Thinking About Thinking in the Primary Classroom

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Declaration

This piece of work was submitted in partial fulfilment of the requirements for the award of Doctorate in Applied Educational Psychology. It has not previously been submitted or assessed for any other qualification and is the students own work.

Dedication

I dedicate this research to Nanny; whose relentless faith, encouragement and support led me to begin this life changing journey; and helped me to remain strong throughout.

Acknowledgements

Overarching Abstract

The current research encompasses three chapters. The first reports on a systematic review of relevant literature. The second connects the findings from the review to the empirical study, whilst reporting on conceptual and methodological considerations. The final chapter reports on the findings from the empirical study and the associated implications.

Researchers and theorists have acknowledged that skilful thinking enables a range of psychological and educational benefits such as enhanced academic performance and increased participation in teaching and learning. A range of interventions exist which have been developed to enhance thinking skills (TS) in school contexts. A systematic review of eleven studies examining a) the effects of TS interventions and b) the nature of TS interventions is presented. Taken in synthesis, findings suggested that interventions often measured individual effects. Teachers and pupils were often consulted at the evaluation stage of an intervention, rather than being involved actively during construction and implementation.

This study aimed to explore how pedagogical action might support processes of teacher and pupil thinking in a primary classroom. Attention was afforded to factors which might support and sustain the implementation of a TS intervention. One teacher and six pupils from a Year Four class participated in the study. Consultations and focus groups were conducted, during the implementation phase of the 'Think Aloud Paired Problem Solving' intervention. Participant experiences of the intervention were explored through discussion and the completion of thinking templates.

Constructionist Grounded Theory (CGT) was applied to the data generation and analysis process. General factors supporting thinking included the stance taken by the teacher, teacher responsiveness and teacher access to further support. Specific factors associated with the TAPPS intervention included particular organisation of pupil learning such as mixed ability pairings, and specific teaching strategies such as questioning. A suggested grounded

theory outlines that there may be some general foundations that need to be in place before a more specific thinking pedagogy is applied. Educational Psychologists can continue to research this with teachers in their ongoing practice through reflective consultations.

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Abstract

The ability to think skilfully has been proposed as one of the most fundamental goals in a child's education (Hu et al., 2011). Researchers and theorists have acknowledged that skilful thinking enables psychological and educational benefits.

The systematic review aimed to explore what is currently known about the effect of thinking skills (TS) interventions on school-aged pupils' cognitive and academic achievements. Specifically, the review focused on the effects of different methodologies employed across interventions and the impact on transfer.

Eleven quantitative studies were subjected to systematic review in accord with the methodology outlined by Petticrew and Roberts (2006). Nine out of the eleven studies reported that the TS intervention employed brought about at least one significant, short term effect on pupils' cognitive and/or academic achievements. Studies using infusion methodologies appeared to be more effective, and the majority of studies observed the effects of both cognitive and academic achievements, suggesting a 'near-far' transfer effect. However, caution should be applied when interpreting such findings given the conceptual variability noted across studies.

The review concludes that more research is required to explore the action teachers' take to construct a thinking pedagogy and how this impacts on their own thinking, as well as the thinking of their pupils.

1. Introduction

1.1 Definitions of thinking skills

The ability to think skilfully has been proposed as one of the most fundamental goals in a child's education (Hu et al., 2011); not simply for the purpose of achieving other cognitive and educational outcomes but as a goal in itself (Csapo, 1997; Massey & Bernard, 2006; Sanz de Acedo Lizarraga, Sanz de Acedo Baquedanono, Goicoa Mangado, & Cardelle-Elawar, 2009; Sanz de Acedo Lizarraga, Sanz de Acedo Baquedanono, & Oliver, 2010). Previous research claims that skilful thinking can enable a range of psychological and educational benefits such as enhanced academic performance (Shayer & Adhami, 2010), efficient cognitive (Topping & Trickey, 2007a, 2007b) and social functioning (Schnitzer, Andries, & Lebeer, 2007), increased participation in teaching and learning (Hargreaves & Moyles, 2002), and enhanced motivation and self esteem towards educational goals (Cattle & Howie, 2008; Jones, 2008). However, there is no single, universally accepted definition of 'thinking skills' (TS); instead, overlapping and broad attempts to coherently provide a definition exist. Subsequently, the literature regularly describes TS and their associated outcomes and cognitive processes interchangeably, for example 'problem solving' and 'self-regulated learning'. Whilst such terms are strongly associated to the wider concept of TS, they should not be considered synonymous.

Historically, TS have been associated with numerous misconceptions; particularly related to the traditional perception that intelligence is a fixed, inherent construct which is stable over time and context. However, a shift in perspective has enabled an infusion of interpretations of TS, to incorporate social, biological, psychological and philosophical dimensions (Fisher, 1990). Such a shift in perspective is reflected in research conducted over several decades suggesting that it is possible to teach people how to think (Sanz de Acedo Lizarraga et al., 2010).

For the purpose of the current review, TS may be operationally considered as cognitive processes which involve both creative and critical facets of the mind; where reasoning and

the generation of ideas are employed to formulate or solve a problem, to make a decision or to seek further understanding, a perspective similar to that of Fisher (1990). In addition, the review incorporates the description of meta-cognition originally outlined by Flavell (1979) as it is now widely accepted that the process of meta-cognition is essential for all thinking endeavours (Burke & Williams, 2008; Higgins, Hall, Baumfield, & Moseley, 2005; Wall & Higgins, 2007).

1.2 Thinking skills and pedagogical style

It is imperative to develop an understanding of the dynamic interaction between TS with school environments and pedagogical style. Criticality ought to be applied to the commonly held assumption that TS develop spontaneously and naturally as a 'by-product' of teaching ordinary school material (Ruggiero, 1995).

Traditionally in formal education, pupils' successes have been measured in terms of how much information or facts pupils can retain and thus recall in examinations (Hu et al., 2011; Resnick, Bill, & Lesgold, 1992). Subsequently, schools have historically discouraged a focus on thinking, viewing pupils as simply the recipients of information and thoughts (Fisher, 1990). There is currently wider awareness that pupils should be assessed by how well they think and process information (Hu et al., 2011) and that TS should become an integral function of the curriculum (Molnar, 2011; Resnick, 1987). Questions arise, however, as to whether it is sufficient to simply outline guidance related to the teaching of TS, or whether wider modifications are necessary in relation to pedagogical style. Such a line of enquiry was pursued by Higgins et al. (2005) who proposed that a TS approach should not only specify the content of what is to be taught, but the underpinning pedagogy of how exactly to teach it.

This finding is mirrored by two large-scale idependent studies (conducted under the previous Labour Government), that were undertaken to review the content and structure of the primary curriculum in England. Firstly, the Cambridge Primary Review (CPR) (Alexander, 2010b), and secondly, the Rose Review (which was completed and published ahead of the

CPR) (Rose, 2009). Both reviews concluded that the primary curriculum should be less prescriptive, and should be broadened out to focus on skill development and pupil wellbeing. Additionally, both reviews recommended that teachers should be given more control over *what* they teach, and *how* they teach. The Rose Review outlined that although curriculum subjects are essential, they are not sufficient, and pupils should be given opportunities to reflect on how they learn (Rose, 2009). However, the reviews yielded limited impact on the National Curriculum, largely due to a change in government. The future of the place of TS interventions within the National Curriculum remains unclear, as outlined on page 55.

1.3 Enhancing Thinking Skills: interventions and approaches

Reviews exist which have explored the nature and effect of TS approaches and interventions on pupils' learning outcomes (Garcia-Moriyon, Rebollo, & Colom, 2004; Higgins et al., 2005; McGuiness, 1999; Trickey & Topping, 2004). In the review conducted by Higgins et al. (2005), TS interventions were defined as "programmes which identify for learners translatable, mental processes and/or require learners to plan, describe and evaluate their thinking and learning."(p. 7) More specifically, distinctions have been made with respect to the methodology employed by such interventions, and the guiding hypotheses of such methodologies. Distinctions between the methodologies employed by TS interventions were drawn by McGuiness (1999) and adapted by Trickey and Topping (2004) to include:

- interventions that can be taught separately from the rest of the curriculum (stand-alone programmes)
- interventions that can be taught as part of an academic subject (subject specific)
- interventions that can be infused across the curriculum (infusion methodology)

1.3.1 Stand- alone programmes

Stand- alone programmes (for example see Feurerstein, Rand, Hoffman, & Miller, 1980; Lipman, 1985) involve the teaching of TS as a separate module in addition to the National

Curriculum. Such programmes promote the transfer of TS from the programme itself to other subjects; the aim is not to 'remove' thinking from the context of core subjects.

1.3.2 Subject-specific programmes

Many researchers adopt the theoretical stance that the teaching of TS should be rooted within specific school subjects (see Dienes, 1963; Shayer & Adey, 1981). 'Cognitive Acceleration' programmes such as 'Cognitive Acceleration through Science Education' (CASE), developed by Shayer and Adey (1981) straddle both Piagetian ideas of cognitive conflict and the schemata of formal operational thinking, and Vygotskian ideas of the social construction of understanding.

1.3.3 Infusion methodology

Infusion methodology combines ideas from both stand-alone and subject specific methodologies. Thinking is incorporated into various school subjects, woven throughout the school curriculum. Such methodology comprises of the parallel teaching of thinking along with the syllabus content. Many researchers assert that infusion methods have the advantage over subject specific methodologies and standard teaching techniques in that far-transfer of learning is promoted (Dewey & Bento, 2009; Sanz de Acedo Lizarraga et al., 2009).

1.3.4 Transfer

Transfer can be defined as learning a skill or acquiring knowledge in one context and applying it subsequently to another situation (Sanz de Acedo Lizarraga et al., 2009). Brainerd (1975) operationalised transfer according to three levels: 'near-near' when the intervention and post-test activities are almost indistinguishable, 'near-far' when the post-test activities require the application of cognitive processes which are similar to those learned during intervention, but the stimuli are different, and 'far-far' when the activities at post-test are different in terms of both material presented and cognitive processes applied. Interventions which promote learning at the far-far transfer level are believed to be the most

robust method for evaluating change in both cognitive structure and the effectiveness of the strategies used (Tomic & Kingma, 1998).

1.4 The focus of the current review

Considering the range of TS interventions offered to schools and teachers, it is important that reviews are undertaken which attempt to integrate and make sense of associated effects. There have been several reviews investigating the effectiveness of TS interventions (Garcia-Moriyon et al., 2004; Higgins et al., 2005; McGuiness, 1999; Moseley, Elliot, Gregson, & Higgins, 2005; Reznitskaya, 2005; Trickey & Topping, 2004) on pupil outcomes, and also research investigating teachers' experiences of implementing TS interventions (Baumfield, 2006; Jones, 2008). Encouraging findings are ubiquitous; widespread throughout the literature is a dominant consensus that TS interventions often lead to positive outcomes for pupils of different age groups, and from different countries (Trickey & Topping, 2004). Consequently, investigations are needed to explore why such approaches are not more firmly embedded in school practices.

Whilst there is extensive literature examining the effects of TS interventions on pupils' cognitive abilities and academic achievements, it appears that what is difficult to determine are the specific aspects of the programmes which are most effective (Higgins et al., 2005). Additionally, further research is needed to examine the causes of such benefits, and in what areas (e.g. age, context, curriculum etc.) TS interventions have the greatest impact (Jones, 2008).

Reviews are required which also focus on efficiency as well as effectiveness (Thinking Skills Review Group, 2004; Topping & Trickey, 2007a, 2007b) as it is often recognised that TS interventions can be costly due to beliefs that a period of around two years is needed to observe associated effects (Blagg, 1991; Feurerstein et al., 1980; Shayer & Adey, 1993). Further exploration of the transfer of learning which occurs following TS interventions would be of additional benefit (Sanz de Acedo Lizarraga et al., 2010) .

The current review asks: **What is known about the effectiveness of thinking skills interventions on school-aged pupil's cognitive achievements?** Included within this broad question are two specific research aims: 1. to examine both the nature and variety of the methodologies underpinning TS interventions and 2. to explore the specific outcomes of TS interventions in relation to transfer of learning.

2. Method

The systematic review followed the method outlined by Petticrew and Roberts (2006). This process involves a number of stages which are summarised in Table 1 and are detailed below.

2.1 The initial search

 Initially it was necessary to define a specific question which would focus the search strategy. This question was developed following initial 'scoping' searches of the literature area and was based on previous reviews. The initial scoping searches of the literature also helped to determine the types of studies needed to answer the question. Although it was found that there were some qualitative and mixed method studies within the field of TS, the literature was found to be based largely on quantitatve studies. A quantitative approach was therefore taken to the current review.

Table 1: The Systematic Review Stages (Petticrew & Roberts, 2006)

1. Clearly define the review question in consultation with anticipated users
2. Determine the types of studies needed to answer the question
3. Carry out a comprehensive literature search to locate these studies
4. Screen the studies found using inclusion criteria to identify studies for in-depth review
5. Describe the included studies to 'map' the field, and critically appraise them for quality and relevance
6. Synthesise studies' findings
7. Communicate outcomes of the review

A preliminary search of the literature helped to identify frequently used terms in relation to the area of review. These terms were collated following the preliminary search, and were applied in the formal review. The terms are displayed in Table 2.

Table 2: Terms used for literature search

Target Population Terms Child*[1]/pupil*/School-age*/school-age*
Outcome Terms 'Cognit* effects'/cognit*/academ*/learn*/achiev*/abilt*
Intervention Terms 'Philosophy for Children'/'Thinking skills intervention*/approach*/program*/'Cognitive Acceleration Programme'

To locate relevant studies, an extensive search was conducted using the following electronic databases: Scopus, Web of Science (accessed through Web of Knowledge), IBBS (International Bibliography of the Social Sciences), Ovid Medline, BEI (British Education Index) and ERIC (Educational Resource Information Centre). In addition, the LibrarySearch (Newcastle University) function was used to conduct a comprehensive search of all the information contained within the Library Catalogue. The 'E-Theses' feature provided by Newcastle University was searched in order to reduce the effects of publication bias. Hand searches were conducted of specific journals, which following initial searches were judged to be of particular relevance to the research question: *British Journal of Educational Psychology, School Psychology International, Thinking Skills and Creativity and Thinking: The Journal of Philosophy for Children.* All searches were conducted between August 2012 and November 2012.

2.2 Defining relevant studies: inclusion and exclusion criteria

A scoping search using the above search terms generated three hundred and thirty three studies. Therefore, in order to refine the identified studies and determine those to be included in the review, inclusion criteria were set. Cole (2008) defines inclusion criteria as 'a set of agreed conditions that studies must meet in order to be included in different stages of the review, based on the research question' (p. 30). The method employed by Higgins et al. (2005) was adopted for the current review. This method which was a two-staged model for determining inclusion criteria within the formal searching process (see Table 3). It was felt this was an appropriate model to follow for two reasons. Firstly, Higgins et al. (2005)

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[1] The * symbol represents where the truncation method was used to broaden the literature search. Truncation retrieves all words with the same stem but with variant endings.

conducted a meta-analysis of the impact of TS interventions which has guided the basis of the current review. In addition, the review applied robust methodology designed by the EPPI-Centre, Institute of Education (see Appendix 1: Detailed list of inclusion and exclusion criteria).

The initial inclusion criteria were applied to screen studies in terms of their relevance to the research question based on information provided in the title, keywords and abstract. This searching process identified 36 studies which met the initial inclusion criteria. At the next stage of the search, additional inclusion and exclusion criteria were created to further refine the search, after which point eleven studies were selected for final review.

Table 3: Refining Inclusion Criteria

Stage One: Initial Inclusion Criteria	Stage 2: Further refining studies selected for review:
Participants: Pupils of compulsory school age (4-16 years) **Settings:** Schools or any educational setting **Intervention:** Studies were included which evaluated the impact of thinking skills interventions on pupils' cognitive and/or academic achievements. **Study Design:** Various designs were included in the initial search to establish the type of study needed to address the review question. **Time, place and language:** Any country, written in or translated into English, within the last ten years (2002 onwards). **Publication:** Both published and unpublished studies were considered.	**Participants:** Studies were included which included a sample of at least ten, school-aged pupils in both an experimental and control group. **Settings:** Schools **Intervention:** Studies which described the impact *only* of TS interventions on teaching, teacher's perceptions or pupils' perceptions were excluded. **Study Design:** Studies which used a control/experimental group design and a pre-post-test methodology were included. Studies including quantitative research data related to the effect of TS interventions on pupils' cognitive and/or academic achievements were included. Where studies reported pupil data which was then not statistically analysed, these studies were excluded. **Time, place and language:** Studies which were excluded if they had been included in previous reviews conducted between 2002 onwards. Therefore, studies were included that were conducted/published from 2006 onwards

2.3 Developing a description of the selected studies

Following the multi-stage screening process outlined above, 11 studies were analysed to provide a synthesis of the information outlined in Table 4.

Table 4: Study information

Participants: number, age; **Study Context:** educational setting and country; **Focus:** group/individual, duration and details of follow-up; **Design:** details of how the study was conducted and how the intervention was delivered; **Independent Measures:** details of the intervention applied; **Dependent Measures:** types of cognitive/academic achievements effected; **Data Collection Methods:** tests/assessments/measures employed to identify nature of effects at pre and post-test; **Findings:** Some of the studies included in the final review reported findings on factors deemed to be inappropriate to the review question (for example, findings related to behavioural observations). Therefore, only relevant findings are reported. Significant results are reported in the summary (not specific statistics) and effect sizes are presented in the review synthesis.

2.4 Assessing quality of studies and weight of evidence for the review question

The studies included in the in-depth review were analysed to determine the quality and the relevance of the evidence in relation to the current review question. The quality and relevance of evidence was assessed using the EPPI-Centre weight of evidence guidance (details of the criteria applied to form a weight of evidence judgement are outlined in Appendix 2: Weight of Evidence Judgements).Weight of evidence judgements were made using four broad criteria (see Table 5). Within these criteria, specific questions are used to guide the researcher towards making an judgement of low, medium or high (see Appendix 2). An overall judgement was formed about each study, taking into consideration the ratings for criteria A, B and C. It is recognised that despite forming judgements based on the EPPI-Centre guidance, the weight of evidence process is still interpretive and susceptible to bias.

