Learning from the ICME international survey on teachers working and learning through collaboration

Report of the South West Professional Development Network Meeting, July 2017

Ruth Trundley and Alison Clark-Wilson

Babcock LDP

Second Floor

Milford House

Pynes Hill

Exeter

Devon

EX2 5GF

Email:

ruth.trundley@babcockinternational.com

Website:

http://www.babcock-education.co.uk/ldp/primarymaths

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Foreword

The National Centre for Excellence in the Teaching of Mathematics (NCETM) works with Maths Hubs across the country to support mathematics professional development, all funded by the government. A key part of the work in hubs has been the setting up of work groups and teacher research groups. These groups involve teachers working collaboratively, often led by other teachers or local professional development providers (sometimes called 'Local Leaders of Mathematics Education') but the extent to which those leading groups are informed about what is known nationally and internationally about collaborative learning is variable. In order to both support and challenge professionals who lead mathematics developments across the South West, Alison Clark-Wilson was invited to join the local PD network meeting in the summer term of 2017 and engage participants in exploring and furthering their understanding of collaborative working, through a collaborative process. We hope this is the start of many conversations about collaborative professional development, both locally and across the country.

Ruth Trundley July 2017

Introduction

Alison Clark-Wilson, UCL Institute of Education, University College London

The context for this South West Professional Development Network meeting was to draw on the findings of a large survey commissioned by the International Congress on Mathematics Instruction (http://www.mathunion.org/icmi) that was reported at the 13th International Congress on Mathematics Education in Hamburg, 2016 (http://www.icme13.org/survey_teams).

This survey focused on mathematics teachers working and learning through collaboration and zoomed in on "the wider professional development scene to focus on the learning that occurs when teachers of mathematics work together collaboratively, and moreover its implications for the mathematics learning of students which motivates their teaching".

The survey was framed by the following questions:

- What is the nature of collaborative work (to include the different roles that teachers can play) and how does this relate to situation, culture and context?
- Who are the people who engage collaboratively to promote the effective learning and teaching of mathematics, what are their roles, and how do they relate to each other within the different communities?
- What methodological and theoretical perspectives are used to guide and inform collaborative working and learning?
- What learning can be observed and how does it relate to collaboration?

The full survey methodology and findings are available at:
https://link.springer.com/article/10.1007/s11858-016-0797-5

The participants for the SW Maths Hubs day were all invited to submit an example or 'case study' from their own experience or practice that had, in some way, aimed to have been collaborative. These narratives, which used a common format (See Appendix), served as a tool to enable the whole group to begin to reflect (in conversation and in writing) on the group's collective knowledge and experiences, informed by key themes from the international survey.

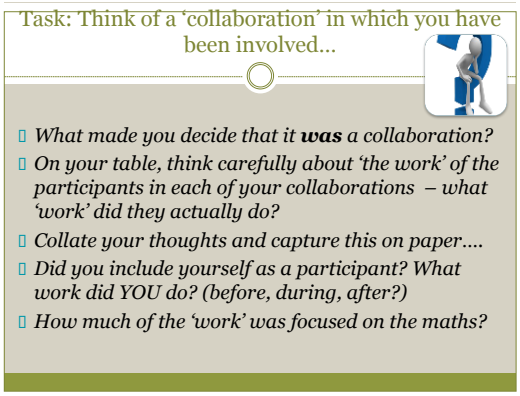
It was a deliberate aim for the group to seek to work collaboratively by trying to avoid judging each other's work, but to engage in open and positive critique and to question, question, question such that the different stories and perspectives enriched the group's learning about *the nature of mathematics teachers' collaborative work*, both individually and collectively.

We worked with the following interpretation of the word collaboration:

> *it implies co-working and possibly also co-learning and involves teachers (of mathematics) in: some joint activity; common purpose; critical dialogue and inquiry; and mutual support; in order to address issues that challenge teachers professionally and enable them to reflect on their role in school and in society.*

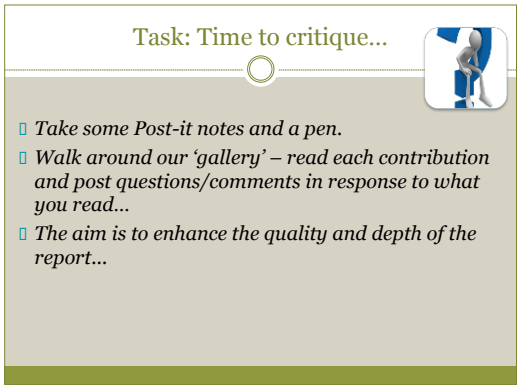
The day was divided into three distinct parts:

