In the mid-70s CSMS\textsuperscript{1} survey 14,000 children aged 10 to 16 were given three Piagetian tests to assess the range of thinking levels at each year. Figure 2 shows the findings:

By 14 only 20\% were showing formal operational thinking (3A&3B). This mattered because current O-level science and maths courses, designed for grammar-school children in the top 20\% of the ability range, required this level from the end of Y8. In the 80s the \textit{Graded Assessment in Maths} scheme for the ILEA found that by the age of 12 the children’s mathematics competence had a 12-year developmental gap between the above-average and those at what would later be National Curriculum Levels 1 and 2.

In 2002 the Government’s own Key Stage 3 statistics for maths showed the same spread, as can be seen in Figure 1. When RCPCM conducted their first Pre-tests on 5 year-olds’ classes they found comparable wide spreads in cognitive development. Two previous intervention projects, CASE\textsuperscript{2} and CAME\textsuperscript{3} for Y7/Y8 pupils had shown that the proportion showing formal operational thinking by Y9 could be doubled (see References) with comparable gains in GCSE science, maths and English three years later.
Given previous success a natural question is whether it could be applied successfully on younger children so that they would have a longer period in their lives to make good use of schooling. The RCPCM project was designed to build on the expertise already developed in the research project CASE@KS1.H&F (1997-2000). Children in Y1 were given, every week, interactive and collaborative learning focused on the major concrete operational schemata described by Piaget. Unlike the original CASE project for Y7/8 the activities were not placed within the context of any particular school subject. The effects of this one year intervention are reported in Adey, Robertson & Venville (2002). The lessons and materials used have now been published as Let’s Think (Adey et al. 2001).

The method proposed in the RCPCM project was twofold. In Y1 ‘Thinking Maths’ lessons (TM) would be designed in such a way that the teachers could be led to manage the children’s collaborative learning in the context of maths using similar skills they were also using in their Let’s Think activities. In Y2 the Let’s Think work would have ceased but the children, already used to the learning strategies practised in the Y1 TM lessons, would now receive further TM lessons at a rate of about one every two weeks. In addition the teachers would be encouraged to use the same teaching skills within the context of their ordinary Numeracy work.

Objectives

This was the Aim given in the original RCPCM Research Proposal

The main aim of the project is to relate a progressive increase in the thinking ability of children over the Key Stage 1 period with an increase in their school achievement, especially in mathematics. This will be delivered through a research-led, evidence-based model for classroom practice ‘context-delivered’ linking the existing Piaget-based CASE@KS1 intervention activities with children’s mathematics learning. This would be achieved by distinguishing between teaching skills related to cognitive intervention (aimed at changing all children’s cognitive levels) and skills related to good instruction (aimed at increasing children’s understanding of mathematics). In years 1 the intervention activities would be very general, combined with modification of Numeracy lessons using the intervention style, and in Year 2 the intervention lessons would be developed in the context of mathematics, but related to children’s previous experience of the CASE@KS1 intervention activities.

The extent to which the five objectives of the proposal were achieved is now reported.

(1) Contributing to the means by which the aims of the National Numeracy project may be realised.

It can be seen, from Figure 5 in the Results section, and from Table 3 that the major aim of the NN Project to increase maths learning as assessed by KS1 Maths has been achieved.

2) Describing through specifics of classroom practice the class-management skills of intervention differentiated to benefit children of all levels of attainment.

To the extent to which the ‘community of practice’ achieved with the project teachers in their PD, as described under Methods, and also the specifics are implicit in the Thinking Maths publication listed under Outputs, it can be said that this has been achieved. But under Future Research Priorities it can be seen that more work needs to be done to make the specifics of classroom strategies explicit.
(3) Developing a style of Professional Development courses for Primary teachers through which they can construct new professional skills by means analogous to those by which they will lead their pupils to collaborate with each other in their own learning.

See section The process of Professional Development (PD) under Methods for detail.

