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Using Pupil Views to Uncover Evidence of Children's Metacognition in Mathematics

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Abstract: This article investigates the impacts of using a thinking skills approach alongside pupil views templates (PVTs) in my primary classroom. This research adopted an "action inquiry" approach—combining elements of action research and case study with mixed methods, including the use of progress and attainment data; a measure of self-concept; and PVTs, to uncover evidence of pupils' metacognition. While this case study offers some context regarding the overall research, it particularly focuses on the development of one pupil, Harry, whose metacognition is evident in the reflections upon learning he recorded on his PVTs. As such, it aims to contribute to existing literature by providing an exemplar of the reflections that can be gained through using PVTs with children and the insight that can be gained into the internal process of learning and metacognition. The case -study structure is designed to keep the two individual voices contained in this research—Harry's, as a pupil, and my own, as a teacher-researcher—distinct and separate. They are presented in separate columns: one that contains a narrative of each case, and another that contains analysis, providing

a physical separation of his voice from my own interpretation of it, enabling Harry to express himself and his experiences from his own perspective. This unconventional format is intended to propose an alternative to analyses which prioritize the interpretation of the researcher by creating space for the participants of research to express themselves in their own words.

Keywords: Thinking skills, metacognition, pupils' perceptions of learning, pupil voice, mathematics

Introduction

This article investigates the impacts of using a thinking skills approach alongside pupil views templates (PVTs) (Wall & Higgins, 2006) in my own primary classroom. It therefore explores the power of pupil voice. While it offers some context regarding the overall research, it particularly focuses on the development of the metacognition of a specific pupil, Harry,[1] as evident in the reflections upon learning he recorded on his PVTs. Accordingly, the article begins by looking at the study design and thinking skills, before moving on to what PVTs are and how they may be used. This explanation is followed by a short discussion about involving pupils in research, after which the article focuses on Harry's experiences in the case study and what may be learned from his articulation of them.

The structure of the case study is designed to keep the two individual voices—Harry's, as a pupil, and my own, as teacher-researcher—distinct and separate, further emphasizing pupil voice. They are presented in two separate columns: one of which contains a narrative of each case, and the other contains analysis. This structure provides a physical separation of his voice from my own interpretation of it, enabling Harry to express himself and his experiences from his own perspective. By creating space for research participants to express themselves in their own words, this unconventional format is intended to propose an alternative to analyses which prioritize the interpretation of the researcher.

The wider context for this article is that, despite the growing body of work surrounding the importance of pupil voice, my experience as a teacher echoes suggestions that pupil consultation in England remains largely tokenistic (Byrom et al., 2007; Mitra, 2018); confined to issues relating to school management (Bland & Atweh, 2004); or, as Rudduck and Flutter (2000) would have it, to "the charmed circle of

[1] Please note that the name Harry is a pseudonym, used to preserve anonymity.

lockers, dinners and uniform" (p. 83). Yet the principal business of schools is, of course, education, and there is evidence to suggest that, when consulted, pupils have many valuable insights to offer (Busher & Cremin, 2012; Fielding, 2001; Lodge, 2005; McIntyre et al., 2005; Rudduck & Flutter, 2000).

Given how important consumerism in education currently is, it remains surprising, and somewhat incongruent, that the importance of pupil consultation is not more widely acknowledged (Rudduck & Flutter, 2000). This inconsistency has led some to suggest that pupils' exclusion from the decision-making process may stem from a belief that pupils are not sufficiently mature or knowledgeable to make valuable contributions in this field (Lodge, 2005). Thus, more than 30 years after the United Nations Convention on the Rights of the Child (UNCRC) affirmed that any child "who is capable of forming his or her own views should have the right to express those views freely in all matters affecting that child" (UNCRC, 1989), there remain those who argue that it has had little impact upon children's day-to-day experiences of our education system (Lodge, 2005).

In this article, I indicate ways in which pupils' immersion in their classrooms means that they are "expert witnesses" (Lodge, 2005, p. 129) with insider perspectives which are not always accessible to those adults working with them, whether as teachers or researchers (Bland & Atweh, 2004). The article also connects with the work of Fielding (2001), Kellet (2005), and Lundy et al. (2011), who argue vehemently in support of involving pupils actively as participants in, rather than simply the subjects of, research, with some suggesting that increased emphasis on child-led research could lead to a shift in power dynamics toward increased control and influence on the part of pupils, and away from adult-dominated representations of educational realities (Grundy, 1998; Kellet, 2005).

The very process of engaging pupils in research, and of seeking their opinions, conveys a powerful message regarding the extent to which pupils' perspectives are valued, with Grundy (1998), for example, suggesting that this approach demonstrates "parity of esteem" (p. 44) between pupils and adults. Perhaps unsurprisingly, there is evidence to suggest that consulting pupils with regard to their learning can increase motivation and engagement (Levin, 2000; McIntyre et al., 2005) and that participating in research may lead to a cycle of increased confidence and self-esteem (Kellet, 2005). Furthermore, taking part in the process of education research may also hold the potential to increase pupils' metacognitive knowledge and skillfulness. By engaging in education research, children necessarily consider teaching and learning and how these practices can be improved and developed: They exercise metacognition.

In accepting the right of pupils to be heard, as well as the potential value of their contribution, it is important to consider how their voice is expressed and represented.

For example, Bland and Atweh (2004) describe the indignation of one group who felt that their work had been overedited, asserting that “it’s meant to be in our words, that people like us can understand and not like a university assignment” (p. 344). In much of the literature, researchers’ voices, as authors, is privileged, recounting the research from their perspective and in their own words. Accordingly, there is a very real danger that pupil voice can be subverted or carefully edited and redacted in order to carry the messages of adults (Hart, 1997).

To conclude, this article aims to contribute to the literature relating to pupil voice in two ways. First, this article outlines my own learning about the development of children’s metacognition as a result of “listening” to pupils’ views of the learning ongoing in our mathematics lessons as, together, we adopted a collaborative, thinking skills-based approach to teaching and learning. Second, this article aims to present an alternative structure for sharing the views of the pupils themselves, presenting the views of one child, Harry, in his own words, in their entirety, and as distinct and separate from my own voice, as teacher-researcher.

Study Design and Thinking Skills

Pupils’ apparent inability to recognize the “how” or “why” of mathematics learning is particularly potent given the perception of success in mathematics as a “supernatural” power, which Picker and Berry (2000) suggest is a consequence of “the general invisibility to pupils of the mathematical process, for with the process hidden, mathematical facility looks more like a power than an ability which anyone has the possibility to learn” (p. 88). There is a considerable body of evidence emphasizing the importance of teaching pupils to think through mathematics to gain deeper understanding of it, evident in the work of Boaler (2006), Jansen (2008), and Westwood (2011), as well as in Wright and Taverner’s (2008) *Thinking Through Mathematics*. Work conducted by the National Centre for Excellence in the Teaching of Mathematics (NCTEM) also emphasizes the importance of developing “deep knowledge,” which has formed the basis of the *Teaching for Mastery* program established in England in 2015, which had been used in more than 5000 schools by July 2019 (NCTEM, 2019).