(The weight of evidence table is presented in Table 5 and a summary of the included studies is presented in Table 6)

2.5 Effect Sizes

Effect sizes are often regarded as the standard benchmark measure in quantitative research. They quantify the differences between two or more groups (Oliver, Venville, & Adey, 2012). J. Cohen (1988)'s description of effect sizes outlines .20 as small, .50 as medium and .80 as large. Cohen's d effect size measurements were included in some studies within the current review; for others alternative methods of observing magnitude were applied (for example, Eta-square). Where alternative methods were applied, or studies did not report effect sizes altogether, Cohen's d was calculated using an online effect size calculator available online through the Centre for Education and Monitoring based at Durham University. For some studies, insufficient statistical data were reported and therefore effect size could not be calculated.

Table 5: Weight of evidence for selected studies

Study	A Soundness of study in terms of research question	B Appropriate design and analysis for review question	C Relevance of focus to review question	D Overall weight in relation to review question
(Topping & Trickey, 2007a, 2007b)	Medium/high	High	High	/High
(Dewey & Bento, 2009)	Medium/high	Medium	Medium	Medium
(Sanz de Acedo Lizarraga et al., 2010)	Low/medium	Low/medium	Medium	Low/medium
(Burke & Williams, 2008)	Medium	Medium	Low/medium	Medium
(Sanz de Acedo Lizarraga et al., 2009)	Low/Medium	Medium	Low/medium	Low/medium
(Oliver et al., 2012)	Medium	Medium/low	Medium	Medium
(Molnar, 2011)	Medium	Medium/high	Medium	Medium
(Cattle & Howie, 2008)	Medium/high	High	High	High
(Hu et al., 2011)	Medium/high	Medium/high	High	Medium/high
(Babai & Levit-Dori, 2009)	Medium	Medium	Low	Low/medium
(Shayer & Adhami, 2010)	High/medium	High/medium	Medium	Medium

Table 6: Summary of included studies

Study	Participants	Study Context	Study Focus	Design	Data Collection Methods	IM*	DM*	Significance
(Topping & Trickey, 2007a, 2007b)	177 pupils 105= EG[2] (4 classes) 72=CG[3] (3 classes) Age 10 at pre test, 12 at post test, 14 at follow-up.	Primary Schools and Secondary Schools in Scotland.	Collaborative, 1 hour per week over 16 months then after 2 years (individual gains tested).	2x2 pre-post intervention/waiting list controls. Not randomly sampled.	• Cognitive Abilities Test 3rd Edition (CAT 3).	Philosophical Enquiry	Verbal reasoning Non Verbal reasoning Quantitative reasoning Overall	p<.01 p<.01 p<.01 p<.01
(Dewey & Bento, 2009)	404 pupils 160 EG 244 CG	8 Primary schools in UK	Individual, 3 points of measurement over 2 yrs.	Quasi-experimental, pre-post & delayed post-test.	• CAT 3	Infusion Methodology (IM) ''Activating Children's Thinking Skills'	Cognitive ability	p=0.13
(Babai & Levit-Dori, 2009)	120 pupils, Grade 9	Across 4 classes, 1 school in Israel.	Individual, short intervention of 3 CASE sessions (first 4 lessons) each 90 minutes in duration.	Pre-post test design	• 'Cognitive level Assessment Test: Science Reasoning Task 2' • Post intervention exam	Short version of CASE	Performance on post-test exam Performance on questions: 'control of variables' reasoning scheme Knowledge in Biology	P=0.001 P<0.001 p=0.072

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[2] EG= Experimental Group
[3] CG= Control Group

Study	Participants	Study Context	Study Focus	Design	Data Collection Methods	IM*	DM*	Significance
(Shayer & Adhami, 2010)	275 pupils, mean age = 5.7yrs.	2 areas in South UK: **Area 1**: 8 experimental (E) classes across 8 schools; 5 control (C) classes. **Area 2:** 10 E classes in 4 schools, 11 C classes.	Individual and collaborative approaches, over 2 years.	Pre-post test design	• 'Piagetian Spatial Relation test' • Standard Assessment Tasks (Key Stage 2 'SATS')	Combination of 'Thinking Maths' and 'Let's Think' derived from CASE programme	Cognitive development Gains at: KS1 English KS2 English KS1 Maths KS2 Maths	Not Reported (NR) NR NR P<.05 NR
(Sanz de Acedo Lizarraga et al., 2010)	58 pupils, 11-13 yrs 27 EG 31 CG	2 Primary Education Centres in Spain	Individual & group, 3 hours daily. Over 1 academic year (Sept-June) No follow up.	Pre and post test.	• Cattell's Intelligence Test, • Battery of Factor Assessment of Intellectual Aptitudes and Creative Intelligence Tests.	'Thinking Actively in an Academic Context'	Intelligence Verbal Reasoning Abstract Reasoning Numerical Reasoning Creativity Academic Achievement	p< 0.001 p<0.001 p<0.001 p<0.001 p<0.001 p<0.001
(Cattle & Howie, 2008)	N=22 EG=10 CG=12, pupils 5-7yrs	Mixed class pupils, South UK.	Individual, conducted by class teacher and researcher over 8 months.	Pre-post test design.	• Raven's Coloured Progressive Matrices • 'Drawing' • Boehm-R Test of Basic Concepts Form D Part 2	CASE	Performance on: Raven's test Drawing test Boehm test	NS NS NS

Study	Participants	Study Context	Study Focus	Design	Data Collection Methods	IM*	DM*	Significance
(Burke & Williams, 2008)	178 pupils, 11-12 yrs 60 CG 58 Collaborative EG 60 Individual EG	7 classes in 6 primary schools in Scotland.	Individual and Collaborative, over 8 weeks.	Pre and Post test.	• Thinking Skills Assessment	Infusion Methodology	Comparing & Contrasting Grouping Reasoning and Conclusions Ideas Decision making Problem solving	$p < 0.0001$ $p < 0.0001$ $p < 0.0001$ $p < 0.0001$ $p < 0.0001$
Sanz de Acedo et al (2009)	Study 1: 118 pupils (mean age= 13.75) EG=57, CG=61 Study 2: 176, EG1=55, EG2=60, CG=61 Study 3: same as EG1 & 2 and CG	Compulsory Secondary Education, Spain.	Individual, over one academic year (Sept-June) and a follow up.	3 studies- Study 1 compared Infusion Methodology (IM) compared with Conventional Methodology (CM) and Study 3 = follow up.	• Cattell, CREA, Evaluate-8, DAT-5 Level 1. • Academic achievement tests A and B.	Infusion Methodology	Intelligence Verbal reasoning Numerical reasoning Abstract reasoning Inductive reasoning Deductive reasoning Creativity Academic achievement	$p < .01$ $p < .05$ $p < .000$ $p < .01$ $p < .000$ $p < .000$ $p < .000$ $p < .000$

Study	Participants	Study Context	Study Focus	Design	Data Collection Methods	IM*	DM*	Significance
(Oliver et al., 2012)	EG=68 (twice tested) (12-14 yrs)	Australian Junior High school classes, low socio-economic area	Individual, over 2 years.	Mixed methods.	• Science Reasoning Tasks, • National Assessment Programme-Literacy and Numeracy (NAPLAN) test, • Western Australian Monitoring Standards in Education (WAMSE)-science component.	Cognitive Acceleration through Science Education (CASE)	Cognitive development Academic achievements; Science Numeracy Reading Spelling	NR NR NR NR NR
(Molnar, 2011)	252 'first grade' pupils (age NR) EG=90 CG-162	5 classes, one school in Hungary	Individual, paired and group work, 10 sessions (20 minutes), 12 tasks per session, 8 weeks.	Pre-post test design, 3 stages of data collection.	• Inductive reasoning test	Inductive reasoning training program, based on 'Klauer's theory of inductive reasoning' and 'Cognitive Training for Children'	Generalization Discrimination Cross-classification Recognising relations Discriminating relations System formation Overall effect of training program	NS P<.01 p<.01 p<.01 p<.01 p<.01 p>.01

Study	Participants	Study Context	Study Focus	Design	Data Collection Methods	IM*	DM*	Significance
(Hu et al., 2011)	N=166 EG=90 CG=76 pupils 6-8yrs	Primary school, Shanxi Province, China.	Individual, over 4 years. Academic achievements measured at 4 points in an academic year, thinking skills test 3 times in 4 years (measures at 6 and 12 months & follow up)	Pre-post test design.	• Raven's Standard Progressive Matrices (pre-test only) • Thinking ability test • Academic achievement test	'Learn to Think'	Comparing and classification	Time 1: NS Time 2: p<.05 Time 3: NS
							Inductive reasoning	Time 1: NS Time 2: NS Time 3: p<.05
							Deductive inference	Time 1:NS Time 2: NS Time 3:p<.05
							Spatial cognition	Time 1:NS Time 2: NS Time 3: p<.05
							Analogical reasoning	Time 1:NS Time 2: NS Time 3: p<.05
							Analogical reasoning	Time 1:NS Time 2: NS Time 3: p<.05
							Abstract-generalization	Time 1: NS Time 2: NS Time 3: p<.05
							Grade 1 (Chinese)	Time 1-3: NS Time 4: p<.05
							Grade 1 (Maths)	Time 1, 2: NS Time 3 & 4: p<.05

Study	Participants	Study Context	Study Focus	Design	Data Collection Methods	IM*	DM*	Significance
Hu et al (2011) cont.							Grade 2 (Chinese)	Time 1: NS Time 2: p<.05 Time 3: p<.01 Time 4:p<.01
							Grade 2 (Maths)	Time 1, 2: NS Time 3: p<.05 Time4: p<.05
							Grade 3 (Chinese)	Time 1: NS Time 2:p<.01 Time 3 p<.001 Time 4: p<.01
							Grade 3 (Maths)	Time 1:p<.01 Time 2:p<.01 Time 3:p<.001 Time 4:p<.001

IM= Independent measure, DM= Dependant Measure*

3. Results

3.1 Synthesis of evidence

To support synthesis of findings across the included studies, as is shown in Table 7

outcomes were combined according to commonality in two themes: Independent measures

(type of thinking skill intervention employed) and dependent measures (type of

cognitive/academic achievement tested).

Table 7: Results according to outcome variable

Intervention Methodology	Specifics	Study	Outcome Variables	Effect Size (Cohen's d)	Follow Up
Infused across curriculum	*'Activating Children's Thinking Skills'*	(Dewey & Bento, 2009)	**Near-far transfer**	Not Reported (NR)	No
	Infusion Method (IM)	(Sanz de Acedo Lizarraga et al., 2009)		Intelligence: 0.6 Verbal R[4]: 0.5 Abstract R: 2.3 Inductive R: 0.7 Deductive R: 0.9 Creativity: 1.26 Academic A[5]:1.5	
	'Thinking Actively in an Academic Context'	(Sanz de Acedo Lizarraga et al., 2010)		Intelligence: 1.0 Verbal R: 1.1 Abstract R: 2.6 Numerical R: 1.5 Creativity: 1.8 Academic A: 0.9	
	General 'infusion approach'	(Burke & Williams, 2008)	**Near transfer**	NR	
	'Learn to Think'	(Hu et al., 2011)[6]	**Near- far transfer**	Thinking Ability: Grade 1: 0.83 Grade 2: 1.45 Grade 3: 1.21 Academic A: Grade 1 (Maths): 0.62 Grade 2 (Maths): 0.87 Grade 1 (Chinese): 0.68 Grade 2 (Chinese): 1.07 Grade 3 (Maths): 1.15 Grade 3 (Chinese): 1.31	Yes, 4yrs

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[4] R=Reasoning
[5] A=Achievement
[6] This study reports the effects of the 'Learn to Think' intervention for three groups (grades 1, 2, & 3) at 3 different times (6 months, 12 months and at the end of the 4 years). I have therefore reported the effect sizes for thinking skills and academic achievement at the end of the intervention, for both clarity and to present a 'final' effect.

Intervention Methodology	Specifics	Study	Outcome Variables	Effect Size (Cohen's d)	Follow Up
Subject-specific	*'Cognitive Acceleration through Science Education'*	(Oliver et al., 2012)	**Near-far transfer**	Cognitive development: 0.47 Academic A: Science: 0.21 Numeracy: -0.04 Reading: 0.06 Spelling:-0.08	No
		(Cattle & Howie, 2008)	**Near transfer**	Performance on 'Drawing Measure': 1.2	No
		(Babai & Levit-Dori, 2009)		Performance on post-test exam: 0.61 Performance on questions which required the use of 'control of variables' reasoning scheme: 0.72 Knowledge and comprehension of subject specific knowledge in Biology: 0.33	
	'Cognitive Acceleration through Maths Education'	(Shayer & Adhami, 2010)		Cognitive dev. LA[7]1: 0.71 LA 2: 0.60 Academic A: English KS1: 0.51 English KS2: 0.36 Maths KS2: 0.21	Yes, 2yrs
Stand-alone programmes	*Philosophical Enquiry*	(Topping & Trickey, 2007a, 2007b)	**Near-far transfer**	Verbal R: 0.4 Quantitative R: 0.33 Non Verbal R: 0.5 Overall: 0.44	
	'Cognitive Training for Children'	(Molnar, 2011)	**Near transfer**	Inductive reasoning at post test: 1.12 Inductive reasoning at follow up: NR	Yes, 1yr

The above table presents the findings of the included studies. Taken in synthesis, the

evidence suggests that TS interventions may have a significant impact on both school-aged

pupils' cognitive and academic achievements. More specifically, the evidence implies that

various methodologies for teaching TS can be successful at promoting both near and far

transfer in the process of learning.

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[7] LA= Local Authority

3.2 General characteristics of the included studies

Table 6 summarises the characteristics of the 11 studies included in the in-depth review. Evidently there is variety between the location of studies; the majority of which were conducted outside of the United Kingdom (N=6). Most of the studies were conducted in primary schools (N=6), and two of the studies conducted their original work in primary schools, later following up their research when the pupils were in secondary education (Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b). There was considerable range between the sample sizes (range= 22-404).

There are also noticeable differences between the duration (range= 4 lessons - 4 years) and frequency (20 minutes-3 hours daily) of interventions administered. Four studies (Hu et al., 2011; Molnar, 2011; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b) provided follow up data which varied from 1 year to 4 years post intervention. Shorter intervention studies may be viewed as problematic; as it is widely reported that at least two years is needed, following an intervention, 'to generate and thus observe cognitive change in children' (Blagg, 1991; Feuerstein et al., 1980; Shayer & Adhami, 2010) cited in Dewey and Bento (2009, p. 335). However, they might equally demonstrate that cognitive enhancement can be achieved by cost and time efficient interventions albeit in the short term (Babai & Levit-Dori, 2009; Burke & Williams, 2008; Molnar, 2011). Specific, time bound interventions might also reduce the likelihood of confounding variables accounting for observed positive effects (Topping & Trickey, 2007a, 2007b).

Disparity exists between studies as to how the control and experimental groups were assigned and with regards to the function of the control group. Some of the studies employed stratified random sampling procedures (N= 4) adding rigour to their methodology and further credibility to the intervention tested. Yet, many of the studies used a controlled sampling procedure, where either researchers, teachers or Local Authority personnel participated in group selection (Cattle & Howie, 2008; Oliver et al., 2012; Sanz de Acedo Lizarraga et al., 2009; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b).

Only two studies reported that they offered delayed intervention to the control group (Dewey & Bento, 2009; Topping & Trickey, 2007a, 2007b), other studies described that control groups received nothing additional or alternative to the standard curriculum (Cattle & Howie, 2008; Hu et al., 2011; Sanz de Acedo Lizarraga et al., 2010) whilst only one study reported that control groups received an alternative, yet irrelevant intervention (Babai & Levit-Dori, 2009). The remainder of studies did not specify any further function of the control group beyond comparison with the experimental group (N=5).

There is almost an equal split between studies specifically outlining that they did not test the effect of the intervention with pupils deemed to have additional educational needs or those of apparent 'low' cognitive ability (N=6), and studies interested in testing the effects on different ability groupings (N=5). Such a disparity is likely to exist due to a commonly discussed theme within the literature; that pupils who appear to be of 'lower ability' probably have reduced meta-cognitive abilities (Hu et al., 2011; Slife, Weiss, & Bell, 1985) and struggle to reap the benefits of interventions without concrete scaffolding. The implementation of TS interventions is therefore often accused of encouraging teachers to 'teach to the middle' (Hu et al., 2011, p. 551), as often it is difficult to adapt the intervention to meet the needs of a wider range of pupils.

There appears to be variability across ages of pupils tested; none of the studies focused on pupils below the age of 5, many examined effects on pupils between the ages of 5 and 8 (n=4), an equal number studied effects of pupils at ages between 11 and 14 (n=4). Only two studies included pupils at the end of Key Stage 2 (Topping & Trickey, 2007a, 2007b) and only one study involved pupils older than the age of 14 (Babai & Levit-Dori, 2009).

3.3 Thinking skills interventions

It can be gleaned from the findings of the current review that the majority of the studies applied either infusion methodology (5 [8]out of the 11 studies) or subject-specific methodology (4 out of the 11 studies). Evident when considering the application of infusion methodology is the lack of consistency of a specific intervention/programme. Each of the five studies applied different versions of an infusion based approach. Such a finding calls into question the conceptual reliability of the term 'infusion based' methodology. However, distinct contrasts are observed when considering subject-specific methodology. Each of the four studies utilising this methodology applies the 'Cognitive Acceleration' intervention, either the science version (CASE) or the maths version (CAME). When taken together, findings related to subject-specific methodology further support the effectiveness of the Cognitive Acceleration approach as a TS intervention.

Only two of the studies (Molnar, 2011; Topping & Trickey, 2007a, 2007b) conducted their research using a stand-alone programme for supporting the development of TS. Despite both these interventions yielding positive effects on pupil achievement, it could be the case that such programmes are difficult to establish in schools given that they are often considered an 'add-on' to the core curriculum (McGuiness, 1999). However, debates exist related to whether explicit teaching of TS is indeed supplementary to the curriculum. It has been argued that although stand-alone interventions are often initiated as a separate activity (for example, Philosophy for Children), the overall aim is that eventually they are infused into a range of subject domains (Fisher, 1998).

Categorising TS interventions according to methodology is possibly a cursory exercise,given that such variety exists between programmes and definitions of their over-arching methodologies. What is possibly more useful to explore, is the focus (individual/collaborative) of the intervention applied and the associated effects. The benefits

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[8] Included in this is the Hu et al. (2011) study, which incorporated aspects of both infusion methodology, and methods of explicit teaching.

of collaborative learning are widely recognised amongst researchers and theorists (for example see Adey, Robertson, & Venville, 2001; De Bono, 1999; Lipman, Sharp, & Oscanyan, 1980; McGuiness, 2003; Swartz & Parks, 1994). Yet, it is observed that minimal research exists to support the advantages of collaborative learning when developing TS (Burke & Williams, 2008). Such an observation is highlighted when taking findings together from the current review, as only four studies explicitly tested and reported on the effects of the intervention in terms of collaborative/interactive learning structures (Burke & Williams, 2008; Molnar, 2011; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b).