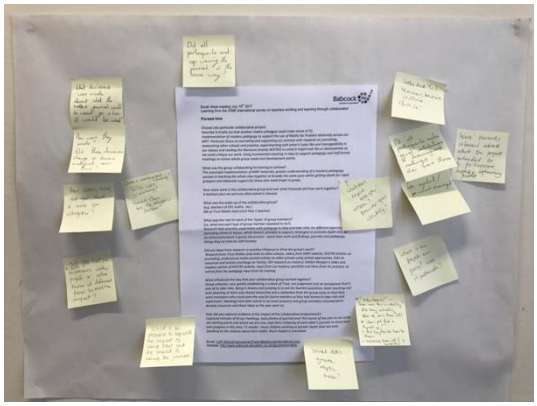
1. Discussion on the nature of collaborative work, prompted by the following task.



2. Discussion of the role that different participants play within collaborative work.

3. A 'gallery walk' of the anonymised reported case studies. This required participants to read, critique and add questions or comments that might support the author to revise and expand their report. A key focus here was to try to articulate the nature of the 'work' that any participants undertook – and to really examine in what way it was both *collaborative* and *mathematical*.





4. Time for individual reflection and further writing, which led to the revised narratives that have been included in this report.

Our aim is that this report might be a useful tool for other education professionals to both reflect on and develop their own collaborative work that involves mathematics teachers.

Participants in the day

Stefanie Burke

Imogen Burrage

Alison Clark-Wilson

Becky Donaldson

Helen Edginton

Helen Edwards

Helen Eversett

Toby Friend

Claire Hill

Alison Hurrell

Simon Lennon

Josh Lury

Vicky Morris

Helena Palmer

Jody Trayte

Ruth Trundley

Debbie Weible

Helen Williams

Linda Wynne

Carolyn Wreghitt

Teachers working and learning through collaboration: Some key themes

The following (familiar) themes emerged during the early discussion:

- It takes **Time** for collaborative projects to work, which means:
    - Projects need to run over an extended period (at least a year to have real impact) so that there is time to establish the group as a learning community.
    - Projects need to include time for reviewing and evaluation – 'doing' is not enough.
    - Some elements of a project take time but are not necessarily (nor immediately) valued by participants and might be ignored. Reflecting in written journals and keeping logs are two tools that can support collaborative work that are often neglected or under-valued by participants. This may be because in England we do not have a culture of publishing our stories of professional development. If this did happen on a more regular basis, teachers would become more used to reflecting through such writing and may value it more as it would be a necessary part of any published report. One suggestion is that publishing some tangible outcomes should be a part of every collaborative project. In our current cultural context, providing times to write, modelling this and providing support, so that the writing goes beyond recount, might be a necessary part of collaborative projects. During the life of a project, participants would hopefully come to value the opportunity to reflect and would take this on for themselves.
- **Choice and decision making are important** if everyone is to view the group as collaborative. Some structures may need to be set but, within these, there needs to be space for discussion and opportunities for all participants to influence decisions so that there is a feeling of shared ownership. This includes defining and refining the key project terminology as a group task, i.e. how things will be named, to ensure common understandings.
- **All participants need to be prepared to: be 'research-minded'**, ask more questions, do things differently and believe that different outcomes are possible. There needs to be a willingness to change. Everyone (including the project 'leaders') needs to believe that, as teachers, they are also researchers. By addressing issues that challenge teachers all participants are more likely to want to find collective solutions and, as a result, will be more prepared to make changes.
- **There is a tension between leading and facilitating a collaborative project. Participants arrive with different expectations of** the 'knowledgeable other' and/or the person who has initiated the group. It is hard to make a collaborative project work if participants believe one person holds all the knowledge and is responsible for the decision making.
- **Collaborative work can be more difficult if participants have not chosen to be involved.**

Advice for someone embarking on a collaborative project

Focus

- Work on issues that challenge teachers professionally.
- From the very start, work to ensure that everyone clearly understands what the project is aiming to achieve, and the respective roles that they will play in the collaborative work.
- Work to ensure that everyone appreciates that collaborative decisions might reshape the project along the way.
- Define the terms in the title of the project, which helps to ensure that everyone understands the focus.
- Keep revisiting the project's aims throughout its lifetime, so that any issues can be addressed and the collaborative focus realigned, as necessary.

