of learning communities. Learning communities are student-centred, where students "are empowered to direct how, when, and in what form learning is achieved. Students take a more active role and personal ownership of the learning process" (Duffy et al., 2004, p. 3). One element of their course is an electronic portfolio, which they argue has the advantage of encouraging students to become active, autonomous learners, and through which feedback from course instructors can be given quickly. They see their electronic portfolio system as an important tool for developing a learning community.

ELECTRONIC PORTFOLIOS

An electronic portfolio (also know as an ePortfolio, e-portfolio, efolio, digital portfolio, webfolio and so on) is essentially an electronic version of a paper-based portfolio, created in a computer environment, and incorporating not just text, but graphic, audio and video material as well. Abrami and Barrett (2005, online) define an electronic portfolio as: "a digital container capable of storing visual and auditory content including text, images, video and sound…designed to support a variety of pedagogical processes and assessment purposes". Challis (2005, online) provides a more in depth definition:

> *An ePortfolio is described as:*
> - *Selective and structured collections of information*
> - *Gathered for specific purposes and showing/evidencing one's accomplishments and growth which are*
> - *Stored digitally and managed by appropriate software*
> - *Developed by using appropriate multimedia and customarily within a web environment and*
> - *Retrieved from a website, or delivered by CD-ROM or by DVD.*

Uses of electronic portfolios

There are three main uses for electronic portfolios: for students while studying, for graduates while moving into or through the workforce, and for institutions for programme assessment or accreditation purposes (Lorenzo & Ittleson, 2005a). The first use allows students to demonstrate their competence (Milman & Kilbane, 2005); develop, demonstrate and reflect on pedagogical practice; show their attitudes, knowledge and skills (Sherry & Bartlett, 2005); document how inquiry works in practice; and provide evidence of reflection (Smits et al., 2005). Electronic portfolios are most commonly used in this way in colleges of education (Lorenzo & Ittleson, 2005a). The second is a way for graduates or those already in the workforce to gain licensure or registration (Milman & Kilbane, 2005; Pecheone, Pigg, Chung, & Souviney, 2005); to showcase their qualifications and competencies in job interviews, for appraisal, or for promotion (Milman & Kilbane, 2005); as well as for critical reflection and learning purposes (Lorenzo & Ittleson, 2005a). The third use is as a vehicle for institution-wide reflection, learning and improvement to demonstrate institutional accountability, to make accreditation processes more visible, and to show collective student progress (Lorenzo & Ittleson, 2005a).

Benefits of electronic portfolios

The benefits of electronic portfolios are many and varied. Several are interrelated, with one benefit following on from another. The following summarises the main points made in the literature:

- *Skill development*. The creation of an electronic portfolio serves to develop multimedia technology skills (Abrami & Barrett, 2005; Barrett, 2000; Heath, 2002, 2005; Wade et al., 2005; Wall, Higgins, Miller, & Packard, 2006), as well as more general literacy, communication and problem solving skills (Abrami & Barrett, 2005; Canada, 2002). Electronic portfolios are also a way to showcase technology skills (Heath, 2002, 2005), and to model technology skills for others (Barrett, 2000; Heath, 2005).
- *Evidence of learning*. As Abrami and Barrett (2005, online) argue, electronic portfolios encourage "flexible, inclusive, and distributed evidence of learning including variable times and places for learning". Electronic portfolios provide a 'rich picture' of student learning and competencies (Love & Cooper, 2004), thus facilitating authentic learning (Love & Cooper, 2004; Wade et al., 2005). They actively involve students (Love & Cooper, 2004) in demonstrating past learning and current learning gains (MacDonald, Liu, Lowell, Tsai, & Lohr, 2004; Wade et al., 2005), and help students to make connections between their course projects and non-academic projects (MacDonald et al., 2004). They help students learn to manage their own professional development, and thus contribute to lifelong learning (Barrett, 2000; Love & Cooper, 2004; Wall et al., 2006). They promise significant pedagogical benefits by stimulating class discussion and providing student-centred learning (Canada, 2002). Finally, electronic portfolios help a learning community to establish its goals and expectations (Ahn, 2004).
- *Feedback*. Electronic portfolios facilitate the exchange of ideas and feedback (Lorenzo & Ittleson, 2005a). Students can receive feedback quickly and regularly throughout the process of constructing their portfolios (Ahn, 2004), across electronic media channels (Abrami & Barrett, 2005). Electronic portfolios contribute to the 'feedback loop' integral to formative assessment (Cambridge, 2001).
- *Reflection*. Just like traditional paper-based portfolios, electronic portfolios encourage students to reflect on their work and their reasons for choosing certain pieces to be incorporated in their portfolio. Students are encouraged to be reflective throughout the entire portfolio process (Ahn, 2004), and to use that reflection to integrate their learning experiences and find meaning in them (Lorenzo & Ittleson, 2005a; Ma & Rada, 2005; Young, 2002). Through reflection, electronic portfolios make meaning out of diverse and unconnected pieces of information (Cambridge, 2001).
- *Psychological benefits*. For those compiling them, electronic portfolios foster a sense of pride in their work, a sense of personal accomplishment, and a feeling of satisfaction (Canada, 2002; Sherry & Bartlett, 2005).
- *Assessment*. Electronic portfolios engage students in the evaluation and assessment process (Wade et al., 2005), as they continually revisit and refine their portfolios. Students gain a better understanding of the assessment they are undertaking (Wall et al., 2006), and can use that assessment to constantly improve their learning (Cambridge, 2001). Electronic portfolios can also help to put failure into context; they can show the steps taken to redress failure, and what the student has learned from the experience (Cambridge, 2001).
- *Artefacts*. Many kinds of artefact can be incorporated into electronic portfolios. They can integrate text and multimedia elements such as pictures, graphics, and audio and video recordings (Abrami & Barrett, 2005; Canada, 2002; Heath, 2005; Love & Cooper, 2004; Milman & Kilbane, 2005; Wade et al., 2005). They also take advantage of work that is already in an electronic format (Heath, 2002, 2005).
- *Maintenance*. Electronic portfolios are easy to maintain, edit and update (Canada, 2002; Heath, 2002, 2005), and because of this are more likely to be constantly revised (Canada, 2002).
- *Portability and sharing*. Whether saved to CD-ROM or to the web, electronic portfolios are easy to carry, to share with others, and to transport into a new system or new working environment (Abrami & Barrett, 2005; Strudler & Wetzel, 2005; Wade et al., 2005). For these reasons, they have longevity, existing beyond the end of a course or a student's university career (Canada, 2002).

- *Access*. Especially when saved to the Internet, electronic portfolios are easily accessible by a number of people. Students can work on their portfolios, and supervisors can review and assess portfolios, from many different sites (Ahn, 2004; Canada, 2002; Heath, 2005; Wade et al., 2005).
- *Audience*. Because of their accessibility, electronic portfolios are viewable by a much larger audience (Ahn, 2004; Strudler & Wetzel, 2005), including students' peers, supervisors, assessors, parents, employers and others (Wade et al., 2005).
- *Organisation*. Electronic portfolios are easy to organise and search (Ahn, 2004; Wade et al., 2005; Young, 2002). Because of their electronic nature, they can be organised in complex ways, with navigational links connecting ideas and artefacts (Canada, 2002; Heath, 2002, 2005). They also look perpetually polished (Canada, 2002).
- *Storage*. Because they do not rely on large binders full of paper, electronic portfolios are easy and efficient to store (Ahn, 2004; Canada, 2002).
- *Cost*. Electronic portfolios are inexpensive (Heath, 2005), especially to reproduce, although initial set-up costs in software and equipment may in fact be quite high.
- *Standardisation*. Electronic portfolios have the potential to be standardised across regions and countries (Abrami & Barrett, 2005), if universal specifications can be agreed upon.
- *Privacy*. Finally, electronic portfolios can include a privacy feature (Young, 2002) to protect student work. Access can be limited to only those that students wish to view their work.

Points of difference from traditional portfolios

While electronic portfolios may be a technological change, but not a conceptual change, from paper portfolios (Barrett & Knezek, 2003; Strudler & Wetzel, 2005), they still have a number of characteristics that differ from traditional portfolios. Challis (2005), Abrami and Barrett (2005) and Strudler and Wetzel (2005) have all provided a variety of points of difference, which are summarised here. Electronic portfolios:
- Are easier to search, and records can be simply retrieved, manipulated, refined and reorganised;
- Reduce effort and time;
- Are more comprehensive and rigorous;
- Can use more extensive material;
- Include pictures, sound, animation, graphic design and video;
- Are much smaller;
- Are cost effective to distribute;
- Are instantly accessible;
- Can have an organisational structure that is not linear or hierarchical;
- Are easy to carry and share with peers, supervisors, parents, employers and others;
- Allow fast feedback;
- Showcase the technological skills of the creator;
- Provide access to a global readership if they are based on the web.