3.4 Outcomes, Measures and transfer effects

The current review focused specifically on quantitative studies which measured cognitive and academic effects. Five studies (Burke & Williams, 2008; Cattle & Howie, 2008; Dewey & Bento, 2009; Molnar, 2011; Topping & Trickey, 2007a, 2007b) focused on cognitive outcomes and did not include data on academic achievements. The remaining six studies assessed the impact of the intervention on both pupils' cognitive and academic achievements. Findings suggest that data collection methods used reflect the intended outcome measures. Specifically, studies concentrating on cognitive effects used standardised cognitive assessments (such as the Cognitive Abilities Test (CAT) and Raven's Standard/Coloured Progressive Matrices) and studies which also investigated academic effects used related educational tests (for example, test results in numeracy, science and literacy).

Ambiguity exists both within and between studies as to the conceptualisation of cognitive and academic skills. Many studies seemed to view 'cognitive ability' (Babai & Levit-Dori, 2009; Cattle & Howie, 2008; Dewey & Bento, 2009; Molnar, 2011; Oliver et al., 2012; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b) as a unitary concept; measurable and observable in its entirety. In contrast, other studies (Burke & Williams, 2008; Hu et al., 2011; Sanz de Acedo Lizarraga et al., 2009) provided mutli-dimensional definitions of cognitive abilities; measuring various related facets. These facets were often related to both inductive

and deductive reasoning skills. The task of synthesising dependent measures is made problematic considering that there is divergence amongst aspects of the reasoning skills measured. One over-arching commonality across the studies is that they all appear to conceptualise cognitive ability/abilities as modifiable, as they all introduce an intervention and hypothesise that this intervention will result in cognitive transformation.

Of interest to the current review was the extent to which TS interventions promoted the transfer of learning. The evidence reported here suggests that transfer of learning effects is determined by intended learning outcomes. Studies that focused on the impact of the intervention on pupils' performance on cognitive and not academic achievements could be categorised as 'near-transfer' (as observed in Babai & Levit-Dori, 2009; Burke & Williams, 2008; Cattle & Howie, 2008; Molnar, 2011), whilst the majority of studies that observed the effects of both cognitive and academic achievements could be categorised as 'near-far' transfer (as observed in Dewey & Bento, 2009; Hu et al., 2011; Oliver et al., 2012; Sanz de Acedo Lizarraga et al., 2009; Sanz de Acedo Lizarraga et al., 2010; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b).

3.5 Effect sizes of outcomes

Findings with regards to interpreting effect sizes should be treated with caution, particularly when considering the described interventions which often require a shift in pedagogical style. TS interventions are likely to require considerably different teaching and learning styles, which could result in a "novel/inspirational effect" (Topping & Trickey, 2007a, p. 283). Therefore, each study should be considered alongside the possibility of results gleaned due to a 'Hawthorne' type outcome (Topping & Trickey, 2007a, 2007b; Trickey & Topping, 2004).

Clearly, this has been recognised by those studies where a follow up was conducted after a considerable length of time. Gains were maintained at follow up for some studies (Hu et al, 2011; Trickey & Topping, 2007; Shayer & Adhami, 2010 and Molnar 2011) at between 1 and 4 years; after which time one might expect the effect of novelty to have somewhat reduced.

These studies were considered to be robust in terms of the methodology employed; which can be observed in Table 5 where they were rated between medium and high in relation to overall weight of evidence.

Where effect sizes were reported or it was possible to calculate them, considerable difference exists between studies (range= 0.04-2.3). One reason for this could be that, as mentioned previously, divergence is present amongst definitions and conceptions of TS. Studies which adopted a single measure of cognitive ability (Babai & Levit-Dori, 2009; Cattle & Howie, 2008; Molnar, 2011; Oliver et al., 2012; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b) generated effect sizes ranging from .33 and 1.2, presenting a range from small to large, yet suggest a more modest range than when combining results from all studies. Where studies tested the effects of interventions on specific elements of thinking skills (such as inductive reasoning (Hu et al, 2011) or decision making (Burke & Williams, 2008) , larger effect sizes are observed (range= .5-2.6). Findings from Sanz de Acedo Lizarraga et al. (2009) and Sanz de Acedo Lizarraga et al. (2010) seem to suggest particularly high effect sizes; if one accepts the subscales used this could hold important implications in relation to TS. Hattie (2008) suggested that an effect size of 1.0 equates to the advancement of a pupil's learning by around two to three years; a theory which could warrant further application of the infusion methodology employed by Sanz de Acedo Lizarraga et al. (2009).

A question arises as to whether it is more statistically reliable to measure one stable concept as opposed to several, loosely defined facets which are open to interpretation. It could be argued that when more measures are statistically analysed, there is increased likelihood that a positive effect will be generated.

4. Conclusions and recommendations

4.1 Summary of principal findings

A number of conclusions can be drawn from review   which examined the effectiveness of TS interventions on pupils' cognitive and/or academic achievements. Eleven studies were identified as suitable for review. All examined the effect of TS interventions on pupils' cognitive and academic achievements. Nine studies reported significant effects in this domain. One of the eleven studies did not report significance levels (Oliver et al., 2012) and the other reported that all measures yielded insignificant findings (Cattle & Howie, 2008). Of the studies which reported significance levels, all reveal effect sizes ranging from small to large.

Concerns arise when taking the studies together to interpret statistical findings, due to the variability identified across them. Studies varied both in terms of their method (e.g. design and sample size) and intervention delivery (e.g. intervention tools and focus). Despite the finding that there was considerable variability in research design (e.g. duration and intensity of intervention, outcome measures, the function of control groups and intervention focus) no clear patterns emerge as to how such variability affected the impact of the interventions. Four of the studies are included in Table 8 to provide an example of such variability.

Table 8: Example of Study Variability

Study	Intervention Focus	Duration	Intensity	Outcome Measures	Function of control groups
Cattle & Howie (2008)	Individual pupils	8 months	Not specified	Performance on cognitive tests only	Comparison with Experimental Group (EG)
Burke & Williams (2008)	Individual and collaborative	8 weeks	3 lessons per week	Performance on specific thinking skills tests	Comparison with EG
Oliver et al (2012)	Individual pupils	2 years	30 lessons	Performance on cognitive and academic tests	Comparison with EG
Babai & Levit-Dori 2009	Individual pupils	Not specified	4 CASE lessons (6 hours in total)	Performance on specific thinking skills test and subject specific achievement (Biology)	Alternative, irrelevant intervention

It appears that interventions employing subject-specific, infusion-based and stand-alone methodologies can be effective in supporting pupils' cognitive and academic achievements. Often observed were near- transfer effects as opposed to far-transfer effects; holding implications for future consideration and research.

The included studies attempted to measure the effect of various TS interventions using quantifiable and positivist methods. Taking such a theoretical and epistemological stance towards the development of TS assumes that such skills are measurable and observable. It is necessary for criticality to be applied to the concept of 'thinking' as something which emerges through only individual cognitive processes; educationalists should also consider the importance of social factors. The influence of social factors in the context of teaching thinking has been widely acknowledged elsewhere (for example Iiskala, Vauras, Lehtinen, & Salonen, 2011; Kutnick & Kington, 2005; Mercer, Dawes, & Staarman, 2009; Myhill, 2006; Oxenford O'Brian, Nocon, & Iceman Sands, 2010; Resnick, Salmon, Zeitz, Wathen, & Holowchak, 1993; Schmitz & Winskel, 2008; Wang, Woo, & Zhao, 2009; Wegerif, Mercer, & Dawes, 1999).

4.2 Limitations of the current review

Limitations are acknowledged related to the current review. One such limitation is how the studies included in the in-depth review were selected and coded. An attempt has been made to outline the systematic review process for transparency purposes; however, both coding and weight of evidence judgements have been made individually as opposed to by multiple reviewers.

 Furthermore, the decision was made to focus exclusively on quantitative studies/findings; yet a mixed methods approach may have been useful in order to triangulate this data alongside behavioural observations and self-perceptions of those involved.

4.3 Recommendations for further research

This review recommends that more research is needed to explore the definitional, conceptual and theoretical nature of TS. It would be useful to explore the perceptions of those whose voice appears to be missing in the existing literature, particularly as part of a genuine endeavour to review and enhance teaching and learning processes. Teachers, pupils and parents could have an active role to play in the construction of such interventions or effective strategies; a possibility not explored in the examined literature.

The existing literature relating to the effectiveness of TS interventions remains unclear. Is the uncertainty within the field related to the frequent attempts to capture and prove the success of a 'one size fits all approach' to developing thinking? If researchers do this, do they fail to attend to and tackle the fundamental changes in education which are needed for pupils to develop thinking? (Glevey, 2006). More explicit research is needed which focuses not only on what teachers *should* be doing to promote TS, but also what they *already* do and how they conceptualise such activities.

Further research could focus on the social factors and collaborative processes which support the development of TS, as referred to on page 38 . Purposeful group work can enable 'jumps in cognitive development' (Shayer & Adhami, 2010, p. 379), therefore research exploring the perceptions of pupils related to TS might take place in group formats.

Pramling (1990) suggested that the focus of teaching should not be on cognitive skills training, but rather a meta-cognitive approach should be adopted in thinking about the curriculum content. Taking this further, teachers might benefit from further opportunities to expand their own meta-cognition towards teaching; as it has been suggested that adopting the role of facilitator, rather than arbiter of pupils' thinking is demanding and thus requires carefully designed support (Oliver et al., 2012).

Another direction for future research would be to adopt a more 'inclusive' approach to exploring TS interventions with pupils. Often described in the literature is a 'middle-ability'

type effect, where pupils who are identified as having additional educational needs or who are deemed to be of 'low' cognitive abilities are excluded from samples (as also observed by Resnick et al., 1992). Such an approach raises serious ethical concerns, especially considering that these excluded groups are often the most in need of specific and guided interventions.

Future research could address the issues outlined above, in order to reach an enhanced understanding of TS interventions..

4.4 Conclusion

Over recent years there has been a considerable amount of literature examining pedagogical and theoretical stances towards education and learning. From this a wider awareness has emerged proposing that pupils should be assessed by how well they think and process information, and that TS should become an integral function of the curriculum.

Thorough analysis of 11 articles arising from the quantitative literature (from 2006 onwards) relating to TS interventions and cognitive achievements revealed some core themes to guide future research. Firstly, definitions of 'TS' and associated outcome measures are ambiguous and vary considerably. Findings from this review suggest interventions have often measured 'individual' effects thus viewing thinking as a process removed from social construction. Where pupils were consulted about their experience of interventions, this often appears to be a tokenistic attempt to demonstrate 'pupil voice', rather than a genuine endeavour to involve pupils as joint researchers. There also appears to be less interest in teacher and pupil perceptions of thinking and how these influence practice. Interestingly there appears to be a lack of research investigating how the joint practice of Educational Psychologists and teachers can amalgamate to review TS interventions. The current review recommends that the above findings are addressed in future research.

Chapter 2: Moving from Systematic Review to Empirical Research

Abstract

The systematic review and empirical research presented in this thesis both explore how thinking skills can be supported in the context of education. Specifically, the current research takes a focus on how a teacher might construct a thinking pedagogy, and how this might impact on teacher and pupil thinking. Chapters 1 and 3 are linked through a focus on how a thinking pedagogy might be supported and sustained in a primary classroom.

There are two main aims of this bridging document. Firstly, the aim is to provide further depth regarding methodological aspects of the research process, in terms of the ontological, epistemological and theoretical stance taken. Secondly, the document aims to outline a rationale for the positioning of participants within the study, together with an outline of the reflexive and ethical considerations taken by myself as a researcher.

1. Introduction

The systematic review investigating the effects of thinking skills (TS) interventions on pupils' cognitive and academic achievements presented in Chapter 1 revealed a number of issues for further consideration. The main conclusions drawn from Chapter 1 are outlined in Box 1.

Box 1: Conclusions from Chapter 1

- 'Thinking skills' as a concept is variable across studies making conclusions difficult;

- Research investigating thinking has been largely reliant on scores on individual cognitive and academic tests, raising questions as to how the dynamic and social aspects of thinking could be explored;

- Often included in research samples were pupils who were not deemed to require additional support with the curriculum. Conclusions often reported that teachers felt that the methods required them to 'teach to the middle', raising questions as to how thinking skills approaches can be developed to be more inclusive methodologies;

- Research presented in Chapter 1 focused largely on 'blanket interventions' which were often considered robust in methodology and part of a wider evidence-base , usually designed and/or delivered by external researchers.

- Where teacher and pupil voices were sought these formed parts of the evaluation process rather than the construction phase/throughout the implementation of the intervention.

Such conclusions demonstrate the potential for further exploration into the field of TS. In this Chapter, I consider certain issues gleaned from previous research in order to develop an appropriate research methodology.

Where Chapter 1 was presented using a third-person academic style of writing, the remainder of this chapter is presented in accord with my view of my role as an active participant in the research process; thus adopting a first-person style.

1.1 Developing a research focus

The literature review focused on pupils' individual, cognitive achievements following a period of intervention. Taking a different perspective in order to develop a more holistic understanding of the wider literature, I became interested in how qualitative, psychological research had addressed and investigated TS interventions. I aimed to explore how the thinking of pupils, and adults, can be shaped by social experience and interactions with others (Mercer, Wegerif, & Dawes, 1999). Additionally, I was motivated to understand more

about how an Educational Psychologist (EP) might facilitate thinking in their work with pupils and adults.

Two particular frames helped to afford the foundations for the empirical study, and to confirm a connection between the systematic review and the final project. The first frame outlines my theoretical stance towards individual and social aspects of thinking, (see below) and the second describes my aim to co-construct participatory research (outlined on page 46). Embedded in both frames, and contributing to the overall research design are the ontological, epistemological and ethical positions I have taken towards the project and how such positions influenced the chosen methodology.

Firstly, I outline the theoretical stance I have taken towards 'thinking' in the current research. Particularly I focus on the concept of thinking in relation to social and cultural influences, and what that might mean for the concept of individual agency.

1.2 Thinking: The relationship between the individual and the social

The position I have taken towards 'thinking' arises from a particular socio-cultural perspective of learning. Socio-cultural theorists generally assert that an individual's learning 'cannot be considered in isolation from the social, cultural and historical context within which the learning takes place' (Oxenford O'Brian et al., 2010). Such a position is grounded in Vygotsky's model of individual development, in which he proposed that "all that is internal in the higher mental functions was at one time external" (Vygotsky, 1991, p. 36). Researchers who adopt this stance when investigating thinking claim that individual aspects of thinking emerge through prior engagement within social practices (Hrastinski, 2009; Littleton & Häkkinen, 1999; Wegerif et al., 1999).

However, within a socio-cultural approach, contention exists surrounding how the individual and social are distinct from one another, and also how they relate to one another (Eteläpelto, Vähäsantanen, Hökkä, & Paloniemi, 2013). Some socio-cultural perspectives assume complete 'inseparability of social context from individual agentic action…hence they see no

need to analyse individual contributions' (Eteläpelto et al., 2013, p. 55). Such a stance appeared problematic to me; as the review found that participation from pupils and teachers was underplayed in TS interventions. I therefore aimed to locate my research within a theoretical position which acknowledged social influences but also valued individual contributions.

Stetsenko (2005) postulates that further understanding is required to incorporate individual subjectivity into socio-cultural perspectives on learning. Billet's (2006) theory of 'relational interdependence' attempts to find a pathway between social determinism and individualistic accounts of learning. This theory accepts that individuals are active agents of change, but there is some level of interdependence with the social context. Individuals are active in the sense that they choose which problems they engage with, and the extent of their engagement (Billett, 2006, 2008).

Criticisms of some social-cultural research state that the notion of individual agency is minimized and that little is understood about 'micro-level negotiations that form the evolving shape of the collective' (Edwards, 2005, p. 180). In light of this critique, it seemed that further research would be useful to understand how the actions of an individual can both shape, and be shaped by, social context. I therefore aimed to explore how individual and social aspects of thinking are experienced and conceptualised at a micro-level.

2. Ontology

Having outlined the area for research focus above, it is necessary to state the ontological and epistemological positions I took, which assisted with sharpening the research focus into an appropriate methodology.

Ontology is the 'study of being and existence in the world' (Burr, 2003, p. 92) and grounds the foundations of a research project, requiring the researcher to consider 'what is the form and nature of reality? And 'what can be known about reality?' (Annells, 1996, p. 384)

Considering the researcher's stance on such questions helps to guide their epistemological and thus methodological approach to the research process.

My intention was to explore participants' experiences of a TS approach and how they made sense of these experiences within a social context. Applying a qualitative approach I took a relativist ontological position which assumes that individuals construct their own interpretations of their experiences and that the only 'realities' we have access to as researchers are various representations (Burr, 2003) of the topic under study.

3. Epistemology

Epistemology refers to 'the nature of the relationship between the knower, the would-be knower and what can be known' (Annells, 1996). In accord with my ontological stance, my epistemological position towards the research was social constructionist. When used ontologically, the term social constructionism (SC) refers to the way that 'our perceptions and experiences are brought into existence and the particular form that they do because of the language that we share' (Burr, 2003, p. 92). Thus, language has a central role in SC; as both a 'carrier' of categories and meanings, and as a medium preceding all activity (Cromby & Nightingale, 1999, p. 3)

SC is grounded within the theory of symbolic interactionism (Mead, 1934), which proposes that as people we construct our own and each other's identities (Danzinger, 1997) through encounters with each other in social interaction (Burr, 2003, p. 13). People are constantly engaged in social processes and interactions with each other. Such processes and interactions take the focus of SC research, as opposed to investigations about the *nature* of people or society, rejecting the essentialism inherent within much of traditional psychology (Burr, 2003, p. 6).

Critiques of SC propose that an almost 'exclusive focus on language and discourse' (Cromby & Nightingale, 1999, p. 1) has resulted in SC failing to attend to other significant elements of human life, including:

- Influences of embodied factors

- Possibilities and constraints inherent in the material world

- The power of institutions and governments

(Cromby & Nightingale, 1999, p. 3)

I believe that in attending to the above elements, whilst also considering findings derived from the SR, I am aware of the possible limitations of viewing phenomena purely from the perspective of SC.