My experience of working as a primary school teacher has taught me that, while pupils are often enthusiastic and eager to please, many had little understanding of the “why” in mathematics. They could not explain their thinking to me, and I believe this challenge was because they did not themselves understand the mathematical activities in which they were engaged and thus could not reasonably be expected to succeed in them. As pupils could not explain their thinking, I took this difficulty as both my starting point and my goal. I achieved this goal by adopting a thinking skills approach to

teaching and learning. There is a wealth of evidence documenting the positive impact of thinking skills approaches on a range of pupil outcomes (e.g., Higgins et al., 2005; Hu et al., 2010; Robson, 2006), with some sources suggesting that the effect of thinking skills "is relatively greater than most other researched educational interventions" (Higgins et al., 2005, p. 4).

Thinking skills approaches are characterized by a focus on developing pupils' ability to identify, plan, and evaluate their thinking and learning. They therefore represent a shift away from procedural learning, in which pupils follow a set of instructions without understanding the justification behind the selection and use of a particular method, toward discussion surrounding the "why" and "how" of learning. Yet, from my perspective as a teacher, there are many education professionals in schools who refer to "doing thinking skills," as if they were a set of tasks which, when completed, tick a metaphorical box to say that thinking skills have been "completed." In contrast, I believe that a thinking skills approach is more akin to a philosophy of learning, a set of beliefs about the conditions which best encourage pupils to engage with their learning. These beliefs include an emphasis upon the development of metacognition through the use of open tasks, with many ways to be successful; review of the strategies used to successfully complete the tasks; the role of the teacher as facilitator rather than instructor; opportunities for pupils to discuss and collaborate; pupils' active engagement in the learning process; and a supportive classroom environment.

Making Thinking Visible: The Use of PVTs

Any investigation into pupils' thinking proposes its own challenges because thinking is an internal, and therefore largely invisible, process (Ritchhart & Perkins, 2008). As a result, it is difficult both to observe and to discern how best to encourage its development. In this scenario, the active, informed understanding and engagement of the pupils is vital, not only according to their rights as key stakeholders or in acknowledgment of the potential value of their contribution, but also through sheer pragmatism. We cannot encourage children to become metacognitively aware and skillful without encouraging them to reflect upon learning. More simply, we cannot gain insights into their thoughts and experiences without asking them to articulate and share them with us, thereby rendering them "visible" (Hattie, 2012; McGregor & Gunter, 2006; Wright & Taverner, 2008).

To this end, I employed PVTs. Originally described by Wall and Higgins (2006), PVTs are specifically designed to gain information on pupils' experiences and beliefs relating to teaching and learning, "but also to go further into the realms of metacognition (thinking about the process of learning)" (Wall, 2008, p. 26). Thus, PVTs provided an opportunity for children to express, as openly and honestly as possible, their

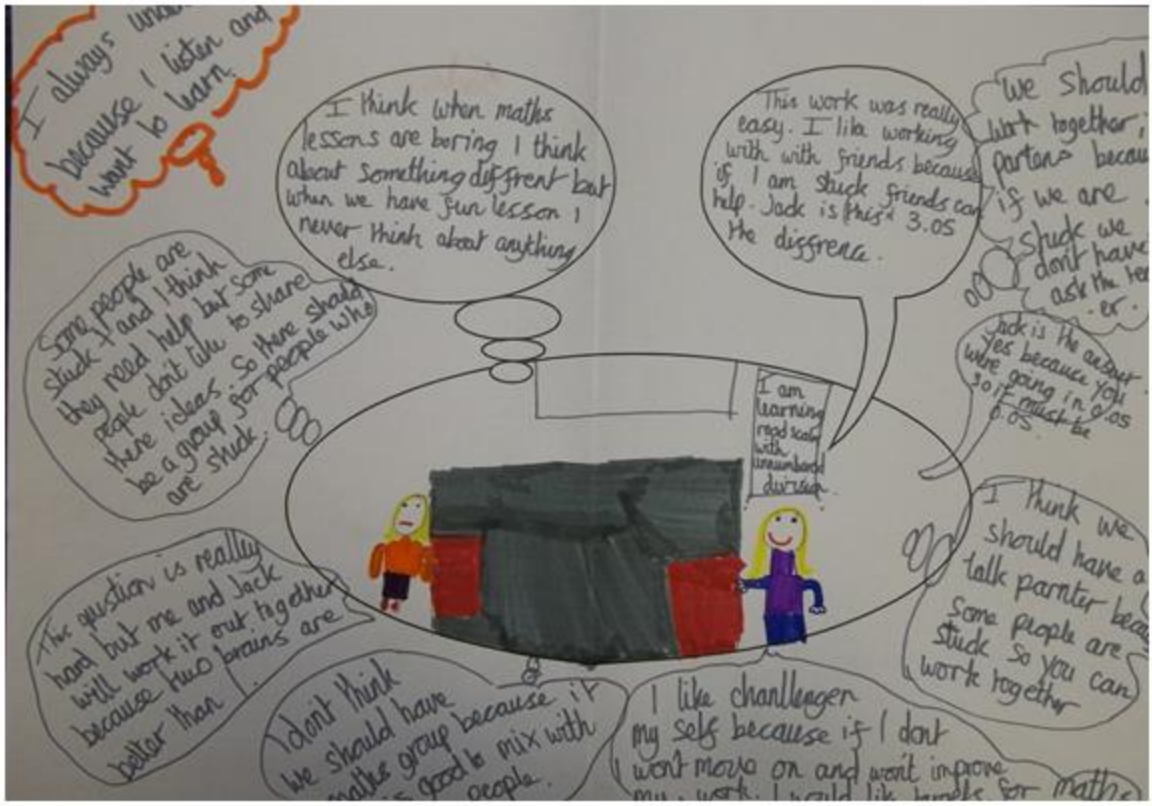
experiences of mathematics lessons. This approach allowed insight into interactions between pupils, and between the pupils and adults working within our classroom. They also provided a means of understanding children's thinking about their mathematics learning, or even about matters unrelated to school, in order to explore whether this was affected by the introduction of the thinking skills approach.

The PVTs used in this investigation included a space for pupils to draw themselves participating in a mathematics lesson, along with thought and speech bubbles. The images that pupils generated provided a further level of insight into their experiences of mathematics learning, and was inspired by Picker and Berry's (2000) use of children's drawings to investigate perceptions of mathematicians. The argument in favor of using images to stimulate discussion is supported by the work of those such as Harper (2002), who argues that "the parts of the brain that process visual information are evolutionarily older than the parts that process verbal information" (p. 13) and that, as a result, "images evoke different deeper elements of human consciousness … [evoking] a different kind of information" (p. 13).