(4) Collection of a data-base of pre and post-test evidence on Year 2, on tests of cognition and mathematics achievement sufficiently substantial to estimate the probable effect of using the methods of the project Nationally.

See section on Results for detail that show the realisation of this.

(5) By relating children's gains assessed as in (4) to the changes in teacher skills over two years, as assessed through the descriptive framework generated by our colleagues in the Leverhulme Numeracy Programme, finding which skills are most related to pupils' achievement in cognition and in mathematics.

After losing a major worker in Year 2 we found ourselves unable to do this on top of the other work of the project. See comment under Future Research Priorities and also see the last paragraph of the section The Thinking Maths lessons under Methods. Stuart Twiss will be presenting his initial work on this objective in his PhD thesis.

Methods

This was a multi-faceted enterprise asking for a multi-faceted presentation. The researchers had already learnt from their previous experience of the pCAME Project, working with Y5 and Y6 teachers and their children, that, just as the most effective mediators for the cognitive development of children are the other children in their class (and home), so too in the development of the corresponding teaching art it is through teachers and researchers working as a 'collective' that the seeds of the new skills are sown. The University research team have the responsibility—a very important one—of communicating the relevant maths and psychological research, but the teachers' skills and personal experience of the children create the lived experience of the Thinking Maths lessons.

The research team at Hammersmith and Fulham in 2001/2002

In this year it was necessary to create the Thinking Maths lessons for Y1 use in 2002/2003. Four teachers, previously selected to assist in PD for the CASE @ KS1 Let's Think lessons in H&F schools were chosen as teacher-researchers. The research team consisted of Michael Shayer and Mundher Adhami from Kings, Anne Robertson as Advisory teacher for H&F, and the four teacher-researchers, and met for a whole afternoon working session every 3 weeks. Initially Shayer and Adhami would suggest mathematical contexts for a possible lesson, then the whole team would work on how the lesson might be presented, and what worksheets & were needed. Then either Anne or one of the teacher-researchers would offer to trial the lesson with a Y1 class, with Shayer and Adhami in support and Shayer would make detailed notes of the trial lesson which would be written up with a time-line for the next team afternoon. From that feedback experience the whole team would then revise the initial lesson plan, and Shayer or Adhami would produce all the materials needed for 2002/2003. Often an amended version of the lesson was re-trialed—sometimes more than once—before the team were satisfied with it. Later some of the ideas for the Thinking Maths lessons (TM) came from the teacher-researchers.
The research team at Bournemouth in 2001/2002

The H&F and King’s team had the responsibility of generating the TM lessons. But the Bournemouth LEA, under the leadership of Stuart Twiss, a Senior Inspector, made the offer to run a parallel replication, in 2002/2004 in Bournemouth schools, of the RCPCM intervention—but taking the collaborative learning aspect of the classroom practice as their focus. To direct this work Stuart, with 3 lead-teachers, all learnt in the classroom the CASE @ KS1 methodology by teaching the Let’s Think lessons. Anne Robertson provided the initial PD in Bournemouth for this. As some Y1 TM lessons became available these were also trialled. The Bournemouth team also met regularly and discussed their experience of teaching both lesson types. In addition, Stuart attended several H&F working afternoons featuring the TM lessons, and Shayer and Adhami attended some of the Bournemouth team meetings.

The generation of the Y2 TM lessons

After 10 Y1 TM lessons had been prepared, a start was made in the summer term 2002 on a few Y2 lessons. For the subsequent work in 2002/2004 only two teacher-researchers were available, but the team work continued as before. Unfortunately Anne Robertson became increasingly incapacitated by a shoulder injury in the Autumn term 2002, then was away for much of 2003 following an unsuccessful operation. She then left both H&F and the project for a post at London Institute of Education in September. H&F appointed another Advisory Teacher with Let’s Think experience to the team for administrative purposes in 2003/2004, but she did not take part in the TM lesson trials, although she attended working afternoons. The project instead paid for two days a week of the teacher-researcher Rachel Edmondson’s time, who trial-taught most of the subsequent Y2 TM lessons. In 2003/2004 the research team was working a term to two terms ahead of the project teachers and generated 19 Y2 TM lessons.

