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The use of portfolios for assessment in Design and Technology Education

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Abstract

This chapter explores the use of portfolios in assessment, starting with a general overview of the nature of assessment portfolios, then moving on to their use within Technology education for developing and assessing capability. I start by considering their early use in public examinations in England and reasons why they were introduced. From this I explore issues presented by using portfolios, their potential and their problems. I draw on a range of research and development projects, mainly from within Technology education, then present a case study of portfolio development from research at Goldsmiths, University of London and use this as a basis for exemplifying the potential of digital portfolios. Finally, I provide hopeful but cautious guidance, drawing from the success stories, the findings and the concerns raised through the chapter.

Key words

Assessment; portfolios; e-portfolios; design processes;

Introduction

Assessment portfolios have become an increasingly common feature of learning and teaching in recent years. A question here might be why? What was wrong with existing assessment systems that made people start looking for an alternative? Davies and Le Mahieu offer a positive answer to this by identifying how portfolio assessment adds value, making visible development over time, allowing greater engagement and effort, supporting “deeper performance”, allowing learners to choose what to include, revealing their “dispositions towards learning” and providing opportunities for a learner to engage with and reflect on what they have done. (Davies & Le Mahieu, 2003, p.148)

The development of e-portfolios is more recent but has emerged for similar reasons. Both ‘paper based’ and digital forms are tools for capturing a range of evidence of learning forming a basis for assessment. Butler (2006) provides a straightforward description of a portfolio as “a collection of evidence that is gathered together to show a person’s learning journey over time and to demonstrate their abilities.” (Butler, 2006, p2). But beyond this quite neutral and somewhat limited description are multiple views of what a portfolio is, what a portfolio is for and what views of education, learning and assessment underpin a portfolio. Their use has become ubiquitous in school and tertiary education, including in areas of professional education such as teacher education. Definitions abound.

From a learning and assessment perspective, the paradigm underpinning the creation and use of a portfolio is important to consider. Barrett identifies two clear distinctions – positivist approaches, “assessment tools to document the attainment of standards” and those within a constructivist model as “stories of deep learning” (Barrett, 2004 para 2). Elton (2007) adds to this a nuance of interpretivist approaches in which each learner is being judged as an individual, often through ipsative assessment. Elton suggests that in an interpretivist model credibility and transferability are more appropriate than the reliability and validity that is required in positivist assessment where “all students are judged against a common yard stick” (Elton, 2007, p.6)

Other approaches to categorizing portfolios relate to their purpose. Mason, Peglar and Weller (2004) identify a range of purposes – assessment portfolios, presentation portfolios, learning portfolios, personal development portfolios, working portfolios. Ridgeway, McCusker

and Pead (2004) pinpoint three purposes – a repository, a stimulus for reflection and as a showcase. In an educational context, a classification around these three purposes is a common approach and link to a further distinction – a portfolio as a journey or as a container. Spendlove and Hopper (2006) suggest that within the Design and Technology community there are just these two perspectives – “that the portfolio is a developmental tool allowing for the development and refinement of ideas over time or that it is a ‘repository’ of and vehicle for the presentation of student’s ‘best work’.” (Spendlove & Hopper, 2006, p. 179). A more nuanced perspective comes from research conducted by Welch and Barlex (2004) who categorised teachers’ responses into four purposes, the first (idea development) linking to the journey and the further three (a collection of ideas, record of what has been done and evidence for assessment) linking more to the concept of container.

Barrett (2004) distinguishes between portfolios for summative assessment, which she describes as representing “a culture of compliance or a checklist of skills” and portfolios for formative assessment that she typifies as being within “a culture of lifelong learning/professional development” (Barrett, 2004, para 6). Differences also exist in terms of the audience for a portfolio. Where the primary purpose is to support formative assessment, the audiences will be the learner themselves, their teacher and possibly other interested parties such as parents. With summative assessment, the primary audience is likely to be an examiner.

