Comparing Analysis Frames For Visual Data Sets: Using Pupil Views Templates to Explore Perspectives of Learning

Abstract

A key challenge of visual methodology is how to combine large-scale qualitative data sets with epistemologically acceptable and rigorous analysis techniques. We argue that a pragmatic approach drawing on ideas from mixed methods is helpful to open up the full potential of visual data. However before we start to 'mix' the stages of analysis we need to be aware of the strengths and weaknesses provided by the various qualitative and quantitative perspectives. This paper therefore provides a methodological discussion based on empirical research experiences with one visual data set: Pupil Views Templates (Wall and Higgins, 2006). We investigate two different approaches to the analysis of this data: inductive and deductive processes. The two approaches are applied separately to the same data set and observations made regarding the affordances and constraints of each process, the findings and implications for developing visual analysis in this area. We show how both processes provide useful insight, but without clear strategy as to how they can be combined to achieve the intent of the research then the true potential of visual data will remain unlocked.

Key words

Introduction

To some extent this is a cautionary tale. It is the tale of the enthusiastic application of visual methods as an approach to empirical mixed method investigation, an account of the appropriate match between visual data and the educational values and the epistemological perspectives of a group of researchers working across a number of different kinds of research projects in education. It also reflects the excitement generated through the development and use of a visually based data collection tool, Pupil Views Templates (Wall, Higgins and Packard, 2007; Wall and Higgins, 2006) that has provided new insights into identified phenomena. Following well received peer-review from the visual research community (Prosser and Loxley, 2008) and from practitioners (Wall *et al*., 2010) and the successful collection of several large data sets, including comparison groups, we are left with three questions that we feel are important in moving this debate forward. In particular this is to develop better understanding our use of the tool we developed:

1) What are the epistemological assumptions associated with visual methods?
2) How do they fit with the practicalities of education research?
3) How can we effectively combine methodological paradigms in order to analyze large sets of complex data without undervaluing or privileging the different sources?

We are educationalists. The field in which we work is important as it provides the context for this research as well as giving insight into our priorities for the research process. Education is a discipline where impact on practice is fundamental (Hammersley, 2003). Ultimately the common objective is for students to become better learners and so a practitioner or policy audience is often privileged in the way that research is designed and reported (Elliott, 2001). Moreover, the needs of these audiences can differ and present

tensions between different approaches. For example, funders and policy makers tend to privilege quantitative data as 'better' evidence of impact; while practitioners are more likely to look for interpretations that consider the complexities of relationships and learning environments which influence teaching and learning interactions, and so qualitative data has greater leverage or greater 'catalytic validity' (Lather, 1986). This means that many researchers feel the demand to undertake research that fulfills multiple purposes and are increasingly using mixed methods (Alise and Teddlie, 2010). Our collective epistemology is largely pragmatic, in the Deweyan sense (Feilzer, 2010). We recognize from our experience that different types of data can be combined to give a more comprehensive picture (Johnson and Onwuegbuzie, 2004) and a single data set can be analyzed from different perspectives to suit different audiences (Greene, 2007). We have a tradition of combining different approaches and perspectives and thinking creatively about methodologies, how they can be combined and 'mixed' to best effect. We make strong connections to the field of mixed methods research and discussion of the most appropriate ways to combine processes has enriched findings and increased rigor in this field (Ozwuegbuzie, Slate, Leech and Collins, 2007).

We came to explore the visual dimension when thinking creatively about what could be included as evidence (Matheson, 2008) when researching children's lives. The repertoire of tools for data collection has been particularly limited when the perspectives of young participants are considered (Thompson, 2008). Many pedagogic activities, particularly in the primary age phase, rely on visual outcomes. These outcomes can only be included as empirical data if the definition of evidence beyond usual verbal qualitative and numerical quantitative is widened. By rethinking outcomes of learning activity and developing shared

understandings with the practitioner community of what can be included as evidence (Baumfield, Hall and Wall, 2008) we have developed some new perspectives on how data can be collected in partnership with teachers, supporting both pedagogic and research aims (Wall and Higgins 2006). As a result of this pragmatic approach to thinking about evidence, visual methods have become an important part of our work.

Visual research is concerned with the production, organization and interpretation of images (Prosser, 2007). It draws on a range of analytical perspectives from a number of disciplinary domains including sociology, media studies, psychology and cultural geography in order to investigate a wide range of research themes ranging from community, power, and gender studies, to spatial relationships, semiotics, participation and involvement. Over the last three decades visual studies have come to play a particularly valuable role in education research. Largely assumed to be sub-set of qualitative enquiry, one of whose main methods is observation, development of the field has led to a growing recognition that observable information and artifacts are important in understanding the complexity of school life (Prosser, 1998). One of the valuable features of visual research is the use of technology to capture review, replay and thereby facilitate deeper and different reflections (Mehan, 1993). However the theory, and to a lesser extent the practice, of the role that these visual data have to play in education enquiry is perhaps less developed.

We are, therefore, particularly interested in the pragmatics and practicalities of researching using a visual method: what are the affordances and constraints researchers have to balance when drawing together findings from a visually based study? Through using a variety of visual methods we have found that while data collection using visual methods is fairly straightforward (see, for example, Woolner *et al*., 2010), the analysis can be

considerably more problematic. The increasing acceptance of visual methods as adding to the field of education research and the development of technologies, such as digital cameras, which support the capture, storage and transfer of data quickly and easily means that this type of enquiry is likely to increase. As a result, visual data sets amenable to qualitative analysis can be assembled with relative ease, but the increase in scale can change the traditional terrain of qualitative analysis. Of course large data sets can be reduced and there are various strategies available for doing this, such as Q methodology (Stephenson, 1953) or other approaches to qualitative synthesis (Major and Savin-Baden, 2011), however if the intent is to survey a diverse population then this becomes challenging and any reduction or narrowing down could impact on the findings.

Long held methodological assumptions tend to place qualitative enquiry as small scale and detailed, while aligning quantitative processes with larger scale, reliable, static and structured data that is a suitable basis for generalization. These standpoints are accepted as having various advantages and disadvantages and the corresponding analysis tools for each are designed and used to build on many of these paradigmatic assumptions. But within our experience a visual data set can provide the researcher with characteristics that can be aligned either way: using the depth of each individual item alongside an increased likelihood of a large number of data items. This is a dilemma: what may be considered paradigmatically appropriate becomes challenging to implement and potentially compromises the quality of the data set. This challenge lends itself to mixed method research thinking (Onwuegbuzie *et al.,* 2007) particularly at the analysis stage.

There is a need therefore for pragmatic empirical exploration of the way different processes can provide different perspectives on the same visual data (Greene, 2008) and the extent to

which decisions can alter the conclusions made and therefore the findings of the research. This exploration is unlikely to uncover a simple and elegant solution: our investigations suggest that multiple approaches produce contradiction, ambiguity and cognitive dissonance.

This paper will explore two complementary ways of analyzing one large data set of Pupil Views Templates (Wall and Higgins, 2006) collected across a single research project, the Learning to Learn (L2L) in Schools Phase 4 Project (Wall *et al.*, 2010). The intent of this element of the larger research project was to survey pupils' perspectives across as many of the participant schools as possible. The first analysis process will be deductive, drawing on a predetermined coding scheme derived from the literature thus fitting with a more objectivist approach that will lead to statistical analysis of the data. The second procedure will draw upon interpretive epistemologies and fit with traditionally qualitative approaches: an inductive, thematic construction of findings which draws on ideas around grounded theory (Glaser and Strauss, 1967) and further discussed in Willig (2001). An overview of each process, its rationale and key findings will be provided before a discussion of the affordances and constraints of each and the way they interact to provide a construction of the sample as a whole and allow generalisability.

