Chapter 4
Assessment Issues and New Technologies: ePortfolio Possibilities

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Introduction: ICT and Assessment in the 21st Century

During the past three decades, we have witnessed dynamic technological changes that have been accompanied by considerable policy developments and initiatives by governments and education systems. For the purposes of this chapter, the technological developments focused on are specifically those related to information and communication technologies (ICT). A comprehensive definition of ICT is adopted here to include not only personal computers, but also allows for consideration of a wider range of new and emerging technologies that can be used for information and communication purposes, such as the Internet, mobile phones, digital cameras, digital video recorders, learning objects, personal digital assistants (PDAs), interactive whiteboards, wireless and networking technologies, podcasts, mp3 players, virtual reality and voice over Internet protocol (VoIP).

These ICT technological developments have coincided with the emergence of a language that positions thinking about teaching, learning and the role of assessment in the 21st century. For example, in shaping the next phase of technology use in education in the United Kingdom, there have been calls for educators to 'fully exploit the power of technology to provide a 21st Century education that reaches and benefits all learners and enable the UK to compete globally' (Becta, 2007a, p. 2). Elsewhere, in the United States, a coalition of leading education, business and technology organisations formulated the reports *Learning for the 21st Century* (Partnership for 21st Century Skills, 2003) and *Assessment of 21st Century Skills: The Current Landscape* (Partnership for 21st Century Skills, 2007). The latter report asks the question, 'How can we best prepare students to succeed in the 21st century?' There are concerns that there is now a 'profound gap between the knowledge and skills most students acquire in school and those required in today's 21st Century communities and technology-infused workplaces' (Partnership for

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21st Century Skills, 2007, p. 4). Furthermore, this raises another critical question, 'How do we measure 21st-century learning?' (Partnership for 21st Century Skills, 2007, p. 4)

Similarly, in Australia, the government has portrayed its vision of the central importance of ICT in the 21st century through its strategic action plans, such as *Learning for the Knowledge Society: An education and training action plan for the information economy* (Education Network Australia, 2000) and *Learning in an Online World: Online Content Strategy* (Department of Education, Training and Youth Affairs (DETYA), 2000). Subsequent strategy statements have built upon those strategic documents and recognised the importance of online content (Ministerial Council for Education, Employment, Training and Youth Affairs (MCEETYA), 2003), pedagogy (MCEETYA, 2005a) and leadership (MCEETYA, 2006), which collectively reflect 'a national vision for improving education and training outcomes for all Australians through the ubiquitous use of information and communications technology (ICT)' (MCEETYA, 2005b, p. 1). The expectation is that ICT can and will transform pedagogies by empowering teachers to 'use planning tools to connect learning programs with curriculum assessment and reporting frameworks' (MCEETYA, 2005a, p. 7). Therefore, there has been the recognition of the important interface of ICT and assessment:

> Significant changes have occurred in education and the use of information and communication technologies (ICT) . . . These reflect inter-related developments in . . . school reform, curriculum, pedagogy and assessment.
>
> (MCEETYA, 2005b, p. 3)

As schools adopt learning management systems (LMSs), local area networks (LANs), learning management content systems (LMCSs) and virtual learning environments (VLEs), it has become apparent that those digital systems, by themselves, have been unable to interact successfully with other digital services, resulting in the emergence of managed learning environments (MLEs). The next likely phase is digital ecosystems conceptualised as learning platforms that keep learning central, enable interoperability and form a foundation for ongoing development through use of new technologies and increased capabilities of educators to use ICT for curriculum, pedagogy and assessment (Ingvarson & Gaffney, 2008). Digital ecosystems might include student administration, LAN (requiring teacher and student logins and passwords), VLE, content repository, community links, utilise Web 2.0 (social networking) technologies and have student assessment and achievement as integral to the platform.

This chapter specifically aims to contribute insights into the possibilities provided by ICT for new ways of assessing learning in the 21st century and highlights some of the implications and issues of using ICT in assessment. Specifically, the chapter provides examples of the use of ICT for assessment, where ICT is the focus, where the content is the focus, where ICT is used as a data-collection tool, as a recording, analysis and communication tool, as a plagiarism detector and used for ePortfolio

purposes. In particular, ePortfolio possibilities are discussed, including the potential of Web 2.0 technologies to enable innovative approaches to the assessment of students' lifelong and life-wide learning.