The challenge with all of the above perspectives is that they imply a simplicity that is rarely present. The context of use, the educational philosophy underpinning a portfolio, the pedagogic practices that surround it, all bring degrees of difference. The underpinning educational philosophy is a key aspect to consider – particularly the contrasting paradigms of positivism and constructivism, identified earlier. Barrett points out that the models are philosophically “at odds” with each other and that positivist approaches tend to be seen by learners as something “done to them” where constructivist approaches are more learner-centred. Paulson and Paulson (1994) provide a fascinating example of the contrasting impacts of these two stances, reporting on research whereby they developed a cognitive model for assessing portfolios that interlinked three axes – a process dimension (purpose, issues, standards, exhibits, judgments), stakeholder dimension (student, teacher, parent, agency) and history dimension (getting started, experiences, outcomes) that, when used in different contexts illustrated quite different approaches – one positivist and one constructivist. They capture these differences in the following description.

“The Atlanta project’s clear focus is on student outcomes of instruction and the entire project is systematically designed to produce student outcomes that lend themselves to summarization across individuals and across groups. ... The Wyoming project’s focus was far more diverse. There were outcomes, but they were very generally defined – certainly not in terms that lend themselves to measurement as we usually think of it. Much of the approach was designed by students and teachers as they went along, guided less by a specific assessment design than a clear statement of philosophy regarding instruction and learning. ... The contrast here is between two models of assessment: the one (represented by Atlanta) we call positivist, the other (represented by Wyoming) we call constructivist” (Paulson & Paulson, 1994, p.7)

This example illustrates the reality that a portfolio is a ‘tool’. As with all tools, the impact, affordances and constraints reside as much with the use of the tool as with the tool itself.

This initial exploration of portfolios opens up perspectives on portfolios. The following section draws on these perspectives, but within the specific context of Technology Education.

The birth of ‘portfolios’ in Technology education

The early use of portfolios in assessing design and technological capability coincided with recognition that the process, and not just the product, of design and technological activity was important. In England this happened around 1970. Portfolios, more commonly referred to as folders at that time, were seen as the place to look for evidence of process. Three initiatives exemplify this development. The first two link to examination courses for sixteen year olds. The first, in 1970, was a significant development in the, then, GCE Ordinary Level in Design and Technology for the London University Examination Board. Until that time examinations at this level had been of two types – a written test and a practical test. George Hicks, the Chief Examiner for course, identified a missing part in this system – that in which learners design and make something, documenting their thinking along the way. Kimbell, (1997) reflecting back on this assessment innovation, recounted how

“a radically new form of examination had squeezed itself into the picture, and no one was quite sure whether it was to be treated as a ‘theory’ or a ‘practical’. It involved writing and other kinds of ‘desk-work’, but it also required practical activity and the manipulation of tools and materials. ... At a stroke [it] had welded theory to practice – lending legitimacy to the notion that it is right and proper to exercise thought and imagination into the world of products and manufacture. However, one of the lessons that candidates learned ... was that in order to gain maximum marks it was necessary to make one’s thinking very clear. ... So the idea of design drawings – collected into a design portfolio – was a natural extension” (Kimbell, 1997 p.6)

At the same time a second examination qualification for sixteen year olds emerged. This was a Certificate in Secondary Education programme entitled ‘A course of study in Design’ developed from the Design and Craft Education Project led by John Eggleston (Schools Council, 1974). The assessment included a practical project accompanied by a project report that provided evidence of the process the learner had been through. The third was an examination course for eighteen year olds – the Oxford Advanced Level GCE entitled simply ‘Design’. Assessing design projects was new and presented significant challenges that were highlighted in an ‘interim appraisal’ after the first year of examination.

“The intention of the sponsors was to establish an A level course in which practical work within a design framework was used as a means of identifying intellectual ability and original thinking. It was essential to avoid ‘soft option’ and hence the standards of assessing are vital to success. Since the very nature of the course calls for just those qualities that are least easily identified, let alone assessed, this is no easy task.” (Aylward, 1971, p. 35)

The solution was to introduce a face to face meeting between the learner and the examiner.

“Finally the candidate is interviewed by the examiner as part of the assessment. Much of the judgment in this total assessment must be subjective and has to be taken on trust. At the same time, as with all public examinations, the examining board bears the responsibility of fixing standards and of awarding the final grades.” (Aylward, 1971, p. 35)

This use of external assessors enabled genuine discussion between learner and examiner focusing on their portfolio and outcome, adding to both reliability and validity of the assessments. This was further increased by an exhibition held at the end of the first year, sharing the work and the examination process, documenting the basis on which assessment judgments were made and identifying issues and challenges to be addressed in coming years. This event heralded another affordance of portfolios – the potential for sharing and discussing assessment amongst teachers and the professional development opportunities that this promotes – a matter to be returned to. A further matter to be returned to is the impact of assessments that were explicitly linked to ‘stages’ in a design process that shifted

attention from the outcome of a design project to the process of its development but which ultimately led to the problem of assessment criteria representing a linear design process.