Organisation

- The time for the activities in the project needs to be built in to the time teachers are already working. They will value it and it shows that they are valued if they are given time either within the school day or as part of school PD. If it is additional to everything else, they may not value it as highly and may find they are asked by their SLT to do other things in that time.
- Build in opportunities to explore some maths together as a means to remind all participants of: what it means to do and learn mathematics; and the nature of mathematics as a school subject and human discipline,
- Have enough structure so that people know what the intention of the project, but not too much so that they think they are implementing someone else's ideas and are not allowed to think, reflect and adjust as they see fit
- Get approval in advance from each school for the recording and showing of video of children.
- Improve any products of the project by building in time for participants to review these and ask questions about and critique what has been produced.
- Involve specialist expertise where you can to ensure that the project offers significant but supported professional challenge for participants.
- Spend time to get everyone talking and meeting each other during the first session – and remember to repeat this if, and when, new participants join the group.
- Invite the head teacher (preferably) or a member of the SLT to 'save the dates' well in advance and make it a condition of their teachers' participation that they (the head teacher) attend at least one session.
- Consider how it might be possible to brief other staff in the school to make everyone aware of the project.
- Publish *something* as a result – these could be curriculum materials, case studies of individual work or a collective project report.

Participants

- Invite teachers to 'apply' by answering some questions that capture their personal aims and context, which can be used to support later project reflections.
- Encourage participation by pairs of teachers from the same school, which supports teachers to sustain their work through mutual support. Cross-phase or year group participation is also very powerful.
- Try to make sure that the people involved have chosen to be there. Where this is not possible, build in early activities and support to enable less-motivated participants to feel valued and to identify with the project's aims.
- Try to make sure that all participants have choices within project – so that they feel a sense of ownership and can adapt and apply their professional learning to their own context.
- Ensure the members of the project have ownership of the focus of their own research to encourage commitment and high level of engagement throughout the time frame.
- Expect the participants *and the leader/facilitator* to not only reflect orally in groups but also individually in writing e.g. in a journal. Allow time for journal writing within meetings, so that it actually happens.
- Encourage participants to keep a learning journal to capture activity and thinking *between meetings* - otherwise much of this experiential learning is lost.

Group leader

- Use the pronoun "we" instead of "you" as much as possible to try to build a sense of equal status within the group.
- Plan the first session very carefully, drawing in participants' 'pre-contributions' where you can - but don't plan any others until you have met the participants and sensed their starting points.
- Try and work with someone – they can tell you you're talking too much!
- Ask the participants what they would like to see and do in further sessions and write this down. Don't promise anything!
- Keep notes of the outcomes of the sessions.
- Communicate to the group between sessions – a social media group or NCETM community is an effective and immediate way to stay in touch!
- Listen to the participants.

Pitfalls to avoid

- Avoid becoming too prescriptive about the ways that participants will work – particularly if teachers are expected to ‘research’ or write about their own practice/context. Lead participants to this in a realistic and supported way.
- Don't do all the work yourself – the aim is that the work is shared, with each participant making a contribution to the whole project.
- As "the lead" person, be careful not to be overly pragmatic (i.e. "just get things done"), which could damage the collaborative approach. Consider inviting participants to take turns to undertake roles such as creating the agenda and capturing key points from discussions.
- Don’t rush into 'doing' before investing time in setting an ethos of collaboration
- Don't cease to consider individual experiences and feelings throughout the undertaking, so that everyone continues to feel safe and confident in the collaborative LEARNING OPPORTUNITY that is being undertaken TOGETHER.
- Don’t answer questions such as ‘Is this what **you** want?’. The participants are not there to satisfy your goals!
- Don’t expect the impact/change to be what you want and don’t try to make this happen by heavy steering.
- Over-planning is a pitfall; be prepared to ditch something if a discussion is going well.
- Don’t assume that all group members will hear/read the same messages and apply things in the same way; think carefully about how to ensure equity, drawing together some common themes and some sort of accountability measures but at the same time not being so prescriptive that it limits experimentation and innovation needed for the project to succeed.
- Don’t let participating teachers think that attending meetings alone will impact on their classroom outcomes. Encourage them to realise that they need to carefully plan and review what they will change or implement.
- Don’t ignore persistent absenteeism or non-commitment to the project. Find out about the issues that have led to this and seek to realign the project’s goals to support the participant(s) to re-engage.