The speech bubble was used to investigate factors external to the pupils (Wall, 2008), such as the behavior and interactions of those around them, as well as the realities of undertaking a particular task in a specific learning environment. When completing the PVTs, the children were therefore asked to record the things they said in the course of the lesson that they had just experienced. While I tried to emphasize that anything that had been said by any person in our classroom could feature in these speech bubbles, the pupils and I also made a shared list of the types of speech that could be included, such as questions asked by group members, shared answers and discussions about working, and requests for classroom equipment such as pencils and rulers. An example of a completed PVT can be found in Figure 1.

Figure 1

Example of a Completed Pupil Views Template



I was particularly careful to stress that I wanted these representations to be as accurate as possible. The children and I therefore discussed the inclusion of conversations which were not related to learning (for example, about out-of-school activities), again emphasising that the PVTs formed part of my learning about our lessons, rather than regular schoolwork. I tried to make it very clear that pupils would not be reprimanded for recording conversations which did not focus upon learning but that, on the contrary, I was interested in gaining an honest picture about what children thought and spoke about during lessons. While it is, of course, possible that some children felt obliged to censor their responses, others seemed to welcome this opportunity to be honest about their experiences, and sometimes their frustrations, of working with others. This response led to the inclusion of comments such as “I hope [Name] will message me on minecraft all about the cheats and building ideas, Hmm? Arrrr [Name]!!!”

The thought bubble was used to encourage pupils to articulate internal processes (Wall, 2008), which could consist simply of their opinions about particular activities, but could also include more developed responses to demonstrate pupils’ thinking about the

learning process itself. This thought bubble was particularly important in light of my aim of investigating the development of pupils' metacognition and, again, I emphasized to pupils that any thoughts they had during lessons, whether related to learning or not, could be included in this section of the PVTs. This task was not without potential challenges: Asking pupils to record their thinking in writing required pupils to draw upon appropriate language, which meant that only aspects of their thinking that they were able to recognize and describe could be captured (Wall et al., 2009).

This issue encompasses two separate potential limitations. The first relates to children's capacity to articulate and reflect upon their thinking, while the second is associated with children's subsequent ability to then record it in writing (Wall et al., 2007). There is some debate surrounding the age, and extent, to which children may be capable of metacognition. Flavell (1979), for example suggests that the metacognition of young children is limited, and even more recent studies maintain the "accepted wisdom" that metacognitive skills do not develop before 8 to 10 years of age (Lai, 2011, p. 15). However, the work of those such as Leutwyler (2009), Wall (2008), and Whitebread et al. (2009) has demonstrated evidence of metacognition in children working in the early years age range (between 3 and 5 years of age). While these findings may appear encouraging, it is important to heed Lai's (2011) warning that metacognition may not develop in a linear fashion, but that instead development may consist of "a shifting distribution in the frequencies with which more or less adequate strategies are applied, with the inhibition of inferior strategies as important an achievement as the acquisition of superior ones" (Kuhn, 2000, p. 179). Thus, it seems that, simply because the 9- and 10-year-old pupils featured in this study may be considered old enough to be capable of metacognition, it does not necessarily follow that developing metacognition will be a straightforward process.

With regard to any potential limitations caused by pupils' capacity to record their reflections in writing, it is important to acknowledge that PVTs have been successfully used with children as young as 5 years of age (Wall et al., 2013). Although there are some suggestions that having to write may limit pupils' responses, Wall et al. (2007) found that responses are often more focused and succinct as a result. I also believe that the format of the PVTs, in using speech and thought bubbles to elicit children's written responses, encourages relatively short pieces of text, often single words or short phrases, which are less demanding for pupils to produce. The National Curriculum (Department for Education [DfE], 2014) program of study for English specifies that by Year 5 (when pupils are between 9 and 10 years of age), "Pupils should be able to write down their ideas quickly" and that "Their grammar and punctuation should be broadly accurate" (DfE, 2014, p. 41). Writing significantly longer texts, often in the form of extended narratives or non-fiction genres, was part of our regular classroom routine.

Because this research was conducted with my own class, I was very familiar with the children's capabilities in writing, and for any children who found writing challenging, I was able to act as scribe, following the advice of Wall et al. (2007). Furthermore, in an attempt to alleviate any potential anxiety which may have been felt as a result of recording ideas and reflections in writing, I emphasized to children that the PVTs would not be "marked" in the usual way, and that they did not need to conform to the usual conventions for writing in terms of spelling and grammar.

It is also important to acknowledge that it could be argued that because PVTs encourage pupils to reflect upon their thinking, they cannot provide true evidence of metacognitive thought. To refute this assertion, I draw upon Wall (2008) and her argument that

> evidence from a template where an individual has declared knowledge of metacognitive process, while also expressing that they are consciously using them in their learning would surpass any subjective evidence from observation completed by a third person. These pupils not only have the knowledge about metacognitive skills and process, but they also know how they are using them in different learning contexts. (p. 32)

Metacognition is an internal process which is not usually visible to external observers. I did consider several methods of attempting to capture pupils' metacognition, but because of the very nature of metacognition, each came with its own flaws. Gascoine et al. (2017), for example, decry the use of self-report methods such as rating scales or questionnaires because of their reliance upon pupils' reading and literacy skills.

Perhaps the most obvious means of assessing metacognition—or, at least, the method which I first attempted—was to observe pupils at work in the hope of observing metacognitive behaviors and charting any development or change in these throughout the course of research. However, this method, too, was not without complications, with Lai (2011) and others observing that a potential lack of awareness surrounding children's cognitive knowledge and monitoring could result in significant underestimation of metacognitive capacity. The practical considerations of scrutinizing video data also rendered this method of investigating metacognition problematic. Initially, I attempted to record a focus group of six volunteers from the focus cohort as they worked, but this approach both reduced the number of pupils whom it was possible to observe and, additionally, the time required to transcribe and scrutinize the resulting interactions was prohibitive when combined with the joint demands of my job as class teacher and teacher-researcher.

In contrast, PVTs had the advantage of facilitating the collection of data from the whole of the focus cohort. Furthermore, the resulting data were already in a written format, thus eliminating the need for transcription prior to analysis. I also felt that PVTs were superior to those methods which relied upon the interpretations of an external observer because of the opportunity they provided for pupils to articulate their own thinking and record this independently. While these templates, by their very nature, require pupils to reflect upon their learning, thereby engaging in metacognition, I believe this particular method is nevertheless preferable to any attempt by a third party (myself, perhaps, as teacher-researcher) to interpret pupils' thoughts and reflections.