Potential and issues arising from the use of assessment portfolios

These early developments raised awareness of the value of focusing on processes – of Design and Technology and of learning more generally. They highlighted the potential for a portfolio to become a tool for reflection – and reflection that is made tangible in some way. They allowed a level of insight into a learner that had not previously been visible to a teacher or to an examiner. The tangible nature of what was documented also afforded opportunities for other teachers to be included. Barrett (2004) stresses the importance of reflection as part of a process of ‘deep learning’ and suggests three dimensions.

“What? (The Past) What have I collected about my life/work/learning? (my artifacts)
So What? (The Present) What do those artifacts show about what I have learned?
(my current reflections on my knowledge, skills and dispositions)
Now What? (The Future) What direction do I want to take in the future? (my future learning goals)” (Barrett, 2004, para 21)

For Barrett, a reflective portfolio of this nature becomes a story of learning –and others have also seen the value of the concept of ‘portfolio as story’. In Design and Technology Martin (2007), for example, suggests that an electronic portfolio that enables storytelling in a digital form is particularly valuable because of the range and types of evidence, including those made possible through the use of digital tools. The study followed different cohorts of pre-service student teachers. What became apparent was that when later cohorts were not restricted in any way in terms of the software used or the size of the portfolio, the story of a project that was documented better reflected the journey that was taken.

Product or process

But, while portfolios can capture the story of a process, the very physicality of a portfolio means that it also becomes a product in its own right. This duality has historically presented problems – especially if collecting and presenting the process overshadows the authenticity of the process itself, sometimes resulting in a beautifully produced portfolio that shows only superficial evidence of thinking and learning.

In Martin’s study the assessment criteria emphasised the students’ process and encouraged risk taking and the students largely felt that the digital nature of the portfolio allowed them to spend less time on making the portfolio ‘pretty’ allowing more time for development. Investing time in making a portfolio ‘pretty’ rather than focusing on the quality of the thinking and development of a project, what Mike Ive, former Chief inspector of Design and Technology in England, called “neat nonsense” (2001) has become a major issue in portfolio assessment. The driver for this has been the quantity and type of evidence deemed necessary – a factor that has side-lined constructivist approaches, as was illustrated above in the work of Paulson and Paulson (1994). Spendlove and Hopper (2006) suggest that this has stifled critical reflection, denied the opportunity for a portfolio to be a “liberating tool” that supports learners in exploring the creative potential of ideas in a design challenge and diminished possibilities for creative dialogue. They conclude that “the portfolio has become ritualistic and a product in itself.” Spendlove and Hopper, 2006, p.180). Like Martin, they worked with pre-service Design and Technology students and found that the repository view of a portfolio existed in many of their students’ minds, along with those of the teachers in schools where students were undertaking placements. Also like Martin they saw electronic portfolios as an opportunity to explore a different model through students undertaking design projects that aimed at breaking the cycle of a redundant model whilst also facilitating good design practice. Encouraging a reflective and speculative process, utilising a wide range of multimedia tools and requiring students to create ‘electronic snapshots’ for peer review that

'filtered' their ideas, designing was put at the core of the students' projects. The approach encouraged risk taking, reflection and critical thinking.

Both Martin's and Spendlove and Hopper's case studies had a common finding in that in both studies students broke free of a linear model of process and the approach taken within the portfolios assisted this. In both case studies the students were supported to manage their projects, but were not directed by a prescriptive process. In the words of one student in Martin's study, "you can make links between specific parts of the design process which makes it more like a true design process (i.e. not a linear process)" (Martin, 2007, p.59). Evidence of this shift is particularly useful as the straitjacket of a linear, prescriptive model of designing has been a major challenge within portfolio assessment, dating back to the early 1970s. The straitjacket is created when assessment criteria and atomistic mark schemes are attached to the requirements for evidence, placing over-emphasis on creating evidence that will result in a high mark.