Issues relating to the use of electronic portfolios

As with traditional paper-based portfolios, a number of issues and challenges arise with the use of electronic portfolios in tertiary education. Abrami and Barrett (2005) discuss the challenges to assessment that electronic portfolios present. Their concern is that it is difficult to authenticate the evidence in such a portfolio – is it really the work of the student in question? The technical knowledge required to create a portfolio may also unfairly disadvantage some students, and the danger is that students will end in being assessed more on their technology prowess. Finally, they mention the difficulty for evaluators in judging the quantity and quality of evidence in a digital environment. Carliner (2005) adds that before they even begin the portfolio process, students should be provided with the assessment criteria.

Challis (2005) believes that electronic portfolios should be integrated across the whole learning process. Courses may need to be restructured to accommodate electronic portfolios, and programme controllers will need to address how reflection is fostered and recognised within their courses, to facilitate portfolio creation for students. Students also need to be engaged in the process, which is helped when they know that the electronic portfolio system will be available long-term, when they see the value of creating a portfolio, and when electronic portfolio tools are intuitive and readily available. Finally, Challis (2005) raises a number of issues that will need to be addressed by an institution: how to manage the volume of data, who will have access to the electronic portfolios, the security and privacy of students' work, and copyright and intellectual property concerns. In other words, some of the benefits of electronic portfolios can also be issues that need to be resolved before they can be successfully implemented.

Barrett and Knezek (2003) argue that electronic portfolio systems need to find a balance between highly structured templates, which scaffold the learning of the portfolio process and are useful for novice portfolio users, and open-ended or self-directed portfolio tools, which foster learners' knowledge of themselves and suit more advanced users. Carliner (2005) agrees, suggesting that electronic portfolio software be designed for users with multiple levels of technical skill.

> *Perhaps software for electronic portfolios could be designed to allow for more flexibility, learning a lesson from the layered user assistance provided for other types of software. Layered assistance provides people with increasing levels of flexibility and freedom as they reach more experienced levels of use* (Carliner, 2005, online).

Both Heath (2005) and Pecheone et al. (2005) agree that electronic portfolio construction takes time, that students need technology skills or adequate training to gain those skills, and that technical problems with software or equipment can be very frustrating and stressful. Heath (2005) adds that if equipment needs to be upgraded to take full advantage of electronic portfolios, the process can also be very expensive. Hauge (2006), in his study on electronic portfolio use in Norwegian teacher education, found that students with high levels of computer experience found electronic portfolios easiest to use, but that students without such experience did eventually catch up.

Tosh, Light, Fleming and Haywood (2005) provide a timely warning of the problems that can be encountered in electronic portfolio implementation if the needs and attitudes of student users are not taken into consideration. Their research shows that addressing issues of buy-in, motivation, assessment and electronic portfolio technology can increase student engagement with portfolios. To improve student buy-in, the way electronic portfolios are promoted is extremely important. Students need to see good examples of electronic portfolios, understand their benefits, and know how they will help students to develop as learners and ultimately gain employment. Students are motivated to work on their portfolios when they can see what they will get out of the experience. Knowing how the electronic portfolio will be assessed is also important, yet it cannot be seen as 'just another assignment', or students will focus on meeting the assessment criteria to the detriment of thinking critically about their learning journey. As Tosh et al. (2005, online) argue, "clear rubrics and scaffolding for students on how to reflect so that they internalize the benefits of reflective practice are clearly needed if this approach to learning is going to be embraced by most learners". Finally, Tosh et al. (2005) document the concerns the students in their study had over the electronic portfolio technology they were using. Many students had problems with the software, complaining it was anything from too complicated to lacking in functionality. Students lamented the time taken to learn the software, and to customise it to their needs. They also had concerns over the privacy of their material in a web-based platform, and wanted control over what was publicly accessible and what was private. An electronic portfolio system needs to be extremely flexible so that it can be adapted to fit students' levels of technical skill, improvements in their skills and confidence over time,

and their preferred styles of working. "It may well be the case that the present generation of template-driven e-portfolios will turn out to be too restrictive for many students as they gain skills in gathering and presenting their work and experiences" (Tosh et al., 2005, online).