I would also argue that, far from being a disadvantage, the pedagogic nature of the PVTs was beneficial to this study. The PVTs served a dual purpose in prompting pupils to reflect upon lessons, providing a form of data collection which allowed me insight into pupils' metacognition, but also as a teaching tool which prompted them to do so. Crucially, this act of asking pupils to complete PVTs to search for evidence of metacognition may have been instrumental in encouraging them to engage in this type of thinking (Freire, 1972). Thus, it may be that the use of PVTs provided not just a window for external observers to examine pupils' thinking, but rather a mirror to reflect pupils' thoughts and actions, enabling the children themselves to consider and develop their own "thinking about thinking."

Each template was completed after a randomly selected lesson, but with hindsight this approach was a limitation of this research, as the lessons on which the PVTs were focused were not always the most interesting for children to reflect upon. This decision was, I think, influenced by my subconscious bias toward the scientific, and an assumption that a randomly selected sample of lessons would gain a fairer insight into the development of pupils' metacognition. It may have been more useful to select lessons according to Pettigrew's (1990) advice that, considering the limited number of cases which can usually be studied, it is logical to select extreme situations in which the process of interest is "transparently observable" (p. 275).

Once completed, the PVTs were considered using a general inductive approach to analysis to allow interrogation of the data set as a whole, identifying trends, patterns, and areas of potential interest as they emerged, rather than being limited by a pre-determined analysis structure (Thomas, 2003). This freedom was particularly appealing as it parallels neatly with my belief that education research is most valuable when it develops in response to specific challenges (Hiebert et al., 2002). Similarly, I believe that these data have been most informative precisely because the details contained within the data sources have directly shaped their analysis.

Involving Pupils in Research

The use of PVTs ensured that, rather than relying upon inferences or assumptions made by myself as an external observer, pupils were able to directly communicate their experiences of mathematics lessons, fulfilling their fundamental right according to the UNCRC (1989). This approach also granted me insight into their perceptions and, therefore, permitted clearer understanding of how to further enhance teaching and learning to suit their needs. I also believe that actively involving pupils in this way created a space for them to share their views as active participants as they themselves reflected on the lessons in which we engaged and shared their experiences and perceptions of them.

The involvement of pupils in research is thus not only ethically valid, but is also supported by the work of Kellet (2005), Lundy et al. (2011), and Pascal and Bertram (2009). It is also consistent with my aim to create a more equitable learning community within the classroom that we shared. To allow pupils the freedom to opt out of submitting any responses that they did not wish to share, I used two trays during each data collection period. This method of opting in or out was decided upon in discussion with the children themselves. At the outset of the research, having discussed the optional nature of including their responses in research, the children and I deliberated how best to achieve this accommodation. It was during this discussion that some of the children proposed the system of using two trays, one labeled simply “Yes,” and the other “No.” They suggested that “Yes” could be used to indicate that pupils were happy for me to include their responses in the research into teaching and learning in mathematics, and that “No” would show that they wished to opt out of submitting their views, instead choosing to keep them private.

During our discussion, the focus cohort decided that this strategy was the most straightforward means of sorting responses to include and exclude from research. Each time these trays were used, their use was recapped and explained to the pupils, and they had the opportunity to ask any necessary questions. Furthermore, in an attempt to minimize any pressure which children may have felt to submit their views against their inclination, these trays were not monitored by an adult, so pupils were able to choose which tray in which to place their completed data collection tool without feeling as though they were being watched or monitored as they did so. It was also emphasized that submitting views was separate from our usual work in class, that this was voluntary, and that there would be no repercussions for non-submission, in an attempt to reduce any concerns children may have felt about potential bias resulting from their decision not to submit their views. Because the children themselves suggested this method, I felt confident that they understood it and had a certain degree of ownership over it. I also

feel that giving pupils the opportunity to share their own ideas regarding this aspect of the research process allowed me to engage them, even in a very small way, as the kind of co-researchers described by Lundy et al. (2011), in which children assume a key role in identifying questions as well as strategies to ensure effective participation for themselves and their peers.

In the end, the majority of pupils were willing—even enthusiastic—to share their views about teaching and learning in mathematics. Throughout the research, many children expressed very positive responses to the discussions we had about our teaching and learning. Perhaps unsurprisingly, they appeared to enjoy being consulted! When asked about their experiences of the PVTs, 84.84% of pupils (28 of the 32 pupils present that day) indicated that they enjoyed using the template, with 45.45% (15 pupils) citing the opportunity to share their ideas about learning as the reason for their enjoyment. A typical response explained, “I like doing this because it is fun and I like to share my ideas.” I believe that comments of this nature suggest the pleasure that pupils felt in being offered the opportunity to share their views and reflections surrounding teaching and learning and, as a result, to influence the teaching they experienced. I believe that this pupil feedback could also perhaps be seen as evidence of the repeating cycle of increasing confidence and self-esteem which Kellet (2005) believes results from involving pupils actively in research.

The Case: Harry

Throughout the course of this research, it became apparent that, when encouraging pupils to reflect upon their learning, some pupils—such as Harry—demonstrated deeper levels of reflection than their peers, commenting more frequently and more reflectively on the strategies and mathematical methods which helped them achieve their learning objective. Flyvbjerg (2006) suggests that, when attempting to maximize insight into a given phenomenon, the selection of random or representative cases may not be the most appropriate or efficient strategy, precisely because those average cases are unlikely to prove the richest or most interesting sources of information. This suggestion is true of Harry: He intrigued me precisely because he stood out from his peers, rather than being representative of them.

I therefore propose that Harry’s case should serve to illustrate the insight that can be gained into pupils’ metacognition through use of PVTs as part of a thinking skills approach to teaching and learning. This case thus acts, not as a “truth,” but instead aims to be informative and to provide a starting point for practitioners to consider their own action inquiry research in their own classroom contexts (Rudduck, 1985; Hall, 2009). The task of generalization is therefore shifted from the researcher to the reader;

in other words, it must be the responsibility of the reader to determine whether the research is relevant to their own situation.

The structure of this case study is designed to keep the two individual voices contained in this research, both that of Harry, as a pupil, and my own, as teacher-research, distinct and separate. These 'voices' are presented in two separate columns in the series of tables included throughout the remainder of this section, beginning with Table 1, which introduces this format. The column on the left contains a narrative of each case, with Harry's thinking as evidenced in his PVTs included in full in bullet point form, along with my own anecdotal notes. The column on the right contains my analysis. I wanted Harry to express himself and his experiences from his own perspective, in his own words, and I felt that the column format provided a physical space in order to separate his voice from my own interpretation of it, reducing the likelihood of "over-editing" or misinterpretation. A small number of key words, chosen to summarize a significant point in the findings, have been marked in bold in each section of the Analysis and Discussion column for ease of interpretation for the reader.