This paper intentionally places the deductive and inductive processes in opposition, although as pragmatic researchers we accept that it is more complicated than this. As a result we do not comply with the parallel form of mixed methods described by Cresswell (2009). This enquiry is important because the application of mixed methods to visual data is relatively novel. By placing these processes in opposition we believe a useful perspective is produced not only on the integration of qualitative and quantitative analysis procedures on

visual data sets, but also on the way that visual data can be explored more generally. Investigating both processes with one visual data set explores the different viewpoints the processes bring, thus allowing for more effective, strategic combining or synthesizing of data in the future. If inductive and deductive analyses are closely related, as Newman and Benz (1998) suggest, then surely the differences will not be great; but if very varying viewpoints are produced there may be something different about visual data that influences these processes and therefore the specific findings or it may be that greater emphasis needs to be placed on the researchers decision to choose one process over another. Further, if a mixed method approach is chosen then the typology used to combine or 'mix' the two perspectives (Nastas, Hitchcock and Brown, 2010) has to be carefully managed from the outset.

Pupil Views Templates

Pupil views templates show common learning scenes in a cartoon form which the children should easily recognize (Wall *et al.*, 2007). Each cartoon has speech and thought bubbles to encourage pupils to think about what they might say and what they think about a learning situation. Many of the details have been left blank so that the children can complete these for themselves if they wish. Details such as facial features of the people involved or particular pieces of equipment used in the activity can be added during the discussion. This means that the individual child can be more personally involved and adapt it to their understanding of the learning context they are experiencing. An example of a completed template can be seen below (figure 1).

When completed in dialogue with other children or an adult this process means that the discussion is constantly focused on the specific learning context under review. The speech

and thought bubbles then work to centre the discussion on the learning and thinking that is taking place, supporting the move from talk about the concrete, what is happening in this learning context, to the more abstract, what and how are they learning.

Figure 1: An example of a completed Pupil Views Template

The templates can be used to explore a specific teaching or learning approach with a particular child, or group of children, as a single activity. They can also be used in combination to investigate learning and teaching more broadly, either across situations or over time. You could, for example, consider how children learn in different situations and aim to increase their awareness of how they learn at different times. By comparing responses, you can investigate how they might learn differently in different subjects, varied circumstances or even times of the day or week, or over the course of a school year. Also if the conversation is widened to include other children, then the talk can support understanding about how individuals might learn differently from each other.

The templates have mainly been used and developed in classrooms across age phases; however, they clearly have potential to bring adults and children together in reflective and productive discussion across a much wider range of contexts beyond schools and formal learning situations. The key idea is that even young children can be asked, using cartoon representations, to reflect on their thinking about different aspects of experience. This has led to the design of templates that can examine the processes of thinking in different learning contexts (Wall *et al.*, 2007).

The templates have been designed as a stimulus for discussion about learning. The scenes are ones that pupils instantly recognize as representations of different learning situations. The familiar setting supports discussion and the design of the picture also means that the pupil can engage with it further. For example, drawing in the faces of the teacher and pupils, adding features of their classroom, or drawing what was on the board in a recent lesson, can help to trigger further reflection. This is also a useful way to support discussion and reduce any tension or implication that there is an expected or a correct way to complete the template and to ensure that the children are able to express their own thoughts and opinions.

In a more traditional interview, dialogue between an adult and child is clearly influenced by the unequal power relationships or by conversation dynamics in which young children quickly become adept at working out what they think adults want to hear. The templates attempt to mitigate this by not only giving the child a familiar type of classroom activity (a type of worksheet), but by also directing the attention towards the templates and away from the adult-child dynamic, and to emphasize through the cartoon representation that it is permissible to talk about what they think. The template forms the basis of an interview about learning and the centre of a complex interaction between an adult (likely to be the teacher), the pupils and the template. The teacher (or other adult) has an important role: they help to initiate the discussion about the chosen learning situation and to a certain extent will steer the dialogue that develops. The template serves as a reminder of the learning context under discussion and is a stimulus for this; however, as part of the process it is also annotated by the children, and so becomes a record of the discussion and a stimulus for further dialogue and ideas of their own.

The templates are consistent with ideas associated with psychological or semiotic tools (Vygotsky, 1978): they mediate pupils' thinking about learning and support them in expressing their ideas about the processes involved. In addition, the templates fulfill a parallel purpose by acting as a pragmatic 'bridge' across the research-practice divide for teachers (Kuhn and Dean, 2004). The templates do this by acting as an empirical research tool for exploring pupils' beliefs about metacognition as well as a pedagogical tool for facilitating dialogue about learning in the classroom (examples of teachers using the templates for both purposes can be seen in Wall *et al*., 2007). The power of the templates within L2L lies in the fact that regardless of the research agenda of the project, the age of the pupils or the learning environment the templates have become a powerful feedback tool informing both teachers and pupils about metacognition. This value for teaching and learning means teachers are more likely to engage with the outcomes authentically, so when they are used as research evidence the richness of the data and its validity is likely to be increased (Wall and Higgins, 2006). Therefore it is possible to see that the images can be used in three ways: as data or evidence; as an elicitation device to collect other data, and as a representation of knowledge.

Methodology

Data used in this paper has been collected as part of the Learning to Learn in Schools Phase 4 Project which involved primary and secondary schools in four regions of England: Cheshire, Cornwall, Enfield and Northumberland (for more information see Wall *et al.* 2010). As part of this project teachers have been supported in using professional enquiry through action research to explore different innovations that they believe fit under the umbrella term of Learning to Learn (Baumfield *et al.,* 2008) sharing their findings publically

as a case study. The involvement of pupils and inclusion of their perspective within these case studies has increased as the project has progressed and Pupil Views Templates have been prominent in the exploration of this aspect of the research. The teachers administered the templates as part of their professional enquiries into learning (Baumfield *et al.,* 2008) supported through the professional development and research support strand of the project (Wall *et al.,* 2010).

This iterative process has meant that we have one visual data set that extends across the project. We made the pragmatic decision to use it as a basis to answer a specific research question: what are the pupils' perspectives of learning to learn? The previous discussion highlights our challenge in deciding on the most appropriate analysis process with which to find out the answer(s).

Qualitative analysis of the templates has been relatively unproblematic at school level. The data sets are small (around 30-50 templates per case study) and the teachers have been happy to explore emerging themes and look for trends within this sample (based on an interpretive analysis process, Glaser and Strauss, 1967). This evidence has been sufficient to inform the teachers' enquiry, to satisfy their largely practitioner audience and to move their professional enquiries forwards at personal and school levels. However, at a project level where the data sets are much larger, 548 templates from 451 pupils in 12 schools across primary and secondary age phases, we are trying to explore generalizations and implications across schools, the project and then extrapolate findings in such a way that will convince a policy and academic audience. At this level a more deductive coding scheme was felt to be the more pragmatic choice. Indeed this was the process used throughout Phase 3, revealing interesting findings around the impact of involvement in Learning to Learn (Wall, 2008).

However on sharing many of these findings at conferences and in papers, commentators have been keen to ask whether we are missing anything from this predominantly closed analysis: do pragmatic decisions mean we miss out on important findings at project level that might be uncovered using more qualitative analysis techniques? This was therefore the rationale for the analysis and discussion in this paper.

Deductive analysis

The written content of each template was transcribed and imported into NVivo8 for analysis using a deductive coding procedure (described below). A code was applied based on the sense and meaning of a pupil's response with a judgment made by the researchers as to the intended meaning, and a category code applied accordingly. A category could therefore be applied to a single word, to a sentence fragment, a full sentence or a paragraph. Results are presented in terms of total words coded as the most sensitive output of NVivo (both proportionally and in relation to the research aims).