Carliner (2005) puts forward the challenge that if educators want to foster electronic portfolios as effective learning tools for their students, they should be modelling them as viable, practical and useful. He is building on the suggestion of Tosh et al. (2005), that one of the most important ways to promote electronic portfolios to students is to show them your own. One of the students in their study had this to say:

> *In terms of promotion the problem is the people trying to explain it have probably never used it so in a way they have no clue what they are talking about, basically. To put it frankly – after listening to them you would be like, Okay so you as an outsider who never even used it is telling us we should do this because it is the best thing since sliced bread but you have never used it – you can't find someone who did use it – you don't have enough information to tell us how to use it – and now you're telling us to use it and we'll grade you on it – this kind of makes it hard for students to accept or appreciate it* (Tosh et al., 2005, online).

Finally, Lorenzo and Ittleson (2005a, pp. 4-5) provide a list of questions that need to be considered before an institution considers adopting electronic portfolios:

- *Should an e-portfolio be an official record of a student's work?*
- *How long should an e-portfolio remain at an institution after the student graduates?*
- *Who owns the e-portfolio?*
- *How should an institution promote and support the use of e-portfolios?*
- *How are e-portfolios evaluated in a manner that is both valid and reliable?*
- *How can institutions encourage reflection in the design and use of e-portfolios?*

Gaps in the literature

Several authors in recent years have identified what they see as gaps in the literature on electronic portfolios. In 2001, Zeichner and Wray considered that more research was needed on the nature and consequences of electronic portfolios over paper-based portfolios, of the nature and consequences of their use for assessment and development purposes, and of the nature and quality of reflection facilitated by such portfolios. Some of these concerns have been addressed in the intervening five years: more research studies on electronic portfolios have since been published (e.g. Beck, Livne, & Bear, 2005; Brown, 2002; Craig, 2003; Delandshere & Arens, 2003; Hauge, 2006; Kimball, 2005; Klenowski et al., 2006; Lynch & Purnawarman, 2004; Ma & Rada, 2005; McNair & Galanouli, 2002; Milman & Kilbane, 2005; Pecheone et al., 2005; Sherry & Bartlett, 2005; Smith & Tillema, 2003; Spendlove & Hopper, 2006; Strudler & Wetzel, 2005; Tosh et al., 2005; Wetzel & Strudler, 2005).

More recently, Brown (2002) laments the lack of focus on adult education, Barrett and Knezek (2003) want more research on the benefits of electronic portfolios over traditional portfolios, and Smith and Tillema (2003) worry about the long-term impact of portfolios. They argue that "a critical appraisal of the portfolio concept is now needed since, after its origination, the portfolio concept has now been expanded to a range of aims and includes so many functions that its features are becoming blurred or are even contradictory" (Smith & Tillema, 2003, p. 628). Challis (2005) goes even further than this, raising the possibility that electronic portfolios may be a 'fad' that will eventually become disreputable and then abandoned. She says it is hard to find "substantive material about the actual use of ePortfolios in the higher education sector in a mature and systematic way" (Challis, 2005, online). Wetzel and Strudler (2005) want research on large-scale implementations of electronic portfolios, to see whether they live up to their promise; Abrami and Barrett (2005) would like to see research conducted on electronic portfolios' underlying processes, their advantages or disadvantages over other types of assessment, and their impact on learning and achievement; and Klenowski et al. (2006) want to

see research on portfolios in postgraduate education. Pearson and Heywood (2004) argue that there are at present no objective ways of measuring reflection, so would like to see more research on reflection on learning. Pinsky and Fryer-Edwards (2004) would like to see more research on portfolios as a tool for assessing professional competence. Beck et al. (2005) want a focus on the impact on teacher professional development, and Davies et al. (2005) want more evidence of portfolios' reliability as a summative assessment tool in medical education.