Table 1

Harry: A Case -Study

Findings	Analysis and Discussion
Each of Harry's completed PVTs, together with a description of each focus lesson, as well as analysis of the responses, are included below. It is important to note that the data contained in the PVTs should not necessarily be expected to form part of any kind of progression. They are based upon disparate lessons, each requiring pupils to use a wide range of different mathematical knowledge and skills. These differences in focus and format rendered any attempt to chart a development in the pupil's thinking problematic and, as a result, it is perhaps more helpful to view the templates as insights into Harry's thinking at each individual point in the research progress.	*Inclusion of the PVTs in their entirety conforms to Mishler's (1990) interpretation of the role of the exemplar, in which the text is presented in full so that it is accessible to others to allow for external assessment of the reliability and trustworthiness of the analysis, as well as the extent to which any findings could be generalizable to other contexts.*

December

Harry completed the template provided in Figure 2 about a word-problem lesson in which pupils worked in mixed-attaining teams of three or four to solve a range of challenging multistep word problems for all operations in a range of contexts including time, money, and measures.

Figure 2

Completed Pupil Views Template: December

This template (Figure 2) suggests that, even at the outset of research, Harry reflected upon his learning and was able to identify some of the ways in which he learned most effectively. Indeed, eight of the 12 comments contained on the template are indicative of metacognitive knowledge or skillfulness. For example, Harry made the following comments.

- I like it when we do it as a year group before the lesson because it helps me and I get people's ideas.
- I like it when the teacher comes around this help me feel more confident.
- I have made progress when I get explained about it.
- I feel I understand more because my friends and teacher help me.
- I think the Numeracy wall helps me because it reminds me and shows what I need help on.
- I feel confident by using RUCSAC and reading and working it out.

- I also feel confident because members of my table kept me right and explained when I was stuck but now I am confident.
- Team member helping to explain [drawing of a light-bulb].

Table 2 contains further exploration of the findings, analysis and discussion relating to this template.

Table 2

Narrative and Analysis: December

Findings	Analysis and Discussion
These comments demonstrate that Harry was able to identify some of the ways in which he worked most effectively very early in the research process. However, I believe this finding raises some questions. Was Harry already metacognitively skillful, and did completing the PVTs simply provide a vehicle for expressing his learning preferences? It is certainly possible: These templates were specifically designed to provide a stimulus for discussion about learning. Furthermore, the thinking skills approach itself is intended to provide opportunities for pupils to discuss their learning, so regardless of whether Harry was metacognitively aware prior to the introduction of the thinking skills approach, the fact that he was clearly reflecting upon his learning at this point in the data collection process can be seen as evidence that, in providing these opportunities both during lessons and in the process of completing the PVTs, it has been successful.	*One of the principal criticisms of this particular data collection tool is that because PVTs encourage pupils to reflect upon their thinking, they cannot provide true evidence of metacognitive thought. Wall (2008) argues that* ***because metacognition is an internal process, evidence from PVTs is superior to any external, third-party observation****. Furthermore, although pupils were asked to record their thinking, they were not prompted with regard to the nature of it, thus any metacognitive skillfulness (for example, where Harry moved beyond this specific lesson in order to generalize about the ways in which he learns most effectively) is entirely spontaneous.*
It is encouraging to note that, at this point in research, Harry was clearly appreciative of the opportunity to collaborate with his peers and to discuss ideas and learning. Indeed, in six of the eight comments cited above, Harry	*This finding is unsurprising. There is a wealth of literature extoling* ***the advantages of creating opportunities for talk*** *and collaborative working, and Jansen (2008), Boaler (2006), and Westwood (2011) also emphasize the*

specifically referenced the sharing of ideas, or an explanation from a team member or teacher as crucial in developing confidence, making progress or helping him when “stuck.” Again, this reference demonstrates the success of the thinking skills approach from an early point in the research process, confirming that, for Harry at least, opportunities for talk and collaboration were instrumental in helping him to feel more confident in his mathematics learning.

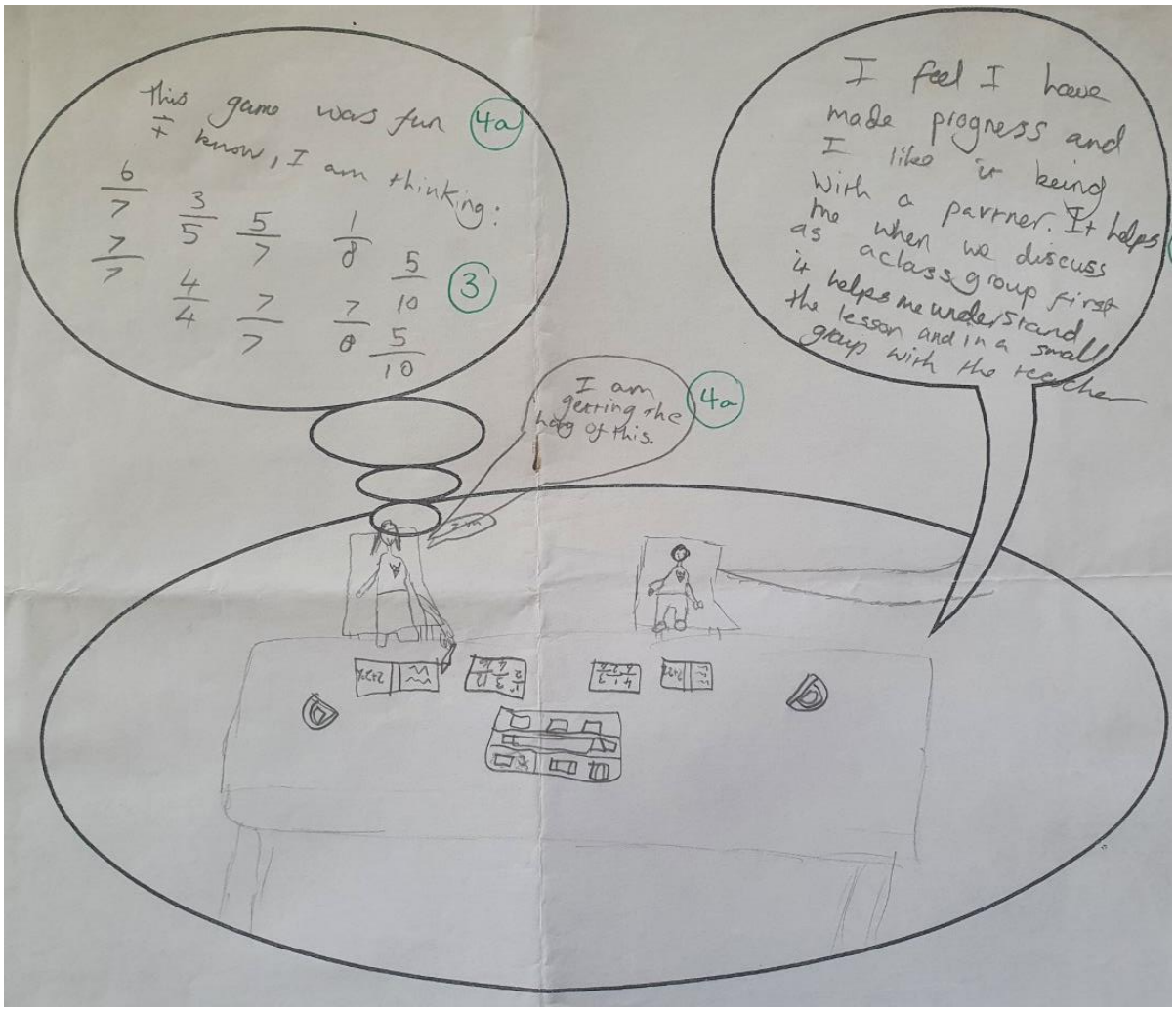
importance of this practice for mathematics in particular.