Assessment and ICT: Technological Pedagogical Content Knowledge for Educators

Both assessment and ICT hold challenges for many teachers. While well-designed assessment can enhance students' learning effectiveness, and *all* teachers should be 'assessment literate' and capable of using assessment to inform instructional practice (Campbell & Collins, 2007), these expectations are not matched by studies of teachers' assessment knowledge (Brookhart, 2001; Campbell & Evans, 2000). Studies dating back as far as 50 years ago have provided similar concerns about inadequate teacher preparation courses in assessment (Mayo, 1967; Noll, 1955). Assessment literacy is an important component of a teacher's pedagogical content knowledge (PCK) (Wang, Wang, & Huang, 2008). PCK was proposed by Schulman (1987) as the 'special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of understanding' (p. 8).

Similarly, in addition to the importance of teachers' assessment literacy, there have been growing expectations for teachers to add ICT literacy to their PCK repertoire, resulting in an interface between assessment literacy and ICT literacy as new technologies provide opportunities for new approaches to assessment. Teachers are gaining access to a range of ICT tools that allow them to not only work online to construct test items, correct test papers and record scores using web-based, database and communications technologies, but also afford opportunities for assessment practices that utilise hypermedia, including audio, video and even virtual or dynamic images (Wang et al., 2008, p. 4). Technological pedagogical content knowledge (TPCK) has been proposed to describe this new knowledge set required by teachers, in order to allow them to effectively capitalise on ICT (AACTE Committee on Innovation and Technology, 2008).

That conceptualisation highlights not only the importance of pedagogical knowledge (knowing how to teach) and content knowledge (knowing what to teach), which teachers need in order to effectively teach and assess students, but also technological knowledge in order to effectively harness the affordances ICT can bring to teaching and assessment in the 21st century. Various education systems have developed expectations or standards for teachers that already go some way towards identifying TPCK, though this might not be explicitly articulated.

For example, the International Society for Technology Education (ISTE, 2007a, 2007b) considers assessment and evaluation as essential conditions for students to be able to effectively leverage technology for learning. It refers to the use of ICT in terms of assessment both *of* learning and *for* learning. In terms of expectations for teachers, the *ISTE NETS for Teachers (NETS·T)* (ISTE, 2000) identifies the fundamental concepts, knowledge, skills and attitudes that teachers need in order to

apply technology in educational settings. In relation to assessment and evaluation, the expectations are that:

> Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies.
>
> A. apply technology in assessing student learning of subject matter using a variety of assessment techniques.
> B. use technology resources to collect and analyse data, interpret results, and communicate findings to improve instructional practice and maximize student learning.
> C. apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.
>
> (ISTE, 2000, p. 9)

Thus, international standards explicitly expect teachers to have technological knowledge (TK) and to be able to 'apply technology' and 'use technology' for assessment and evaluation purposes (TPCK). However, the interface between TK and PCK presents new challenges in assessing student learning, including challenging traditional models of assessment that were generally confined to pencil and paper. Many of today's students are immersed in rich technological environments outside of formal schooling. They increasingly access information and communicate using mobile devices and online in a networked, multimedia, hypertextual, digital world. The activities provided by these online spaces are becoming increasingly important in the development of identity and are a repository for an individual's life experiences and a reflection of their growth and development over time. In the past, it might have been sufficient for teachers to understand how to design paper and pencil, or oral assessments, but now teachers need to embrace the affordances and implications of ICT for assessment as well. The question that now needs to be addressed is, 'How might ICT be used for assessment purposes?'

Possible Uses of ICT for Assessment

ICT can assist assessment through ICT-based assessment, ePortfolios, Performance and Assessment (PANDA) data and software packages that can be used for screening, target setting and assessment purposes (Becta, 2004). In addition to providing an efficient means for data collection, manipulation and reporting, the use of ICT for assessment is being progressively introduced, whereby students are expected to interact with on-screen tests using computers to enable effective data collection and data access, which is then used to inform learning and teaching (Becta, 2004). ICT obviously makes the collection and analysis of assessment data efficient and effective, but we would argue that limiting of the use of the technology for these purposes does not harness its full assessment potential.

The ways in which ICT might be used for assessment are dependent upon how the role of ICT in teaching and learning is perceived and what types of assessment are required (Bitter & Legacy, 2006; Bitter & Pierson, 2005). For example, the

focus of assessment might be the ICT itself as reflected in the aim of the recently introduced National ICT Literacy Test in Australian schools (MCEETYA, 2007). Unfortunately, while this form of assessment might answer questions related to *whether or not* students can use ICT tools proficiently, it is limited in its provision of evidence about student learning, particularly in terms of *how* students are able to use ICT for learning in a range of curriculum contexts, and for the development of creative, complex and critical thinking.