ELECTRONIC PORTFOLIO ADOPTION AND IMPLEMENTATION

Success criteria

The successful implementation of the electronic portfolio concept relies on several factors. Students need to be introduced to the concept and be given clearly articulated reasons for constructing an electronic portfolio (Chang, 2001; Klenowski et al., 2006). The purpose of the portfolio should be clearly connected to the curriculum and goals of the programme they are studying (Wetzel & Strudler, 2005). They need to know what types of evidence and how many pieces they should include (Canada, 2002), what the requirements are for reflection and self-assessment (Chang, 2001), how the portfolio will be assessed (Carliner, 2005), and what weight the portfolio will have in their final grade (Canada, 2002). Constructing a portfolio should be a reflective process, through which students construct meaning and understanding out of their learning (Klenowski et al., 2006). Students need to be encouraged to capture the uniqueness of their learning stories, though Klenowski et al. (2006) warn that this can also lead to anxiety in students. Lecturers need to provide encouragement and support to their students (Chang, 2001; Wetzel & Strudler, 2005) to help them through the experience.

Studies show that the motivation of students when constructing their portfolios is very important (Al Kahtani, 1999; Chang, 2001; Tosh et al., 2005). Motivation can be encouraged through enabling student decision-making, ensuring students have ownership of their portfolios, and public access to and recognition of students' work over the web. Likewise, student and educator 'buy-in' to the portfolio concept (Tosh et al., 2005; Wetzel & Strudler, 2005) helps ensure its success. This can be facilitated for students by showing them examples of past electronic portfolios and demonstrating their effectiveness in making learning gains (Abrami & Barrett, 2005), as well as ensuring they have adequate resources and sufficient access to technology to complete the portfolio (Wetzel & Strudler, 2005). For staff, knowing they have strong and supportive leadership and the necessary resources (Strudler & Wetzel, 2005) helps to secure their participation in an electronic portfolio project.

For electronic portfolio systems to be successful, a different set of criteria needs to be met. Ahn (2004) believes that the planning process is a key element of success. Those wishing to implement a system must "critically examine how e-portfolios will be used…and then design [or adopt] software that addresses those needs" (Ahn, 2004, online). Ways need to be found to integrate meaningful reflection into the electronic portfolio, to balance standardisation with the ability for a system to be flexible enough to respond to student need, and to protect the privacy of those contributing to portfolios (Kimball, 2005). A system needs to 'stand alone', without constant nurturing from academic staff (Wetzel & Strudler, 2005). Finally, institutions need to recognise that implementing an electronic portfolio system is a long-term endeavour (Ahn, 2004) that will be most successful if time is spent in the initial piloting stages before it becomes available programme- or institution-wide (Wetzel & Strudler, 2005).

Yancey (2001, pp. 84-86) neatly summarises the factors necessary for the successful design and creation of an electronic portfolio system in a series of questions:
- *What is/are the purpose/s?*
- *How familiar is the portfolio concept? Is the familiarity a plus or a minus?*
- *Who wants to create an electronic portfolio, and why?*
- *Who wants to read an electronic portfolio, and why?*

- *Why electronic? What about electronic is central to the model? And is sufficient infrastructure (resources, knowledge, commitment) available for the electronic portfolio?*
- *What processes are entailed: What resources are presumed?*
- *What faculty development component does the model assume or include?*
- *What skills will students need to develop?*
- *What curricula enhancement does the model assume or include?*
- *How will the portfolio be introduced?*
- *How will the portfolio be reviewed?*

Barriers to implementation

A number of barriers to the implementation of electronic portfolios also exist. Summarising from the issues raised in the literature (Canada, 2002; Lorenzo & Ittleson, 2005a, 2005b; Sherry & Bartlett, 2005; Tosh et al., 2005; Wetzel & Strudler, 2005), the following list has been compiled:
- The need for adequate hardware and software;
- The accessibility of that hardware and software;
- Lack of technology skills amongst students and staff;
- Technical problems with the equipment or electronic portfolio system;
- The need for support when problems are encountered;
- Maintenance of the hardware;
- Adequate storage space and server reliability;
- Demands on staff time;
- How to use students' time efficiently;
- How to overcome issues of ownership and intellectual property;
- Problems with security and privacy of data;
- Lack of features or of control over those features;
- The need for access and permission controls;
- How to transport electronic portfolios into new systems as students move on; and
- The need for common standards between different electronic portfolio systems.

Educational and pedagogical considerations

Portfolios are based on constructivist philosophy (Abrami & Barrett, 2005; Chang, 2001; Klenowski et al., 2006; Meeus, Questier, & Derks, 2006; Strudler & Wetzel, 2005). Klenowski et al. (2006, p. 278) give a definition of constructivism that is useful for those thinking of implementing portfolio assessment: "knowledge is constructed through activities such as participatory learning, open-ended questioning, discussion and investigation. Facilitation helps learners construct their own schema for internalizing information and organizing it so that it becomes their own".