In the first stage of analysis, documents were coded according to the variables of gender and age. The latter was initially coded as how many years of age, but this had to be collapsed into three bands because the cell sizes were too small for the statistical analysis. The bands were approximately based on the UK National Curriculum phases: 4-7 years equivalent to infant school age; 8-11 years (junior) and 12-15 years (secondary school age). The text units were also tagged at this stage with whether they were written in the speech bubble or thought bubble. In the second stage of the analysis the statements were categorized using Moseley *et al.*'s (2005a; 2005b) model of thinking. This framework was chosen as a basis for coding because it represents a comprehensive synthesis across research and theory into learning (the rationale is more fully outlined in Wall 2008). The

statements were categorized as to whether they were predominantly evidence of cognitive

skills (information gathering, building understanding, or productive thinking; and/or

whether they were evidence of metacognitive thought (strategic and reflective thinking in

Moseley *et al.*'s (2005a) model). The following definitions based on this analysis were used:

- **Information Gathering (IG):** Characterized by recall of ideas and processes and

  recognition or basic comprehension of information they have been told or have

  read.

- **Building Understanding (BU):** This required some organization of ideas and

  recollections, some idea of relationships or connections, with some development of

  meaning about implications and/or patterns that could be applied or interpreted.

- **Productive Thinking (PT):** These comments tended to show more complex thinking

  such as reasoning, problem solving and some movement of understanding beyond

  the concrete and towards the abstract. Ideas that were generalisable or creative

  were placed also in this category.

- **Strategic and Reflective thinking:** Comments represented an awareness of the

  process of learning, including a reflective or strategic element to the statement or

  explicit thinking about learning (metacognitive awareness of learning).

The statements labeled as strategic and reflective learning, and therefore indicative of

metacognition, were then further analyzed for evidence of metacognitive knowledge and

metacognitive skillfulness (Veenman, Kok and Blöte, 2005).   These categories were

characterized in the following ways:

- **Metacognitive Knowledge (MK):** Comments in this category showed an understanding that the learner could think about learning, and could talk about some of the processes which supported their own learning (declarative knowledge).

- **Metacognitive Skillfulness (MS):** Comments within this category involved the procedural application and translation of thinking and learning skills across different contexts or for different purposes (for definitions see also Veenman and Spaans, (2005: 160).

This coding system has been checked for inter-rater reliability, across four researchers involved in the projects, with an agreement of 82%. Exemplification of the coding can be seen in Table 1 where examples of each coding category are given. In this table all the examples were taken from the same school where teachers were focusing their professional enquiry on how Circle Time could support children in talking about their learning experiences. These templates come from a class including Year 1 and 2 pupils (age 5, 6 and 7 years old). It should be noted that the categories used were not necessarily mutually exclusive and a single text unit could be classified as fitting under more than one heading.

Table 1: Table exemplifying the different coding groups using children's reflections on Circle Time gathered as part of the L2L Phase 3 Evaluation

Inductive analysis

The inductive analysis was completed by an experienced research associate who had not previously been involved with the Learning to Learn in Schools research project and had no knowledge of Pupil Views Templates or the prior analyses that had been undertaken. It was hoped that this would ensure the minimum of bias through exposure to findings and discussion centered on previous analysis procedures of the same or similar data sets. The process that was undertaken was driven by this individual and what she felt was the most appropriate and pragmatic way forward in providing the most accurate representation and summarisation of the data, according to fit, relevance, workability, and modifiability (Glaser and Strauss, 1967; Glaser, 1998). This analysis can be read in full in the annual report of the project (Wall *et al.*, 2010).

Due to practical considerations around an immersion, text driven, strategy (Miller and Crabtree, 1999) the large sample of PVTs had to be reduced. A sub-sample of 96 templates was therefore chosen for this part of the analysis: five templates were chosen at random from each of the twelve schools that used the templates as part of their case study research. However, on occasion fewer than five were used, this could be due to legibility of the templates or fewer than five being submitted by the school. In addition for some schools where templates had been used for a variety of purposes or in different classes, additional sets of five were taken to represent these strands of research and to try to ensure that, as far as possible, theoretical sampling principles could be followed within the analytical framing of the research. A process of construct generation was then used to explore the prominent trends and themes in two stages firstly at school level and then across the project sample as a whole. Themes and trends were recorded as part of a mind

map including whether the data was represented in words (one of the written comments) or visually (added as part of the cartoon).

Results

Deductive analysis

The full analysis of this data can be seen in Wall *et al.* (2010) and Higgins, Remedios and Wall (*in preparation*).

In terms of this paper, the purpose of the quantitative analysis was to comment on the interactive nature of the factors examined in this study, namely, Age, Gender and Type of Skill. The quantitative analysis focussed on differences between means and specifically whether there would be differences in five dependent variables that were based on observers' scores of pupils' ability to perform several cognitive skills. These skills were Information gathering (IG), Building understanding (BU), Productive thinking (PT), Meta-cognitive knowledge (MK) and Meta-cognitive skilfulness (MS). These five dependent variables were mapped against two factors, age (three levels: year 4-6, KS1, year 7-9, KS2 and year 10-15, KS3) and gender (two levels: Male and Female). The purpose of the statistical analysis was to examine whether the factors of Age, Gender and Type of Skill interacted in any statistical way.

With regards to interaction effects, the following effects were hypothesised:

- There would be an Age by Gender interaction whereby boys would only use more sophisticated cognitive thinking in years 4-6, and 7-9, but that these gains would be equalised in years 10-15,

- There would be an Age by Thinking Skill interaction whereby pupils skill use would be higher in years 10-15 relative to years 4-6, and 7-9.

- There would be a Gender by Thinking Skill interaction whereby Boys would be more likely to use Information Gathering skills relative to Girls but all other Thinking Skills would not be different by Gender.

In terms of an interaction between all three factors, it was expected that the two-way MANOVA would be significant. Table 2 summarises the means and standard deviations for the five measures of Thinking Skills broken down by factors of Age (range) and Gender.

Table 2: Means and standard deviations (in italics) for the five measures of Thinking Skills broken down by factors of Age (range) and Gender. Standard errors for marginal means are in parentheses and italics.

The means in Table 2 show that Age seems to be a key factor but that there seems to be some potential interactive effects across Age, Gender and Type of Thinking Skill. For example, there seem to be consistent effects of Age but less consistent effects for Gender. The patterns of findings do not seem consistent across Types of Thinking. To examine where the interaction effects might be significant, a MANOVA was conducted.

Because MANOVA effectively creates a combined DV, the first stage of the MANOVA was to evaluate the multivariate hypothesis that the population means on the multiple dependent variables are equal across groups. The two-way MANOVA examining Age x Gender was just about significant, Wilks' λ = .95, F (10, 692) = 1.92, p <. 05, partial eta squared = .03. Power

to detect the effect was .87. The significant two-way MANOVA points to a significant (three-way) interaction effect of the IVs and the DVs though it should be noted that the significance level (p=.04) was marginal.

Interpreting results for two-way MANOVA analyses is notoriously problematic (Tabanchik and Fidell, 1996; Green and Salkind, 2003; Leech, Barrett and Morgan, 2005). Researchers often recommend that if the two-way MANOVA is significant (in effect a confirmation of a three-way interaction), subsequent analyses are better interpreted using a series of two-way ANOVAs against the individual DVs (see Tabanchik and Fidell, 1996, p.375-378). To control for possible type I errors, a more conservative alpha was used when examining the one and two-way interactions. With 3 x 2 comparisons, a reasonable alpha would be .05/6= .008 and these levels were applied in the next stage of the analysis.