ICT, when used for assessment purposes as a data-collection tool, recording, analysis and communication tool, and as a plagiarism detector (Bitter & Pierson, 2005), offers advantages afforded by ICT largely by making the assessment process more efficient, particularly in terms of large-scale assessment of students, where the focus is on assessment for mastery of skills and content (Forcier & Descy, 2002, pp. 300–301). In discussing additional ways in which ICT can be used for assessment, Bitter and Legacy (2006, pp. 208–217) provide examples where ICT tools are integrated into assessment practices, while Finger, Russell, Jamieson-Proctor, and Russell (2007) suggest that ICT software can be categorised according to the function it serves, such as ICT-assisted instruction for online tutorials, simulation, instructional games, problem solving, integrated learning systems (ILSs) and ICT assistant tools (see also Newby, Stepich, Lehman, & Russell, 2006) or support tools (see Roblyer, 2006) for word processing, presentation software, spreadsheets, databases, material generators, data collection and analysis tools, graphics tools, planning and organising tools, research and reference tools and content area tools (Finger et al., 2007, pp. 174–177). Drawing upon these categorisations, the following summary provides examples of the use of ICT for assessment where ICT is the focus, where the content is the focus, where ICT is used as a data collection tool, where ICT is used as a recording, analysis and communication tool, where ICT is utilised as a plagiarism detector and is used for ePortfolio purposes.

ICT as the Focus

This has been evident in large national, state or district studies, often involving online surveys to collect data related to ICT performance indicators, such as the number of computers, time spent by students using computers and, more recently, emphasis has been on obtaining data about student ICT skills and competencies. Examples include the *iSkills* (Educational Testing Service, 2008a—see <www.ets.org/ictliteracy>) and *NETS Online Technology Assessment* (ISTE, 2007c—see <www.iste.org/resources/asmt/msiste>). In Australia, the *MCEETYA National Assessment Program—ICT Literacy Years 6 & 10 Report 2005* (MCEETYA, 2007) obtained ICT literacy data about Year 6 and Year 10 students and, interestingly, indicated among its conclusions that:

> One should not assume that students are uniformly becoming adept because they use ICT so widely in their daily lives. The results of the assessment survey suggest that students use ICT in a relatively limited way and this is reflected in the overall level of ICT literacy.

> Communication with peers and using the Internet to look up information are frequent applications but there is much less frequent use of applications that involve creating, analysing or transforming information.
>
> (MCEETYA, 2007, p. xiv)

Content as the Focus

Where content is the focus, ICT is seen as a tool for instructional delivery, communication or information searching and delivery, and student learning is measured on mastery of content objectives. For these purposes, strategies for assessment with ICT need to be designed in ways consistent with quality assessment principles. Examples include the design and use of ICT programs for planning, assessment, recording and reporting of student achievement, such as *Assessment Management Solutions* (Excelsior Software, 2008—see <www.gradebook.com>), collaborative Internet projects such as *ThinkQuest* (Oracle Education Foundation, 2008—see <www.thinkquest.org>), the use of learning objects, such as those developed by The Le@rning Federation (Curriculum Corporation, 2008—see <www.thelearningfederation.edu.au>), LMSs such as Blackboard, LAMS and online assessment rubrics, for example, *Kathy Schrock's Teacher Helpers: Assessment and Rubric Information* (Discovery Education, 2008—see <school.discovery.com/schrockguide/assess.html>).

ICT as a Data-Collection Tool

Numerous examples exist whereby ICT can be used to develop tests, such as computer-based tests, computer adaptive tests and test-creation applications. These applications usually have the function to collate and archive results. Examples include:

- Computer-based tests, which are often computer-based versions of traditional paper-based tests. Essay grading software tends to be limited in its ability to assess creativity or organisation of writing; for example, *Intelligent Essay Assessor* (Pearson Education, 2008a—see <www.knowledge-technologies.com/prodIEA.shtml>).
- Computer adaptive tests, which are able to change their form in response to the input from the student being tested; for example, *GRE®—Graduate Record Examinations®* (Educational Testing Service, 2008b—see <www.gre.com>).
- Test-creation applications are available whereby teachers can create their own online quizzes, exams and tests, and access banks of tests and test items already created; for example, *Test banks: Rubistar* (Altec at University of Kansas, 2008—see <rubistar.4teachers.org>); FunBrain's Quiz lab.com (Pearson Education, 2008b—see <www.FunBrain.com>); QUIA (QUIA Corporation, 2008—see <www.quia.com>); and WebAssign (North Carolina State University, 2007—see <www.webassign.net>).

ICT as a Recording, Analysis and Communication Tool

For assessment applications in which ICT is used as a recording, analysis and communication tool, ICT is used to assist teachers with quantitative and qualitative record keeping. In addition, ICT can enable the generation of reporting to various audiences to portray student learning. Examples include:

- Quantitative record keeping. Through the use of spreadsheet software, ICT enables formulae for statistical calculations, analysis and graphical representation. Applications can be used for attendance, calculating grades from scores, and web-based grade book management systems can allow teachers to manage grades online, including emailing students their results; for example, *ThinkWave Educator* (Thinkwave Inc., 2007—see <www.thinkwave.com>).
- Qualitative record keeping. Qualitative information such as observations and anecdotal records can be created, stored and accessed digitally.