The research design: 2002 to 2004

The RCPCM intervention featured 8 experimental classes in 8 H&F schools and 10 experimental classes in 4 schools in Bournemouth. H&F provided 5 Controls classes and Bournemouth provided 11. Table 1 shows the research design.
<table>
<thead>
<tr>
<th>Year</th>
<th>Main Study Experimental Schools</th>
<th>Main Study Control Schools</th>
</tr>
</thead>
</table>
| Sept. 2002-July 2003 | Pre-tests: nferNelson Maths 5 & Piagetian Spatial test  
Y1 teachers use *Let’s Think* each week during the year  
Y1 use 10 TM lessons during the year | Pre-tests: nferNelson Maths 5 & Piagetian Spatial test                                       |
| Sept. 2003-July 2004 | Y2 teachers use 15 TM lessons during the year and also ‘bridge’ to their Numeracy work | Post-tests: NFER Maths 7, Piagetian Spatial test and KS1 SATs in Maths                      |
| July 2004  | Post-tests: NFER Maths 7, Piagetian Spatial test and KS1 SATs in Maths                           |                                                                                           |

The Piagetian Spatial test from the CSMS survey is answered only in terms of the children’s drawings. It was modified for 5 year-olds as a Pre-test by asking them only to complete figures, e.g. for water in a jar, the jar was drawn for them: they had only to pencil in where the water was. But for a post-test, after trialling with 7 year-olds, the Spatial test was found usable entirely in terms of the children’s own drawings, as previously with 10 year-olds.

*The Thinking Maths lessons*

In two lengthy articles the use of both the mathematics education and the psychological research literature is described in detail (Shayer, 2003 and Shayer, 2005). Space permits only the principles of their use to be described here.

The insights into cognitive development from both Piaget and Vygotsky are used in the conduct of a *Thinking Maths* lesson. Both believe in the virtues of collaborative learning. But Piaget himself made a seminal contribution to the mathematics literature in his book on Number (Piaget & Szeminska, 1952). From this and elsewhere (Shayer & Adey, 1981; Hart, 1981) it was found possible to assess all the statements in the National Curriculum (NC) in terms of demand levels from early concrete through to concrete generalisation. Similarly the levels of the different agendas in a TM lesson were also assessed. From data in the monograph Shayer, Demetriou and Pervez, 1988: approximately 20% of the population of 7 year-olds tested at the mature concrete level on at least two-thirds of the Piagetian tests they were given. This 20% coincides with the proportion selected after 1945 at 11+ for grammar school education. Thus the target aimed for in Y2 TM lessons was mature concrete (for the Y1 lessons it had been middle concrete). Each lesson started with an episode at a lower level, and the episodes—up to 3—were designed so that children from a wide range of initial cognitive abilities could make some progress each from their present level during each lesson.

Looking at the agenda of the TM lessons (and also the children) through Piagetian eyes is thus an essential aspect of the art. But Piaget’s work tells us nothing (except the importance of ‘cognitive conflict’) about how to teach the lessons. For this we turn to Vygotsky’s concept of the Zone of Proximal Development (ZPD). It describes the social process of shared cognition that a group of children work within while working
on a problem. But it also describes the psychology of each individual child. Each child has many assured competencies: things he can do ‘without thinking’ and which result in success on tests. But his/her individual ZPD possesses also concepts—as one can see described in minute detail in every published work of Piaget—that are in the process of formation (hence Proximal). On Vygotsky’s account of cognitive development most—but not all—jumps in children’s cognitive development are made when they witness a successful performance in a child like themselves in their social milieu. At that point they complete their ZPD by a process of internalisation, and then perform as if they had always known that concept. The conduct of the TM lessons is made so as to promote this process.