Table 3 summarizes the findings across the five dependent variables. It reveals that there were very few main effects for Gender but, as suggested by the means in Table 2, there were consistent main effects for Age. Only one interaction effect was observed (building understanding) but some of the interaction effects were marginally non-significant.

Table 3: Summary of main effects and interactions for the five dependent variables examined in this study

Across four of the five dependent measures, the pattern observed was that skill usage was significantly more prevalent in age ranges 8-11 relative to age ranges 4-7 but significantly *less* in age ranges 12-15 relative to age ranges 8-11. The findings in relation to gender were

more equivocal with the results suggesting that boys performed better at some skills and girls at others.

A full analysis of each type of cognitive and metacognitive variable has been completed, but within the constraints of this paper and to provide an overall picture of the data, we have collapsed the ratings for the four positive thinking skills (building understanding, productive thinking, metacognitive knowledge and metacognitive skillfulness), positive because there is a perceived action by the learner on the learned knowledge, an association, an adaptation or abstraction of the knowledge, or an awareness of the way this knowledge came about. This variable is labeled "Positive Thinking" and the same factorial analyses was conducted as used for the single measures. The means can be seen in figure 2.

Figure 2: Means for the dependent variable "Positive Thinking" broken down by Key Stage and Gender

Figure 2 revealed a main effect for Age Range $F_{(2,)}=32.29$, $p <.001$, $\eta2 = .16$ and a main effect for Gender s $F_{(1,)}=22.54$, $p <.001$, $\eta2 = .06$. The interaction was not significant. In terms of hypotheses, the findings were contrary to expectation. It was thought that the interaction would show that boys would only use more sophisticated cognitive thinking in age ranges 4-7and age range 8-11 but that these gains would be equalized in age range 12-15. Firstly, the interaction was non-significant ($p = .31$). Secondly, the main effect for gender was in favor of girls, not boys. And thirdly, and most surprisingly, rather than pupils using more sophisticated thinking skills in age-range 12-15, the consistent finding both generally (see Table 3) and when the measures were collapsed (Figure 2) was that pupils used positive

Page | 19

thinking skills significantly more in age ranges 8-11 relative to age ranges 4-7 but significantly *less* in age ranges 12-15 relative to age ranges 8-11. In other words, there was a consistent and marked drop off in skill usage in the later age-ranges relative to a peak skill usage in the age range 8-11.

Inductive analysis

It became apparent that this analysis of the templates revealed extensive additional information about different learning situations. The visual representation of different contexts appeared to mean that we could infer further information about children's understandings of learning processes, support for these processes, and outcomes. Therefore the key themes identified were affective and motivational dispositions to different learning experiences, ideas about progression, understanding of tools for learning and the importance of managing social contexts for effective learning to take place. These will be exemplified and discussed in turn.

Dispositions: For many students comments about learning were closely linked to emotions and motivation. Comments provided evidence of a predominantly happy outlook on learning. However students tended to single out specific aspects that they particularly favored. This could be because of the content, the type of activity or the processes that they associated with learning in this context:

> *My favorite subject is literacy. I like learning about stories and verbs. And I give out the literacy books. (age 8)*

> *I feel happy. It is good because I have fun (female, aged 5)*

The templates certainly gained insight around different learning contexts and Learning to Learn. For example this student comments particularly on learning outside of school:

I feel nice because I like learning out of school. Wow, this is fascinating (age 7)

Progression: The templates revealed a strong theme around progression. Students demonstrated a strong understanding of what it meant to succeed in learning, how they had progressed and the evidence that they needed to know that they had moved forwards. For example,

"I know that I'm making progress because I'm getting higher marks in tests and teachers say well done and that I'm getting full triangles." (age 9)

Linked to the idea of progression was value in being presented with something new. Students really appreciated new pieces of information, new experiences and new ways of learning:

Are you learning anything new? I am learning loads – its well interesting (age 11)

I like learning in the park because I can discover new things (age 6)

The students could see benefit in moving forwards in their learning, with regards to self motivation as well as strategic insight into their own learning career:

I liked it because at the end I had something that I had made myself (age 14)

Tools for learning: 'Tools for learning' was a comprehensive category which provided the most cross over with the deductive analysis findings. Many of the students elaborated on tools and individuals that helped them to learn and the way in which they described them

reflected elements of metacognition, and particularly metacognitive skillfulness. For example, the student below is talking about how different techniques support her learning:

The best way to learn my spellings is practicing at home and breaking them up.

The best way to practice my timetables is to use my fingers. (age 8)

The following child is starting to think how techniques and tools can be transferred to other lessons to support learning; this would fit with ideas surrounding metacognitive skillfulness:

I think we should keep putting colored squares to help by putting it in the maths

books and I think we should put it in other books as well. (age 9)

Tools could be activities like those above, but they could also be physical resources such as computers and clocks:

I think I learn best when I listen and look at things and work on the laptops with

a partner, like playing on a game to help fractions, divisions and times tables

(age 9)

Students were keen to highlight the impact of using these tools. This was in terms of the pace of their learning or the speed with which it was completed:

I learnt that if you help someone on a job you can work together and get the job

done faster (age 14)

As well as the amount of work that could be completed:

I prefer working as a team as we were one of the first finished and got everything

done. It was good because you didn't have as much pressure on you (age 14)

Social aspects of learning: Earlier findings from the project as well as in Year One of Phase 4 (Wall *et al.*, 2009) have shown strong associations between Learning to Learn approaches and specific types of talk and characteristics of social learning. Further evidence of this relationship was found within this sample of Pupil Views Templates. Students articulated the importance of group work:

> *I think I learn more by working in a team because you can teach each other new things (age 14)*

> *I like sharing the workload, it worked well. You can listen more to the video (age 14)*

A key trend was the support gained from working with others, particularly peers. For some this was a friend:

> *I think I am making progress because I am checking with my friends (age 9)*

> *I like sitting next to my friend doing my work (age 5-6)*

But others cited the characteristics of the peer as being just as important as friendship to aid learning. Students showed critical thinking about how best to manage their work with peers:

> *I'm all right with lollypop partners, but they are a bit distracting when you're with your mates. But when you're with your friends you are not afraid to discuss with each other (age 9)*

> *I like working with different people because you can see what ideas they have and more. (age 12)*

This critical reflection related not only to whom they worked with, but related this decision to different subjects and the social pairings and groupings that might be more or less effective:

I don't like it when we do times in maths because if I am on five and other people are finished they laugh at me. If we did times tables more, I would get better at it (age 8)

I think activate helps me to concentrate especially as I've got two irritating boys around me (age unknown)

Students also expressed perspectives on talk with their teacher. Comments focused on the support provided by teachers for learning:

*Miss ****** helps me to learn (age 6)*

But it also related to the learning role model that the teacher could provide:

Wow, this teacher knows a lot about history. I'm impressed. I wish I was him knowing all this. (age 12)

Parents were also mentioned as having an important role to play in their learning:

I want to show it to my mam so they are proud of me (age 14)

I would show them to my mum so she would know what I am capable of (age 14)

This was not just a 'show and tell' capacity, but also a two way relationship where students talked about sharing learning and enjoying the outcomes together:

> *I would like to share my work with my mum because she always checks what I*
>
> *have done and enjoys my work (age 14)*

While social contexts were predominant in the templates, there were also comments which related to the positives of working independently:

> *I learn better on my own because you don't get distracted by anyone. I get my*
>
> *work done quicker and I won't get told off for talking. I will do my work neater*
>
> *and I will concentrate because no-one will be there to talk to (age 9)*

Again critical reflection was evident with regards to when it was best to work with peers and when to work independently:

> *Less confidence when you have to do everything. I like working on my own when*
>
> *I am certain, but I don't like it sometimes if I am uncertain (age 14)*

Overall, the Pupil Views Templates showed students communicating their learning in a wide variety of ways to a range of people. They were able to critically reflect on combinations of who, when and what would suit different kinds of learning and this showed a strategic (metacognitively skillful) perspective.