Technology as a Plagiarism Detector

Major challenges and issues relate to the social, legal and ethical issues of online assessment. Educators are being presented with issues of academic integrity and academic misconduct, often related to plagiarism, which have tended to increase due to students' easy access to online content. ICT applications and processes have been developed to detect plagiarism; for example, *TurnItIn Digital Assessment Suite* (TurnItIn, 2008—see <www.turnitin.com>) and *SafeAssign* (Blackboard, 2007—see <www.safeassign.com>). The implication for schools and school systems is the need to develop and revise policies to cover new problems created by ICT related to plagiarism, and ICT itself is providing some of the preventive and detection solutions to these challenges.

ePortfolio Assessment

We argue that ePortfolios provide an extremely powerful means for developing stories of deep learning through an increased range of evidence such as text, audio, narration and digital video when compared with the more limited paper-based forms of assessment evidence. A more comprehensive discussion and the possibilities of ePortfolios are provided later in this chapter.

We contend that it is important to select and design the assessment based upon an educationally justifiable rationale for the use of ICT. In relation to TPCK, a central issue is that teachers require substantive knowledge of assessment, TPK to use the new technologies and PCK. This seems unlikely to be the case in many settings. For example, in the United Kingdom, Ofsted (2005) reported that students' ICT was not systematically assessed and that in many cases teachers were too easily impressed with mediocre application of ICT by pupils. Disturbingly, even where ICT work

was assessed, pupils generally received insufficient feedback on how they could improve their work, and in many schools teachers did not evaluate how well pupils applied and used their ICT skills across the curriculum (Ofsted, 2005). Interestingly, the methodological aspect in relation to the use of ICT to support assessment that seemed most to capture people's imagination was the use of computer-based item banks (Matters, 2006).

Due to the increasing use of student performance data within a high-stakes accountability environment, in relation to methodological perspectives, it is important to consider carefully the conduct, analysis and interpretation of the data (Matters, 2006). This is a contested territory that requires careful consideration of the purpose of the assessment that ICT is enabling, the ways in which the data might be interpreted and the ways in which the data might be used. An ethical perspective is required which 'encompasses the social and political components of data use' (Matters, 2006, p. 52) and, therefore, interplays with the methodological and strategic perspectives, such as fairness in assessment, appropriate data use and anticipating the consequences of the use of data (Matters, 2006).

Consequently, ICT use for assessment purposes needs to be guided by principles of quality assessment and the ways in which assessment can assist learning, rather than being a means for inappropriate methodological, strategic and ethical approaches to data collection, analysis and interpretation. Connectedness and responsiveness is a hallmark of quality assessment and should take 'account of students' interests, capabilities and repertoires of practice, both inside and outside schooling, including the actual and virtual communities in which students live' (Wyatt-Smith, Cumming, & Elkins, 2005, p. 278). However, being online without an intentional purpose will not necessarily result in meaningful learning, and the current generation of learners is learning to use the World Wide Web as an electronic encyclopaedia from which they copy others' ideas instead of learning to create and represent their own unique ideas (Jonassen, 2000). That is, if teachers and students use the new ICT-enabled resources in largely traditional tasks, this might 'provide an incremental advantage over existing practices' (Grabe & Grabe, 2004, p. 237). Rather, alternative approaches should be implemented by educators that offer a 'transformational advantage' (Grabe & Grabe, 2004, p. 237), whereby the Internet can provide tools for communication, inquiry and construction (Bruce & Levin, 1997).

With access to new and emerging technologies, and with the skills to use those technologies, students will be able to produce work that demonstrates their knowledge and understanding in ways that many might find difficult to imagine (Forcier & Descy, 2002). New possibilities for assessment have become available through online or eLearning environments. An extensive range of online tools is now available, such as email, bulletin boards, discussion forums, blogs, wikis, chat rooms, instant messaging and videoconferencing. Most higher education institutions and an increasing number of schools have adopted course management systems such as Blackboard™, which provide an environment for online learning and assessment. In particular, Web 2.0 technologies, often referred to as social networking technologies, have enabled cyber-collaboration whereby many users located in diverse

settings can interact synchronously and asynchronously. The implications for educators are how to capitalise upon the use of these technologies for assessing student learning in a networked, digital world.

