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Chicken or egg: links between approaches to gathering data through authentic assessment activity and ways of supporting sustainable assessment of creative performance

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Related SIG: Creativity (also links to Assessment SIG and Research Methods SIG)

Abstract

This paper draws on research conducted to explore issues of creativity and sustainable assessment in the context of primary/secondary transition. The research project (Capability and Progression in Transition through Assessment for Learning in Design and Technology: CAPITTAL-DT; McLaren et al. 2006) was undertaken in associate primary and secondary school settings in 2 local authorities in Scotland and was funded by the Determined to Succeed division within Scottish Executive Education Department (SEED).

The research undertaken had two drivers. The first was evidence from within Scotland that both teaching and learning of Design and Technology was identified as weak (e.g. HMIE 2002, Dakers 2005), that of particular concern was the tendency for teachers to focus on making products rather than on thinking skills and creative processes and that assessment as part of learning and teaching was “good or better in only 24% of schools” (HMIE 2004). The second driver was research that had just been completed for the Department for Education and Skills (DfES) that explored approaches to assessing creativity within Design & Technology (the Assessing Design Innovation project, Kimbell et al. 2004). This research utilised an approach to authentic summative assessment that indicated additional potential to contribute to assessment for learning. These two drivers combined to provide both a research need and a research opportunity.

The study involved learners from 7 schools. The participants (n=225) were in Primary 6 (10-11years old), Primary7 (11-12years old) and Secondary 1 (12-13 years old). Intervention and control research cohorts were created to take a quasi-experimental approach. The research gathered baseline and follow-up data before and after transition (either from Primary 6 to Primary 7, or from Primary 7 to Secondary 1) and, for intervention cohorts, tracked curricula experiences in the intervening 9-month period.

The baseline and follow-up data was gathered through authentic assessment activities adapted and developed from the Assessing Design Innovation project. The dataset was created from:

- a ‘Learner Attitudes Towards Creativity’ questionnaire;
- an authentic assessment activity structure (Stables & Kimbell, 2000; Kimbell et al., 2004);
- a ‘learner evaluation’ questionnaire.

A range of data was created by the study:

- quantitative performance data derived from a creativity assessment rubric (Kimbell et al, 2004);
- quantitative attitudinal and evaluative data;
- qualitative guided and free response data that was analysed using derived content analysis;
- qualitative data derived from semi-structured interviews with teachers to provide illustrative accounts of the related learning and teaching that had been undertaken between baseline and follow-up data collection.

This paper explores the relationship between the approaches used for data gathering, the findings from the data and the insights offered for further approaches to sustainable assessment. Analysis of the data showed links between the creative performance of learners, their attitudes to creativity, the level of sophistication they demonstrated in self and peer reflection and, most importantly, how these changed over the transition period. The ability to gather and relate these data was created by the use of the authentic assessment activity as the core stimulus for the data. This paper will provide an insight into how this was undertaken and explore the potential the approach offers other curriculum areas.

* * * * *

Gathering evidence through dynamic authentic assessment

The main study discussed in this paper used a particular approach to capturing baseline and follow-up performance data built from a model developed originally as part of the Assessment of Performance Unit (APU) Design and Technology survey (Kimbell et al., 1991; Kimbell & Stables, 2007). This approach is based on the principle of capturing evidence of capability dynamically through an authentic design activity undertaken in a short timeframe. The original activities ranged from 90 to 150 minutes, were set within challenging and rich design contexts, were structured to promote evidence of both action and reflection and were choreographed and standardised through an administrator's script and a particular style of unfolding response booklet or portfolio. Because of the short timeframe, we came to call this particular approach the 'unpickled portfolio' (Stables & Kimbell, 2000) as the learners produced a portfolio of design work without the more typical steeping (or pickling) in a lengthy design project. Critical to the approach is a particular view of process that denies the validity of linear or cyclical models, preferring a model that iterates between action and reflection as a logical progression of taking an ill-formed, hazy idea and evolving it to the point at which it has taken a more complex, detailed and developed form. This view of process is captured in the model we presented through the original project report (ibid) and shown here as figure 1.