Discussion

Matheson (2008) gives four key considerations to understanding the credibility and utility of imaged-based research: quality of the research design, attention to context, adequacy of the image from multiple perspectives and the contribution images make to new knowledge. The latter two points are particularly relevant to this discussion. As has been illustrated, through the two analyses, visual methods and techniques can be used in such a way that they suit a range of approaches. In a broadly positivist approach the data generated can be

used and analyzed in a deductive fashion with the credibility established procedurally according to the accepted norms within the epistemological framework (for example by measuring inter-rater reliability for coding, employing participant validation techniques of the interpretation or other methods within this paradigm). A methodology that adopts a more interpretivist approach or follows a more critical epistemology in using images also has accepted norms and practices to establish credibility. So, for example, it is likely that images produced or adapted by participants would be privileged over those produced by a researcher. This would then be consistent with the intention to understand the meaningfulness of the area under investigation from the participants' perspective. The use of the templates would be to elicit participants' perspectives and allow some freedom in the development of the focus and themes of the research. Pupil views templates have the potential to be adopted as a method suitable within either of these paradigms. Yet, it is important to ask whether a single approach can ever do justice to the complexity of a visual data set and the extent to which clarity can be achieved when these different analysis procedures are combined.

In this paper through completing both analysis processes side by side in the context of one data set it has been possible to explore the contribution made towards better understanding of pupils' perspectives of learning as well as pinpointing any potential gaps. There is no doubt that new insight has been provided into the development of metacognitive skillfulness as part of a Learning to Learn approach. Both the deductive and inductive analyses have evidenced pupil articulations of skillfulness at a younger age than might have been previously expected in the literature (for example, Kuhn, 1999; Bartsch, Horvarth and Estes, 2003). However each approach has provided its own lens with which to

view this finding. The quantitative analysis showed a statistically significant drop off in positive thinking in secondary schools. While the qualitative process, gave examples of the complexity of pupils' understanding and the way the learning environment might be tailored to facilitate this development; for example, when and where it is or is not appropriate to work with friends. Neither of these findings was confirmed or triangulated by the other analysis and if either process were asked to stand alone then it leaves the uneasy conclusion that implications from the data would have remained unknown. This means that choice of analysis technique can be a risky business.

The deductive approach constrained the data into a form that provided opportunities for observations to be made across the sample and as a result generalizations made. Indeed by undertaking this process it has produced new insight into how metacognitive knowledge and skillfulness develops in schools. However, we understand that some researchers will question the use of such a detailed statistical analysis being used to explore what is largely accepted as a qualitative data source; the extent to which this level of statistical analysis convenes paradigmatic assumptions on both sides and as such make any findings problematic is an important debate. However, the scale of the data set does suggest this type of process as the only pragmatic way an analysis can encompass the sample as a whole. In this analysis all sources were included and coded. It is arguably the case that the quantity represented by the number of sources in this data set is somewhat accounted for by using this process, but the quality of the data, the detail, is arguably missed as a consequence. This is perhaps where more qualitative approaches come more into their own.

The interpretivist approach to analyzing the templates, therefore, contrasts by placing the texts at the heart of the analysis, driving the construct generation process. A process that

Miller and Crabtree (1999) call immersion. However the number of templates remained a problem and a decision had to be made early on to include only a sub-sample in the full analysis. If this had not been done then the scale would have been overwhelming and the approach unmanageable. To account for this many conversations took place over the way this sampling procedure should be done and the implications it would have, but no real definitive answers were found; there were advantages and disadvantages to each. In the end a stratified random sampling frame (Bryman, 2003) was used based on the variation across schools and the need to represent each school to some extent in the analysis. It should be recognized that the sub-sample that remained was still large in qualitative terms and meant that some of the analysis process still had to be condensed due to this scale and pragmatic considerations still dominated. However, by only analyzing a sub-set of the data then compromises in the analysis were already inherent in this approach.

Interpreting the reduced sample using an approach based on ideas related to grounded theory (Glaser and Strauss 1967) remained no small task. The multiple ways the templates could be looked at remained immense: not only was there the text and the visual elements to explore but also the ways that they interrelated, for example, their location on the page in relation to each other: does a comment with a drawn exemplar mean something different to a comment or image alone? The deductive analysis had the considerable disadvantage of only using the written text: the visual element of the template was 'demoted' to being an important part of the process by which this text was elicited. It was therefore hoped in the inductive analysis that this would be remedied and due consideration made of this visual aspect. However even though a sub-sample was used and the grounded theory approach was very open, the range of possibilities for interpretation of one template was extensive

and the potential combinations, therefore, across the sample, were vast. Indeed there was a perceived fear that this open-ended nature of the data could lead to the text being by-passed; in other words, the interpretation could follow avenues which became so dislocated from what the child originally intended when completing the template that the resulting findings would be misaligned with the research intentions. The researcher completing this element was driven by the number of potential avenues for analysis to quickly corroborate themes and provide some sort of structure to the analysis; therefore the analysis quickly moved from immersion to editing (Miller and Crabtree, 1999).

It becomes quickly apparent that analysis choice is important when interpreting a complex data set such as that provided by visual data and has a significant influence on the findings. The two analyses of this one data set bring different perspectives and therefore different outcomes. If sole use were to be made of any one approach only a single dimension from the data set would be realized. While this may be an advantage in terms of researchers' fidelity to epistemological traditions, the disadvantage is that detail and nuance can be missed. Onwuegbuzie and Teddlie (2003) describe two reasons for mixed methods, representation and legitimization. This paper has shown that without strategic integration of the quantitative and qualitative processes then the findings can be contradictory rather than providing a coherent representation of the data. Therefore in terms of legitimization of the findings doubt is placed on the separate interpretive processes and synthesising the two aspects holistically study is problematic. The question is whether this is a characteristic of visual data, the complexity inherent in each piece of data and the scale on which it can be collected, or it is something to be considered more widely in terms or mixed methods analysis.

Bringing these two processes together under a mixed method framework is still challenging (Creswell, Plano-Clark, Gutmann, and Hanson, 2003). In this example we are suggesting a mixed methods analysis stage rather than a mixed method process starting from research question and data collection. We believe that the intention of our research question in terms of understanding children's thinking in a L2L context was appropriate for mixed methods (Newman, Ridenour, Newman and DeMarco, 2003), but that a single data set and analysis prevents the application of an interaction between the different techniques and understanding the applicability of the data to the research question.

As argued in the introduction to this paper a case could be made that visual data tends to span the supposed divide between qualitative and quantitative data due to its depth and scale, but a single analystic approaches still only produces one data set. In this paper we are arguing that the mixed method interaction is between the qualitative and quantitative analysis and that this could not become fully apparent until the latter stages of the research. By undertaking the two different analysis processes in engaging with the visual we have shown how important the planned interaction between these perspectives is, even at this latter stage. Only in this way will better understanding of a data set, its potential for analysis and its implications in terms of the research question can be understood. We aimed for both generalization and a depth of understanding but by taking the two processes in isolation we perhaps undermined the potential of the findings. The simple combination of the two techniques used in this paper means that the complexity represented by the data set is under-developed. Further thought is needed about how full mixed methods analysis, from both perspectives, can be completed. Thinking about how the processes interact and are related to each other is crucial and only in this way can integration through

Onwuegbuzie *et al.*'s (2007) steps of 'correlate, consolidate, compare and integrate' be achieved.