ePortfolio Approaches

Portfolios have been used for a variety of purposes for some time and have usually been perceived as being a collection of student work, both formative and summative in nature. Traditional portfolios might be described as a work-in-progress that contain a collection of physical artefacts which reflect a student's development and progress over time, with the final product and portfolio evidence presented as a paper copy for assessment (Barrett, 2005). In theorising portfolio approaches, Barrett (2004, 2005) notes the limitations of a portfolio approach, which foregrounds the collection of evidence and consequently recommends that a more effective approach needs to be underpinned by assessment *for* learning, is to emphasise reflection and its importance in promoting deep learning, as displayed in Fig. 4.1.

ePortfolios, also known as digital portfolios or electronic portfolios, tend to be a collection of authentic and more diverse evidence than the traditional portfolios, drawn from a larger archive representing what a person or organisation has learned over time, upon which the person or organisation has reflected, and has been designed for presentation to one or more audiences for a particular rhetorical purpose (Barrett, 2005). The ePortfolio process, involving collecting, selecting, reflecting, directing and celebrating, can be enhanced through the use of ICT, through the use of multimedia, hypermedia and eLearning architecture to enable archiving, linking and thinking, storytelling, collaborating and publishing, as displayed in Fig. 4.2. ICT extends the ability over largely linear, paper-based portfolios

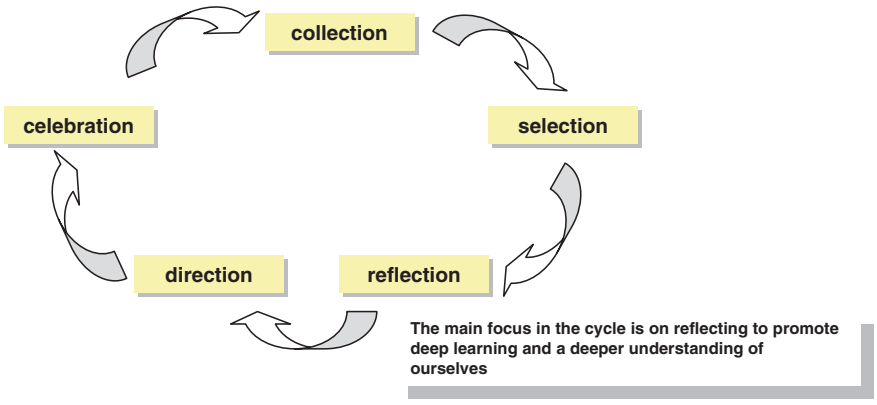

Fig. 4.1 Reflective portfolio process—emphasis is on *reflection* (Source: adapted from Barrett, 2005)

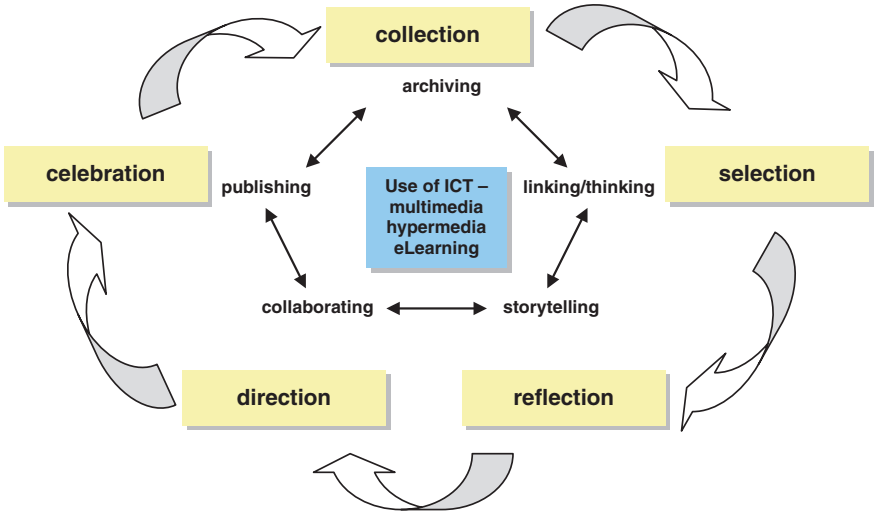

Fig. 4.2 Enhanced ePortfolio process enabled through ICT

to communicate digital stories of learning through ePortfolios using video, audio, graphics and text in a web-based, digital, hypertextual portfolio.

In higher education, three types of academic portfolios have become prominent, namely:

Student learning portfolios—these are purposeful collections of examples of student work annotated (ideally) with students' reflective commentary.

Teaching portfolios—these consist of course syllabi, assignments, student work and other artefacts, collected by practising or aspiring teachers with the intention of fostering self-reflection and peer review of teaching.