Each Episode of the lesson is a 3-Act play. The first, called Concrete Preparation, introduces the lesson agenda at a level where all in the class can participate. But even here the construction of a communal ZPD is aimed at. Many children are asked to describe what they see is the task ahead. In some cases the children are asked quickly in pairs, while sitting on the carpet, to attempt the easier parts of the task. Then different pairs are asked to offer their ideas, which others then discuss. In the second act children, in groups from two to 4 or 5 are asked to go to their tables and attempt the first worksheet. In a few minutes time they will be asked to present their ideas to the rest of the class, so they do not waste time in ‘neat work’: they discuss vigorously with each other, using pencils on papers, until they feel they have something worth saying or showing. Act 3 is again communal—often on the carpet in front of the whiteboard again—where their different solutions are shown and shared with the whole class. Thus in Acts 1 and 2 the shared ZPD is created, in which children offer alternating insights which enter the minds of all to work with. But Act 3, well managed by the teacher, gives maximum chances for the individual ZPDs on the children to be completed as they witness the ideas produced by the other groups. Often Act 3 leads naturally to the next Episode with agenda usually at a higher level.

From this description follows the interest of the RCPCM team in collaborative learning, for which the Bournemouth group was enlisted. The H&F team worked on the TM lesson methodology: Twiss in Bournemouth was asked to use the literature of collaborative learning, and through working with and observing his teachers to describe the specifics of how to promote that Vygotskian aspect in all phases of the TM lessons.

The grounding of the RCPCM work in the maths education research literature

The detailed specifics, and how they were used, are found in Shayer, 2005. But from Cable (1997) and Vergnaud (1983) were drawn the importance of concepts of measure in even 5 year-olds’ development of their concept of number, neglected in much current teaching including the National Numeracy scheme. From the work of Butterworth, 1999, and Dehaene, 1997 (and by implication from the early work of Dienes also) come the importance of multiple representations of number using both sides of the brain. From Bryant & Pireni (1996) and also Piaget & Szeminska (1952) come the insight that even 5 and 6 year-olds have primitive concepts of multiplicative relations between numbers as well as additive, and hence the link with measures, which are based on the ratio between the size of an object and the measure unit. And from much of the work of Nunes (1996. with Peter Bryant; 1999; 2002) detailed empirical research of how to promote multiplicative thinking was drawn on in the construction of TM lessons, with the intention, by the end of Y2, of evening up the balance in children’s experience of number between the additive and multiplicative (ratio) aspects.
The process of Professional Development (PD)

Given this description of RCPCM classroom processes it follows that simply ‘telling’ teachers how was not an option. Just as each pupil—in interaction with other children in their close environment—has to construct each cognitive concept in their own mind, so too the PD of teachers needs a parallel process. The teachers need that not only for the development of their own skills: undergoing the same process themselves also gives them insight into managing their pupils’ learning. In two-day PD sessions teachers were split into groups of 4: each group was given the teacher’s guides and materials for a new different *Thinking Maths* lesson. They were to discuss the lesson content and then produce a lesson plan sufficiently detailed so that they could then give and explain it to the others. After the groups had shown to each other the lesson plans, and answered questions arising, each group would then go out to a Primary school class accompanied by a member of the research team, and team-teach their lesson. Later at the Teacher’s Centre each group would report how their lesson plan had been realised, what difficulties they had encountered, and further ideas for teaching the lesson. If necessary Shayer or Adhami would then modify the Teacher’s Guide for the lesson according to their feedback, and provide all teachers with the revised version for their own classes.

In addition each school was visited by Rachel Edmondson to see TM lessons taught and give the teacher personal feedback. Subsequent PD sessions would begin with a detailed reporting by teachers of their experience of teaching the lessons to their own pupils, then followed by further work on new lessons as before. Everything to do with the specifics of both the Piagetian and the Vygotskian aspect of the art would be explored both in context and in terms of the teachers’ own experience. From the ‘collective’ established by this way of working Shayer and Adhami were able to communicate in a responsive way things to do both with the maths and the psychology.