Conclusion

The nature of the Pupil Views Template data set, their development and use in the Learning to Learn project has been largely ecological and pragmatic in nature, fitting with the ethos of the wider project. However when we chose to ask a specific question of this visual data set we opened up an enquiry about the most appropriate way in which to analyze the data they represented across the project. We wanted to achieve fidelity with the source material and the individual children who had completed the templates, but also wanted to draw conclusions extending across the whole data set. We wanted them to fulfill multiple purposes. The focus of this paper, therefore, is whether a deductive or inductive analysis process might best fit this purpose when the data set is visual.

Each template includes a visual structure that facilitates a response either in text or visual representation, thus resulting in individual pieces of data that are multi-facetted and dense with information. In addition, the ease and economy of administration means that they can be collected on a scale that multiplies this complexity exponentially (Wall and Higgins, 2006). The resulting density and quantity of information could be considered to be overwhelming. In the Learning to Learn Project Pupil Views Templates were collected with the intent to explore perspectives across schools participating in this national project and as a result an analysis drawing on quantitative traditions was chosen to meet these objectives (Wall, 2008). If the sample had been smaller and the intent not to survey the population but rather to get a rich understanding of the children's perceptions of learning to learn in their contexts, then the decisions would have been different and a more interpretivist approach

might have been appropriated thus allowing the complexity of the sources to be interrogated and the themes across the sample to emerge. The intent therefore with which data is collected and the nature of the questions being asked has to be central in influencing the nature of the sample and therefore the analysis techniques applied and this does seem to be more important where visual data is concerned. This is likely to be cogent with the epistemology of the researcher, but this paper has shown that an advantage of visual data is the potential to cross and mix paradigmatic assumptions as discussed within the mixed method genre by Newman *et al.* (2003).

Table 4: Themes and analyses with abductive inferences

This means that attempts to triangulate ideas across the visual data set from multiple standpoints are possible and for some purposes may be encouraged. We have compared just two such approaches, admittedly representing two very different methodological positions, but by using these lenses to explore the data we have started to provide a different, more nuanced representation of what it can tell us (Table 4).

The deductive analysis provided a snapshot of the data across the project which has enabled certain hypotheses to be tested and generalizations as a consequence to be made; while, the inductive analysis provided examples and depth to pupil experience (c.f. Harry, Sturges, and Klinger, 2005). These are aspects that complement each other very well and if taken together can be seen to somewhat rationalize results. However there are gaps; the apparent decline in the recording of productive thinking in secondary schools is not apparent anywhere in the inductive analysis. The attempt to follow a grounded theory

approach faithfully meant that no predetermined structures were given to the researcher as it was felt this might compromise the procedure and only those deemed to have arisen from the data were used as this process progressed. In comparing the outcomes of the different forms of analysis, a particular frame is brought to bear on the themes generated. For the aims of this paper it is important to note that unless some focus or strategy is applied to the combination of qualitative and quantitative analysis then aspects of potential triangulation and complementarity could be missed. This is why this paper is presented as a cautionary tale: mixed analysis can supply a more nuanced perspective on the topic, not only showing what happened but can also give some insight as to why, but there is also the risk of findings 'missing' each other. The two obvious strategies for synthesis necessarily draw on each of the underpinning paradigms. Based on the theory-led deductive analysis the inductive categories can be compared and contrasted. Alternatively the findings from the deductive analysis can be added as data to the inductive process and a further stage of assessing fit with existing codes and categories (see Feilzer (2009 p 7) for a discussion of the integrative options). One further possibility also emerges based on the work of Charles Saunders Peirce (1986), another Pragmatist, in terms of abduction in using the juxtaposition of findings to generate further abductive inferences (Shank and Cunningham, 1996; Feilzer, 2009). The tensions between the two perspectives are not fully resolved, but used as a sufficient basis for inference that can be tested by subsequent action and enquiry (the final column in table 3). In our work this tension is apparent in the warrant from the research for the different audiences, academic, policy and practitioner and a different synthesis, or resolution, may be required for the different audiences.

References

Alise, M.A. and Teddlie, C. (2010). A continuation of the Paradigm Wars? Prevalence Rates
of Methodological Approaches Across the Social/Behavioural Sciences. *Journal of
Mixed Methods Research,* **4**(2), 103-126.

Bartsch, K., Horvarth, K., and Estes, D. (2003). Young children's talk about learning events.
Cognitive Development, **18**, 177–193.

Baumfield, V., Hall, E., and Wall, K. (2008). *Action Research in the Classroom*. London: SAGE
Publications.

Bryman, A. (2003). *Social Research Methods*. Oxford: Oxford University Press.

Cresswell, J.W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods
Approaches (3rd Edition).* Thousand Oaks, CA: Sage.

Cresswell, J.W., Plano-Clark, V.L., Gutmann, M.L. and Hanson, W.D. (2003). Advanced Mixed
Methods Design. In A. Tashakkori and C. Teddlie (Eds.), *Handbook of Mixed Methods
in Social and Behavioural Research* (pp. 209-241), Thousand Oaks: SAGE Publications.

Elliot, J. (2001). Making evidence-based practice educational. *British Education Research
Journal,* **27**(5), 555-574.

Feilzer, M.F. (2010). Doing Mixed Methods Research Pragmatically: Implications for the
Rediscovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods
Research*, **4**(1), 6-16.

Glaser, B.G. (1998). *Doing Grounded Theory - Issues and Discussions*. Mill Valley, CA.: Sociology Press.

Glaser, B.G. and Strauss, A.L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Chicago, IL: Aldine Publishing Company.

Green, S. B., and Salkind, N. J. (2003). *Using SPSS for Windows: Analyzing and understanding data* (3rd ed.), Upper Saddle River, NJ: Prentice-Hall.

Greene, J.C. (2007). *Mixed Methods in Social Enquiry,* San Fransisco, CA.: Jossey-Bass.

Greene, J.C. (2008). Is Mixed Methods Social Enquiry a Distinctive Methodology? *Journal of Mixed Methods Research*, **2**(1), 7-22.

Hammersley, M. (2003). 'Can and Should Educational Research be Educative?' *Oxford Review of Education*, **29**(1), 3-25.

Harry, B., Sturges, K.M. and Klingner, J.K. (2005). Mapping the Process: An Exemplar of Process and Challenge in Grounded Theory Analysis. *Educational Researcher,* **34**, 3-13.

Higgins, S., Remedios, R. and Wall, K. (*in preparation*). Exploring the Development of Pupils' Declarative Knowledge of Metacognition.

Johnson, R. B., and Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, **33**(7), 14-26.

Kuhn, D. and Dean, D. (2004). Metacognition: A Bridge Between Cognitive Psychology and Educational Practice, *Theory into Practice*, **43**(4), 268-273.

Kuhn, D. (1999). Metacognitive development. In L. Balter and C. S. Tamis-LeMonda (Eds.), *Child psychology: A handbook of contemporary issues* (pp. 209-241), Philadelphia, Psychology Press.

Lather,P. (1986). Issues of Validity in Openly Ideological Research: Between a Rock and a Soft Place. *Interchange,* **17**(4), 63-84.

Leech, N., Barrett, K. C., and Morgan, G. (2005). *SPSS for Intermediate Statistics: Use and Interpretation*. Mahwah, NJ: Erlbaum.

Major, C.H. and Savin-Baden, M. (2011). Integration of qualitative evidence: towards construction of academic knowledge in social science and professional fields. *Qualitative Research,* 11, 645-663.

Matheson, S. (2008). Seeing is Believing: The credibility of imaged based research and evaluation. In S. Donaldson, C. Christie and M. Mark (Eds.) *What Counts as Credible Evidence in Research and Evaluation*. London: Sage Publications.