Kimball (2005) argues that good portfolio pedagogy revolves around the thoughtful collection of evidence, reflection that reconsiders and makes a story out of learning experiences, and making connections between disparate ideas and actions. In his view, portfolio pedagogy "seeks to encourage students to become dynamic participants in their own learning…students are not merely the users of the system; they are, or should be, the *authors* of it" (Kimball, 2005, p. 442, original emphasis). Of importance here are issues of ownership, authorship and the balance of power between students and lecturers. Kimball believes that portfolios can help to shift that power towards students. McNair and Galanouli (2002) likewise think that change can be brought about by the use of computers in tertiary education, as typified by the use of electronic portfolios. Technology skills must not be viewed as a discrete set of skills, but rather as a way of enhancing learning and teaching. The focus of electronic portfolios must be on learning, not on the technology used to facilitate that learning:

> *ePortfolios will be worth the effort if and only if we use them to improve important activities in academic life. To put it another way, we need to shift our focus from the ePortfolio software itself – its features, its reliability, and so on – to the activities and outcomes for which that software is to be used* (Ehrmann, 2006, p. 181).

Electronic portfolios influence student learning through the process of construction and through collaboration with and feedback from academic staff (Lynch & Purnawarman, 2004). In fact, for Chang (2001), discussions between students and their teachers lie at the core of the portfolio methodology. This requires academic staff to be as committed to and involved in the portfolio process as their students. In the words of Klenowski et al. (2006, p. 268),

> *To use portfolios to support professional development, learning and technology requires tutors to understand some key assessment concepts such as the link between learning objectives as success criteria, the use of rich questioning and the role of feedback in a pedagogy focused on learning, self- and peer-assessment.*

Acosta and Liu (2006) envisage electronic portfolios as a way of shifting the locus of control from teacher to student, which entails changes in curriculum design and leads to the development of social capital. They define social capital as "using collective power and resources to improve and benefit society and the individual through strong relationships and active interactions" (Acosta & Liu, 2006, p. 21). Electronic portfolios can help students to make connections between different aspects of their lives and help them to form their social identities, and their identity within their discipline of study.

An electronic portfolio system cannot be implemented without consideration of how the portfolios will be assessed. Electronic portfolios can be used for both formative purposes, to facilitate student learning, and for summative purposes, to assess how much a student has learnt over a course of study (Beck et al., 2005; Klenowski et al., 2006). Beck et al. (2005, p. 235), however, argue that the best use of electronic portfolios is for formative assessment, as they make use of strategies "such as reflective inquiry, individual student and lesson narratives and professional and peer support".

Given that the assessment of electronic portfolios is unavoidable when they are put to use in tertiary education, many authors in the literature agree that students need to be provided with clear assessment guidelines, based on established and reliable standards (e.g. Canada, 2002; Carliner, 2005; Lynch & Purnawarman, 2004; Tosh et al., 2005). Students can be assessed on how their evidence and reflection show their learning gains (Tosh et al., 2005), and how these accomplishments link to the standards and learning outcomes of their course of study (Lorenzo & Ittleson, 2005c).

Both Delandshere and Arens (2003) and Meeus et al. (2006) raise questions over the validity of electronic portfolios as an assessment tool. For Delandshere and Arens (2003), the problem lies in the differences between individual portfolio raters, and differences in understandings of what constitutes 'evidence' and 'reflection'. For Meeus et al. (2006, p. 137), the indirect nature of the evidence is problematic:

> *Portfolio only informs us about the student's competencies in an indirect way. There is no direct observation. The indirect nature of this representation raises the question as to the validity of portfolio. To what extent is the picture painted by the student a correct representation of his or her real competencies? Students who possess a high level of media competence may gain an unfair advantage from an attractive packaging. It is the responsibility of the course tutors to use an evaluation system which prevents such practices as far as possible.*

Support and technical considerations

The planning and implementation of an electronic portfolio system requires the consideration of a number of technical issues. Before a system can be chosen or specially designed, the reasons for implementing a system, who will use it and who will be its audience need to be

identified (Heath, 2002). The existing technology skills of staff and students, and the available financial, hardware and software resources (Barrett, 2000; Heath, 2002; Lorenzo & Ittleson, 2005a; McNair & Galanouli, 2002) need to be considered.