While the original approach was developed some 20 years ago, it has seen considerable development through recent projects including, most importantly for this paper, the Assessing Design Innovation project (Kimbell et. al., 2004). In this project the activity was developed to take a slightly longer form (6 hours), to include peer and self evaluation and to promote opportunities for developing ideas through 3D modelling, captured and included immediately within the portfolio via digital technology. The approach, both in its original and later forms, has been primarily aimed at summative assessment – for APU to develop a snapshot of the design and technological capability of the nation's population of 15 year olds, for Assessing Design Innovation to provide summative GCSE-type assessment of creative and innovative performance. However, from the outset we have been conscious that the very nature of dynamic, authentic assessment simulates curriculum activity and as a result can provide opportunities for both teachers and learners to self-reflect on task, and thereby for meta-cognition. From the very earliest trials of this approach (for the APU survey) what quickly became apparent was that evidence of the **action** being undertaken by learners was

relatively easy to 'see' as it typically took some tangible form (drawings, models, etc) but that evidence of **reflection** tended to be invisible as it was taking place inside the learner's head..

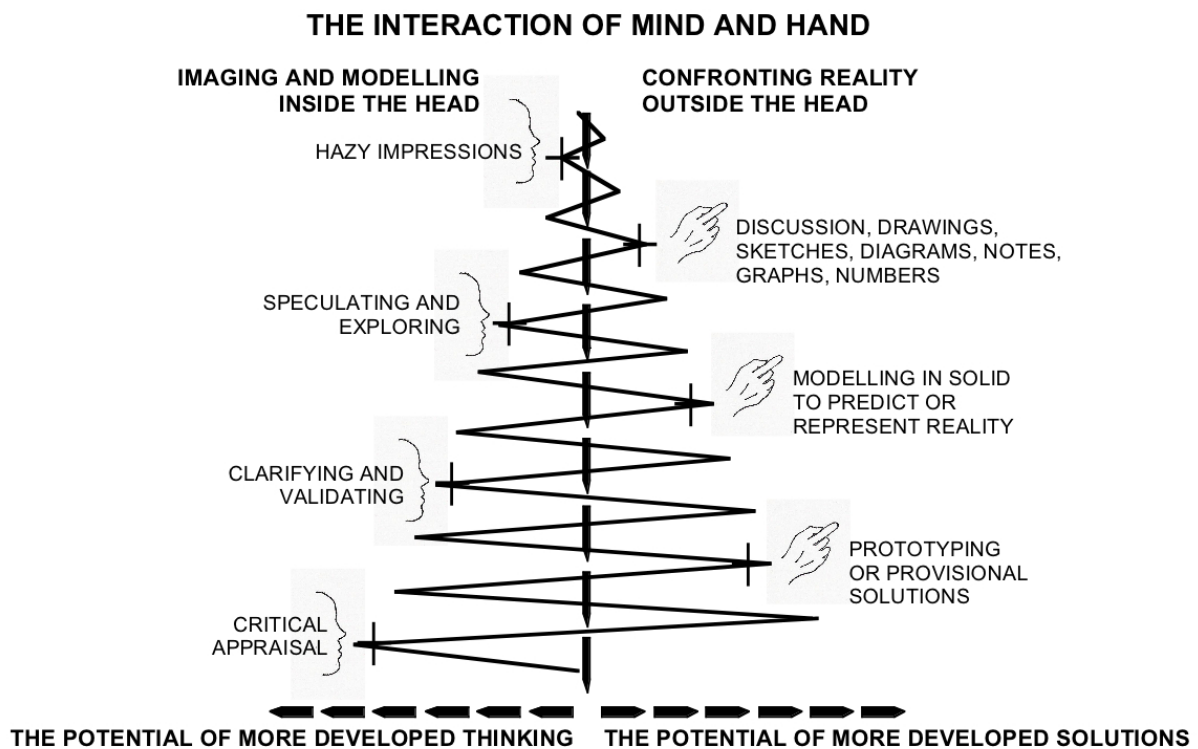


Figure 1 The APU Design and Technology model of process

To address this assessment problem, we developed an increasingly sophisticated approach to introducing strategic evidence ‘prompts’, designed to introduce a ‘pause for thought’, for example on the criteria for success of the product under development, or for the areas where further development was still needed. The following outline of one of these early tasks illustrates our approach

The learners first watched a short (8 minute) video, introducing a scenario that highlighted design opportunities and issues (e.g. around the increasing difficulties elderly people face in preparing food). The design task then proceeded via the following prompts.