Mehan, H. (1993). Why I like to look: On the use of videotape as an instrument in educational research. In M. Schratz (Ed) *Qualitative voices in educational research.* London, Falmer Press.

Miller, W.L. and Crabtree, B.F. (1999). Clinical Research: A multi-method typology and qualitative roadmap. In B.F. Crabtree, and W.L. Miller, (Eds.) *Doing Qualitative Research Second Edition.* Sage Publications: London.

Moseley, D., Baumfield, V., Elliott, J., Higgins, S., Miller, J. and Newton D. P. (2005a).

Frameworks for thinking: a handbook for teaching and learning. Cambridge:

Cambridge University Press.

Moseley, D., Elliott, J., Gregson, M. and Higgins, S. (2005b). Thinking Skills Frameworks for

Use in Education and Training. *British Educational Research Journal,* **31**(3), 81-101.

Nastasi, B.K., Hitchcock, J.H. and Brown, L.M. (2010). An inclusive framework for

conceptualizing mixed methods design typologies: moving toward fully integrated

synergistic research models. In A. Tashakkori, and C. Teddlie, (Eds.) *Handbook of*

Mixed Methods in Social and Behavioural Research (2nd Ed, pp. 305-338), Thousand

Oaks: SAGE Publications.

Newman, I. and Benz, C.R. (1998). *Qualitative-Quanitative Research Methodology: Exploring*

the interactive continuum. Carbondale, Il.: Southern Illinois State Press.

Newman I., Ridenour C.S., Newman C., and DeMarco, G.M.P.Jr (2003). A Typology of

Research Purposes and its Relationship to Mixed Methods. In A, Tashakkori and C.

Teddlie (Eds.) *Handbook of Mixed Methods in Social and Behavioural* Research

(pp.167-188), Thousand Oaks: SAGE Publications.

Onwuegbuzie, A. J., and Teddlie, C. (2003). A Framework for Analyzing Data in Mixed

Methods Research. In A, Tashakkori and C. Teddlie (Eds.) *Handbook of Mixed*

Methods in Social and Behavioural Research (pp. 351-383), Thousand Oaks: SAGE

Publications.

Onwuegbuzie, A. J., Slate, J.R., Leech, N.L., and Collins, K.M.T (2007). Conducting Mixed

Analyses: A general typology. *International Journal of Multiple Research Approaches*,
1(1), 4-18.

Peirce, C.S., (1986). Writings of Charles S. Peirce, A Chronological Edition, Peirce Edition

Project (eds.), Indiana University Press, Bloomington and Indianopolis, IN, 1981–.
Volume 1 (1857–1866), 1981. Volume 2 (1867–1871), 1984. Volume 3 (1872–1878),
1986.

Prosser, J. (Ed.) (1998). *Image-based Research.* London, RoutledgeFalmer.

Prosser, J. (2007). Visual methods and the visual culture of schools. *Visual Studies*, 22(1), 13-

30.

Prosser, J. and Loxley, A. (2008). *Introducing Visual Methods.* Discussion paper available at:

http://www.ncrm.ac.uk/research/outputs/publications/ [accessed 30/11/10].

Shank, G. and Cunningham, D.J. (1996). Modeling the six modes of Peircian abduction for

educational purposes. In M. Gasser (ed.), *On-line Proceedings of the 1996 Midwest
Artifical Intelligence and Cognitive Science Conference* (Indiana, 1996). Available at:
http://www.cs.indiana.edu/event/maics96/Proceedings/shank.html [accessed
30/11/10].

Stevenson, W. (1953). *The Study of Behavior: Q Technique and its methodology.* Chicago:

University of Chicago Press.

Tabachnick, B.G., and Fidell, L.S. (1996). *Using Multivariate statistics.* New York: Harper

Collins.

Thompson, P. (Ed.) (2008). *Doing Visual Research with Children and Young People*. London, Routledge.

Veenman, M.V.J., Kok, R. and Blöte, A.W. (2005). The relation between intellectual and metacognitive skills in early adolescence. *Instructional Science*, **33**, 193–211.

Veenman, M.V.J. and Spaans, M.A. (2005). Relation between intellectual and metacognitive skills: Age and task difference. *Learning and Individual Differences*, **15**, 159–176.

Vygotsky, L. S. (1978). *Mind in society: the development of higher psychological processes.* Cambridge, MA.: Harvard University Press.

Wall, K. (2008). Understanding Metacognition through the use of Pupil Views Templates: Pupil Views of Learning to Learn. *Thinking Skills and Creativity*, **3**, 23-33

Wall, K., Hall, E., Baumfield, V., Higgins, S., Rafferty, V., Remedios, R., Thomas, U., Tiplady, L., Towler, C. and Woolner, P. (2010). *Learning to Learn in Schools Phase 4 and Learning to Learn in Further Education Projects: Annual Report.* London, Campaign for Learning. Available at: www.campaign-for-learning.org.uk

Wall, K., Hall, E., Higgins, S., Leat, D., Thomas, U., Tiplady, L., Towler, C. and Woolner, P (2009). *Learning to Learn in Schools Phase 4 Year One Report*. London: Campaign for Learning. Available at: www.campaign-for-learning.org.uk

Wall, K. and Higgins, S. (2006*).* Facilitating and supporting talk with pupils about metacognition: a research and learning tool. *International Journal of Research and Methods in Education,* **29**(1), 39-53.

Wall, K., Higgins, S. and Packard, E. (2007). *Talking about Learning: Using templates to find out pupils' views.* Devon, Southgate Publishing.

Wagner, J. (2004). Constructing credible images: Documentary studies, social research, and visual studies, *American Behavioral Scientist*, 47(12), 1477-1506.

Willig, C. (2001). *Qualitative Research In Psychology: A Practical Guide to Theory and Method*. Buckingham: OUP.

Woolner, P., Clark. J., Hall, E., Tiplady, L., Thomas, U., and Wall, K. (2010). Pictures are necessary but not sufficient: Using a range of visual methods to engage users about school design. *Learning Environment Research*, **13**(1), 1-22

Figure 1 content (Pupil Response Record – Interactive Whiteboards):

Pupil Response Record – Interactive Whiteboards

Name: GIRL
Age: 10

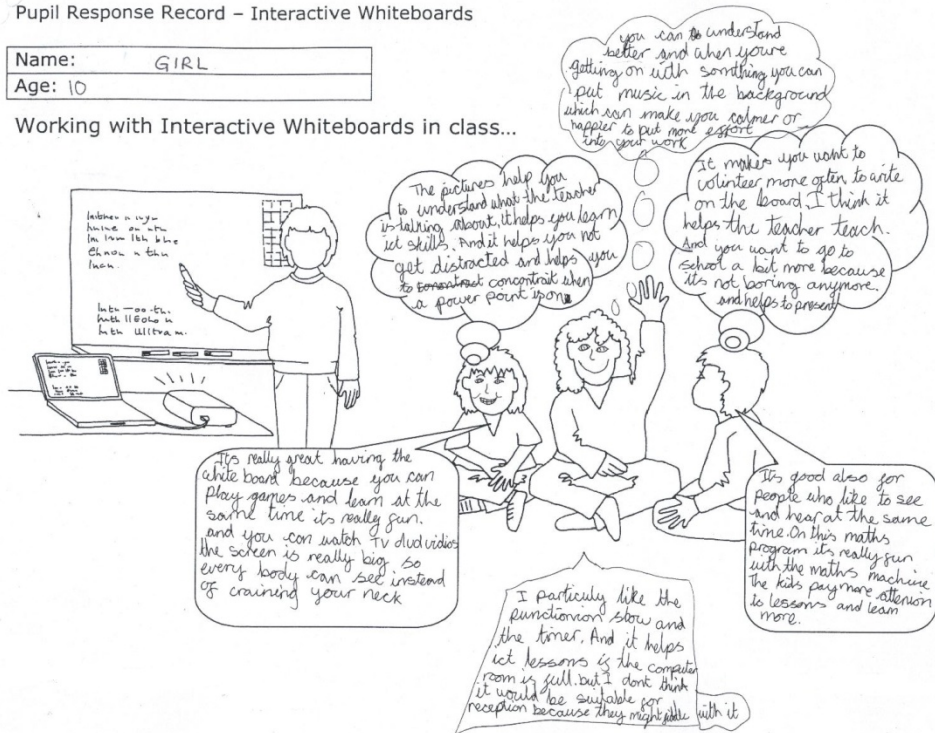Working with Interactive Whiteboards in class…