**Results**

**Effects on cognitive development**

In Figure 1 the method of data-analysis is shown with H&F schools in red, and Bournemouth in green. The regression of the post test 2004 Spatial task class means on the 2002 Pre-tests is computed for the control classes—shown in blue. The residuals shown in Figure 1 the estimate the difference between the Post-test level found and what would be predicted from the controls’ regression.
The effect-sizes shown in Figure 2 are then computed by dividing the residualised gain scores by the standard deviation of the population norms for the Spatial Task estimated from the CSMS survey.

Both H&F and Bournemouth schools show considerable gains, but the distributions are bi-modal rather than normal, as will be commented on later.

As a guide to the Piagetian scale used in Figure 1, ‘3’ is the Early Concrete level (2A), ‘4’ is Middle Concrete (2A/B) and ‘5’ is Mature Concrete.

A related statistic is the proportion of children at the Mature Concrete level or above.
In the monograph Shayer, Demetriou & Pervez, 1988 surveying 5 to 10 year-olds, it was shown that the proportion of 7 year-old children in Greece, Australia and Pakistan succeeding on at least two-thirds of Piagetian tests at the Mature Concrete level was between 15 and 20%. This is similar to the proportion shown in the CSMS survey for 14 year-olds at the Early Formal level (‘7’ on the Piagetian scale) and also the proportion selected for grammar school education at 11+ in the 1945 Act.

Table 2 shows that all the H&F schools, and most of the Bournemouth schools had below-average intakes in 2002 (from the Predicted %2B+ column). Yet nearly all classes of 7 year-olds at post-test were well above-average in the percentage at the Mature Concrete level.
Table 2: Percentage at the Mature Concrete Level (2B) or above

<table>
<thead>
<tr>
<th>School (Class)</th>
<th>Predicted % 2B+</th>
<th>Obtained %2B+</th>
<th>Gain %</th>
</tr>
</thead>
<tbody>
<tr>
<td>H&amp;F 1</td>
<td>1.2</td>
<td>26.3</td>
<td>25.1</td>
</tr>
<tr>
<td>H&amp;F 2</td>
<td>4.8</td>
<td>20</td>
<td>15.2</td>
</tr>
<tr>
<td>H&amp;F 3</td>
<td>7.4</td>
<td>39.1</td>
<td>31.7</td>
</tr>
<tr>
<td>H&amp;F 4</td>
<td>8.5</td>
<td>9.1</td>
<td>0.6</td>
</tr>
<tr>
<td>H&amp;F 5</td>
<td>9.3</td>
<td>55</td>
<td>45.7</td>
</tr>
<tr>
<td>H&amp;F 6</td>
<td>11.8</td>
<td>20.8</td>
<td>9</td>
</tr>
<tr>
<td>H&amp;F 7</td>
<td>13.9</td>
<td>34.8</td>
<td>20.9</td>
</tr>
<tr>
<td>H&amp;F 8</td>
<td>15.0</td>
<td>26.3</td>
<td>11.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bournemouth</th>
<th>Predicted % 2B+</th>
<th>Obtained %2B+</th>
<th>Gain %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td>1.4</td>
<td>35.3</td>
<td>33.9</td>
</tr>
<tr>
<td>A1</td>
<td>8.7</td>
<td>18.5</td>
<td>9.8</td>
</tr>
<tr>
<td>C1</td>
<td>8.7</td>
<td>45.5</td>
<td>36.8</td>
</tr>
<tr>
<td>C3</td>
<td>12.4</td>
<td>55</td>
<td>42.6</td>
</tr>
<tr>
<td>B1</td>
<td>13.1</td>
<td>23.1</td>
<td>10</td>
</tr>
<tr>
<td>A2</td>
<td>14.4</td>
<td>35.7</td>
<td>21.3</td>
</tr>
<tr>
<td>D</td>
<td>14.7</td>
<td>14.3</td>
<td>-0.4</td>
</tr>
<tr>
<td>B2</td>
<td>15</td>
<td>28.6</td>
<td>13.6</td>
</tr>
<tr>
<td>C4</td>
<td>20.9</td>
<td>50</td>
<td>29.1</td>
</tr>
<tr>
<td>C2</td>
<td>26.9</td>
<td>45</td>
<td>18.1</td>
</tr>
</tbody>
</table>