1. Consider the task and ‘jot down’ initial design ideas.
2. Prompt 1 (after 20 minutes) – what will the design need to do and be like if it is going to be successful?
3. Prompt 2 (after 30 minutes) – review work to date and annotate with a *red pen*, identifying which ideas are good – and why, and which need changing or abandoning – and why.
4. Continue to develop design ideas towards a solution.
5. Prompt 3 (after 60 minutes) – review your work and note down all the design problems that still need to be sorted out.
6. Prompt 4 (after 75 minutes) – note down what you now need to know (that you don’t already know) to take your ideas further. How/where will you find out?
7. Prompt 5 (after 80 minutes) – look back at the task and your own success criteria – how do your ideas measure up?

While the introduction of the prompts was initially for the benefit of summative assessment, we quickly realised that, if introduced into a rich context and design challenge to which

learners had developed a level of commitment, the prompts operated at three levels. First, they allowed the assessor (or the teacher) to 'see' evidence of design thinking. Second, they enabled the learner to make their own thinking visible to themselves and from this enable them to take more thoughtful and objective stance in developing their design product. Thirdly, we were conscious that, at least for some learners, the very act of thinking about their designing caused them to gain a better understanding of themselves as a designer – to be meta-cognitive about their own designing processes.

In recent development of this approach in the Assessing Design Innovation project we enhanced this process further by explicitly introducing the concept of the 'critical friend' into the structure of the activity. There were three aspects to this. First, each learner worked on their own design project, but within a group of three 'critical friends' who were encouraged to provide constructive criticism and support. This allowed for informal discussion throughout the assessment activity. Second, we required the group to make active contributions to the early design ideas being generated by their 'friends' that could then be acted on, adapted, rejected or simply used as a stimulus for reflecting on their own ideas. Third we included two opportunities within the activity for peer and self evaluation. As with other prompts introduced in the activity, the primary aim behind each of these was to lay bare the design thinking of each learner. But as with the previous prompts, we also recognised the powerful effect each had on the way learners engaged with their tasks.

We have likened this elsewhere to the way one can be clearer about what one has done when the evidence is reflected (or played) back.

It is as if the evidence speaks in a mirror - to the listener (directly) and back to the speaker (indirectly) creating a form of playback. The 'playback' in turn has two benefits: directly improving the learners' product and indirectly improving the learners' process. So, in general, the more we can encourage the learners to speak to us, the more they hear themselves externalise their thinking, developing both the design ideas they are working on and the generality of their practice. (Stables & Kimbell, 2007, p.176)

It was the dual value of the approach that attracted us to use it in the main study reported here –Capability and Progression in Transition through Assessment for Learning in Design and Technology: CAPITTAL-DT. (McLaren et al. 2006). The main assessment focus in this study was on formative rather than summative assessment, but we also wished to capture snapshots of learner capability at the beginning and end of the project. By using the unpickled portfolio approach we had a research tool that would allow us to do this and which also allowed us to embed and develop approaches more directly targeted at assessment *for* learning.

The value of techniques used for formative assessment

In Scotland the title of the overall assessment initiative is 'Assessment is for learning' which takes account of: summative assessment, entitled assessment **of** learning; support to progress learning and help create the next steps such as the personal planning, termed assessment **as** learning; and the diagnostic stimulating intervention type is the assessment **for** learning. By adapting and extending the structure of the Assessing Design Innovation task we were also able to broaden its potential as an assessment tool in respect of these different dimensions.

By retaining all key features within the structure while reducing the timeframe from 6 to 3 hours, we had a task that was manageable by the young learners (10 – 12 year olds) and informative in respect of the capability it evidenced. Within the task itself, the learners had the following opportunities to reflect on their own work:

- At the early stage of development on receiving back the comments and developments from their 'critical friends' (35 minutes into activity);
- When asked to reflect back on the task set to identify criteria for a successful response (45 minutes into activity);
- After further development work, when explicitly asked to reflect on strengths and areas for development in their ideas (70 minutes into the activity);
- As they built the photographic storyboard with digital images of their 3D modelling of ideas (90, 115 and 140 minutes into activity);
- Reviewing evaluative comments from their critical friends and writing their own self evaluation comments on their design work in advance of 'fast-forwarding' their ideas to show how they envision them looking if fully developed; (145 minutes into activity);
- Reflecting back on their work and identifying what they might do differently if they started again (175 minutes into the activity).