Figure 1: An example of a completed Pupil Views Template

Table 1: Table exemplifying the different coding groups using children's reflections on Circle Time gathered as part of the L2L Phase 3 Evaluation

Information Gathering		*In Circle Time we share our thoughts and smiles*
Building Understanding		*I like Circle Time because you tell other children about you*
Productive Thinking		*I didn't feel nervous because I got to know the other children and new friends.*
Strategic & Reflective Thinking	Metacognitive Knowledge	*Circle Time is a bit scary because sometimes you have to speak in front of everyone.*
	Metacognitive Skillfulness	*If people are stuck on a work, asking the person or a friend to help you.*

Table 2: Means and standard deviations (in italics) for the five measures of Thinking Skills broken down by factors of Age (range) and Gender. Standard errors for marginal means are in parentheses and italics.

Information Gathering				
	Female		Male	
	Mean	s.d.	Mean	s.d.	Total
4-7	3.9	*5.09*	4.6	*4.95*	**4.23** *(.72)*
8-11	7.1	*11.24*	7.6	*11.41*	**7.31** *(1.06)*
12-15	17.4	*12.86*	15.7	*11.31*	**16.56** *(.89)*
Total	**9.46**	*(.71)*	**9.28**	*.(75)*	

Building Understanding				
	Female		Male	
	Mean	s.d.	Mean	s.d.	Total
4-7	11.0	*11.57*	8.7	*9.60*	**9.81** *(1.10)*
8-11	30.5	*17.36*	15.9	*16.78*	**23.20** *(1.62)*
12-15	17.0	*17.31*	13.4	*15.54*	**15.18** *(1.35)*
Total	**19.47**	*(1.09)*	**12.65**	*(1.15)*	

Productive Thinking				
	Female		Male	
	Mean	s.d.	Mean	s.d.	Total
4-7	4.8	*11.38*	1.9	*5.29*	**3.35** *(1.00)*
8-11	11.1	*19.66*	12.7	*19.71*	**11.91** *(1.47)*
12-15	7.9	*15.57*	1.1	*5.16*	**4.52** *(1.23)*
Total	**7.92**	*(1.00)*	**5.26**	*(1.01)*	

Meta-cognitive Knowledge				
	Female		Male	
	Mean	s.d.	Mean	s.d.	Total
4-7	9.6	*15.50*	5.2	*9.53*	**7.38** *(1.18)*
8-11	27.7	*22.30*	13.9	*17.67*	**20.82** *(1.73)*
12-15	16.1	*16.91*	6.7	*10.41*	**11.42** *(1.45)*
Total	**17.80**	*(1.17)*	**8.62**	*(1.01)*	

Meta-cognitive Skillfulness				
	Female		Male	
	Mean	s.d.	Mean	s.d.	Total
4-7	3.7	*10.35*	1.7	*5.06*	**2.71** *(.84)*
8-11	7.1	*13.86*	9.2	*17.97*	**8.12** *(1.23)*
12-15	4.5	*11.88*	1.7	*6.03*	**3.14** *(1.03)*
Total	**5.10**	*(.83)*	**4.21**	*(.87)*	

Table 3: Summary of main effects and interactions for the five dependent variables examined in this study

Dependent variable	Main effect Gender		Main Effect Age Range		Gender x Age Range interaction	
	p	η2	*p*	η2	*p*	η2
Information Gathering	.88		*>.001*	.25	.58	
Building Understanding	*>.001*	.05	*>.001*	.12	*> .05*	.03
Productive Thinking	.06		*>.001*	.07	.06	
Metacognitive Knowledge	*>.001*	.08	*>.001*	.11	.06	
Metacognitive Skillfulness	.40		*>.001*	.04	.06	

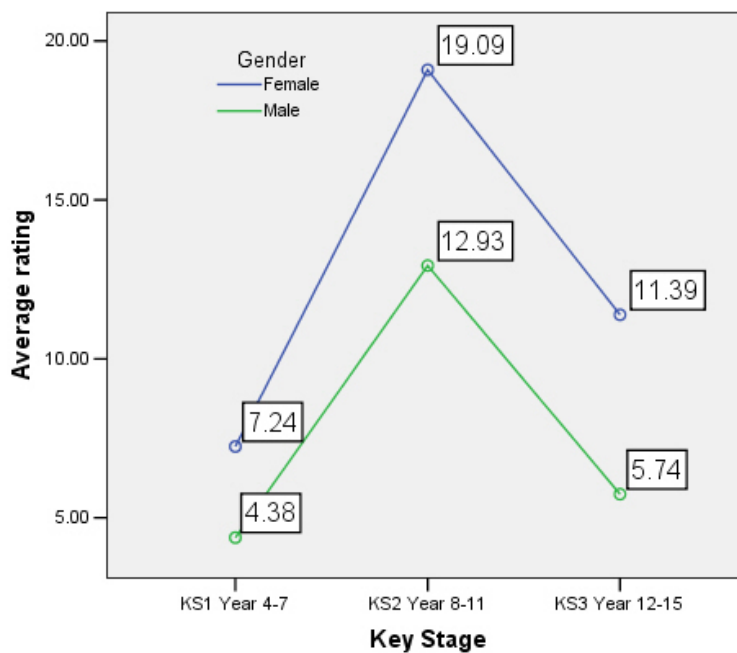*P = p value*   η2 = partial eta squared effect size

Figure 2: Means for the dependent variable "Positive Thinking" broken down by Key Stage and Gender

Table 4: Themes and analyses with abductive inferences

Theme	Inductive analysis	Deductive analysis	Abductive inferences
Gender	Gender as '*insider*'; perceptions of gender as experienced in classrooms.	Gender as analysis variable ('*outsider*'); significant difference in 'positive thinking' category.	Limited significant differences and similar performance overall suggests cultural, rather than educational basis for gender differences.
Progression	Phenomena of progression *from* individual learner perspectives.	Progression *of* individuals thinking about learning with age.	Diversity of experience contributes sufficient conditions for progress.
Dispositions	Expressed in individual comments (positive and negative) – importance of the affective and motivational.	Role of context inferred from apparent complex skill decline in older pupils. Affective and motivational dimension absent in analysis.	Affective and motivational aspects are a necessary component of L2L dispositions.
Context	Influence of context on individuals (e.g. parents, teachers, learning out of school).	School, age and task as variables for analysis.	Despite the variation in context and experience developmental patterns are apparent indicating possible limits of L2L.
Tools for learning	Importance of tools in developing self-efficacy and L2L agency.	Patterns in distribution of meta-cognitive skillfulness.	Tools form a mediating role in developing L2L.
Social aspects of learning	Importance of others, critical reflection.	Patterns in distribution of meta-cognitive skillfulness.	Social influences may limit L2L in older pupils.