A study conducted by Doppelt (2009) also explored the opportunity of introducing an alternative model of portfolio assessment that placed significant focus on process. The study was undertaken with sixteen to eighteen year olds who were engaged in a mechatronics course within the context of a design-based learning project. Portfolios were used for the students' graduation projects and the research that was undertaken focused on both the implementation of a creative development process, documented through a portfolio, and utilising a model of creative thinking skills to assess the portfolios. Through a creative development process learners were encouraged to systematically reflect to "develop awareness of their internal thinking processes and learn to direct their own thinking and document it" (p.62). Focusing on reflection removed the need for learners to "slavishly" follow a linear design process. Interestingly all of the 128 learners involved in the study showed high levels of achievement overall, although this was far more evident in relation to the creative thinking skills in the development and evaluation of the product or system at the centre of their project than they evidenced in learning, thinking and problem solving activities. Doppelt considered that the ability to reveal these differences through the portfolio and associated pedagogy highlighted areas where more focus is needed in learning and teaching.

Evidence – the goods and the bads

In the three studies outlined above there has been emphasis on encouraging learners to document processes in ways that show a trajectory of thought and action through a development process. However, there is a genuine concern with the way in which portfolios can be overloaded with documentation that has little direct relevance to the project being undertaken, but that may contribute to the learner achieving a higher grade. At the heart of both positions is the need for evidence. What separates out the two positions is the nature of the evidence seen as necessary and the purposes that it serves – development and learning or meeting pre-set assessment criteria. This links back to the earlier discussion about the purpose of the assessment in question. Where assessment is summative, particularly in relation to external or 'high stakes' testing, the evidence is created in response to meeting a particular set of standards. Where it is formative it is more likely to be diagnostic, revealing what a learner has or hasn't understood, can or cannot do, and indicating where emphasis in learning and teaching is now needed.

Whether the purpose is ostensibly formative or summative there is a clear danger that, where portfolios are concerned, evidence generation can become a major activity, often creating 'after the event' rather than 'in the moment' evidence. Teachers will joke about assessing a portfolio by weighing it, but in reality creating evidence can become burdensome, both for the creator and the assessor. It can also become displacement activity, taking valuable time away from development and learning, or simply a misguided assumption that the more evidence and the more beautifully it is presented, the higher the

mark will be. This issue has been reported repeatedly in England through school inspection reports from the Office for Standards in Education (e.g. Ofsted, 2002, 2004, 2011) where it has been linked to superficial and superfluous work, wasted time and even gender issues, identifying it as a de-motivational aspect for boys. However, recent reports have found evidence that using e-portfolios can overcome this issue.

“Over the last three years, the technology to use electronic portfolios has developed so that students’ achievement can be recorded in different ways, through use of voice recording, digital photography and video footage in addition to writing. Such developments are at an early stage and were relatively uncommon However, the examples observed suggest that the opportunity to use them more widely, supported by appropriate training for staff, could help to overcome a common problem in capturing student’s achievement more fully.” (Ofsted 2011, p.33)

The following example from an inspection report in one school underscores the value.

“Students record their work as it develops, taking photographs on mobile phones or digital cameras to download later into computer-based portfolios. Brief annotations alongside the photographs enable students to explain when and why they made decisions to amend their work. This approach minimises paperwork and places the focus securely on designing and making high-quality original products.” (Ofsted 2011, p.51)

The push for more and more evidence has a clear link to perceptions of reliability in assessment processes which in turn links to increasing focus on teacher accountability, and a nervousness that portfolio assessment is inherently subjective and can’t be trusted. A number of strategies aim to increase reliability in portfolio assessment, such as the use of rubrics, benchmarked ‘exemplar’ portfolios and assessment moderation sessions where teachers collectively assess work to develop shared understandings. These are all undeniably constructive and useful strategies. But it is equally valuable to consider the viewpoint of Elton (2007), shared earlier in this chapter, for whom an interpretivist stance would suggest that reliability is the wrong lens and that credibility and transferability would be more appropriate to support the development of an individual learner.