But we wished to further enhance the self-reflective elements and so added a learner evaluation questionnaire that was completed after each task (baseline and post intervention). The questionnaire invited the learners to consider further things they felt they had learned and things they would like to get better at. Each participant was prompted by the following stem sentences.

- *I was best at...*
- *The easiest thing was...*
- *The most difficult thing was...*
- *Today I learned...*
- *I want to get better at...*

A combination of the assessment activity and the learner evaluation produced a considerable amount of evidence providing insights into the learners' design thinking and capability. The question we wish to raise through this paper is the extent to which the level of capability we witnessed was merely **exposed by** the activity as opposed to **developed through** the activity: what came first, existing capability or capability enhanced through a summative assessment task? As with chickens and eggs it seems impossible to separate out a logical sequence. However, through the range of data we collected, insights were provided into the relationships between summative and formative assessment, between the activity and capability evidenced, and intriguingly between capability and attitudes to creativity.

Research sample

Schools and learners involved in this study were drawn from primary and secondary schools in the south west of Scotland. The study involved learners from 7 schools in the process of transition either between Primary 6 and Primary 7, or between Primary 7 and secondary 1. The participants (n=225) were in Primary 6 (10-11years old), Primary7 (11-12years old) and Secondary 1 (12-13 years old). Three cohorts were involved: one where there was direct intervention during a 9 month period by the research team working with teachers to develop formative assessment approaches; one where there was indirect intervention, where the teachers were aware of the aims and tools of the study and prepared their schemes of work in a way they felt would support the learners (this group we termed the 'in-the-know cohort) and thirdly a control cohort drawn from similar schools. The research gathered baseline and follow-up data before and after transition (either from Primary 6 to Primary 7, or from Primary 7 to Secondary 1) and, for the two intervention cohorts, tracked curricula experiences in the intervening 9-month period.

CAPITTA DT assessment process

Learner No:

step 1 holistic	step 2 headlines	characterised by ...	step 3 categorising details
<p>Overall is the work</p> <p>risky, exciting, 'wow', showing growth and synthesis <input type="radio"/></p> <p>risky but playing safe with some growth and synthesis <input type="radio"/></p> <p>generally safe with some surprises but little growth or synthesis <input type="radio"/></p> <p>routine, formulaic, static and unresolved; a bit of a 'yawn' <input type="radio"/></p>	<p>having ideas (sparkiness)</p> <p><i>looking for starting points... risk/comfort zone getting outside conventional constraints</i></p>	<p>eg. explicitly choosing a risky task or expressing a risky idea; dicing on the edge; suspending reality; bending rules; courting failure</p> <p>eg. suspends reality & take on challenge: running with risky ideas towards unknown, but still cautious</p> <p>eg. plays at the edge of a safe task or idea: sets them on the path to achieve something new: dipping toes in</p> <p>eg. plays safe: works within existing experience/reality/repertoire: needs a 'kick start'</p>	<p></p>
	<p>growing ideas (modelling)</p> <p><i>experimenting, exploring, looking forward to herd's a solution, ... growing and developing ideas</i></p>	<p>eg. ideas grow dynamically through a rich web of thought & action, using appropriate modelling techniques</p> <p>eg. some idea growth through the integration of thought=>action with appropriate techniques used and dynamic development as a result</p> <p>eg. ideas or parts of ideas being explored through modelling and this impacts on development</p> <p>eg. ideas largely static and unmoving</p>	<p></p>
	<p>growing ideas (optimising)</p> <p><i>looking forward to herd's a solution... dealing with complexity and trade offs, synthesising a solution</i></p>	<p>eg. deals with complexity and trade-offs: independently and appropriately brings ideas together towards a solution</p> <p>eg. evidence of optimising and joined up thinking: sees some complexity & need for trade offs: some effective action:</p> <p>eg. takes some action to avoid problems or difficulties: but tendency to compromise</p> <p>eg. unable to see complexities and the need for balancing decisions: little evidence of conscious synthesising</p>	<p></p>
	<p>proving ideas (thoughtfulness and criticality)</p> <p><i>ongoing reflection on the effectiveness of ideas and developments ... mindful of the task... stepping outside the design to see it as others might</i></p>	<p>eg. independently thinks through strengths, weaknesses & consequences: clear self-critical approach: takes appropriate account of others' opinions</p> <p>eg. has some recognition of strengths & weaknesses from various standpoints and of others' views</p> <p>eg. aware of the need to check things out: prepared to listen to others, but little depth of thought</p> <p>eg. very little evidence of reflection: uncritical: takes little account of others' opinions</p>	<p></p>
	<p>Addressing the brief</p> <p>addressed brief fully <input type="radio"/></p> <p>addressed brief partially <input type="radio"/></p> <p>disregarded brief <input type="radio"/></p> <p>lost the plot <input type="radio"/></p>		