Electronic portfolio developers have four different options when considering which system to adopt: one designed in-house to meet institution-specific requirements; an open source system freely available over the Internet that either meets requirements as is, or can be readily adapted; a commercially available system that the institution is willing to purchase; or using 'common tools' such as Microsoft Word, Internet browsers and so on, to design a portfolio that can then be uploaded to the web or saved to CD-ROM (Lorenzo & Ittleson, 2005a; Strudler & Wetzel, 2005). Whatever the type of system that is chosen, several practical and technical requirements need to be met (Abrami & Barrett, 2005; Barrett, 2000; Barrett & Knezek, 2003; Challis, 2005; Lorenzo & Ittleson, 2005a; Meeus et al., 2006; Siegle, 2002; Tosh et al., 2005):

- A way of organising content;
- A way of tracking student progress;
- A way of archiving and storing large amounts of data;
- A way of retrieving data;
- How reflective pieces will be linked to artefacts;
- How assessment results will be incorporated into the electronic portfolio;
- A way of publishing the portfolio, so a variety of versions can be produced for different audiences;
- How flexibility for the organisation of data will be ensured;
- Which coding language will be used;
- Which technical standards need to be met so the system will communicate reliably with other systems;
- Which file formats will be recognised by the system;
- How security and access permissions will be set;
- How scalability will be ensured so that a large volume of users can access the system;
- How the system will ensure maximum accessibility and usability for users of all levels of skill;
- The inclusion of a wizard tool;
- What kinds of technical support will be available for users;
- How the privacy and intellectual property of users will be protected;
- How long an electronic portfolio will exist in the system: indefinitely, or for an agreed upon length of time after a student graduates; and
- How portability will be ensured, so that students can take their electronic portfolio to another institution or choose to maintain it on their own.

MacDonald et al. (2004, p. 54) warn that "the software used to create the portfolio can constrain or enhance the process and the final product". Addressing all the above concerns to best meet the needs of students and staff at an institution is essential for the success of any electronic portfolio initiative.

Institutional change and impact

One of the greatest challenges to portfolio implementation is managing the institutional change that arises as a consequence (Carliner, 2005). To be successful, electronic portfolios necessitate that reflective learning practices become embedded in the culture of the institution (Ahn, 2004), which means that programmes of study may need to be radically restructured (Challis, 2005). In addition, institutions can be "held open to scrutiny" (Craig, 2003, p. 123) as their students' work becomes widely accessible via the Internet, so it is in the best interests of management and administration staff to be involved in the planning and implementation phases of an electronic portfolio development. When such change is being established, institutional support is important. Those in positions of leadership can help to encourage other staff to participate, can provide the necessary technology, financial and human resources, and can

foster a collaborative and respectful culture for the development process (Strudler & Wetzel, 2005). As Strudler and Wetzel (2005, p. 414) argue, "change mandated from administration…can lead to successful change if accompanied by support, training, and an understanding of the change process…[Otherwise], top-down change often leads to resistance during implementation".

CONCLUSIONS AND RECOMMENDATIONS

If properly implemented and used well, electronic portfolios can be a powerful tool for capturing student learning. Through the process of constructing an electronic portfolio, students learn to apply reflective thinking to their experiences, thus generating meaning and recognising the next steps they need to take on their learning journey. If only narrowly considered as a way of organising student work, then electronic portfolios will fail to truly help students to learn. Likewise, too great an emphasis on students meeting standards for competency will endanger the reflective and learning potential of electronic portfolios.

To be successful users of electronic portfolios, students need to understand the reasons for constructing a portfolio, be given clear guidelines, and have access to an electronic portfolio system that is easy to use and gives them as much flexibility or as much structure as they require. They also need the support of their lecturers. Academic staff need to be committed to the portfolio process, and willing to give students regular and useful feedback on their work and reflections.

Institutions need to be aware of the impact that an electronic portfolio development will have. Electronic portfolios need to be an integral part of a programme of study, not an 'added-on' assessment, which may necessitate the review and restructuring of courses. The type of portfolio required, its purpose and its audience need to be clearly articulated. Students and academic staff using an electronic portfolio system need the time, skills and resources to do so successfully. Institutions need to provide strong leadership to encourage their staff to participate in an electronic portfolio development, whilst also enabling collaboration and staff input into decision-making. Institutions also need to recognise that the process of implementing an electronic portfolio system is a long-term one, and it may take several years before the full benefits will be seen.

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