The focus on evidence, how much, how presented and so on, begs another question – what purpose is the evidence serving. Between a teacher and learner it can be a point for dialogue, confirming, or not, understandings, providing the basis for next steps. Collecting this together in a portfolio provides opportunities to look both backwards and forwards on a learning journey. For high stakes assessment it may be that all that is needed is a score to create a rank to award a grade. If the latter is what is needed then recent research (Pollitt, 2004, 2012) would suggest that judging rather than marking the evidence is more appropriate and holistic judgement, linked to a system of making comparisons of pairs of portfolios is all that is required to award grades. This approach is explored in more detail in Richard Kimbell’s Chapter in this book. The approach is also one that has its own ‘added value’ in increased reliability in grading and potential to open up more democratic approaches to portfolio assessment – something explored later in this chapter.

Collecting or curating?

A further issue that arises in relation to evidence in portfolio assessment is that of manageability – the very nature of a portfolio, holding considerable amounts of documentation of learning raises the question of organisation, access and storage. Where a portfolio is seen as a repository for evidence then systems of indexing, or digital tagging are possible. Where a portfolio is a story of learning this management issue can become an opportunity for learners to become curators of their own learning. The value of learners

being at the centre of making decisions about what should be included in their portfolio is highlighted by Davies and Le Mahieu (2003), suggesting, for example, how it helps learners organize their thinking in advance of discussing their work, kindling ownership and responsibility while adding authenticity and validity in assessment processes. They also suggest that it increases learner motivation. Removing them from the decision making has the opposite effect.

In a study by Hardy, Tinney and Davies (2012), working with pre-service teachers on a design project that was documented through an e-portfolio, the authors found that some valued the reflection that was prompted by documenting their project. However, others didn't recognise the portfolio they had created as a place where they had evidenced their learning, even when the analysis of the portfolios indicated that they had. This is exemplified by a student who felt that the portfolio had taught her to upload photos, but nothing about manufacturing processes, but whose portfolio provided a thoughtful and detailed reflection on her making and the authors could see evidence of the learner "constructing knowledge [that] would lead to the student determining their own priorities in their learning." (p. 207)

An issue that arose in this study were the limitations or challenges of the digital tools available to them. This is a finding frequently repeated in relation to digital portfolios, reported within this chapter and elsewhere (Martin, 2007; Stables, Dagan & Davies, 2015; Williams, 2013b). But while digital portfolios bring challenges, they also open up welcome opportunities.

Going digital

While paper based and digital portfolios have the same goal of documenting evidence of learning over time, digital portfolios have an added dimension through the range of tools with which evidence can be captured. However, despite the tools being utilised, approaches to creating digital portfolios can be distinctly different, the most significant difference being whether they are created in real-time or as an 'after the event' presentation. The latter is frequently evidenced through the use of powerpoint, falling into the category of a presentation portfolio. The former leans to an authenticity that makes learning visible within a task being tackled, adding validity to an assessment process through evidence that captures real-time performance, often literally through the voice of the learner. Lin and Dwyer (2006) suggest that traditional approaches to assessment are not always effective in capturing a learning process and that digital approaches have greater potential because of the multiple levels of assessment possible and the ways in which they can incorporate interactive multimedia tools. Such tools have benefits for learning itself as well as assessment of learning.

Williams (2013b) suggests that a shift to digital assessment emerged in Australia in line with a shift to high-stakes assessment in exit examinations for learners, in part because learning outcomes could not be easily captured in paper based systems. In a study exploring the use of digital assessment across a range of curriculum areas (Applied Information Technology, Engineering Studies, Italian Studies, Physical Education Studies), particularly focusing on ways of capturing evidence in authentic, performance contexts that could support reliable summative high stakes assessment, it was found that both learners and teachers were amenable, with learners generally preferring digital documenting to paper based. While they suggested frustration at some technical limitations, they explained that they could do their 'best' work in this way, that they could be more creative, they could correct mistakes and change things more easily and document their process through a range of digital tools.

Such tools open up opportunities to understand and support different learning styles and increase ownership and student voice. They also offer more general opportunities to

increase digital literacy, for both learners and teachers, even if at the outset the lack of skill may be a hindrance. Further possibilities emerge with web-based portfolios, potential spotted at an early stage by Sanders (2000) who foresaw possibilities for promoting and sharing achievements within and beyond the subject area. When comparing web-based portfolios with conventional ones he highlighted that “the Web allows us new options such as animation, navigation, digital audio/video, virtual reality, and interactivity.” (p.12)

As a way of exemplifying many of the affordances of digital portfolios, as well as drawing attention to some of their constraints, I will now turn to research on portfolio-based assessment that has been developed by a team at Goldsmiths, University of London.