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Figure 3: The assessment rubric.

Range of data gathered

Through the assessment activity we were particularly concerned to gain some measure of each learner's creativity and innovation in the context of design and technology. To this end, we assessed the work utilising the assessment rubric developed empirically through the Assessing Design Innovation project that first gave a *holistic* assessment of creativity and innovation on a 'wow' to 'yawn' continuum, and then provided descriptors that diagnostically spotlighted evidence throughout the activity around three dimensions: *having* ideas, *growing* ideas and *proving* (or appraising) ideas. (see figure 3.)

A second data set was gathered through an 'Attitude to Creativity' questionnaire that each learner completed twice – once before the baseline testing took place and once at the same time as the post-intervention testing. This questionnaire was developed from an approach introduced in the 1980's (Raat et. al. 1987) and used extensively since that focused on Attitudes to Technology. In our questionnaire, we first asked for a prioritising of concepts relating to creativity and school subjects in which one could be creative, and then provided 35 statements about creativity with which to agree or disagree (on a 4 point scale). The statements were themed, but presented randomly. Table 1 indicates the way they were themed, the numbers indicate the order in which they appeared on the questionnaire.

Attitude to Creativity Questionnaire statements (response on a scale of: 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree)	
<i>What are creative people good at?</i>	<i>What is it like being creative?</i>
3. Creative people are really good at drawing	5. Being creative is difficult
12. To be good at Technology Education you need to be creative	7. Being allowed to be creative is more fun
17. Creative people can be good at anything	13. Projects where you have to follow instructions are boring
19. Creative people are good at maths	<i>Creativity is useful?</i>
21. Scientists give the world the best ideas	4. Creative people can improve other people's lives
30. You don't need to be good at Art to be creative	20. Creative ideas are a waste of time
<i>Who can be creative?</i>	27. Creative ideas don't help people in their everyday life
8. You can learn to become more creative	3. Scotland needs creative people
14. The cleverer you are the more creative you are.	<i>Creativity and achievement</i>
22. Some people are just born creative	6. Creative pupils always get high marks
29. Everybody can be creative in their own way	16. Teachers don't like pupils to be creative
35. Only a few people are creative	18. Teachers know when I've done creative work
<i>Girls and boys?</i>	26. You can get high marks in Technology without being creative
15. Girls are more creative than boys	32. Its easy to do a test to see how creative you are
23. Boys and girls are equally creative	<i>Creativity and employment</i>
36. Boys use their imagination more than girls	9. The more creative you are the more you get paid at work
<i>How to be creative</i>	24. Its better to have a creative job than to earn lots of money
10. Creative people break rules	34. Being creative won't get you a good job
11. Being creative means having ideas that no one else has had	
25. Creative ideas just happen	
28. To be imaginative you have to think hard	
31. I can be more creative outside of school	

Table 1: Statements from the Attitude to Creativity Questionnaire

In addition to this data, we also had a third data set gathered through the Learner Evaluation Questionnaire, as outlined above.

Insights provided by linked data analysis

Both through individual and linked data analysis (reported in detail elsewhere: McLaren et al 2006; Bain and McLaren 2006; Stables 2006) two areas of importance that emerged were:

- links between attitudes to creativity and creative performance;
- links between learner self reflection and creative performance

When the data was initially analysed, within individual data sets we explored standard aspects such as gender difference, but suprisingly little emerged as a result. It wasn't until we began to look for differences by subdividing the data in relation to performance on the focused assessment activity that more interesting facets became apparent. As we had both pre and post intervention performance data, we were able to create data subsets such as:

- consistently high performers;
- consistently low performers;
- improvers;

- those whose performance weakened.