Institutional portfolios—these contain examples of [an] institution's activities, programs and initiatives, each expressing an element of reflection and self-assessment. (Ketcheson, 2001, p. 84)

Similarly, in school settings, interest is being taken in ePortfolio approaches, and a recent study of existing practices by Bussitil-Reynaud et al. (2006) identified four types of ePortfolio being used in schools in the United Kingdom, namely:

Transition ePortfolios—relevant administrative and educational information about the learner is transferred from one institution to another as a learner progresses.

Assessment ePortfolios—information and evidence about work undertaken by learners and achievements for assessing or matching against specified criteria is collected and managed.

Presentation ePortfolios—learners select and present evidence of personal information or achievements;

Learning ePortfolios—the learner develops a broader, more general resource that can support whatever the individual wants to do and that could form the basis

of any of the previous portfolios if desired (Bussitil-Reynaud et al., 2006, cited in Becta, 2007b, p. 31).

Central to any of these ePortfolio approaches is the aim of enabling learning stories and reflections by students to emerge through the use of their own voice. This approach could be described as a meta-narrative that reflects a 'story' of learning. The 'stories' encourage learners to connect their formal study with their life experiences, including their personal use of new technologies and, therefore, provide a means for connectedness and relevance, which is a feature of quality assessment (Wyatt-Smith et al., 2005). We know that stories are distinguished from silences and there are narratives that assist to provide representations of reality and representations of culture (Preskill, 1998). Bourdieu (1991) refers to teachers' stories as cultural capital, as they provide them with their knowledge, ideas, attitudes and values (Hatch, 2004), and Preskill (1998) categorises the cultural capital into the narratives of social criticism, apprenticeship, reflective practice, journey and hope.

The narrative of reflective practice is also evident in the narrative of journey, 'for without reflection, growth and change cannot occur' (Hatch, 2004, p. 117). The narrative of reflective practice becomes important in student learning: What worked well? What do I need to know? What have I learned? Where have I been? Where do I want to go? Who am I? Who do I want to become? ePortfolios are becoming increasingly used as assessment and presentation portfolios in ways in which learners are required to design and create an ePortfolio to portray a personal story of deep learning, reflecting the metaphor of 'story' and 'journey' (Paulson & Paulson, 1994; Preskill, 1998). Clearly, ePortfolios can take various forms and be guided by different purposes and audiences. Tolley (2008) believes that 'this is where we are at with e-Portfolios—many different opinions and for different purposes.' (p. 2)

ePortfolios: Assessment for Learning and Assessment of Learning

While there are many instances in the assessment literature of the notion that assessment *for* learning and assessment *of* learning are dichotomous, the two are different not merely dichotomous (Matters, 2006). Matters indicates that the term 'assessment for learning', originally used by the Assessment Reform Group (2002) in the United Kingdom, highlighted the value of assessment to enhance learning compared with assessment *of* learning. In highlighting the extensive debate surrounding the terms assessment *of* and assessment *for* learning, Matters parodies Churchill's well-known statement made during World War II, by stating that 'Never in the field of educational assessment was so much written by so many about so few prepositions' (Matters, 2006, p. 25). However, when formulating the use of ePortfolios for assessment purposes, we must first ask, 'What kind of assessment do we require?' (Barrett, 2006). As summarised in Table 4.1, we provide a summary of Barrett's main ideas in relation to ePortfolios used for assessment *of* learning and for assessment *for* learning.

Table 4.1 ePortfolios—assessment *of* learning and assessment *for* learning

Portfolios used for assessment *of* learning	Portfolios that support assessment *for* learning
Purpose of portfolio is prescribed by institution	Purpose of portfolio agreed upon with learner
Artefacts mandated by institution to determine outcomes of instruction	Artefacts selected by learner to tell the story of their learning
Portfolio usually developed at the end of a class, term or program—time limited	Portfolio maintained on an ongoing basis throughout the class, term or program—time flexible
Portfolio and/or artefacts usually 'scored' based on a rubric and quantitative data is collected for external audiences	Portfolio and artefacts reviewed with learner and used to provide feedback to improve learning
Portfolio is usually structured around a set of outcomes, goals or standards	Portfolio organisation is determined by learner or negotiated with mentor/advisor/teacher
Sometimes used to make high-stakes decisions	Rarely used for high-stakes decisions
Summative—what has been learned to date? (past to present)	Formative—what are the learning needs in the future? (present to future)
Requires extrinsic motivation	Fosters intrinsic motivation—engages the learner
Audience: external—little choice	Audience: learner, family, friends—learner can choose

Source: Adapted from Barrett, 2006.