**Mean gain** 19.9

**Note:** The Bournemouth schools are coded so as to show more than one class in the same school.
It seems reasonable to assume that those children already at the Mature Concrete level by 7 will be those still in the top 20% of population ability norms when they reach secondary school.

*Effects shown on the nferNelson Maths 7 test*

Although the nferNelson Maths 5 test was used as one of the Pre-tests in 2002 it was found troublesome to administer in both LEAs, and the data were both unreliable and to give underestimates of the order of a standard deviation. Thus only the CSMS Spatial task was used as a predictor. The data were analysed in the same way as for cognitive development above, and the effect-sizes are shown in Figure 3.
Effects shown on Key Stage 1 Maths

The effect-sizes shown in Figure 4 are larger than for nferNelson Maths 7 and are considered to be a better indicator of children’s mathematical competence.

Again, there are some schools showing large effects, but the distribution is more like bi-modal or even tri-modal.

To show a quantitative record Table 2 was prepared to summarise the effects shown in Figures 1, 3&4.
It can be seen that the mean effect-sizes on cognitive development were similar in both LEAs.

The mean effects on KS1 Maths were about 60% of those for cognitive development for H&F and much lower for Bournemouth. Two aspects of this require comment.

From our previous intervention work it is only a year after the end of an intervention that the full effects on school achievement were found. There is a very simple reason for this: while for the CASE project the context of science and for the CAME and RCPCM projects the context of maths were chosen for the intervention, the teaching style is aimed at cognitive development. Children’s actual maths performance will be determined—in addition to the quality of the instructional teaching—by their cognitive development at the time. Over the two-year period the graph of children’s development will be in the form of an S-shaped curve, much of the first year being only a little above average, and only towards the end of the second year will the intervention effect attain the maximum. Yet over all this period their maths learning has been proceeding, so, integrated over the two years, only a little over a half of the effect on maths achievement would be achieved. It is in Y3 that the full effects are to be expected.

The second aspect relates to the PD that was available in each LEA. The Bournemouth team had been charged with the responsibility of elaborating and describing the Vygotskian collaborative learning aspect of the RCPCM intervention. Initially this was focussed strongly on the CASE @ KS1 Let’s Think part of the intervention in Y1, and for much of the Thinking Maths work this LEA used their Let’s Think groups of six children in a powerful way, even in the whole-class teaching of the maths lessons. In the first year and for a term in the second the H&F and King’s
staff were able to assist them in this. But with the loss—in effect from Christmas 2003—of a major staff member from H&F Shayer and Adhami found that it was all they could manage just to keep pace with the generation of the Y2 TM lessons and to look after the PD of their H&F teachers. Thus Twiss in Bournemouth was provided with the TM lessons with their at-the-time minimal Teacher’s Guides—in H&F supplemented in detail by the collaborative learning of the teachers in the PD sessions—and had to manage unassisted. Nevertheless two of his lead teachers obtained creditable results on KS1 Maths in addition to cognitive development of their classes.

The significance of the results

Figure 1 shows that from the variation of the Control classes’ results it is reasonable to interpret them in terms of parameters that average the results—shown as the regression line—and also show the variation in terms of normal distribution around the regression line. But it makes no sense to parametrise the results for the H&F and Bournemouth classes. Each of these—seen in relation to the Controls’ regression line—is an individual event asking for interpretation. Just under 0.3 of a standard deviation is required for statistical significance for an individual class: that is, to place them outside the expected limits of variation for the control classes.