Link between attitude to creativity and performance

From the attitude to creativity an interesting trend appeared when we used these subsets to explore the data, whereby the high performers were at variance in their views of creativity in relation to the general view of the learners, and this often related closely to the teachers' attitude. The following three statements illustrate this.

The first is the statement "Creative people can improve other people's lives", where the mean performance of those who agree with the statement is significantly higher (at .01 on a ttest) across the full performance profile in test 1 and higher across the profile in test 2 (with having ideas at the .01 sig.level). In addition, the teachers involved in the project who undertook a similar attitudinal questionnaire also valued this statement highly, suggesting a relationship between the way the teachers and the high performers value creativity for its usefulness. The second is "its easy to take a test to see how creative you are" with which, at a general level, the learners agreed, the teachers disagreed. But the performance data showed that those learners disagreeing with the statement have a higher performance mean, once again aligning them with the teachers. The third statement is "Its better to have a creative job than earn lots of money". With this statement there was general disagreement by both learners and teachers, with the exception of the high performers, who were more likely to agree – again showing a positive attitude towards creativity.

The creativity questionnaire also contained a free response question, asking simply for a personal response to what creativity meant to each individual. In these it is possible to detect a qualitative difference between the high and low performers, the high performers providing a greater level of comment about creativity **processes** and also demonstrating a more sophisticated level of understanding. The following examples typify the two types of responses.

"Using your imagination to help yourself and other people." (Learner 01/01/06: high performer)

"Having fun and having crazy and colourful ideas. Having fun when you write, talk, draw or make something." (Learner 07/02/45: high performer)

"Coming up with ideas that at either quite mad or ideas that make you think about the idea." (Learner 01/01/05: high improver)

"Making things." (Learner 08/01/04: low performer)

"Be good at art." (Learner 07/02/35: low performer)

"Being good at coming up with ideas." (Learner 01/01/04: low performer)

Not only did the higher performers show a more sophisticated view of process, in the post-intervention questionnaire there was increased evidence of statements that were not just about **having** ideas but reflecting the importance of **growing** those ideas

"Means you think up ideas and you put that idea forward by putting it in your final design.

Creativity means making things out of your creative ideas." (Learner 10/01/12: high improver)

"Being able to have good ideas / being able to make things and try to change things to better things." (Learner 07/02/35: high performer)

All of the consistently (i.e. in both the pre and post assessment activity) high performers and also the high improvers came from either an intervention or in-the-know school where there had been an emphasis on developing creative responses and self and peer assessment strategies. The increased awareness shown through the statements, including the emergence of comments relating to growing ideas, appeared to indicate a link to the improvement in performance, where the largest assessed improvement was in "growing ideas". With the higher performers we believe we witnessed part of the chain reaction

between their learning experiences, self-awareness and a deeper, metacognitive understanding of creativity beginning to crystallise. This was further evidenced when we looked at the linked data of learner self reflection.

Link between learner self reflection and performance

The key aspects that were apparent when we considered this data were that higher performing learners seemed to be readily able to state what they themselves felt they were good at and that this often mapped closely to the judgment of the assessment team using the rubric. These learners were also willing to suggest what they would like to get better at. The following two examples illustrate this.

Learner 07/02/29/7 identified he is best at 'coming up with ideas', and 'having ideas' was his highest score for in both activities. He stated that he had learned he is 'good at model making' (although in both activities he notes this as being the most difficult aspect) and 'ok at designing' in activity 2. He also stated that he wanted to get better at 'designing things' and 'putting his ideas into words'.

Learner 01/01/06 identified that she is best at as 'designing the model' and 'designing my ideas' and finds the easiest aspect 'coming up with a design'. She also scores consistently well in 'having ideas'. She noted after the first activity that she had learned 'I am better at designing than modelling' and her lowest performance is in 'growing ideas'. After the activity she identified this as something she wants to get better at and, interestingly, it remained her target 9 months later, even though she had improved her scores in this aspect. She does, however, indicate that she is aware she is better by this time, writing in her self reflection that she has learned 'how to put my ideas into action'.