From the ‘unpickled’ portfolio to project e-scape

Portfolio-based assessment emerged as a research tool in a major study - The Assessment of Performance in Design and Technology. The study, commissioned by the UK Government’s Education Department, required the research team to assess the design and technological capability of a 2% sample of fifteen year-olds in England, Wales and Northern Ireland – about 10,000 learners. The detail of this is reported elsewhere (Kimbell, Stables, Wheeler, Wozniak & Kelly, 1991) but for the purpose of this chapter a significant development was what we came to call the “unpickled portfolio” (Stables & Kimbell, 2000). A major challenge in the study was a constraint placed by the funders – that we had to assess capability largely through paper and pencil tests. This raised concerns about validity and thus reliability for the team. Dismissing standard paper-based test formats, we explored and developed an approach to scaffolding a design task that fast-forwarded learners into a design context (for example designing that addressed the challenges for elderly people, carrying shopping, preparing meals etc.) and then engaged them in an assessment activity that was choreographed to enable a dynamic iteration between active and reflective modes of designing as they displayed their level of capability in designing to meet such challenges. The work was recorded in a unique, unfolding portfolio, designed to support the choreography of the subtasks. The whole ‘test’ was completed within ninety minutes – hence the label of unpickled portfolio, distinguishing it from more typical long projects where evidence is created across time through learners being immersed in all the good pickling juices of learning and teaching.

This approach informed and underpinned our research and development work in assessment (Kimbell & Stables, 2007) and in 2004 we had the opportunity to take the concept as the basis for the development of an e-portfolio – which gave birth to the e-scape project. (e-solutions for creative assessment in portfolio environments, Kimbell, et al., 2009). This project was undertaken in the context of high stakes assessment, exploring the potential of an e-portfolio for ‘controlled assessment’ in Design and Technology GCSE – an external examination of 16 year olds in England and Wales. Controlled assessment refers to a studio/workshop based design and technology assessment, undertaken under timed conditions, with no teaching support.

While our approach has had much in common with other types of portfolio assessment, there is one significant difference. The approach fits clearly into ‘portfolio as journey’ model. But while other portfolios of this type are largely curated, after the event, stories of learning and development, our approach has been to capture evidence in real time, the ‘trace-left-behind’ as the designing and developing progresses. This creates a working portfolio, warts and all. Going digital, working in collaboration with learning technology partners, has meant going web-based and this has enabled many opportunities, some mentioned in other projects above, some uniquely developed. The approach built directly from the ‘unpickled’ structure – a design and technological activity scaffolded though iterating between action and reflection. The activities take place in studios and workshops, using all available and appropriate materials, tools and components for a project, and documenting through

handheld devices such as smart phones, tablets and digital notepads. Learners are intermittently prompted, via the electronic device, to document progress: take photos of work in progress, add voice files explaining what is working, what isn't, what next steps will be taken; share work with a 'critical' friend and get their views on your progress; make a 'walk-through' video showing how your model works; and so on. The documenting, whether text, drawing, photo, video or mindmap, is instantly synchronized to a web portfolio, so that when the project is done, the portfolio is almost complete. A final prompt enables reviewing and annotating the portfolio with 'hindsight' style comments.

The approach removes certain of the problems highlighted earlier in the chapter – there is no additional 'burden' or time wasting in preparing the portfolio, there is no need to organize or curate the work – everything is documented in real time, but within a structure. The learner's voice is literally present throughout – an aspect that has occasionally startled us by the level of confidence or honesty a learner displays. We have had learners present a 'rap' to explain their project', sing a song or talk with absolute honesty about all the mistakes they have made.

Initial research was undertaken in England, within the subject of Design and Technology mainly with 15 – 18 year olds, but also with learners as young as 9. Two smaller projects explored e-scape in science investigations and geography fieldtrips, showing its use across curricular areas and outside of formal classrooms, studios and laboratories. The system has also been used with undergraduate students and primary learners and in other countries. For example, the portfolio software used in the latter stages of Williams' study in Western Australia (2013a) was e-scape. The views learner's expressed (outlined above) have been paralleled in other studies. One project, the Assessment in My Palm project, undertaken in Israel (Dagan & Stables, 2013) explored using e-scape across a wide range of curriculum areas and for formative assessment. Learners responded well to the range of digital tools available to them and how the approach allowed teachers to better understand their work, as illustrated in the following comments.