Early attempts to develop ePortfolios tended to use ICT applications that were often published on CD and, in some instances, if the file size permitted, were uploaded to the Internet. Examples included Microsoft Office documents, Apple iLife06 (iDVD containing photos and video and published on a DVD) and webpage editors such as Dreamweaver and Microsoft FrontPage to create webpage repositories for information and a way to link to other static documents such as portable document format (PDF) files and .jpg format photos. New possibilities are now available for designing web-based ePortfolios using Web 2.0 tools such as blogs and wikispaces, and Open Source Portfolios, such as OSP and Elgg. They offer both creators and audiences more flexibility and access options, are able to be integrated with formal coursework and offer opportunities for peer review and group collaboration through employing Web 2.0 technologies (Zhang, Olfman, & Ractman, 2007), which are explored in the following section.

ePortfolios and Web 2.0 Technologies

Beyond the formal schooling experiences of students, there has been a proliferation in more recent times of social networking, evidenced by the high levels of engagement with texting (text messaging via mobile phone), iPhones, MSN, MySpace, FlickR, Facebook and YouTube, and numerous other social networking sites that enable blogging and wikis. The entry to Internet communication and publishing is minimal when compared with paper-based publishing. Information exchange in

Web 1.0 tended to be characterised by the webpage with hyperlinks, while Web 2.0 technologies enable linking and exchanging information, data and communication over the web (Kelly, 2007). To illustrate, Really Simple Syndication (RSS) publishes updated content (for example, news headlines and podcasts) in a standardised format, allowing web users to subscribe to regularly published RSS feeds on websites in an automated manner.

Central to the concept of Web 2.0 is that it involves connections and collaborations between people, and connections between ideas and hypermedia. Therefore, Web 2.0 companies design the social aspect of the application into the architecture (Kelly, 2007) and, unlike economic theory, whereby the increasing use of a resource results in a depreciation of its value, the more that a resource is used in the Web 2.0 environment, the greater the value it aggregates (Bricklin, 2000, cited in Kelly). Thus, social software can 'take advantage of and cultivate collective knowledge' (Kelly, 2007, p. 2). Connectivism attempts to account for learning in a digital age, where knowledge is growing exponentially, where new information is being acquired and reconstituted or remixed, and where know-how and know-what is being supplemented by know-where (Siemens, 2004). Consequently, there is a distinction between Web 1.0, which is usually represented by traditional static web pages, and Web 2.0, which is represented by server-side software that is more interactive and is sometimes called the 'Participatory Web' based on an architecture for interaction (Barrett, 2006). Thomas Friedman, in his revised version of *The World is Flat*, 'changed his fourth "flattener" from "Open-Sourcing" (Self-Organizing Collaborative Communities) to "Uploading" (Online Communities, Open Source, Blogging, Wikipedia and social networks)' (Barrett, 2006, p. 5).

From her review of Web 2.0 developments and possibilities, Barrett (2006) revised her earlier work on ePortfolios to conceptualise what she refers to as ePortfolio 2.0, and this is summarised in Table 4.2.

Table 4.2 ePortfolios 1.0 and ePortfolios 2.0

ePortfolios 1.0	**ePortfolios 2.0**
Hierarchical, designed	Networked, emergent
Metaphor: Portfolio as checklist	Metaphor: Portfolio as story
Data-driven	Learner-driven
Focus on standardisation	Focus on individuality, creativity
Feedback from authority figures	Feedback from community of learners
Large, complex systems	Small pieces, loosely joined—'Mash-ups'
Web-based form	Blog and wiki
Positivist	Constructivist, connectivist
Accountability-driven	Learning-focused
Proprietary	Open standards
Digital paper (text & and images)	Digital story (multimedia)
Local storage (hard drives, CD)	Network storage (lifetime personal web space)

Source: Adapted from Barrett, 2006, p. 7.

In terms of the TK and subsequent TPCK demands on teachers, ePortfolio 2.0 requires new knowledge and understandings of social networking technologies and their implications (for example, legal and ethical uses, plagiarism, copyright and digital rights management), the challenges of lack of control over access and content, interoperability, contemporary theories of learning, such as social constructivism and connectivism, and new approaches to assessment, such as the metaphor of ePortfolio as story, rather than as a checklist. Students can be expected to be motivated by and want more attractive technology options built into their formal course experience, including multimedia and collaborative tools (Zhang et al., 2007).