February

Harry completed the template featured in Figure 3 about a very different lesson, featuring a game-based lesson on probability during which pupils worked in mixed-attaining pairs to calculate the probability that the next card would be higher or lower, inspired by ITV’s 1980s game show, *Play Your Cards Right*.

Figure 3

Completed Pupil Views Template: February



Harry included just five units of text on this template:

- This game was fun.
- I know, I am thinking 6/7, 3/5, 5/7, 1/8, 5/10, 7/7, 4/4, 7/7, 7/8, 5/10.
- I am getting the hang of this.
- I feel I have made progress and I like it being with a partner.
- It helps me when we discuss as a class group first it helps me understand the lesson and in a small group with the teacher.

These text units are discussed in greater detail in Table 3, below.

xxx

Table 3

Narrative and Analysis: February

Findings	Analysis and Discussion
I believe the comparative scarcity of detail included on this template emphasizes that some lessons are better than others in encouraging reflections of this type, and that this kind of simple and repetitive task perhaps did not require the same complex thinking or collaborative teamwork as the previous lesson. In addition, although I had originally intended pairs to work together to produce the probabilities, the pupils interpreted the activity as a contest in which they competed against one another to win the "game" by working out the most probabilities correctly. I believe that this competitive spirit curtailed collaboration, as pupils sought not to support one another to develop understanding for the shared benefit of the team, as in the previous collaborative problem-solving lesson, but rather to beat the other in order to emerge victorious.	*Upon reflection, it is important to admit that the central activity of this lesson was not one which was based upon thinking skills principles. This lesson provided rather mechanical practice of representing probabilities as fractions. The pupils enjoyed it, but it was not backed with the level of discussion which more customarily characterized our lessons. This lesson was—like each of the lessons about which the PVTs were completed—selected at random. I believe that Harry's response raises the issue of* ***whether randomly selecting focus lessons was the most useful strategy here****, or whether it would have been beneficial to again select those sessions in which metacognition was likely to be most evident (Pettigrew, 1990).*
Of the five comments listed above, only the final two contain reflections surrounding ways in which Harry felt that he learned most successfully. It is heartening, however, to note that these comments echo Harry's belief that working collaboratively aided the development of his understanding. However, in light of the competitive manner in which pupils interpreted this	*Following my analysis of the previous template it is interesting to note that while Harry acknowledges that he enjoys working with a partner and feels that this practice helps him make progress, he* ***does not again refer to an improvement in his confidence****. This difference could suggest that Harry did not find this lesson sufficiently challenging, or that, while enjoyable,*

task, it is unclear whether Harry was one of those who did work collaboratively, or whether he had simply learned that I, as teacher-researcher, believe that working with others helps children to learn more effectively, and whether he therefore gave the answer he believed I wanted to hear.

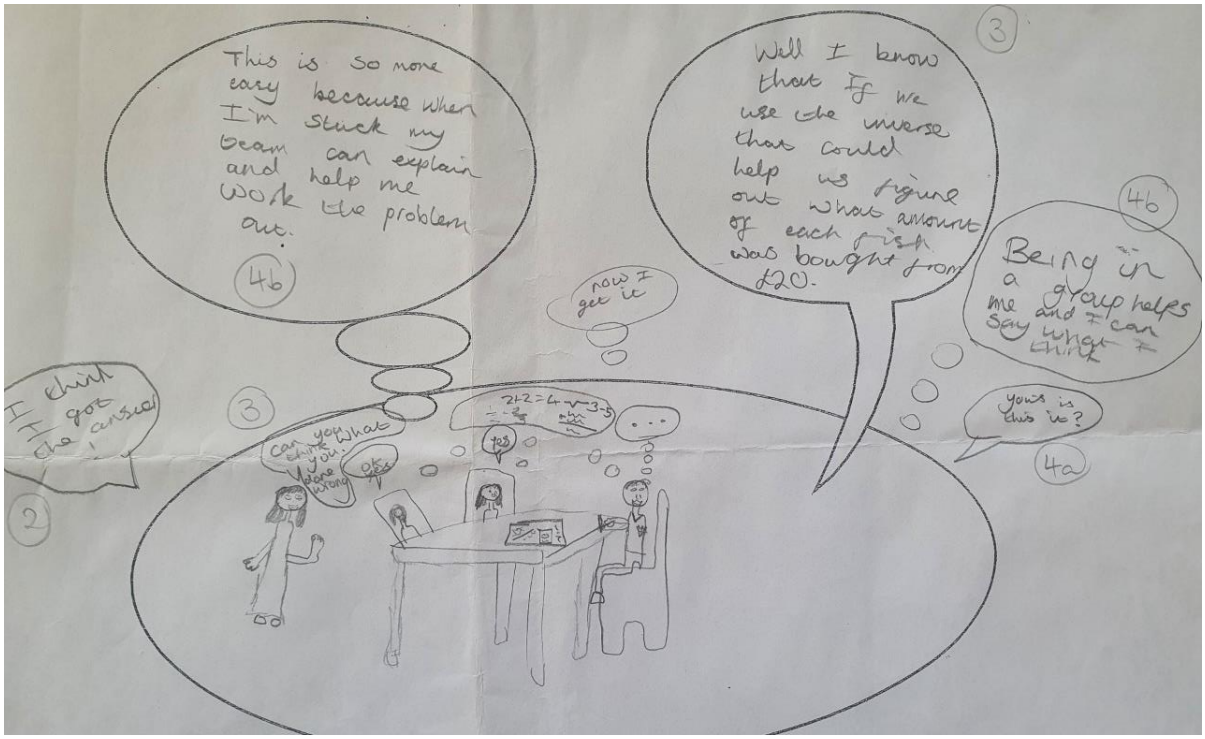
collaborative working did not here materially contribute to his learning.