4. Methodology

This section describes the general approach taken towards the methodology, a brief outline of how the study was designed, and includes a rationale for the selected method of analysis.

4.1 Co-constructing Participatory Research

With my ontological and epistemological positions transparent, an important step towards designing an appropriate research methodology was to consider how the project could be co-constructed with participants and key stake holders.

Although all of the studies included in the review reported scores on individual performance indicators, many also attempted to reflect some level of qualitative evaluation. Often, this included investigating participant experiences at the end of the project. It struck me that what was perhaps missing from the included studies, was a genuine attempt to invite participation from pupils and teachers throughout the intervention process; from the *construction* phase through to evaluation. van der Riet (2008) claims that participatory research aims to go 'beyond the research endeavour, to become a form of social activism' (p. 551). Participant construction therefore, may augment the possibility that the TS approach moves beyond that of an intervention and moves towards general pedagogical style (as noted by Baumfield, 2006).

In aiming to co-construct a participatory research process I sought to develop methodology which would develop participants' understanding of their experiences (Mercer, 1995) *and* extend their thinking. Participatory research allows for a 'dialectical tension between the participant's knowledge and the more theoretical and academic knowledge of the researcher' (van der Riet, 2008, p. 555), producing a more 'profound understanding of the situation' (Reason, 1994, p. 328). Whilst taking this approach to participative research with adults, implications may therefore include enhanced professional awareness. However, implications for pupil participants may require further scrutiny (as is discussed on page 51).

4.2 Design

My work as a TEP in a Local Authority in the North East of England afforded me access to several primary schools through on-going casework activities. During a planning meeting at one mainstream primary school between myself and a Special Educational Needs Co-ordinator (SENCo)/Deputy Head Teacher, it became apparent that we shared mutual interests in the field of exploring TS. The SENCo explained that a related school priority was to introduce paired-problem solving activities to the teaching of maths alongside the National Curriculum, through the 'Think Aloud Paired Problem Solving' (TAPPS) approach.

As outlined in Chapter 1 (page 39), previous research has often 'introduced' TS approaches to teachers via external officers or academic researchers. The current research differs in that the Year 4 teacher implemented the TAPPS intervention; and as a researcher I was interested to explore this with participants. Findings from the SR and wider literature suggested further research could explore the experiences of *teachers* implementing TS approaches. Yet, I was also keen to invite participation from *pupils* in order to form an enhanced understanding of the intervention from multiple perspectives (pupil participation is discussed in further depth on page 51).

In line with my approach to employing Grounded Theory methodology (see page 49) I made a deliberate decision not to research TAPPS in any depth (see Dunne, 2011 for a critical

discussion on this decision). In taking this decision I was less likely to become immersed in existing perspectives, which could result in the 'investigation becoming circumscribed by pre-ordained constructs and limited expectations (Fassinger, 2005, p. 158). Related to my epistemological position, I regarded the TAPPs intervention as a social construction; the discourse around TAPPs would form it's existence (Foucault, 1972), e.g. TAPPS would not 'exist' independently of the use of language both *about* it and *within* it. Therefore, it made sense to study participants' experiences of TAPPs within the context of social interaction, whilst also providing participants with opportunities for individual reflection (See Chapter 3, page 62 for an outline of 'thinking templates').

Verbal aspects of the research process included the use of teacher-researcher consultations (TC) and teacher-researcher-pupil focus groups (FG) (see Chapter 3 page 61). Such methodologies may enable dialogue between participants and researchers (see Chapter 3, page 57 for a brief outline of the concept of dialogue). Box 2 depicts possible transformative effects which may arise for any participant (adult or child) as a result of engaging in dialogic research processes (such as a focus group or a consultation).

Box 2: Transformative possibilities arising from engagement in dialogic research, adapted from Lodge (2005, p. 135)

Dialogic research processes can:

- prompt reflection, critical investigation, analysis, interpretation and re-organisation of knowledge
- connect one's own narrative to that of others in the wider organisation
- make more sense of one's own experience
- enhance understanding of how adults and young people learn

One way of facilitating further participation is to include visual data generation methods. Thus, thinking templates were used to support and extend participant thinking in data generation (see Chapter 3 page 62). Visual methods may serve as 'mediating tools' which can facilitate processes of social learning (Mercer, Hennessy, & Warwick, 2010).

Additionally, the tangibility of a visual representation may potentially create the space for dialogue, and enable individuals to re-enter the context in which their actions were generated (van der Riet, 2008, p. 549).

 I was interested to design a methodology which could be fluid and accommodate both data generation and data analysis. Below, I outline how this methodology was selected.

4.3 Constructionist Grounded Theory

In seeking a research methodology and analytic framework that would be coherent with my epistemological and ontological position, I was drawn to the concept of a social constructionist version of grounded theory (CGT) (Charmaz, 2006) which attempts to move beyond criticisms of the original grounded theory (GT) method as one resembling 'inductivist positivism' (Willig, 2008, p. 46).

Originally described by Glaser and Strauss (1967), GT as a method was developed to offer systematic strategies for qualitative research practice (Willig, 2008). Glaser and Strauss (1967) proposed that through systematic qualitiave analysis, theories could be generated related to social processes.

Box 3: Defining Components of GT practice adapted from Willig (2008, p. 6)

- Simultaneous involvement in data collection and analysis
- Constructing analytic codes and categories from data, not from preconceived logically deduced hypotheses
- Using the constant comparative method, which involves making comparisons during each stage of the analysis
- Advancing theory development during each step of data collection and analysis
- Memo-writing to elaborate categories, specify their properties, define relationships between categories and identify gaps
- Sampling aimed toward theory construction, not for population representativeness.

Box 3 depicts some of the defining components of the original GT method as proposed by Glaser and Strauss (1967).

What struck me about this method was the requirement of simultaneous engagement with data generation and analysis. Considering the research process as dynamic; each

subsequent stage informed by apparent findings, seemed to fit with my ambition to make the research process useful and informative for participants. Engaging in data analysis *between* generation sessions, enabled me to adjust my questions, build on apparent data codes and generate further understandings based on participants' experiences.

It is widely documented that there has been a variety of epistemological positions taken to the GT method over the past several decades (Annells, 1996; Mills, Bonner, & Francis, 2006), therefore researchers must make explicit their epistemological premises prior to embarking on GT (Charmaz, 1989; Corbin & Strauss, 1990; Dunne, 2011).

The constructionist revision of the GT approach permits the researcher to be a part of the world they study (Charmaz, 2006) and 'sees knowledge as socially produced, takes a reflective stance…(and) assumes that we produce knowledge by grappling with empirical problems' (Charmaz, 2009, pp. 129-130). Thus, I believe that the constructionist grounded theory (CGT) method is coherent with my ontological and epistemological positions.

The use of CGT shares some features with phenomenological methods which equally aim to identify categories of meaning using a systematic approach to analysing text (Willig, 2008). However, Interpretative Phenomenological Analysis (IPA) invites participants to 'describe' their experiences rather than 'construct' them in a social context (Starks & Trinidad, 2007).

The details of how I applied the CGT method to generate and analyse data are outlined in Chapter 3, page 66.

5. Ethics and Reflexivity

In this final section I address the ethical considerations which arose throughout the research process. In doing so, I allude to the important reflexions I made in contemplating my own position as researcher. In both data generation methodologies (consultations and focus groups) it was necessary to give thought to how the social and power dynamics would be acknowledged and managed. This is of significance given that power relationships are likely

to be magnified when research is conducted within the context of a school (Woolner, Hall, Wall, & Dennison, 2007). In any social dialogue, differing identities can result in multiple perspectives being valued according to a hierarchy. One way to overcome such hierarchy is to establish a climate in which diversity of views and opinions are recognised and valued (Cooper, Chak, Cornish, & Gillespie, 2013). Such a consideration was especially important when positioning pupils as participants in research.

5.1 Positioning pupils in research

Widespread across the critical literature examining pupil participation in research is the view that it is not enough to listen to or report on the perspectives of pupils. What is critical is the extent to which pupil participation precedes action and change (Cook-Sather, 2006; Holdsworth, 2000). 'Pupil participation' as a concept within research should however, be carefully considered. The focus should be on research *with* pupils; listening to their opinions should not become tokenistic (Dockett, Eienarsdottir, & Perry, 2011; Morrow & Richards, 1996; Tay-Lim, 2013). The four key dimensions outlined below assisted me to reach a meaningful understanding of how to plan my research with pupils:

- Space: create opportunities for pupils to express their views

- Voice: facilitate the expression of these views

- Audience: actively listen to these views

- Influence: respond accordingly to these views

(adapted from Lundy, 2007)

Pupil participation in previous educational research has arguably taken focus on performance and outcomes. Focusing on performance may reduce pupil participation whilst actively debating the value and processes of learning can be empowering for adults and pupils alike (Holdsworth, 2000). Therefore, pupils who were invited to participate in the research were not invited to do so based on their current academic level or any additional learning need. The current research aimed to encourage pupil participants to problematize,

debate and reflect on processes of thinking and learning. The introduction of focus groups (see Chapter 3, page 61) aimed to support such reflection.

It is vital at this point to draw attention to how findings in Chapter 3 are reported. As research question number 1 (outlined on page 67) specifically applied to pedagogy; it is likely that the teacher's accounts are referred to more frequently and that pupil accounts in light of this particular question may appear limited. However, the method of analysis (CGT) aimed to generate a theory of experiences related to thinking in the classroom across participants and over time. Mutual credence was offered to the accounts of pupils and adults in the generation of the suggested grounded theory (see page 81). In drawing distinction between 'pupil' data and 'teacher' data I would warn that one could be at risk of contributing to a 'romantic' notion of the child (Filer, Pollard, & Thiessen, 2002) resulting in possible tokenism and distorted accounts (Fielding & Rudduck, 2002; Hart, Espinosa, Iltus, & Lorenzo, 1997).

5.2 Researcher Reflexivity

Finally, I outline my stance as a reflexive researcher and attend to my own professional learning as a result of this research. A reflexive researcher critically reflects on how they have constructed, or assisted with the construction of, the knowledge gleaned from the research process (Guillemin & Gillam, 2004). In my attempt to co-construct a methodology suitable for exploring and enhancing the thinking of participants, I also paid significant attention to my role within this process, and the development of my own thinking. Crucially, I considered how I may have shaped the experience of TAPPs and other related activities for participants, through my data generation and analysis methodologies. The findings in Chapter 3 therefore reflect multi-dimensional processes of thinking and reflection which have undoubtedly been influenced by my role as researcher.

As a result of the above, it is necessary to attend to the professional learning that has occurred for me as a result of this research, from the perspective of a TEP and researcher.

5.3 Researcher Learning

Linking the current research to the practice of Applied Educational Psychology was an ongoing source of personal reflection. From the outset, I gave consideration to how the research methodology mirrored elements of EP practice. As a TEP approaching this work I recognised that I may have brought fresh insight to the perspectives of participants. The method of consultation was applied therefore, as a mechanism which could accommodate this dynamic.

Consultation can be described as a process in which *both* EP and service user bring expertise (Bozic, 2004; Larney, 2003) in order to reach new understandings (Bozic, 2004; Bozic & Carter, 2002; Cleven & Gutkin, 1988; Hymer, Michael, & Todd, 2002; Leadbetter, 2006). Previous research suggests that there is a unique synergy specific to the relationship between teacher and EP (Brown & Kennedy, 2011; Davies, Howes, & Farrell, 2008; Kennedy, Cameron, & Monsen, 2009) which is often observed in the context of consultation.

I would suggest that in the current research, the method of consultation generated a form of 'relational expertise' (Edwards, 2011); i.e. in bringing together aspects of individual expertise, an additional form of expertise was created. This relational expertise emerged in the shared space created through the research process. This space seemed to act as a 'boundary' in which the 'resources from different practices (were) brought together to expand interpretations of multi-faceted tasks' (Edwards, 2011, p. 34). Such reflections on my professional learning as a result of this research should be taken into account with other implications for EP practice as outlined in Chapter 3, page 81.

Chapter 3: How can pedagogical action support thinking in a primary classroom?

Abstract

Previous research suggests that thinking skills (TS) can be influenced and are not inherently fixed. A variety of interventions have been designed by researchers to enhance the thinking skills of pupils at school.

This study aimed to explore how pedagogical action might support processes of teacher and pupil thinking in a primary classroom. Attention was afforded to factors which might support and sustain the implementation of a TS intervention. One teacher and six pupils from a Year Four class participated in the study. Consultations and focus groups were conducted, during the implementation phase of the 'Think Aloud Paired Problem Solving' (TAPPS) intervention. Participant experiences of the intervention were explored through discussion and the completion of thinking templates.

Constructionist Grounded Theory was applied to the data generation and analysis process. General factors supporting thinking included the stance taken by the teacher, teacher responsiveness and teacher access to further support. Specific factors associated with the TAPPS intervention included particular organisation of pupil learning such as mixed ability pairings, and specific teaching strategies such as questioning. A suggested grounded theory outlines that there may be some general foundations that need to be in place before a more specific thinking pedagogy is applied. Educational Psychologists can continue to research this with teachers in their ongoing practice through reflective consultations.

1. Introduction

This chapter reports on findings from a small-scale study exploring pedagogical and learning experiences in the context of a thinking skills (TS) intervention; 'Think Aloud Paired Problem Solving (TAPPS). As Chapter One reported on previous thinking skills (TS) studies, this introduction outlines a brief political context to the research and sets out the conceptual framework.

1.1 Political Context

In September 2013, the Coalition Government published a new NC to be taught from September 2014. A key message is that although the NC will include *what* teachers will teach, it will not dictate to teachers *how* they should teach (Department for Education, 2013b). Pedagogical changes should, in theory, be designed by schools themselves (Department for Education, 2013a). This approach seems linked to the recommendations outlined earlier set out by (Rose, 2009) and (Alexander, 2010b) (see page 13). However, what remains unclear is how the teaching of TS will be incorporated expliticlty into the new curriculum.

Literature exists exploring the variety of pedagogical approaches teachers can take to their practice (as demonstrated in Chapter 1). Less attention has been paid to how teachers can be supported to make informed choices about their teaching. However, the current research acknowledges that complexity surrounds how teachers make decisions about their teaching, as outlined below.

1.2 Conceptual Framework

The conceptual framework for this research draws on three key areas of previous research:

- Teacher participation in interventions
- Teacher agency and pedagogic action
- Dialogue and group work

1.2.1 Teacher Participation in Interventions

As outlined in Chapter 1, previous research has led to an accepted view that TS can be influenced (Babai & Levit-Dori, 2009; Burke & Williams, 2008; Cattle & Howie, 2008; Dewey & Bento, 2009; Hu et al., 2011; Molnar, 2011; Oliver et al., 2012; Sanz de Acedo Lizarraga et al., 2009; Sanz de Acedo Lizarraga et al., 2010; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b; Trickey & Topping, 2004). Taking this view suggests that intervention can enhance processes of thinking.

Teachers in the UK education system today are likely to be familiar with a variety of government, local-authority or school-based interventions (Baines, Blatchford, & Chowne, 2007). However, seldom are teachers responsible for designing additional interventions for themselves. Jones (2008) highlights the importance of teacher participation when implementing interventions, suggesting: "if teachers are to help students become self-regulated learners, their own self-regulation has to be unleashed as well' (p. 322). However, it is recognised that teacher participation is part of a wider picture related to individual action and agency, which will now be discussed in further depth.

1.2.2 Teacher Agency and Pedagogical Action

As outlined in Chapter 2 (page 44), the current research is located within a socio-cultural perspective in line with Billett (2006)'s theory of relational interdependence. Briefly, this theoretical position is relevant as it permits and values some level of individual agency. Teacher agency is arguably part of a complex dynamic; shaping and shaped by societal and school structural and cultural factors (Lasky, 2005). One way that teacher agency can manifest is through pedagogical action. Edwards (2001) suggests that pedagogical action requires a teacher to manipulate the learning environment to help learners make further sense of the knowledge available to them. It is therefore necessary to consider how particular pedagogical action can support individual and social processes of thinking. Pedagogical action is captured here in research related to dialogue and group work.

1.2.3 Dialogue

Dialogue can be conceptualised as a collaborative model of communication involving two or more individuals in a process of mutual exchange (Markova, 1995), characterised by perspective taking and interactional feedback (Krauss, Fussell, & Chen, 1995). Dialogue as a concept is encapsulated in this research as a pedagogical process which may enhance participation and individual agentic action.

Teaching methods that support dialogue between pupils may comprise of paired or group work based activities (for example see Burke & Williams, 2008; Iiskala et al., 2011; Molnar, 2011; Shayer & Adhami, 2010; Topping & Trickey, 2007a, 2007b). However, as outlined below, achieving effective group and paired work can be an intricate process.

1.2.4 Group and paired working

Complexity exists surrounding the concepts of 'collaborative thinking' and 'group work' in the context of the classroom (Rojas-Drummond & Mercer, 2003). Many researchers in this field have taken a critical stance towards how group and paired work is implemented in the classroom. Evidence from empirical research suggests that many current grouping arrangements are just as likely to impede learning as they are to endorse it (for example, see Topping & Bryce, 2004) . Alternatively, it is claimed that enhanced learning *can* be achieved when the relationship between group size, interaction type and learning tasks are strategically planned for (Blatchford, Kutnick, Baines, & Galton, 2003). Additionally, it has been proposed that teachers should have access to support when implementing group activities (Blatchford et al., 2003).

In summary, group and paired work in the context of the primary classroom requires a) strategic planning, b) ongoing support for teachers and c) mechanisms to support social and individual agency. In the current study, these key points were addressed through the teacher's implementation of the 'Think Aloud Paired Problem Solving' (TAPPS) intervention.

1.3 Think Aloud Paired Problem Solving (TAPPS)

TAPPS involves reciprocal teaching to engage learners in cognitive processing (Johnson & Chung, 1999; Lochhead & Whimbey, 1987). The method involves two pupils who work together, taking turns in adopting roles of 'problem-solver' (PS) and 'listener'/'monitor'. The PS verbalises their thinking as they problem-solve, whilst the monitor observes the process. The aim is to make the PS aware of whether their own problem solving process is reasonable (Johnson & Chung, 1999).

1.4 Study Aims

The overarching aim of the current study was to explore how pedagogical action taken by the teacher supported processes of thinking within the primary classroom. Three subordinate aims are included in Box 4.