The results as seen in Figures 2 & 4 and Tables 2&3 can address two questions: If an LEA invests in the same amount and style of PD as was used in the RCPCM Project with a group of schools, what is the magnitude and range of effects their teachers are likely to produce? And, given the whole methodology of the RCPCM project successfully used by a teacher what effects on their children can be expected?

For the first, taking the means for cognitive development for H&F and Bournemouth as shown in Tables 2 &3, and the KS1 maths results for H&F in Table 3, would be a reasonable answer. But such an answer needs to show the variation as well (it is not ‘normal’), as shown in Figure 2.

For the second question, What can the RCPCM methodology deliver? it is reasonable to take, in Figure 2 on cognitive effects, the top 3 results for H&F and the top 2 results from Bournemouth and use the median of 1.07 standard deviations as representative of the group. For KS1 Maths, the 3 H&F classes and 1 Bournemouth in Figure 4 give a median value of 0.74 SD, well worth a school investing in. But one might also ask the supplementary question, For a first-time use of the RCPCM methodology, what about those teachers who internalise some of it? In Figure 2 one might select a mode consisting of those classes above 0.3SD effect, but excluding the top 5. These have a median of 0.48 SD for cognition, again well worth investing in.

One final question. In Table 4 a stem-and-leaf diagram for all the effects of all the classes on the CSMS Spatial test are given both for the original Adey’s one-year intervention project CASE@KS1 and for RCPCM, in order to address the question, How much of the RCPCM project effects are attributable to the use of CASE@KS1?
For this question it would seem that the 1.07 SD median for the top mode of RCPCM and the 0.6 SD median for the top mode of CASE @ KS1 is the best answer if we wish to estimate their potential in the hands of the best teachers. There is but one proviso to this suggested interpretation: the CASE @ KS1 research was Government funded, and about twice the PD time and number of teacher-tutors was provided, compared with RCPCM.

Activities

The practice of both CASE @ KS1 and RCPCM were featured in workshops at the Annual Cognitive Acceleration Convention in Cardiff in 2004 and will feature even more at the next CA Convention in Gateshead in June 2005. A pilot 6-day RCPCM PD course is underway in Islington. The 10 practising teachers and 7 consultants collaboratively study, trial and reflect on the activities with groups of children in a model adapted from the research phase. The course seems promising after two third of its duration, is advertised for next year for a new cohort, while the pilot group itself is expected to continue with a Y2-3 course of a similar structure.

Outputs

The 10 Y1 TM lessons with Teachers’ Guides were published by nferNelson in June 2004 with the title Lets’ Think through Maths! The 19 Y2 lessons are currently being edited for publication in September by nferNelson, with a related title.

The overall theory and practice of the RCPCM project were reported in January 2005:

Shayer and Adhami will give a paper on the RCPCM results at the EARLI Conference in Cyprus in August 2005 that will also be expanded for publication in *Learning and Instruction*.

**Impacts**

The general intervention strategy of the RCPCM project is believed to be of great significance for the future learning and development of Primary school children, and it is to be hoped that the ESRC will be proactive in negotiating its propagation by the DfES.

**Future Research Priorities**

A detailed and theory based description of the classroom processes of the RCPCM methodology has yet to be made, although the PhD thesis of Stuart Twiss to come should serve as a basis.

**References**

For **CASE**


For **CAME**


2 Cognitive Acceleration through Science Education (1984-87). Research project funded by the SSRC

3 Cognitive Acceleration in Mathematics Education (1993-97). Research projects funded by the Leverhulme Trust, the Esmée Fairbairn Foundation and the ESRC.

4 CASE@KS1.H&F. Research project based at King’s College funded as part of a Single Regeneration Budget granted to the Hammersmith and Fulham LEA by the DfES.