March

Harry completed this template (Figure 4) following a lesson in which pupils worked collaboratively in a mixed-attaining team of three or four pupils to solve one of the "Mathematical Challenges for Able Pupils" produced by the Department for Education and Employment (2000). This challenge required pupils to use their understanding of inverse operations to work out how many of each different type of fish a customer bought with £20.

Figure 4

Completed Pupil Views Template: March



Harry included six units of text on this template. Four of these comments are of particular interest:

1. This is so more easy because when I'm stuck my team can explain and help me work the problem out.
2. Well I know that if we use the inverse that could help us figure out what amount of each fish was bought from £20.
3. Being in a group helps me and I can say what I think.
4. Yous is this it?[2]

Table 4

Narrative and Analysis: March

Findings	Analysis and Discussion
Two of these text units, responses 1 and 3, again refer to Harry's continued belief that collaboration supports his learning in mathematics. I also find the second response interesting as it demonstrates the extent to which Harry could explain why a particular strategy was needed, suggesting his deeper understanding of the mathematics involved. This response is encouraging as it is precisely this deeper understanding of why specific methods were needed for particular situations that originally drove my desire to adopt a thinking skills approach. Furthermore, this explanation is given in one of the speech bubbles, showing that	*This second response is a clear acknowledgment that Harry **knows which strategy he requires to solve this particular problem**. I believe this response constitutes a marked departure from his earlier templates in which he describes working with others to find out which strategies to use. Here, Harry knows himself which strategy he needs and is confident enough to say so.* *This shift could indicate the impact of the thinking skills approach in making these processes and decisions very visible to pupils through use of routines such as the debrief, thus avoiding any sense that success in mathematics is akin to a*

[2] Please note that "yous" is a plural form of "you" commonly used in the Geordie dialect which is native to Newcastle, England.

it formed part of the group's discussions, and could suggest that explanations of this type constituted part of their regular interactions. I also find Harry's fourth response interesting as it confirms that he was using the other members of his group as sounding boards to confirm his own conclusions about his work. I believe that comments of this type make it very easy to understand why Harry felt so much more confident when working with a group.

supernatural or magical power, rather than learned knowledge and skill (Picker & Berry, 2000).

Also of interest is the illustration of one of the conversations that took place during the lesson between myself, as class teacher, and Harry's group. I am pictured asking what appears to be a singularly unhelpful question: "Can you think what you [have] done wrong?" Perhaps surprisingly, one group member is shown with a speech bubble replying "OK, yes," while another has a thought bubble with a complicated-looking series of calculations. Yet another pupil has a thought bubble which states "Now I get it," suggesting that my rather oblique question actually helped the pupils further their understanding. I find this response particularly interesting as, although in the first comment listed above Harry expressly states that he believes that discussions with teachers help him to develop his understanding, the conversation he has depicted in fact shows me asking his group to work out for themselves where they made a mistake and why this error occurred. This links to a key element of a thinking skills

Upon first reading the literature relating to thinking skills it struck me that, in order to fully embrace the approach, an overhaul of the roles of both teacher and pupil were required. This need is particularly evident in Hu et al.'s (2010) assertion that "learning to learn means taking over from the teacher the control and management of your own learning and thinking" (p. 537).

This episode could suggest that Harry and I have begun to alter classroom dynamics in order to promote ***true reflection on the part of the pupils*** *in place of rather blind and passive acceptance of what the teacher says (Watson, 2001).*

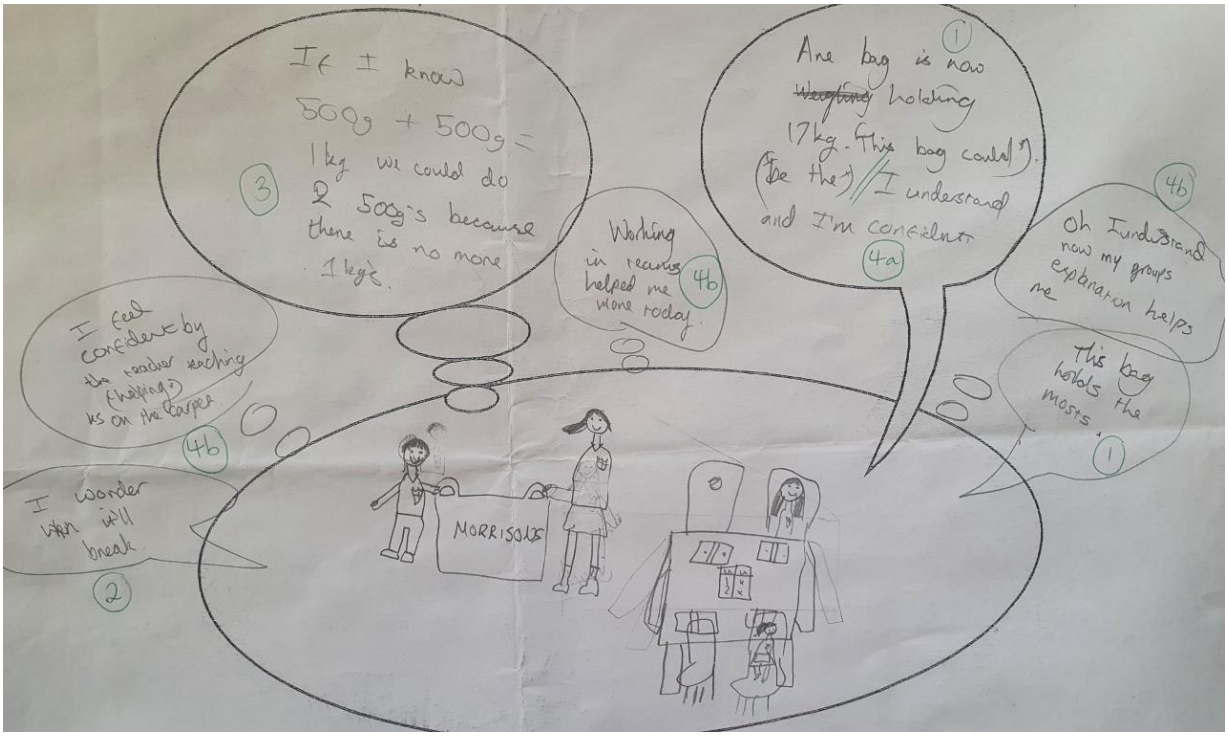
approach in which the teacher assumes the role of a facilitator rather than instructor. Here, in working collaboratively, the pupils themselves have actually been the agents of their own development in understanding, although they perhaps felt more confident as a result of my presence and questioning.