Box 4: Subordinate Research Aims

- To provide further insight into how teachers conceptualise thinking and what pedagogical practices they might use to support thinking

- To provide an opportunity for participants to review aspects of their thinking

- To consider how EPs might uniquely support teacher and pupil thinking

2. Method

This section includes participant information and describes the methodologies employed to generate data. The analytic process is also outlined.

2.1 Participants

The following participants were invited to take part in the research:

- One female teacher (NQT year)

- Six Year 4 pupils (between the ages of eight and nine years; 2 male, 4 female)

Through discussion with the teacher, six pupils were identified as meeting the criteria for participation outlined in Box 5.

Box 5: Criteria for Participation

- Pupils were receiving the TAPPs intervention as part of their whole-class teaching, taught by the teacher participant.

- Pupils would understand the basic verbal instructions presented during the group, but were not required to verbally express their experiences due to the non-verbal aspect of the study.

- Pupils demonstrated a range of academic abilities in an attempt to reflect the diversity of talents and aptitudes often observed in a typical primary classroom.

The study did not aim to provide generalisable outcomes; as stated by L. Cohen, Manion, and Morrison (2011) qualitative research values the uniqueness of social situations. The approach taken to validity was in line with that of Bradbury and Reason (2006) who suggest that participatory research should move beyond a search for the truth, towards an understanding of how research can generate change at institutional and individual levels.

2.2 Ethics

Information regarding the research and letters requesting parental consent were issued to all parents of pupils in the Year 4 class. Once parental consent was obtained, pupils were then provided with information about the study and were invited to consent (see Appendix 3). Similarly, the teacher participant was provided with information about the research and invited to provide her written consent (see Appendix 4).

Ethical approval was sought and granted through Newcastle University's Faculty of Humanities and Social Science Ethics committee. Professional ethical standards set out by the Health Care Professionals Council (2008) and The British Psychological Society (2010) were also adhered to.

2.3 Design

The design of the current study included two methods of data generation; teacher-researcher consultations, and teacher-pupil-researcher focus groups. Figure 1 depicts the

research process; and how the TAPPS intervention served as a mediating focus for reflection and discussion.

Figure 1: Research process
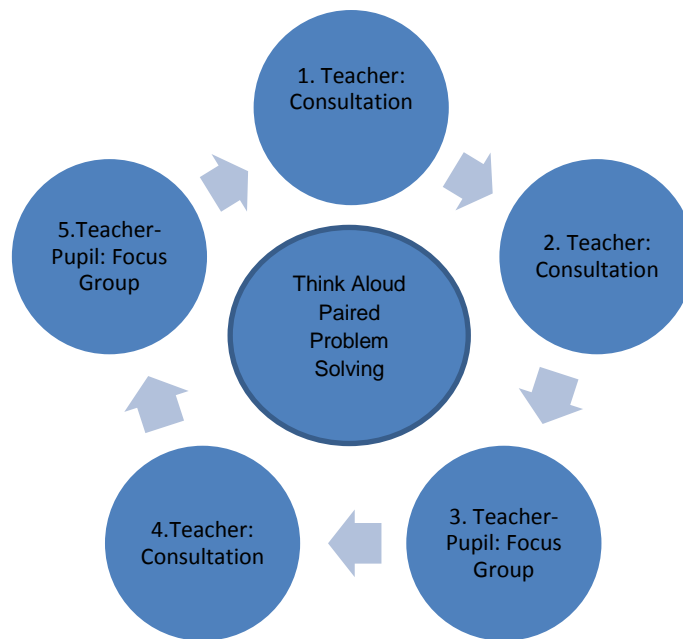
2.4 Teacher Consultations

A rationale for conducting consultations as part of this research is outlined in Chapter 2 (page 53). As part of this rationale, I explained that consultation as a process invites teachers and EPs to bring expertise, in order to reach new understandings, which can result in a unique synergy. Although not the central focus of the current research, I have included examples of discussions that took place during consultations in Table 9. This may demonstrate how I as a TEP and researcher expanded the teacher's thinking, and equally how she expanded my thinking.

 Prompt questions used to guide consultations are located in Appendix 5.

Table 9: Examples of talk based on facets of consultation

Both EP and Teacher bring expertise	Reaching new understandings	Unique synergy between EP and Teacher
Consultation 1, Lines 278-286: Teacher: 'How do you think it's best to introduce the approach to the children, like just jump straight in or introduce it in phases, in groups or a whole class?' Trainee Educational Psychologist (TEP): 'What's your thinking about that?' Teacher: 'I think that I could try and use it with a small group first and get them to work in pairs…I don't know, or maybe I could brief the whole class first?' TEP: 'Yeah, I mean you could do that anyway. Then, if you wanted to think about trialling it with small groups then you've told the whole class this is what we're doing. Or you could model it to the whole class, with some children?'	Consultation 2, Lines 40-46: TEP: 'So how did the children come to understand the different roles they would take?' Teacher: 'It was modelled to the children- yes it was modelled by myself and (Deputy Head). They have all had the opportunity to take both roles and they seem to be adapting to the roles well' Consultation 2, Lines 76-80: TEP: 'So is there anything that you have noticed about how your teaching may have changed or has altered when you've been doing this?' Teacher: 'I do think… I think I'm thinking more about their thinking.'	Consultation 2, Lines 202-205 TEP: 'How has that happened? Is that to do with you giving them examples of questions you might ask?' Teacher: 'Yeah I think it's probably both, I think it's me modelling and giving examples; they know what to ask and how to tackle problems a little bit more' Consultation 3, Lines 485-490: TEP: 'It would be interesting to see how that's worked out in that class; I know there's a diverse mix of children in that class isn't there. Is that like you not wanting to put a limit on their thinking? But then mediating when appropriate?' Teacher: 'Yeah like intervening when the time is right, like when they've already had an element of challenge.'

2.5 Focus groups

Discussion was supported between participants through focus groups (FGs). Within FGs, participants were supported to reflect on their experiences through both collective discussion and individual activity (see page 62 'Thinking Templates').

Criticisms of FGs warn of their possible naïve idealism. In particular, how difficult it is to achieve genuine participatory and mutual dialogue (Cooper et al., 2013). Furthermore, abilities to think aloud, share thoughts and engage in discussion should not be universally assumed (Barnes, 2008). In some situations, group discussions may benefit from adopting a transparent framework which supports productive dialogue (Mercer, 2000).

2.6 Exploratory Talk

'Exploratory talk' (Barnes, 2008; Mercer, 1995; Wegerif & Mercer, 1997) proposes a framework to support talk. Figure 2 outlines the framework, which can be used in both classroom based activities and research.

Figure 2: Principles of Exploratory Talk, adapted from Mercer (1995) and Wegerif and Mercer (1997)

1) All relevant information is shared

2) The group seeks to reach agreement

3) The group takes responsibility for decisions

4) Reasons are expected

5) Challenges are accepted

6) Alternatives are discussed before a decision is taken

7) All in the group are encouraged to speak by other group members

Figure 2 was shared at the beginning of each FG and displayed throughout. The principles were explained in more depth to support pupil understanding. FGs lasted for between 45-60 minutes and participants were reminded of their right to withdraw at any stage during their involvement.

2.7 Thinking Templates

'Pupil views templates' (PVTs) (Wall & Higgins, 2007; Wall, Higgins, Miller, & Pickard, 2006; Wall, Higgins, & Smith, 2005) were used to support discussion and stimulate individual reflection. PVTs aim to support processes of thinking in relation to a specific aspect of learning; in this case TAPPS. The templates include a cartoon representation of the learning activity and pupils are asked to reflect on 'internal' and 'external' aspects of their experience. The internal aspects are represented by a 'thought bubble' and pupils are asked to note down their individual thoughts, feelings and ideas about the activity. The external aspects are represented by a 'speech bubble' and pupils are asked to note down examples of what they might tell others about the activity. Figure 3 depicts a PVT which was completed during

the second focus group. Examples of prompt questions used to complete the PVTs are included in Appendix 6.

Figure 3: Example of completed Pupil View Template
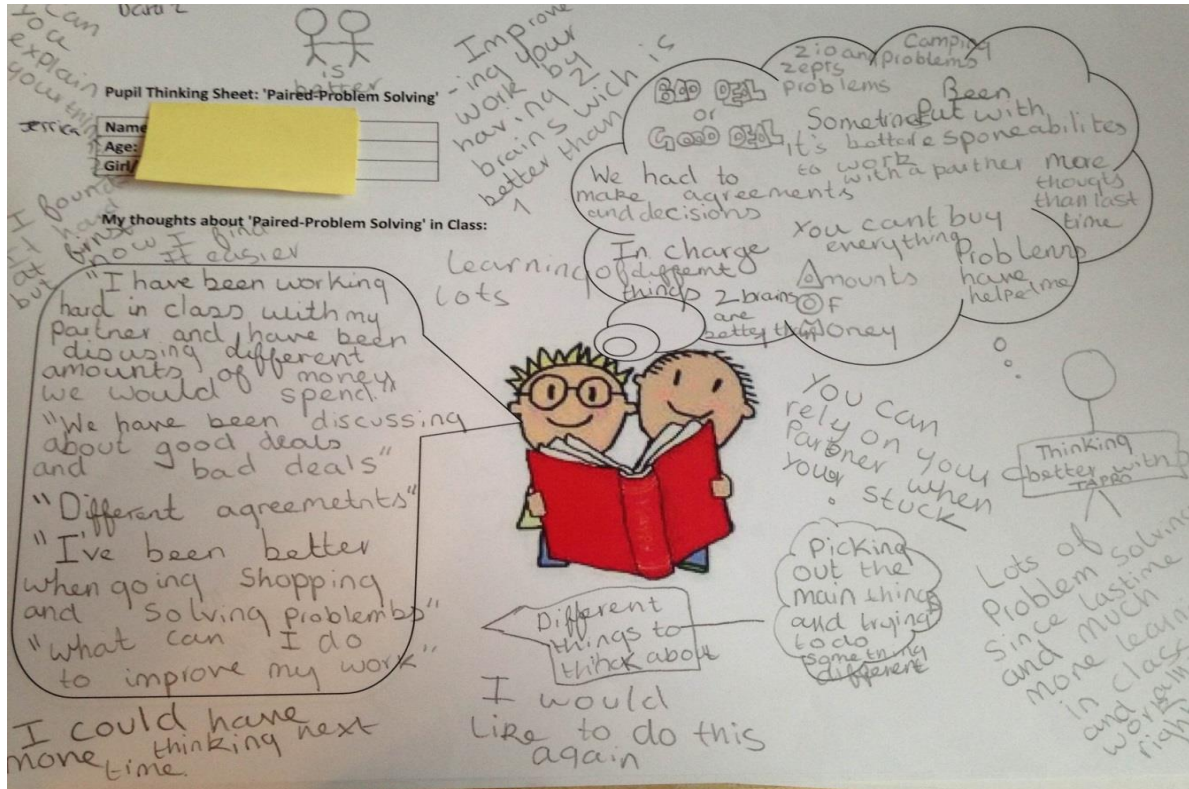
In addition to the use of PVTs, a similar mechanism was developed which aimed to support teacher thinking and reflection between data generation sessions. 'Teacher Thinking Templates' (TTTs) were designed using a similar format to the PVTs as depicted in Figure 4.

The templates provided a focus for discussion and reflection during each consultation session. The teacher was invited to experiment with how the TTTs could support her thinking and reflections between research sessions, thus providing a tool for the teacher to 'reflect in action' (Schon, 1987) . Examples of prompt questions used to support both teacher-researcher consultations and the completion of the TTTs are located in Appendix 6.

Figure 4: Example of a completed Teacher Thinking Template
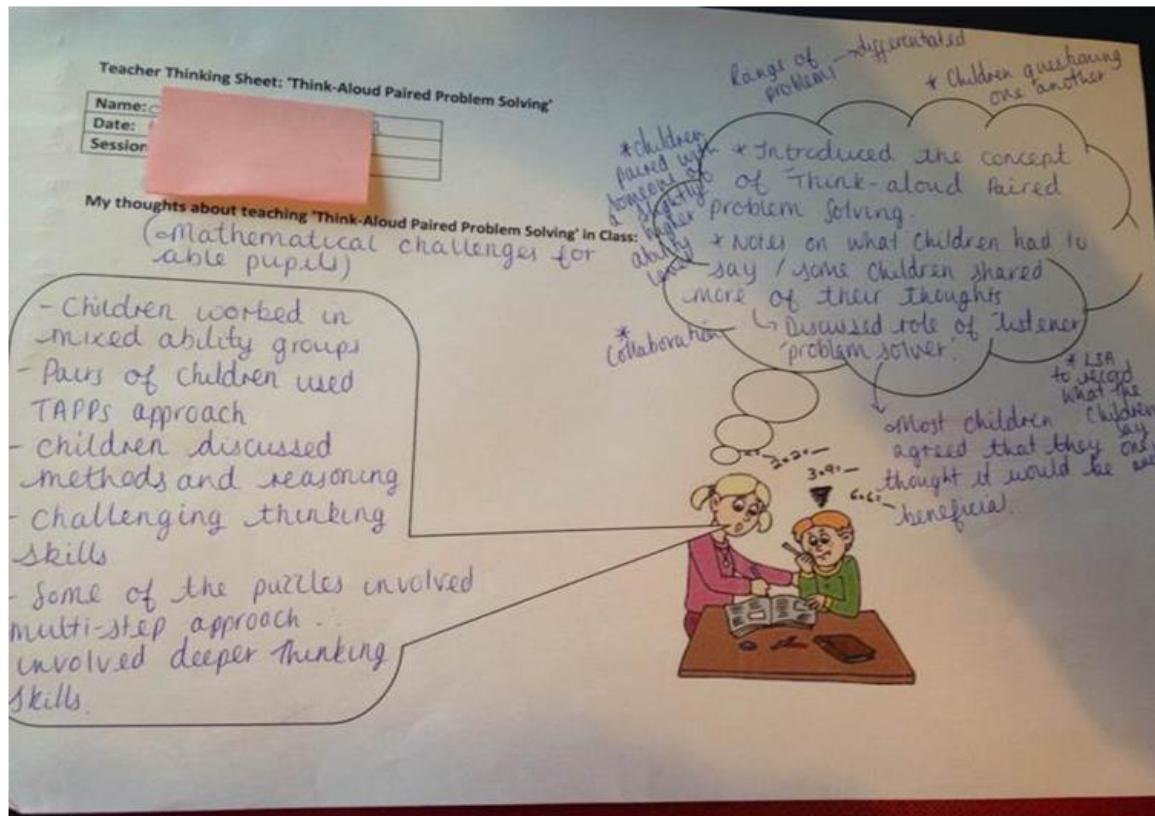
2.8 Analytic Framework

The chosen method of analysis was constructionist grounded theory (CGT) (Charmaz, 2000, 2006) (see Chapter 2 page 49). The stages of the analysis process and how these were incorporated into the overall design of the study are set out in Figure 5 .

Consistent with CGT, comparisons were made between data generated across sessions and between participants. Conversations were transcribed and a process of initial coding was applied, providing descriptive labels to distinct features of an experience. Similarly, data included in the templates were also subjected to coding. Connections between the codes and their linked concepts were labelled as 'axial codes'. This process of focused coding was based upon the identification of similarity and difference (Dey, 1999). Theoretical categories were formed by grouping instances which appeared to share central characteristics (Willig, 2008).

Theoretical sampling occurred between each data generation session. This required the construction of initial ideas about the data based on apparent links between data codes.

Initial construction guided further empirical enquiry and shaped the focus of subsequent consultation and focus group sessions. Theoretical saturation (when gathering fresh data ceases to reveal new theoretical insights) was achieved after three teacher consultations and two FGs. Early analysis of the data encourages the probing of a suggested theory, supporting the researcher to identify when theoretical saturation is reached (Fassinger, 2005).The process of 'memo writing' throughout the study documented the development of theoretical categories and eventually formed the basis of the final grounded theory (see Appendix 7 for an example audit trail which demonstrates the process of coding and memo writing).