Potential for adoption and adaptation

The way learners, particularly in the intervention schools, were increasingly able to describe, reflect and explain both in peer and self review serves as an important discriminator to progress designerly thought and action – something key in making progress in the curriculum area of design and technology. Through the dissemination of the CAPITAL DT and other projects, the approach has had much exposure within the international Technology Education community and has now been adopted as an integral part of the GCSE assessment for the OCR Awarding Body GCSE Design and Technology Product Design examination. A further project, developed directly from Assessing Design Innovation, has moved the approach more firmly into a digital world. This project, *e-scape*, also funded through DfES, has taken the entire Assessing Design Innovation structure and replaced much of the paper-based portfolio, with its evidence prompts and unfolding structure, with a digitally based portfolio captured through hand-held (or PDA) computers. This has provided opportunities for increased multimodal responses, utilising the PDA's camera (in the hands of the learners themselves) for creating the storyboard of developments, its drawing facility for developing and sharing ideas amongst the 'critical friends', its note taking tool for written responses and, most valuably, its voice recorder for collecting spoken reflections on developments literally from the 'voice' of the learner. This new model has been through a 'proof of concept' stage and has been trialed within design and technology settings.

But, as *e-scape* enters its third phase of development is being developed in parallel with geography and science settings. While we have used the approach in other projects to assess aspects of literacy (Stables et al., 2001) and generic competence within a citizenship context, (Stables et al, 2003) this latest development is providing an opportunity for us to explore the extent to which the approach has the potential to **infuse** (McGuinness et al, 2007) thinking skills across curriculum areas. Early discussions with developers from geography and science are already indicating huge potential for drawing on the approach to assess procedural thinking and capability of 'being a geographer' and 'being scientific' in

ways that sit comfortably with the revised National Curriculum 'Importance' statements for these areas and that break through some of the ritualised, formulaic summative assessments that currently take place. What is still to be seen is what aspects of the approach translate effectively.

In conclusion ...

The question we raised earlier in this paper is about whether the levels of capability we were witnessing in each assessment task was merely **exposed by** the activity as opposed to being **developed through** the activity – to return to our analogy, were we measuring the quality of the chicken, or providing the 'ingredients' through the use of activity prompts structure etc to nurture its development?. Inevitably there has been an element of both, and this would not be so with a traditional 'test', designed to show what a learner knows. So, while we explicitly set out to gain a measure of their creative capability (as much what they could **do** as what they **knew**), there was clearly considerably more going on during the three hours of the activity. We were struck when conducting these assessments that, despite the fact that the learners knew the activity was for assessment purposes, none showed anxiety, none enquired about how well they were doing or had done – the potential 'examination' dimension appeared entirely removed from their minds. It was also apparent that they enjoyed engaging with the activity, and this is corroborated by the evaluation questionnaire where, when asked to 'strongly agree', 'agree', 'disagree' or 'strongly disagree' with the statement "I enjoyed today's activity because we had to design something" the mean averages were 3.38 and 3.43 respectively for the first and second activity, 'strongly agree' being scored at 4. So, the learners enjoyed the activity (which, from the teacher interviews, it was apparent that was unlike anything they had done previously) and were prepared to reflect on what they had learned and what targets they had for improvement.

A teacher working with the level of learner comment provided, alongside teacher judgments of performance, would be in a secure position to create meaningful interventions that could be seen to meet the personal planning identified by the learner. This illustrates the inter-relationship and mutual support assessment *of* learning has with assessment *as* and *for* learning. This is very much in the ethos and following the principles of assessment used as a **dynamic** aspect of teaching and learning, illustrating how summative assessment can also be used to support formative purposes.

In each of the settings in which it has been used to date (both within and beyond Design and Technology) a major key to its value is the emphasis on *thinking* within action – on supporting learners to become more thoughtful and doing this by making the thinking **visible** to both the learner and the assessor (and potentially teacher), the value of which is highlighted in these words of David Perkins.

As educators, we can work to make thinking much more visible than it usually is in classrooms. When we do so, we are giving students more to build on and learn from. By making the dancers visible, we are making it much easier to learn to dance. (Perkins, 2003, p.2)

This 'visibility' is critical to creating a climate in which metacognition is fostered – and in an assessment context we believe is critical in creating the links between assessment *as*, *of* and *for* learning and that the approach taken in this research provides an effective vehicle to progress such assessments. We hope soon to be able to illustrate how this approach can similarly support procedurally-focused assessment in other curricular areas.

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