May

Harry completed this final PVT (Figure 5) about a very practical lesson in which pupils worked in mixed-attaining groups of three or four to investigate which carrier bag was most suitable for me to shop for a whole school celebration. The groups first identified strength as the most important characteristic and then designed an investigation to find the strongest supermarket carrier bag.

Figure 5

Completed Pupil Views Template: May



This lesson was more practical than the previous lessons and engendered a different type of responses. Harry included eight text units on his completed template. Two of these comments contain straightforward recall of details from the lesson: “Our bag is now holding 17kg,” and “This bag holds most.” However, the remaining six responses are more interesting:

- I wonder when it will break.
- I feel confident by the teacher teaching us on the carpet.
- If I know 500g + 500g = 1kg we could do 2 500gs because there is no more 1kgs.
- Working in teams helped me more today.
- I understand and I’m confident.
- Oh I understand now my group’s explanation helps me.

Table 5 contains discussion of this PVT data.

Table 5

Harry’s Pupil Views Template: May

Findings	Analysis and Discussion
The first of the text units reveals speculation, a type of thinking associated with the ‘Creating’ level of Bloom’s Revised Taxonomy (Krathwohl, 2002) that has not been evident in any of the templates Harry previously completed. This type of thinking suggests that Harry was beginning to make predictions, and was thinking more deeply about the task he was engaged in during this lesson. However, this may also merely be a by-product of this type of lesson; the children were asked to find the strongest bag and	*The probable success of this lesson in inspiring thinking of this nature again causes me to question my decision to randomly select lessons for the PVTs. This was done in an attempt to improve reliability, yet it would perhaps have been* ***more useful to identify specific lessons*** *so that pupils were asked to reflect upon experiences, or extreme cases, which were more conducive to the exercise (Pettigrew, 1990).*

were taught when carrying out investigations, particularly during Science lessons, to make predictions and hypotheses. Certainly, this task bears a stronger resemblance to our scientific investigations than it does to our customary mathematics lessons.	
Harry's third comment is also of interest as he once again provides an explanation of his reasoning. However, in contrast to the explanation included in the template from March, this explanation in given in a thought bubble, suggesting that it was part of Harry's personal, independent reasoning about the task, and it is unclear whether this was ever shared with the rest of his group. Finally, comments two, four and six once again reiterate Harry's belief that discussing his learning with others helped him to make progress both in his understanding and confidence.	*It is interesting that after a notable absence in his second and third templates, it is only in this final template that Harry once again makes explicit reference to his **confidence**.*

Conclusions

Harry's PVTs demonstrate:

- He was metacognitively aware, repeatedly referring to the learning situations in which he felt most confident and successful.
- His comments did not materially change during the data collection period, thus failing to reveal any kind of development in Harry's metacognition, although they do show that he was actively aware of himself as a learner and some of his learning preferences.
- Harry clearly and consistently stated that working in a group helped him to make progress, to understand when he was stuck, and to feel more confident.

This final point is key: Such strong statements provide clear evidence that, for Harry at least, the use of a thinking skills approach achieved what was intended. Specifically, by giving pupils more opportunities to work together, they developed their mathematical ability and confidence in the subject. While I was initially disappointed by the non-developmental nature of the responses indicating Harry's metacognition, this outcome should perhaps have been anticipated. PVTs are specifically intended to encourage pupils to reflect upon their thinking, and therefore it is to be expected that pupils would do so from the outset.

While it may be possible to argue that the data obtained from Harry's PVTs is in some ways discouraging because of the lack of clarity surrounding the development of metacognition, for me, these data demonstrated the potential utility of PVTs in uncovering evidence of metacognition itself. This use could provide a valuable means of assessment to determine pupils' current range and use of strategies in order to inform and enhance future teaching and learning. For me, as a teacher-researcher, the PVTs used in this study provided valuable insights into Harry's perceptions of mathematics lessons and how these may have been influenced by the thinking skills approach. I valued the details that these templates gave me about what actually took place: the conversations pupils had, who was participating and who was not doing their fair share, and the feedback about the tasks themselves and whether Harry found these sufficiently challenging. This information allowed me to discover the realities of my classroom context as they really were, from the "expert witnesses" (Rudduck & Flutter, 2000) best placed to describe and share these.

Metacognition is, as I have previously acknowledged, an internal process, and thus any attempt to render it visible is necessarily subject to potential difficulties in terms of the accuracy of representation—not just on the part of anyone seeking to interpret the information gathered, but also on the part of the children themselves in their attempts to accurately record their thinking. However, as imperfect as this approach may have been, by representing Harry's views in his own words, I believe that PVTs succeeded in providing insight into his thought processes, allowing me to study these for whatever may emerge. I also believe that this format, encompassing three distinct forms of data—including thoughts, speech, and children's own representations of learning—perhaps provided greater scope for pupils to reflect upon their own experiences of learning than may have been recorded through a single format alone, such as the type of narrative interview employed in many similar studies (Bland & Atweh, 2004; McIntyre et al., 2005; Rudduck & Flutter, 2000).

Including each of the four PVTs completed by Harry in their entirety provided a coherent description of his experiences throughout the research process. I believe that

adoption of this particular format proposes an alternative method for representation of pupil voice in reducing the impact of the interpretation and mediation of the researcher—in which the researcher edits the views to be included by selecting relevant quotations—and thus holds the potential to avoid the accusations of "over-editing" levelled at some previous researchers, such as Bland and Atweh (2004), while still providing space for pupils to express themselves "in our words, that people like us can understand and not like a university assignment" (p. 344). Representation in this form reduces the impact of potential bias by transparently presenting the findings of this particular aspect of research in an informative manner, so that readers may judge for themselves the significance of the data. However, more significantly, I believe that creating a physical space for pupils' contributions to be "heard" in their entirety goes further toward creating that "parity of esteem" (Grundy, 1998, p. 44) between participants which is necessary for truly transformative communication, acknowledging the fundamental nature of pupils' contribution as co-researchers.

Discussion Questions

1. What is the potential of pupil views templates as a means of rendering pupils' experiences and thinking more visible? To what extent did this data collection tool achieve this objective here? Could this tool be useful to explore other contexts and situations?

2. To what extent can Harry be considered as a co-researcher? How could this perspective have influenced the development of metacognition?

3. What can Harry's experiences of the Thinking Skills approach tell us about the potential of an approach of this nature more widely? Which conditions would need to be in place to create a similar impact in a different context?

4. To what extent did my position as a teacher-researcher influence this study? Is it necessary to be positioned within the classroom to gain insights of this nature upon pupils' experiences?

5. What are the advantages and disadvantages of the position of teacher-researcher for issues relating to both pedagogy and research, for example for objectivity?

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