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                    ┌─────────────────────────┐
                    │    Research questions    │
                    └─────────────────────────┘
                                 │
                    ┌─────────────────────────┐
                    │    Literature review     │
                    └─────────────────────────┘
```

Data generation: Teacher consultation 1. Initial line by line coding

Introduction of Teacher Thinking Sheets and Pupil Views Templates

Data generation: Teacher consultation 2, Focus Group 1. Initial line- by- line coding.

Focused coding

Initial memos raising codes to tentative categories

Data generation: Teacher consultation 3, Focus Group 2. Initial line- by- line coding.

Focused coding

Advanced memos. Refining conceptual categories

Theoretical memo writing

Refining concepts

Adapting theoretical concepts

Sorting memos, diagramming concepts, theoretical saturation

Writing draft theory

TAPPS implemented in the classroom and applied throughout. TTSs and PVTs used to support learning and research based discussions
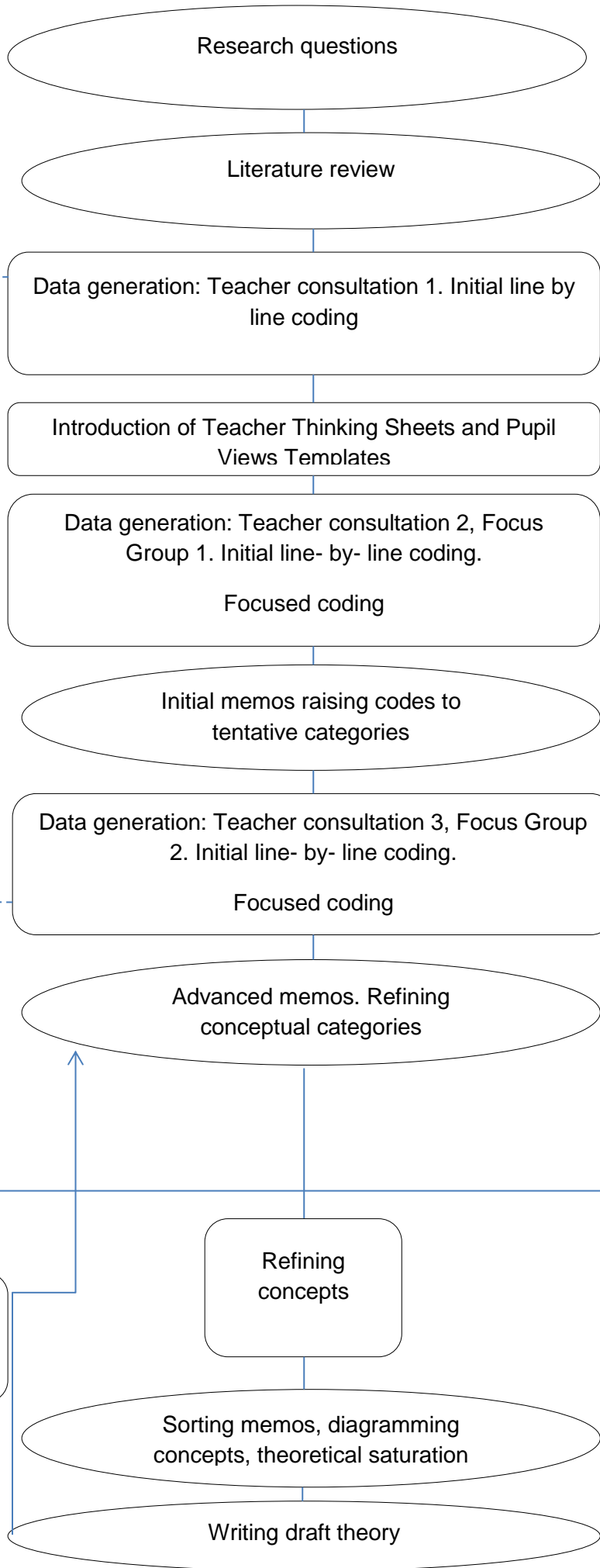
Constant comparative methods

66

Figure 5: Analysis Process & Study Design

3. Findings

The analysis of transcripts and templates sought to identify general pedagogical factors which seemed to support thinking in the classroom, and specific pedagogical factors associated with the TAPPS intervention. This section outlines the findings in relation to the research questions outlined in Box 6 whilst attending to relevant theory and previous research.

Box 6: Research Questions

How can pedagogical action support thinking in a primary classroom? Particularly in terms of:

1. How general pedagogical factors supported participant thinking;

2. How specific aspects of the TAPPS intervention supported participant thinking

3.1 Findings Set 1: General pedagogical factors supporting thinking

The first set of findings was generated through teacher consultation sessions[9] and explored factors which appeared to support the implementation of the TAPPS intervention.

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[9] These findings were therefore generated through teacher participant data only and are labelled 'P1' (Participant 1)

Figure 6: Teacher Action: axial codes and supporting quotes

Core Category: Teacher Action	
Axial Codes	Supporting Quotes
Teacher Responsiveness and Flexibility	P1: "I think I'm adapting to it as we go really throughout the process" P1: "...and like I keep trying different things like I pair the children to see what's working best" P1: "So I think really in a way it's about experimenting and seeing what works best for your class" P1: "It's kind of like balancing it in a way; you don't want to do too much because they might switch off." P1: "But I think it's been nice this year to try out different things and to reflect upon that, to see what works and I think it's about what children you have in the class; what works with one group maybe wouldn't work with another group."
Teacher Stance	P1: "In a way I think I have taken a little bit of a step back and walked round the groups, listened in to conversations and it's been nice to spend that time listening to how children are thinking." P1: "I was actually going to tell the whole of the class but then I thought no, hold back, and see if they can spot that." P1: "If a teacher was to just say 'that's wrong' that's obviously going to make the children think negatively about themselves and just think 'well I can't approach this task' and they might carry that on to the next lesson." P1: "I think in a way it's nice for the children to realise their mistakes instead of me just saying 'that's wrong, check it' so in a way I do think it's strengthened my relationship with the children in terms of challenging them."
Teacher support factors	P1: "But obviously it's been like a new thing to start, like I have had to go and speak to (deputy head) and say what's the best way to start and do you think I should do this." P1: "Well, the first session both (deputy head) and I worked in the class together, it was my PPA time but we went in together, and we'd planned together lots of different problem solving activities." P1: "I think we are quite lucky because with us being quite a small school so everyone's really supportive so I'll go to (deputy head) or other teachers in the school and say 'what do you think about this' and I've already said to the year 5 teacher like if she wants to use any of the stuff then that's fine she can just adapt it." P1: "I've been putting all my thinking into the thought bubble, and here I thought it would be easier…to put the lesson and really how I differentiated the lesson and the different activities"

3.2 Core Category: Teacher Action

One core category was identified; 'Teacher Action' which developed through three associated axial codes: 'Teacher responsiveness and flexibility', 'Teacher stance' and 'Teacher support factors'. Figure 6 presents some quotes that support the development of the category and associated axial codes.

3.2.1 Axial Code: Teacher Responsiveness and Flexibility

During consultations, the teacher reported on her flexible and responsive approach to teaching (see Figure 6). Yet, at other times the teacher seemed to place value on the structured aspect of TAPPS. During the first teacher consultation she reported:

D1[10], P1: "... but if we are doing it as a structured approach then hopefully we will see a greater improvement."

Paradoxically, a structured approach may actually permit some level of flexibility. The teacher may have felt reassured by the boundaries of the intervention, yet as her confidence began to flourish, her levels of flexibility and responsiveness may have been enhanced. Previous research suggests that teachers benefit from having adequate guidance (Aubrey, Ghent, & Kanira, 2012), and structure and scaffolding (Topping & Trickey, 2007) when implementing interventions. Yet, according to Jones (2008) and Green, Condy, and Chigona (2012) teachers also require autonomous opportunities to explore wider issues relating to thinking skills.

One psychological theory which may explain this requirement for a balance between structure and autonomy derives from Self Determination Theory (e.g. see Deci & Ryan, 2000; Deci & Ryan, 2004; Ryan & Deci, 2000) and is evidenced in empirical research specifically focusing on the impact of pedagogical style on pupil learning. In their work, Jang, Reeve, and Deci (2010) found that the provision of *autonomy support* and *structure*,

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[10] Direct quotes are preceded by the point in time in which data was generated, e.g. D3 represents the third teacher-researcher consultation.

although distinct concepts, are equally important for pupil engagement within learning. The current research seems to take this finding further, proposing that teachers also require autonomy support and structure, especially in their pursuit to implement new pedagogical methods.

3.2.2 Axial Code: Teacher stance

The quotes included in Figure 6 demonstrate how the teacher experienced a shift in her role over the course of the intervention, towards more of an observer of pupil thinking, and less of an intervener. Previous research supports the notion that adopting a thinking pedagogy can facilitate a shift in stance of the teacher from a 'distributor' to a 'facilitator' of knowledge (Oliver et al., 2012; Reznitskaya et al., 2012; Thwaites, 2005). It is suggested that a change in interactional style can lead to increased pupil participation in the classroom (Brown & Kennedy, 2011); and the TAPPS intervention appeared to offer a structured approach to engaging in various interaction styles (for example paired working and role taking).

3.2.3 Axial Code: Teacher support factors

From the outset, it seemed important to the teacher that TAPPS would be coherent with the wider school context and ethos. This coherence seemed to support the teacher in implementing the intervention in accord with existing school approaches to teaching thinking. Specifically, the teacher placed value on the support of her colleagues (as demonstrated in Figure 6). She commented particularly on the advice she sought during the initial implementation period; the benefits of co-working with other members of school staff, and opportunities to engage in on-going review:

The need for teacher support when designing and/or implementing an intervention appears crucial and is outlined in a wealth of TS studies (Endler & Bond, 2008; Jones, 2008; McGuiness, 1999; Trickey & Topping, 2004). However, findings from this study along with suggestions from Burke and Williams (2008) state that support must be ongoing and dynamic, and available within the context of existing school resources. Opportunities for

teacher reflection are not just required during the initial implementation phase, but also as teachers become more reflective and confident in their practice (Dewey & Bento, 2009).

However, the challenges and complexity of teaching in a primary classroom may limit opportunities for ongoing teacher reflection:

D2, P1: "With that much going on in school, so many different lessons, three weeks down the line, you don't tend to actually remember what you were actually thinking at an exact point- you'll remember the outcome of what the children have achieved and you'll actually have that on record, but in terms of your own thoughts, it's harder to track back your own thinking at that time."

Green et al. (2012) warn that concerns reflecting the 'realities of local classrooms...cannot be ignored' (p. 327). In an attempt to address such concerns, the current study offered two distinct opportunities to support teacher thinking; teacher consultations and Teacher Thinking Templates. Both aspects were identified as supporting the teacher to develop her thinking and practice in relation to TAPPS:

D3, P1: "it's been nice to have someone who has the time to share my thoughts because it's so busy in school it's not always the case that you get an allocated time to sit and think about your own thoughts."

The dynamic and unrestricted use of the TTTs further supported the teacher to use them in a way which was supportive of her particular practice (see Figure 6). Previous research suggests written reflections support teachers to gain a clear picture of their experiences (Boud & Walker, 1992; Mezirow, 1990), providing a 'tangible representation' of their teacher identity (Chitpin & Simon, 2009).

3.3 Summary of general pedagogical factors supporting thinking

General pedagogical factors that a) supported the implementation of TAPPS and b) developed as a result of engaging in TAPPS have so far been discussed. It appears that

implementing a structured approach, such as TAPPS, may initially support teacher confidence towards a thinking pedagogy. Yet, teacher flexibility and responsiveness is equally important for engaging in reflection around wider issues relating to thinking. Furthermore, adopting a thinking pedagogy can support a shift in teacher stance towards more of a 'facilitator'.

To successfully incorporate a TS intervention such as TAPPS into a specific teaching context, teachers may benefit from support from colleagues and the opportunity to engage in a process of review. Additionally, the current study suggests a new mechanism for written teacher reflection through the use of Teacher Thinking Templates.

3.4 Findings Set 2: Specific TAPPS factors supporting thinking

The second set of findings comprises of data from teacher and pupil participants; generated through consultations, FGs and thinking templates. The findings relate to the factors specific to TAPPS which were found to support the thinking of participants. Teacher and pupil data are brought together here to construct the grounded theory; teacher and pupil data are not reported separately as doing so may risk representation of tokenistic or stereotypical accounts (as outlined in Chapter 2, page 52) . Yet, distinction is drawn where contrasts arise so as not to dilute participant opinion into the overall theory.

The specific factors associated with the TAPPS intervention that appeared to support thinking included two core categories: adopting particular 'Learning Arrangements' and the use of specific 'Teaching and Learning strategies'. The particular learning arrangements appeared to include the use of more paired working and mixed ability groupings. Teaching and learning strategies included the use of questioning; and encouraging pupils to make links between maths activities and 'real life'.

These areas will be now be explored in further depth.

3.5 Core Category: Learning Arrangements

This core category was formed from two axial codes 'Paired Work' and 'Mixed Abilities'.

Figure **7** presents supporting quotes to demonstrate the development of the axial codes and the overall core category.

3.5.1 Axial Code: Paired Work

As outlined on page 58, the TAPPS intervention required pupils to work in pairs to take on different roles within problem solving tasks. Paired work was identified as an important aspect supporting pupil and teacher thinking. Yet, some difference was observed between participants' accounts. The teacher appeared to report on how paired work helped pupils to complete functional aspects of tasks. When describing one particular TAPPs activity, she explained that paired working appeared helpful in terms of breaking tasks down and place keeping:

D2: "It involved lots of thinking, but working together they were able to think of each individual step. I think, when they are working independently, they lose where they are up to"

Figure 7: Learning Arrangements: axial codes and supporting quotes

Core Category: Learning Arrangements	
Axial Codes	Supporting Quotes
Paired Work	*P1: "But I think having somebody next to them, somebody to work collaboratively with; I'm starting to see them developing strategies that approach more complex problems"* *P2 "Yeah, because if you don't know the answer they (partner) give you a bit of support"* *P3: "I have been thinking about (my partner's) ideas as well as mine"* *P5:"When you are working by yourself, if you are stuck your partner can't help you while he is working his out, but he can help you when you are working together"*
Mixed Abilities	*P1: "I'd paired them so that they were in their groups but so that each pair included somebody of a higher level so that was still challenging their thinking; the higher ability child with the lower ability child so I'd looked at all my levels and paired them in a way so that there was still someone like a little bit higher."* *D2, P1: "And I keep swapping the class around so that they aren't working with the same partners, so that they are working with different partners to see how*

	they work together."
	P1:"I've noticed a huge improvement with the lower ability children in my class because they are working together, and I can see the benefit that it's having"

In contrast, some pupils appeared to focus their reflections based on the social and interactive aspects of paired working. They appeared to place importance on who they were working with and how this influenced their performance within tasks:

 FG 1 P4: *"Well I'd switched tables and I was working with Tim[11] and I think Becky but then I think I work better with Tim because we reach different agreements"*

FG 2, P6*: "I would say the best thing about TAPPS is working with your friends and having more thoughts"*

Participants raised important points about how social dynamics may influence the experience of paired working in a negative way:

FG1 P3*: "When I struggle, I want to tell someone, but I don't…"*

In addition, pupils also evidenced their awareness that TAPPS required the management of differing opinions:

FG1 P3*: "Some people don't have the same ideas to your partner"*

FG1 P4*: "Even if there's two of you, you might not always get the right answer"*

Previous literature has attended to cognitive processes and effects associated with group and paid working (Baines et al., 2007; Gillies, Nichols, & Burgh, 2011; Iiskala et al., 2011; Schmitz & Winskel, 2008). Yet, as findings from the data would suggest, relational aspects of paired and group work are also important. Research which has focused on such aspects has taken a focus on the effect of friendship on task performance in paired/group work (e.g.

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[11] All names used have been altered to protect participant and non-participants' anonymity

Kutnick & Kington, 2005). However, the findings from the current study also reflect the struggles pupils experienced whilst working with the 'other' (Markova, 2003).

Pupil participants seemed confident to share their contrasting and sometimes negative accounts of the TAPPS intervention. This contribution from pupils should not be underestimated; as noted by Cook-Sather (2006) if pupils perceive their views to be illegitimate or subject to disapproval, they may often respond with 'silence' as an informed choice. The particular stance taken by the teacher outlined on page 70 may have reassured pupils that their comments were legitimate and valued (Fielding & Rudduck, 2002).

3.5.2 Axial Code: Mixed Abilities

Throughout, the teacher demonstrated her ongoing interest in developing a teaching approach which could cater for a wide range of academic abilities. Prior to the implementation of TAPPs, she described her response to managing a class with a range of learning abilities as 'differentiation':

D1, P1: ..."there's quite a range (in the class) … so when I plan lessons the differentiation needs to be quite spot on..."

As the intervention progressed she described her surprise as she began to experiment organising pupils into mixed ability groups. Such surprise may reflect the view that group work is only productive for more academically able pupils (Baines et al., 2007; Thwaites, 2005) (as also noted in Chapter 1, page 39).

D1, P1: "Sometimes I put them in mixed ability groups… it can be quite surprising that the children who are lower ability are the ones who are quite hands on."

Ongoing experimentation and observation of how pupils responded to various ability groupings helped the teacher to notice a mechanism which supported the apparent diversity in the classroom:

D2, P1: "I'd paired the children so that the children were with someone who was slightly higher ability, but only slightly."

The above quote mirrors a view outlined by Iiskala et al. (2011) who suggested that high-level collaborative processes are more likely to occur when pupils are working at a similar proficiency level. This perspective was evidenced in research by Topping and Bryce (2004) examining the effects of peer-tutoring on thinking skills. It may be that if there is a considerable difference between proficiency levels, then tutors become disengaged. Dillenbourg (1999) claimed that effective collaboration is achieved only when pupils are able to establish a shared goal and conduct similar actions, again suggesting that similar proficiency levels may be beneficial.

Such a perspective appears in contrast with Vygotskian theory claiming that learning takes place during interaction with a more knowledgeable participant (Schmitz & Winskel, 2008) who is able to provide support and *extend* learning (Vygotsky, 1978). It may be that pairing pupils at a similar proficiency level, whilst still providing a slightly more knowledgeable other is an effective mechanism for paired work (similar findings were observed by Fawcett & Garton, 2005)

3.6 Core Category: Teaching and Learning Strategies

The core category 'Teaching and Learning Strategies' encompassed the axial codes 'Making Links to Real Life' and 'Questioning'.

Figure 8 presents supporting quotes to demonstrate the development of the axial codes and overall core category.

Figure 8: Teaching and Learning strategies: axial codes and supporting quotes

Core Category: Teaching and Learning Strategies	
Axial Codes	Supporting Quotes
Making Links to Real Life	P1:" It's making the children realise, why are we doing this, what's it relevant for and why do I need to know this" P1: "But, in a way I think it's making it more real life for them and how they can tackle problems, like when they leave school" P3: "When I go to the shop I'm not very good at adding the price up but now I've started the problem solving I'm better at it" P1: "... it was a maths problem we were working on the other week, I'd put lots of different flowers on the board and I told the children that they were in charge of planning and organising the flowers for my wedding next year and the children love, anything that you can put into a real life" P4: "Sometimes when I've been going to the shop with my mum, she has a list and she says this is what I want- she says try not to spend over ten pounds and she leaves me in charge to go and get the things, and sometimes when I go there I haven't been very good at my adding up, but now that I've started doing the TAPPs it's helped me get better and see if it's a good deal or a bad deal."
Questioning	P1:" I think also, through effective questioning you can understand whether they have grasped the concept" P5: (provides examples of questions used in TAPPS): 'Is that the right answer? Check that again. Can you explain your answers and your thoughts?' P4: (provides examples of questions used in TAPPS) "Is that the right answer? Are you right? Can you help me?" P1:"So I used lots of open ended questions- what would be the best value? Can you explain to me how you have got that? So the children are starting to think more than just yes and no..." P1:"I've used questioning like 'can you think of any other strategies you might want to use?' or 'are there any other ways that might save you time?"

3.6.1 Axial Code: Making Links to Real Life

The teacher hoped that through TAPPS, pupils would become more aware of overarching

learning objectives through making activities linked to real life situations:

D1, P1 :(its) "making them want to think about how they can progress not just 'we're doing

this' and making links to real life approaches"