Learner 1 "I thought this was really interesting. Normally when I do projects I will write. When I write I use a very official language. When I was doing this project it was interesting because I would just speak and my teacher was seeing a video of me speaking about my work rather than writing very formally, that's very interesting. It gives me an idea of a different way to work and express myself."

Learner 2 "I think when we did this the teacher could tell more about what we were saying and also understand better what we were saying. It was more of a conversation rather than a report."

A further dimension that emerged from this project was the value of learners with different learning styles being able to choose how they communicated their thinking. This was highlighted by special needs teachers where learner motivation was high and using alternative tools to document their work improved learning and engendered feelings of self-worth through the success achieved.

The software, and in particular its web-based nature, also allowed for an alternative approach to assessment, based on holistic judgment and a system of adaptive comparative judgement mentioned earlier. This system is explained in more detail by Richard Kimbell's Chapter in this book, but, in brief, judgments are made about the overarching quality of capability based on systematically comparing the web-based portfolios against each other. The validity of the portfolios emerges through the real time, authentic evidence they provide. From a reliability point of view, the system produces a highly reliable ranking – extremely useful in high stakes assessment. From a manageability perspective, storage and access through the internet becomes extremely simple. But the approach also has value in two

further ways, both of which were revealed by including learners in the judging process. What became clear was that the process of seeing a range of work from their peers, making judgements and articulating their reasons for the judgments had a significant effect on their understanding of their own learning and development processes (Kimbell et al, 2009; Seery. Canty & Phelan, 2012). In addition, the potential is opened up for more democratic forms of assessment. Any number of stakeholders could potentially be involved from teachers to peers to parents to employers.

As Sanders suggested back in 2000, once a portfolio goes digital and web-based, any number of digitally based tools and resources can be incorporated. Our current research is exploring the potential of bringing Artificial Intelligence into a portfolio through an on-screen avatar that takes a coaching role with a learner, asking questions about the learner's project, prompting the learner to think more deeply about what they are doing as they articulate their answers. The research is in an early stage, but indicates yet further potential for digital portfolios. (Stables, Kimbell, Wheeler & Derrick, 2016)

Conclusion – considerations for creating portfolio-based assessments for the future.

At the time of writing this chapter a pertinent scenario is being played out in the high stakes assessment arena of Design and Technology Education in England and Wales. The National Curriculum (5-14 year olds) and the examination requirements for GCSE Design and Technology (the external examination taken typically by 16 year olds) have gone through a 'step change'. Concerns expressed over a number of years about ritualised projects linked to portfolios structured around a linear process of designing, coupled with a perceived lack of challenge and relevance in projects has led to a major shift to iterative processes of designing and contextually based design challenges where learners have genuine ownership. This is reflected in the requirements placed on the Awarding Organisations who specify the requirements for the GCSE qualification and who are now faced with providing the structure and assessment scheme for a portfolio-based assessment that rises to these new challenges whilst maintaining reliability and validity. Initial models are emerging that represent a spectrum of approaches from the innovative, challenging and risky to the minimally invasive. Over the next few years we will see how this scenario plays out.

But guidance offered from the research drawn on in this chapter would suggest any person or organisation creating assessment portfolios would be wise to:

- Be clear about the purpose of the assessment;
- Be clear about the nature of the portfolio (paper/digital/on-line/curated/collected/choreographed);
- Be clear about the educational paradigm that the assessment is operating within and use this as a 'health warning' on structures and systems as they are developed;
- Be clear about the impact the approach to assessment may have on the learning that it aims to assess;
- Explore and articulate the 'added value' of all aspects of a proposed model;
- Exploit the possibilities offered by new technologies;
- Ensure that any evidence required is authentically drawn from the learning being assessed;
- Consider a level of flexibility that places no undue challenges that distract from the authenticity of the learning being assessed;
- Consider approaches that allow all learners to achieve their best.

A wealth of evidence supports the potential for assessment portfolios, despite the challenges that come with new pedagogic and digital approaches. All systems of assessment in

Technology Education, whether high stakes, summative assessment of learning or ongoing assessment for learning, can now exploit their use to provide assessment that genuinely supports learning and teaching processes, optimising the time teachers and learners spend together and maximising the learning taking place.

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