ePortfolio 2.0, used within a paradigm of assessment *for* learning, has the potential to truly engage learners, as students are motivated to use online social networking sites, enabling students to perceive their ePortfolios as an 'academic MySpace' (Barrett, 2006, p. 8). This opens up possibilities for learning to be mediated by interaction with others, of collaborative learning and what Wenger (<70> 1998, <71> 2001) describes as a 'community of practice'. With Web 2.0 tools, student work can be posted and feedback invited (for example, through blogging), collaboration invited (for example, through wikis and Google.docs) and, if necessary, authorship can be tracked, for accountability. The increasing popularity of these kinds of websites have been observed by Zhang et al. (2007), who subscribed to the MSN Group *PhD students* for 6 months and found that about 10 new members joined the group each week. Furthermore, they investigated the site statistics reports of *Phinished.org* and found that an average of 200 000 pages are requested per month. However, while commercial learning environment systems such as Blackboard™ and Open Source such as Moodle provide discussion forums, blogs and wiki support, a key criticism is that those tools are limited to the students, instructor and teaching assistants, and collaborative content needs to be able to connect to course materials and ePortfolio systems in the online, networked digital world of the student outside formal education (Zhang et al., 2007).

An alternative model is proposed by Cohn and Hibbitts (2004), who suggest that 'rather than limit people to the e-portfolio model, why not develop a model providing a personal Web space for everyone, for their lifetimes and beyond?' (p. 1). They refer to this as the Lifetime Personal Web Space (LPWS), which could store searchable content (personal, business, social and educational) that was important in a user's past and will be accessible for future use, as well as for use in current projects. They indicate that the virtual structure of the LPWS could consist of multiple cells with flexible entry points, allowing internal cells and connections to external web-based courses, mentors, peer reviewers and libraries. The primary user of the LPWS would decide what sections were public or private, and it would be available anywhere, anytime. Similarly, Tolley (2008) proposes the *Universal ePortfolio* and identifies that the 'prime directives' for any ePortfolio must be:

1. **Portable.** It cannot be located in any one institution or embedded within a proprietary Virtual Learning Environment (VLE).
2. **Personal.** It is 'owned' by the user and is customisable to the user's age, stage and style.

3. **Generic.** It is not modelled on any particular curriculum delivery system or content.
4. **Web 2.0.** It should be compliant with all generic formats within the application.
5. **MIS-free.** It is not 'hard-wired' to any institution's MIS infrastructure.
6. **'Light'.** It is not a permanent repository of all of a user's files, rather a 'transit camp'.
7. **Life-long.** Ownership must be maintainable as a continuity, ages '5–95'.
8. **Life-wide.** It is capable of being used by all ages and abilities through a wide range of assistive templates.
9. **Accessible.** It must recognise common standards of accessibility in terms of both outputs and inputs.
10. **Credible**. Evidence of any summative assessment must be linked to a secure repository; that is, the awarding body or a central MIAP/Minerva archive. (Tolley, 2008, pp. 5–6)

This provides directions for educators in capitalising upon new technologies to enable rich evidence to demonstrate evidence for the assessment of life-long and life-wide learning. A key issue for educators is how to create sustainable communities of practice based on building and supporting learning communities around ePortfolios (Evans & Powell, 2007). Models, such as the *learning landscape* model, have been proposed to help students see learning as more than just a narrow course or program but, rather, for students to view learning in ways that incorporate experience from a variety of contexts through social networking, whereby 'Learning with computers is not about programming or drill and practice, nor about multimedia, nor about fast updating or cost-efficiency—it is all about humans sharing ideas' (Tosh, Werdmuller, Chen, & Haywood, 2006, p. 7). The *learning landscape* acts as a focus for students when building their ePortfolios using Web 2.0 tools so that they are encouraged to link the various components that comprise the ePortfolio in order to maximise its usefulness for life-long and life-wide learning. Ownership of the ePortfolio resides with the user rather than an educational institution or teacher, and takes advantage of online communities of learners to create powerful social learning environments.

Conclusion

This chapter commences by acknowledging the implications of the rapid technological changes and expectations of teaching and learning in the 21st century. ICT now enables the potential for new approaches to assessing learning to be realised, and accompanying this, there are new challenges and expectations for teachers. Technological knowledge (TK) is now an important expectation for teachers. The conceptualisation of technological pedagogical content knowledge (TPCK) is useful in highlighting TK as an additional consideration to PCK conceptualised by Schulman (1987). We argue that there is an interface between ICT and assessment.

This chapter provides a synthesis of the purposes of ICT use for assessment where ICT is the focus, where the content is the focus, where ICT is used as a data-collection tool, as a recording, analysis and communication tool, as a plagiarism detector and used for ePortfolio purposes. Subsequently, ePortfolio approaches enabled by ICT are analysed, and possibilities of ePortfolios enhanced by Web 2.0 technologies are presented and discussed. Our concluding advice is that educators need a strong understanding of how students are learning in the 21st century in order to inform their creation and selection of powerful approaches that use the affordances of ICT to assess students and provide a diverse range of evidence of the students' learning journey.

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