Higgins, Baumfield, and Leat (2001) claim that in teaching thinking, activities must have a clear purpose and connect to other aspects of learning. Yet Webb and Treagust (2006) claim that this is seldom observed in many UK classrooms, and that pupils often lack a shared understanding with the teacher of many of the activities in which they are presented with. Green et al. (2012) assert that pupil motivation can be enhanced if pupils perceive topics to resonate with their own lives. It seemed that in the current study, the teacher made efforts to connect TAPPS activities to relevant, every-day concerns:

D2, P1:"We have talked a lot about making estimations and how that's so important in life so for example if they go to the supermarket they know how much roughly to spend"

Some pupils reported on the development of their estimation skills and how exactly this was important in the context of their everyday lives:

FG2, P2:"When I go to the shop I'm not very good at adding the price up but now I've started the problem solving I'm better at it"

Arguably, in focusing on equipping pupils' with skills for the future; pupils are positioned as 'adults-in-the-making' (Skolnick, 1975; Thorne, 1987). A focus on 'deferred outcomes' (Holdsworth, 2000, p. 352) conceptualises pupils as citizens of the future, rather than citizens of the present (Wyn, 1995) They are viewed as in a process of becoming (Christensen & Prout, 2002) and their experiences of the 'here and now' may be marginalised. In the study, current experiences *and* the possibilities of future skill development were considered to be mutually important.

3.6.2 Axial Code: Questioning

The mechanism of questioning seemed to support pupils to develop their thinking, and the teacher to 'access' such enhanced pupil thinking. Questioning therefore in this respect is a mutually beneficial process; allowing the teacher insight into the realms of pupil thinking and enabling pupils to demonstrate additional accomplishment which may have otherwise remained unearthed:

D1, P1:" I think sometimes during lessons you'll realise that some children who you think are not thinking… through questioning you'll be able to see that they actually are thinking about what your delivering and what the lesson is based on."

Questioning as a pedagogical approach to teaching thinking has been well scrutinised in the wider literature. Although questions can be viewed as a significant feature in a teacher's armoury (Myhill & Dunkin, 2005); it is claimed that teachers do not regularly use questions to support and extend learning. Instead, questions are often used to control and steer class discussions (Watts, Alsop, Gould, & Walsh, 1997; Wood & Wood, 1988). In the current study it appears that the teacher observed the possible benefits of questioning in relation to supporting thinking. Questioning as a means to accessing pupil thinking has been observed elsewhere (Wilks & Emery, 1997; Zolnar, 1999) and has been linked to enhanced teacher esteem and creativity.

Baumfield (2006) claims that a shift in teacher questioning can be one of the first, tangible changes to teacher practice during engagement in TS approaches. The current findings appear to add to research by Baumfield (2006) as pupils were also found to use more questioning. Pupil questioning may have been observed due to the structure suggested by the TAPPS intervention which involved paired working and the opportunities to adopt distinct roles.

3.7 Summary of specific TAPPS features supporting thinking

Paired working reportedly helped pupils to complete functional aspects of TAPPS activities. Yet, some pupil participants reported on the social and interactive aspects experienced within paired work. Ongoing experimentation of how to group and pair pupils led the teacher to merge two seemingly distinct theoretical perspectives; a slightly more knowledgeable other was paired with a pupil of a similar proficiency level.

The teacher connected TAPPS activities to every-day experiences. The process of questioning reportedly supported both pupil and teacher thinking. Changes in discussion and interaction styles may account for, in part, the shift in teacher stance examined earlier.

4. Concluding Comments

In this final section conclusions are drawn from the current study, and implications for the practice of EPs are discussed. Additionally, the limitations of this study will be highlighted alongside possible directions for future research.

4.1 General Conclusions

This study applied CGT to explore pedagogical factors supporting thinking in a primary classroom. Attention was afforded to specific pedagogical factors associated with a TS intervention, alongside more general factors which appeared to support and sustain a thinking skills pedagogy. The suggested grounded theory (outlined in Figure 9) suggests that constructing a thinking skills pedagogy may involve a multi-stepped approach, for example. general pedagogical factors such as the flexibility and responsiveness of the teacher, the stance she took towards her teaching and her access to support, were in existence (to some degree) prior to the implementation of TAPPS. Arguably, such factors enabled the teacher in this context to be in a position to consider employing an intervention such as TAPPS. Learning arrangements, such as paired working and mixed abilities seemed to precede more specific teaching and learning strategies, such as questioning and making links to real life.

 Whilst it is suggested that general pedagogical factors and learning arrangements may platform specific thinking skills teaching techniques, it is also proposed that all pedagogical action in the context of a classroom may be in a state of flux. Figure 9 proposes that initially, general pedagogical factors could precede planning for specific learning arrangements, and that as a result, specific teaching and learning strategies may be more firmly embedded. It also suggests that once embedded, the teacher and pupils may return to earlier stages of construction.

Figure 9: Suggested Grounded Theory: General and Specific Pedagogical Factors Supporting Thinking Skills
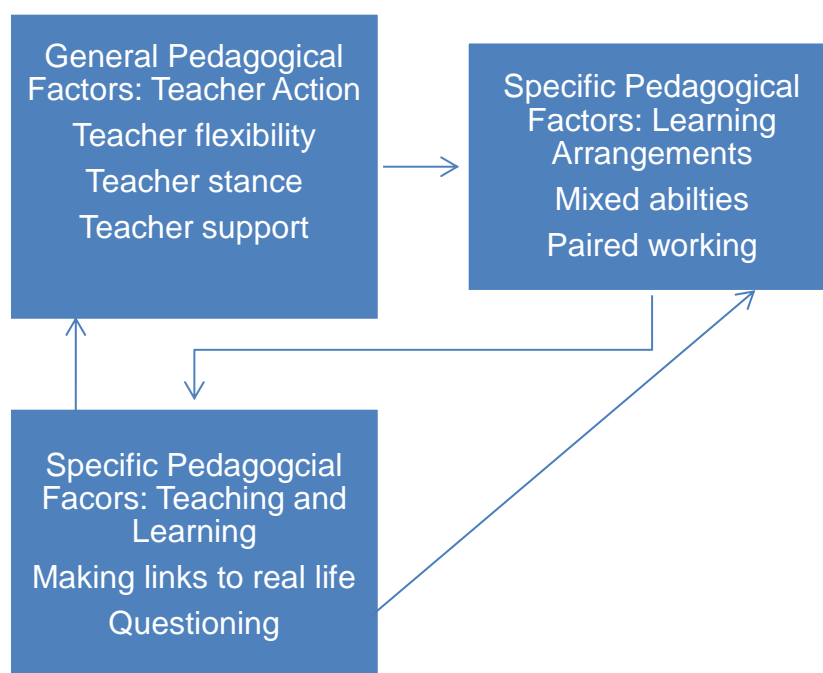
4.2 Implications for EP practice

The current research illustrates how EPs can contribute to teacher and pupil development; applying their skills in consultation to educational research and working collaboratively with school staff to co-construct mutually beneficial projects (as outlined in Chapter 2, page 46 **Error! Bookmark not defined.**).

The findings from this research can be used to affect EP practice specifically in relation to work with pupils and teachers in the context of teaching and learning:

4.2.1 Teacher Learning

The current research suggests that providing opportunities for reflection is beneficial for teacher learning. EPs may use their skills in consultation to explore aspects of teacher practice, which may in turn impact on teacher thinking and pedagogical action.

The development of the TTTs suggests that a brief, written document might support teachers who implement specific interventions. These may be particularly beneficial when left to the

individual teacher to complete according to their own agendas. Using the TTTs as a scaffold to mediate joint reflection within consultations could be applied to other concerns/aspects of practice that a teacher may bring for discussion with an EP.

4.2.2 Pupil Learning

The current research suggests that a relational approach should be adopted when organising paired or group working. If relational issues are not explicitly considered by teachers, differences between pupils may ultimately remain hidden and could inhibit learning (Baines et al., 2007; Fawcett & Garton, 2005). EPs could provide the chance to raise and discuss these issues with teachers during consultation. In addition, EPs might offer and/or support training in advanced group work skills, drawing attention to the principles of exploratory talk (Mercer, 1995).

PVTs seemed to provide pupils with an opportunity to contribute to the research process without the requirement for speech or using written words. EPs could make further use of the templates, either in their work with individuals or groups of pupils to explore their experiences of learning. The templates could contribute to inclusive practices as they appear to provide a mechanism of participation for pupils who may find it difficult to provide a verbal response.

4.2.3 Possibilities for pupils in research

The current study took a distinctive and critical approach to the participation of pupils in educational research. Participation was conceptualised as a mechanism for change, not to obtain tokenistic or manipulated accounts of pupil experience (Hart et al., 1997). The current research suggests that pupils may benefit from being part of a process which reflects on aspects of education. Such an implication is particularly relevant given the political changes and curriculum reform outlined on page 55.

5. Limitations and further research

As with all CGT studies, the findings of the current study should not be generalised to other primary classrooms. It is hoped that this study will raise further interest in this area and allow for further exploration of how TS are conceptualised and incorporated into wider pedagogies for thinking; in both primary and secondary schools. A small sample was used in the current study in order to capture the depth of, rather than a range of experiences. However, it is recognised that the data generated by the pupil participants may not have represented the experiences of the whole class.

Baumfield (2006) supports the notion of conducting research in the context of the classroom, but warns that often there is little space or time to think and reflect. Therefore, although the teacher consultations and FGs may have provided this for the purpose of the current study, they may prove difficult to sustain on a long term basis. Additionally, further research is required into how PVTs and TTTs could support ongoing reflection for pupils and teachers in the complex context of the classroom.

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7. Appendices

Appendix 1: Detailed list of inclusion and exclusion criteria

Inclusion Criteria[12]	Exclusion Criteria[13]
1. Studies evaluating the impact of the implementation of thinking skills interventions on pupil's cognitive achievements. (For the purpose of the current review, I applied the working definition of 'thinking skills interventions' adopted by Higgins et al in the 2005 meta-analysis: '*thinking skills interventions are defined as approaches or programmes which require learners to articulate and evaluate learning strategies and/or which identify specific thinking processes that are amenable to instruction in order to improve teaching and /or learning*' I adopted the impact criteria outlined by Higgins et al (2005) in order to simply include *'self regulation, meta-cognitive functioning, and/or pupil attainment'*. 2. Studies set in a school/ schools and/or any educational setting 3. Studies written in/translated into English 4. Studies which were conducted/published in the last 10 years 5. Studies which used a control/comparison group AND a pre-post test design AND contained data on at least 10 pupils 7. Studies including empirical research data related to the effect of such programmes on pupils' cognitive achievements 6. Studies which were NOT included in the Higgins et al (2005) meta-analysis of 'thinking skills interventions', OR Trickey & Topping's (2004) systematic review on 'Philosophy for Children', OR Garcia-Moriyon et al 's (2004) meta-analysis of 'Philosophy for Children'.	1. Studies which did NOT evaluate the impact of thinking skills interventions on pupils' cognitive achievements 2. Studies not conducted in a school/schools and/or any educational setting 3. Studies which were not written in OR translated into English 4. Studies conducted/published over 10 years ago 5. Editorials, book reviews, resources, guides, manuals, meta-analyses, systematic literature reviews. 6. Studies which described pupils' thinking or learning without implementing a thinking skills intervention and evaluating its effects on cognitive achievements. 7. Studies included in the Higgins et al (2005) meta-analysis of 'thinking skills interventions', OR Trickey & Topping's (2004) systematic review on 'Philosophy for Children', OR Garcia-Moriyon et al 's (2005) meta-analysis of 'Philosophy for Children'. 8. Studies which included pupil data which was then NOT statistically analysed 9. Studies which did NOT use a control/comparison group AND a pre-post test design AND contained data on at least 10 pupils 10. Studies which evaluated the impact ONLY of thinking skills interventions on teaching/teacher's perceptions/attitudes/pedagogical style/pupil perceptions/attitudes.

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[12] Inclusion criteria 1-4 were applied to the initial search for articles related to research question and criterion 5-6 were used to select papers for the final review.

[13] Exclusion criteria 1-5 were applied to the initial search for articles related to research question and criterion 6-10 were used to select papers for the final review.

Appendix 2: Weight of Evidence Judgements

Study	1. Trickey & Topping (2007)	2.Dewey & Bento (2009)	3. Lizzaraga et al (2010)	4. Burke & Williams (2008)	5. Lizzaraga et al (2009)
Ethical Concerns	Considers 'language skills' & socio economic factors	Schools were not randomly selected.	Parents' consent; stated that they were 'informed' did they have a choice? No children included with SEN.	No children with SEN.	No children with SEN. No random sampling.
Involvement of service users?	Professional development for teachers, parents/pupils not involved in design.	Teachers and pupils not involved in construction of study, but does investigate pupil's self-perceptions throughout study.	Teachers provided with guidance. No pupil/teacher/parent perceptions.	Pupils' perceptions of themselves as learners were examined.	Teachers assisted with some of the measurement tests but largely conducted by researchers.
Is there sufficient justification for how the study was conducted?	Yes	Yes; infusion methodology transferable to school context.	Yes; range of data collection methods outlined and reasons why they were used.	Yes; theoretical outline & gap in research discussed.	Yes; theoretical outlined and gap in research discussed.
Is choice of research design appropriate?	Yes	Yes	Yes	Yes	Yes
Have attempts been made to ensure repeatability/reliability of data collection methods?	Yes; norm referenced CAT3 used- relates to external exams taken at 16 years old. Triangulation, reliability coefficients between .89 and .96.	Yes; norm referenced used CAT3 alongside self-perception scales and other qualitative measures.	Yes; CIT reported as used in previous studies. Reliability index= a=0.81 (Cronbarch's Alpha) alongside other standardised measures exploring other aspects of cognition (see paper for other reliability scores).	Yes; inter-judge reliability scores ranged from 83% to 100% for both the scoring of the skills questions and metacognitive questions.	Yes;Cronbarch's alpha for each of the measures used are reported.
Have attempts been made to ensure validity/trustworthiness of data collection methods?	Yes; established through a factor analysis of 9 subtests & correlation between CAT3 scores & other evidence of intellectual ability.	Yes; and triangulated with other data collection methods.	Yes; none of the items of the tests used to collect data were the target for specific training, which helped to evaluate level of transfer achieved.	Based on Beyer (2001) six task format; but does not report a pilot of this adapted test.	Yes; a range of methods used.
Have attempts been made to ensure repeatability/reliability of data analysis methods?	Effect sizes calculated using Cohen's D (single comparisons) and partial eta-squared (n2) for multiple comparisons.	Partial eta-squared effect sizes calculated for multiple comparisons.	Eta-square effect sizes calculated.	Yes; statistical analysis methods employed.	Yes; statistical analysis methods employed.

Study	1. Trickey & Topping (2007)	2.Dewey & Bento (2009)	3. Lizzaraga et al (2010)	4. Burke & Williams (2008)	5. Lizzaraga et al (2009)
Have attempts been made to ensure validity of data analysis methods?	Yes; looks at factors such as gender, and pre-test ability.	Yes; looked at whether CAT mean scores were product of time or the intervention.	Influence of gender on the effects of the intervention examined.	Yes; triangulated with other data analysis methods.	Yes; three studies conducted.
Have attempts been made to overcome error/bias?	Standardised testing and scoring- but recognises possible 'Hawthorne effect'- i.e. p4C a 'novel' method.	Fidelity checks conducted, but researchers point out that these could have been more rigorous.	Used various methods to explore various factors associated with cognitive ability.	On-going training and support delivered to teachers to establish consistency across teachers.	No random sampling.
How generalisable are the results?	Large sample size, different schools, over time, standardised measures, and effect size calculated.	Large sample size, different schools, over 2 years, effect sizes calculated.	Not a very large sample size- n=58. Teacher's reports-students' academic level 'low' to begin with, and socio-economic status reported to be 'medium-low'	No evidence reported as to whether learners were applying these skills on other contexts.	Sample described using teachers reports- academic level 'low' and socio-economical level 'medium-low'
Are conclusions about study warranted/plausible?	Yes; study recognises methodological pitfalls. Follow up at 2yrs still found positive gains.	Yes; but some variability in how intervention was delivered across teachers was reported.	Method more effective for males- but sample size was small and not reflective of the wider population, yet measures used seem robust.	Differences between the nature of individual and collaborative thinking skills not discussed- conclusion that either learning format will result in increased thinking skills.	Were the teachers selected especially enthusiastic or interested in the method?
Are the conclusions trustworthy?	Measures 'cognitive ability' as a single dimension?	Again, cognitive ability viewed as a single dimension as measured by CAT, but positive gains made despite some variance in teaching style.	Study looks at a range of factors rather than viewing cognitive ability as one dimension, yet only small sample size, however does suggest that transfer of thinking skills is possible following an intervention to academic and psychometric tests.	Lots of 'measures' used to gather data and test hypotheses.	To what degree were other factors controlled for?
Weight of Evidence A	**Medium/high**	**Medium/high**	**Low/medium**	**Medium**	**Low/medium**
Weight of Evidence B	**High**	**Medium**	**Low/medium**	**Medium**	**Medium**
Weight of Evidence C	**High**	**Medium**	**Medium**	**Low/medium**	**Low/medium**
Weight of Evidence D	**High**	**Medium**	**Low/medium**	**Low/medium**	**Medium**

Study	6 Oliver et al (2012)	7 Molnar (2011)	8 Cattle & Howie (2008)	9 Hu et al (2011)	10 Babai & Levit-Dori (2009)	11 Shayer & Adhami (2010)
Ethical Concerns	Process not outlined with regards to consent etc. Not all pupils were 'tested twice', and not all pupils received intervention. Paper does not outline sample selection process.	Consent details for pupils and their parents not outlined. Some pupils tested individually, some in pairs/groups. Authors state that they 'do not have data' on these proportions.	None of the children included in the study were on the SEN register, received free school meals (FSM) or were working at lower attainment levels.	CG pupils exposed to 'thinking skills' activities designed for the EG, albeit it an unavoidable circumstance rather than a deliberate ethical decision. 'Teaching to the middle'- teachers unable to adapt materials for pupils of a range of abilities.	Again, only average ability pupils took part in the study. Consent details not outlined.	Children from a wider range of abilities participated in study. Schools were 'selected' by advisory teachers. Not a random selection, but believed to be representative of the population.
Involvement of service users?	Teachers participated in Professional Development (PD) over 6 days prior to intervention delivery.	Teachers received training prior to intervention and had participation in designing some of the tasks used.	Teachers underwent a carefully designed professional development training programme with the developers of the programme.	Intervention lessons taught by members of the research teams rather than the teachers.	No discussion about consent, or development with teachers/pupils.	Teachers included as researchers, to some degree...
Is there sufficient justification for how the study was conducted?	Details outlining theoretical background are provided.	Yes- detailed theoretical and research background outlined.	Yes- outlined previous research and why it is helpful to follow up in an alternative context. Adds to an existing body of literature on the 'CASE' programme & to address prior 'critiques' of such studies.	Theoretical structure outlined.	Irrelevant intervention for control group implemented to remove possible bias due to intervention variable.	Strong theoretical and research background- drew on Piagetian and Vygotskian approaches to devise the intervention lessons. Based on previous literature, and located within the NC.

Study	6 Oliver et al (2012)	7 Molnar (2011)	8 Cattle & Howie (2008)	9 Hu et al (2011)	10 Babai & Levit-Dori (2009)	11 Shayer & Adhami (2010)
Is choice of research design appropriate?	Mixed methods design- aimed to integrate findings from both quantitative and qualitative measures. Clear research questions outlined relevant to study.	Pre-test-post-test-follow up (after one year) in order to test direct and longitudinal effects. Is 1 year a sufficient follow up?	Very small sample size Investigated cognitive and affective factors so adopted a quasi-experimental design.	Yes- looks at cognitive and affective factors using appropriate data collection and analysis methods based on research question.	Good, clear rationale outlined with a relevant research backdrop.	Yes- 2 different local authorities, different schools, experimental and control groups.
Have attempts been made to ensure repeatability/reliability of data collection methods?	Cognitive level of pupils determined prior to intervention using Science Reasoning Tasks (SRTs) Yet, different measure employed following intervention. In all measures, researchers cross checked scoring for reliability.	Attempts made to ensure that given the young age of the students many of the tasks were non-verbal in nature, as to ensure it was an accurate measure of their reasoning skills rather than reading abilities. Cronbach= .87	All methods use have theoretical underpinnings relevant to the research investigation. Administration of measures not delivered by researchers, however.	Researchers explored if there were different effects on students of different academic achievement levels- categorised into three groups- high score, mid score and low score.	Specificity of size of research sample? Short intervention of only three sessions? Only applicable for one, quite specific area of cognitive reasoning- directly linked to science.	Piagetian Spatial Relations test, established in previous research studies (CSMS, 1974-1979). Scoring decisions taken from the drawings in Piaget & Inhelder (1956). Test reliability=.82
Have attempts been made to ensure validity/trustworthiness of data collection methods?	Pupils in the control group started at a lower mean cognitive level than the control population. SRTs are a claimed to be a well validated measure.	Based on 'Klauer's theory of inductive reasoning and the German 'Cognitive training for children program'. Validity was ensured by construction and precise alignment between the framework and the test.	Pre-intervention scores did have an influence on gains made in 'Drawing' measure, as revealed by ANCOVA tests.	All students exposed to thinking skills activities in normal class environment, even the CG. Contaminated data?	Based on CASE programme which has a strong literature base. 'Science Reasoning Task 2' was used- validated by previous researchers and has been used for over 30 years, and based on Piaget & Inhelder (1974).	KS1 (Standardised Assessment Tasks)

Study	6 Oliver et al (2012)	7 Molnar (2011)	8 Cattle & Howie (2008)	9 Hu et al (2011)	10 Babai & Levit-Dori (2009)	11 Shayer & Adhami (2010)
Have attempts been made to ensure repeatability/reliability of data analysis methods?	The authors do not report the statistical tests used to analyse the data.	Authors outline that 'mean and standard deviation were computed and an independent sample t-test was used' Cohen's D calculated and reported.	Yes	Yes- Cronbach's alpha 0.89	Science Reasoning Task- see above.	See above
Have attempts been made to ensure validity of data analysis methods?	Statistical methods used in quantitative analysis not conducted? Use of SRT and academic achievements? No post-hoc analysis.	Distribution curves for sub-samples were compared to see whether the intervention resulted in a similar effect for pupils with different original levels of inductive reasoning, and to see whether the intervention effect was stable over time.	Yes	Confirmatory factor analysis showed that the fit index for six factors is very good, suggesting that the test has good construct validity.	Means, SD reported and ANOVA conducted.	Yes
Have attempts been made to overcome error/bias?	Control data was reported to be 'temporally and spatially dislocated' (p.1405) from EG. No post-hoc analysis conducted.	Tests were conducted between the EG and CG at pre-test- no significant difference found. No data provided as to whether this was due to test format (individual, group)	Gain scores were influenced by the pre-intervention scores.	Random sampling method applied to remove participant selection bias.	Small group of pupils in 'formal operations level'. Post intervention exam- not enough details outlining how this was designed, or by whom.	Reported variation between teachers- the 'teacher effect'.

Study	6 Oliver et al (2012)	7 Molnar (2011)	8 Cattle & Howie (2008)	9 Hu et al (2011)	10 Babai & Levit-Dori (2009)	11 Shayer & Adhami (2010)
How generalisable are the results?	Research conducted in a 'low socioeconomic region' in Australia. Although cognitive measures used are likely to be relevant to other schools in different countries, there academic measurements are country-specific. Uses 'far-transfer' measures- achievements looking for effects in science, numeracy, reading and spelling. Twice-tested sample only n=68. Cohen's D effect sizes calculated.	Relatively small sample (n=90) Conducted in Hungary No data provided about sample proportions in groups/individual work Study suggests a long-term effect which is perhaps more generalisable? I.e. far-transfer? Found to be unrelated to gender. Large effect size found- applicable to an International Context- d=1.12.	Attempts were made to establish generalisability- using a 'far-transfer' measure (Raven's Progressive Matrices). However, both EG and CG made significant gains at similar levels of significance. Conducted using a 'rural sample'	Good sample size. Looks at results at different times-4 tests overall.	Good sample size. Conducted in Israel. Intervention only seemed to have an impact on pupils' in the 'concrete developmental stage', and those found in the transition stage from concrete to formal operations level.	Low socio-economic area, with high mobility- yet provides data to outline sample. Sample size diminished largely by the post-test.
Are conclusions about study warranted/plausible?	A discussion is provided related to 'why does this intervention have a positive effect on...' which is thought provoking. Authors note the limitations of the sample and generalisability.	Yes	Yes	Yes- analysed 'sub-scales' of thinking ability.	Only small amount of intervention sessions? Exam at end of intervention- only 17 questions- 11 of which multiple choice. Element of luck?	Sample-all twice tested, although in doing this 43% of sample size lost.

Study	6 Oliver et al (2012)	7 Molnar (2011)	8 Cattle & Howie (2008)	9 Hu et al (2011)	10 Babai & Levit-Dori (2009)	11 Shayer & Adhami (2010)
Are the conclusions trustworthy?	In terms of that specific sample in that specific setting, possibly so. However, not in terms of generalising the findings to a wider population.	Yes- given that reading skills were controlled for, and a follow up test was conducted. Yet, small sample size and no clarity on the format of the tests.	Consider that gain scores were influenced by pre-intervention scores. Conclusions reached are however, tentative- as they outline that significant differences were only found with the near-transfer task and not the far.	Yes- but more likely to result in type 1 error as looked at sub scales of thinking ability?	In terms of a specific, cognitive reasoning ability related to science.	Over a long time- 4 years. As the researchers note- a whole range of factors can impact on pupil learning within this time frame.
Weight of Evidence A	Medium	Medium	Medium/High	Medium/High	Medium	High/medium
Weight of Evidence B	Medium/low	Medium/High	High	Medium/High	Medium	High/medium
Weight of Evidence C	Medium	Medium	High	High	Low	Medium
Weight of Evidence D	Medium	Medium	High	Medium/High	Low/medium	Medium

Newcastle University

How can pedagogical action support thinking in a primary classroom?

Dear pupil,

I am currently studying at Newcastle University where I am soon to be carrying out a research project. As part of this research project I am interested to find out more about **what helps children to think in the classroom**. I am interested in speaking to a teacher to understand what they do to help children to think. **I also believe it is important to ask a group of children about their views on 'thinking'**.

The project will involve **6 children** who will take part in **2 group discussions** about what helps them to think. These groups will last for around **an hour at a time during the school day.** The class teacher and I will be in the groups to help the children to have the discussions. In the groups the children will be invited to share their experiences of 'thinking'. They will also be supported to complete a picture-based activity which will help them to think about their learning.

Only six children can be a part of the groups for this project, so many of the children in the class will not be directly part of the research. However, during the groups it will be discussed how some of the interesting ideas that the selected children come up with can be shared with the whole class.

During the groups I will use a **'Dictaphone'** which is a small voice recorder. This is so I can record all the interesting ideas that are shared during the group. After each group I will listen again to the recordings and will use them to write about the discussions that took place in the groups. **I will be the only person who listens again to these recordings and I will not share any of the children's names when I am writing about the groups.**

If you decide that you would like to be a part of this group, please can you write your name below. **You can say that you don't want to be a part of the group at any time** and if you do so I will not use any of the ideas that you share.
Thank you

Rachel Durkin (Trainee Educational Psychologist)

For further information on this research please contact Rachel Durkin at

r.durkin@newcastle.ac.uk

………………………………………………………………………………………………………

How can pedagogical action support thinking in a primary classroom?

Please return this consent form to ……………………by…………………………….

I give my consent to participate in a small group that will help provide further understanding into young people's thoughts about what helps them to think at school:

Name of child:. . . . . Class…………………...

Signature: . . . . Date:. . . . .

How can pedagogical action support thinking in a primary classroom?

Dear Teacher,

I am currently undertaking research for my Doctorate in Applied Educational Psychology at Newcastle University. The area that I have chosen to research is how the development of thinking skills are supported by the education system, specifically in the processes of teaching and learning. I am particularly interested in how the process of meta-cognitive reflection and group discussion can further facilitate the process of thinking, for both teachers, pupils and researchers. The research process I have in mind is multi-layered and could be as follows:

Layer 1: Teacher-Researcher Consultations
I would like to support a teacher to take part in a series of reflective consultations about an area of their practice which they believe supports the development of pupil thinking. This would involve three teacher-researcher consultation interviews where we could jointly review practice and discuss further ways of supporting the process of thinking. Ideally this could run over the course of three months, one consultation monthly. My role as researcher would be influenced by my work as a Trainee Educational Psychologist (TEP) and therefore I would hope that these consultations would be transformative, promoting change and reflection for future practice.

Layer 2: Teacher-Pupil- Researcher Focus Groups
As part of the ongoing consultations I hope to invite a group of six children to reflect on what they believe supports and challenges their thinking in the classroom. These groups would involve a joint discussion between teacher, researcher and pupils to explore both the individual and social psychological factors supporting thinking skills. To mediate this process, I could introduce a visual activity which facilitates meta-cognitive thinking and would enable pupils to reflect specifically on the individual and social processes of learning. This activity is based on the work of Wall & Higgins (2006) who developed 'Pupil View Templates'. I hope to adapt these templates to develop their use with teachers. The adapted templates would be used in each of the FGS to facilitate discussions and provide a 'picture' of how thinking has developed over time.

Layer 3: Supporting future practice & wider awareness
Following completion of the three consultations and the focus group discussions, I would be keen to explore with the teacher and/or a member of senior management how the findings of the research could be communicated to a wider audience. This might involve a joint presentation at a locality cluster meeting/ visiting a neighbouring school to share the findings.

Although there is a wealth of research on interventions which are believed to support thinking skills in schools, teachers and pupils are seldom consulted during an intervention as part of an ongoing, reflective process.

If you would like to be part of the research process I would be very interested to work alongside you. If so, please could you sign below. You are free at any time withdraw from the research. You are also free to ask any questions about the research. All data would be verbally recorded for the purpose of transcription, and confidentiality and anonymity will be maintained throughout.

Yours sincerely
Rachel Durkin
Trainee Educational Psychologist

For further information on this research please contact Rachel Durkin at

r.durkin@newcastle.ac.uk

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How can pedagogical action support thinking in a primary classroom?

I agree / do not agree to take part in this research.

Signed…………………………………………………….. Date………………………………

Printed…………………………………………………….

Appendix 5: Example of prompt teacher questions used to support consultations and Teacher Thinking Templates

Thought Bubbles	Speech Bubbles
How has TAPPS evolved/developed since our last meeting?	How would you summarise the benefits of TAPPS to other teachers?
How are you noticing changes in the pupils' thinking and problem solving skills?	How would you summarise the challenges of TAPPS to other teachers?
Are you learning anything about how the pupil's work differently together during TAPPS?	How would you say this process has added to your existing ideas about teaching and learning?
How have you been able to overcome any observed challenges?	How might others use/describe TAPPS differently?
Is TAPPS beginning to change the way you think about teaching pupils to problem solve? How?	Would you want to share your work in TAPPS with anyone? Why/How/Who?
How might TAPPS change how you do things in the future?	Who do you think would benefit the most from learning using the TAPPS? How could those who don't benefit as much be assisted?
How have you continuing to reflect on your own practice?	What would others notice about how your teaching has changed during the process of TAPPS?
Are there other areas of your teaching that have been influenced by your teaching of TAPPS? How do you think this has been possible?	Has the research process helped you to think differently about how you teach? Who would notice this, what might they say?
Has the TAPPS presented any challenges to your preferred teaching style?	What would you say is important to you about teaching pupils to think and problem solve?
Did the second research session help you think differently about TAPPS? How?	What would you say to others about the use of TTS?
Did the second research session help you to think differently about your own thinking? How?	What would you say to others about the use of PVTS?
How was the focus group helpful for your own practice? - How was it useful for the pupils? How might this be shared across the class?	How might you continue to use these/adapt these for your future work?
	What else might you need to continue to promote effective problem solving skills and thinking skills in this schools?
	What would you say has been the most important/valuable part of being involved in this research project?

Are there any challenges you would like to discuss as a result of the TAPPS or the research process?

Is there anything you hope to develop/change in your teaching before the next research session? What will help you to do this?

Appendix 6: Example pupil prompt questions to support completion of PVTs and focus group discussion

Thought Bubbles	Speech Bubbles
What are you learning when you are using TAPPS?	Would you tell another school/class/pupils/teacher to use TAPPS? Why?
What new skills are you developing when using TAPPS?	What do other pupils/teachers/parents learn with the TAPPS?
What did are you learning about how you learn when using TAPPS?	What would you say is good about using the TAPPS?
What about working with other people, are you learning anything new?	What would you say could be better about using TAPPS?
Is the TAPPS changing the way you think about learning? How?	What are some of the questions you might ask in TAPPS? What questions do others ask you?
How will TAPPS change how you do things in the future?	How could you use TAPPS differently?
How did the TAPPS help you with your work (in any subject)?	Would you want to share your work in TAPPS with anyone? Why/How/Who?
	Who do you think would benefit the most from learning using the TAPPS?

Appendix 7: Analysis Audit Trail

Participant/Data Set/Page & Line Number	Transcript	Initial Coding	Memos	Axial Coding	Core Category
Participant 1 Teacher consultation 1 Page 2 Line 54-56	*"I think it's also important to have a range of opportunities for the children to work independently and then they can work collaboratively with friends and they can develop their thinking further really, through the use of collaborative learning."*	Creating different opportunities Valuing both independent and collaborative learning Viewing collaboration as a method to develop thinking	15.5.13: The teacher seems to value providing pupils with a variety of opportunities in terms of how they are organised to approach learning; she appears to take the view that although independent working is important, thinking is enhanced further through the process of collaboration.	Paired working	Learning Arrangements
Line 58-68	*"I think, in my class there's quite a range so there's children who are working at a low level two, and there's children who are moving up into a level four, so that's quite- when I plan lessons the differentiation needs to be quite spot on really to make sure that all children are able to progress and meet their learning targets and their goals and to*	Reflecting on range of abilities Explaining current approach as differentiation Reflecting on own role? Wanting all children to achieve	15.5.13: The teacher appears to express a specific observation of improvement related to the pairing and grouping of pupils of different abilities. She appears to report on this observation, describing her surprise that pupils who appear of lower ability can effectively problem-solve alongside their apparently more able	Mixed Abilities	Learning Arrangements

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	achieve to their potential really. But then, also when .we have done problem-solving within the whole maths lessons it's interesting to see how they work together as a group. Sometimes I put them in mixed ability groups and they have to tackle a problem and it is sometimes quite surprising that the children who are lower ability are the ones who are quite hands on."	Noticing exceptions to observed differences? Observing how pupils work together Experimenting with grouping Feeling surprised, noticing exceptions. Observing differences-particularly lower ability	peers. This level of surprise may be related to how it stands in contrast to her use of the pedagogical approach of 'differentiation'; when organising pupils in mixed ability groups one would assume that there would be less differentiation required, if any at all. It is also interesting to notice how she appears to take a stand back and observe this phenomenon, which may reflect her level of comfort with responding to what appears to work well in a given lesson/task.		
Page 3, Line 98-103	*"Well I do that now, through questioning, through marking, through day to day activities. But I think if they are actually thinking aloud, whilst they are solving a problem that will help. Sometimes I do say like, 'why have you done that?' or 'can you*	Reflecting on ongoing assessments Existing pedagogical approach Verbalising whilst simultaneously problem solving Reflecting on use of questioning	4.9.13: I am wondering whether the teacher describes the process of questioning as one which not only provides *access* to pupil thinking but also *enhances* processes of problem solving. Questioning therefore appears a multi-faceted, mutually	Questioning	Teaching and Learning Strategies

	explain your strategy you're using there?' But I think if they are working with a partner and verbalising every single step that they're doing then I do think it will have a good effect."	Using partners to enhance problem solving skills Verbalising thoughts at each step	beneficially mechanism of pedagogy. She reflects on her existing approaches to questioning but hopes that TAPPS will enhance this by use of peer support.		

Participant/Data Set/Page & Line Number	Transcript	Initial Coding	Memos	Axial Coding	Core Category
Participant 6, Focus Group 2 Page 6 Lines 168-173	*"I've been getting better at- when I've been going shopping with my mum, my mum has an amount of money in her purse and she asks me to count it so when we went to ASDA one day, my mum was going to go a penny over as she was going to buy something like a jar of Nutella, so we had to put some things back and I said to my mum that I've been doing all of this and she said 'then you can work it out"*	Improving problem solving Relating to every day concerns Describing recent experience in relation to problem solving Informing parent about involvement in problem solving intervention	13.7.13: Pupils appeared to reflect on their work in TAPPS much more in focus group 2, often through the use of examples of problem solving tasks and how these mirrored the concerns of every day life, particularly in relation to spending money and shopping. They appeared to make links between what they had learned in TAPPS and how this would assist them in other aspects of life. 14.7.13:	Making Links to Real Life	Teaching and Learning Strategies

Participant 4, Focus Group 2. Page 7 Lines 200-203	*"It's better to work with a partner than by yourself, because sometimes you can get stuck by yourself. If your partner is busy working and you're stuck and you don't know what you're doing, and you can't work it out, it's better working with a partner because they can easily help you if they know the answer"*	Preferring to work together Not wanting to get stuck Feelings of uncertainty if get stuck in a task Having someone to help is important	Pupils reported on the affective aspects of paired and group working; they talked about how independent working can be problematic if they became stuck, where working with a peer acted as a resource in which to move the learning on.	Paired working	Learning Formats