Collaborative Projects – Case Study 1:

Using the ‘Big 5’ to develop mastery approaches in KS2 mathematics

Working in turn with year teams in a Junior school (three teachers per year group) to develop mastery approaches to teaching and learning; demonstration lesson based on the ‘Big 5’ in practice to facilitate discussion led by the adviser, joint planning/SKE workshop, team teaching with the adviser with two teachers observed by colleagues and videoed & final reflection meeting.

The group was aiming to further develop understanding and implement the aims of the primary curriculum (fluency, reasoning and problem-solving) and mastery principles, including deepening understanding, keeping the class together, challenging pupils through depth and greater reasoning/cognitive demands of tasks.

Each group consisted of three teachers in the same year group (parallel classes – one group for each of years 3, 4, 5 and 6) and the adviser. Each project spanned over approximately three weeks.

The Adviser gave a demonstration lesson to illustrate the ‘Big 5’ Mastery ideas, led a subject knowledge workshop based on a maths topic (such as fractions or Multiplication/division), supported the year team with ideas for lesson sequences, key representations (such as the bar model or resources such as Numicon or the bead bar) and taught alongside the teachers observed by colleagues. The Adviser also led the final discussion/reflection session and wrote a report for the HT.

All teachers worked in year teams after the demo lesson and subject knowledge workshop to plan a sequence of lessons for two to three weeks (longer on key topics) and develop resources which could be used by all classes, such as a ppt presentation or practical resources such as laminated ‘pizza’ circles for a fractions sequence; the two teachers team teaching with the adviser planned their own lesson and taught alongside the Adviser, observed and videoed by colleagues.

The work of the group was influenced by NCETM’s ‘Big 5 Idea for Mastery teaching’ from the teaching for mastery specialist training and Nunes research on Fractions (2009).

Time and costing constraints influenced the project (a small scale short term project over three weeks) in terms of releasing a whole year team at one time and the adviser charges.

Teachers chose the maths topic for the project to give ownership and planned their shared lesson individually to make it bespoke for their class; although the ‘same’ lesson in the sequence, they were different depending on the focus for the teacher and personal preferences for example use of ICT and understanding of using the bar model etc.

Lessons and the workshops were videoed to aid discussion, to be shared with all staff at a later date in CPD meetings, pupils’ work was copied and used in the final discussion (and staff CPD) and a report for the school was written by the adviser with outcomes/recommendations for year teams and whole school change.

Alison Hurrell, Independent Adviser working on behalf of Plymouth Council, July 2017

Collaborative Projects – Case Study 2: Numbers Count

Continuing Numbers Count teachers are expected to have a wider impact on the teaching and learning of mathematics throughout their school. This might include:

- observing children in the classroom
- supporting colleagues
- leading staff development
- working with the mathematics co-ordinator
- supporting lighter touch interventions

Each year Numbers Count teachers work collaboratively to develop an aspect of their practice which will have a wider impact on the teaching and learning of maths in their own schools. In the past teachers have focused on such things as:

- Devising a calculation policy which reflects the principles of Numbers Count
- Planning and delivering workshops for teachers, TAs and parents
- Implement and develop the use of lesson study as a PD model
- Develop homework booklets for each year group

As the lead trainer, my role is to support and guide them to do this as effectively as possible. I support them by providing a framework with questions and prompts to guide and structure their action research. This allows me to signpost them to relevant research. Numbers Count teachers are used to reading research as part of their professional development. Often my role is reminding them of something they have already read which is relevant.

Each group or individual may have a different focus depending on the specific needs of their school. Numbers Count teachers have a link teacher in their own school whose main role is to promote and support the programme within the school. A focus for the collaborative task is decided in consultation with the link teacher and will be linked to whole school key priorities. The link teacher is encouraged to be part of the collaboration task activities where possible. The aim is that this action research will have an impact on the teaching and learning of mathematics across the school.

The number in the group varies from year to year depending on the size of the whole group. Within the bigger group teachers will form smaller groups of two or three. This is sometimes determined by geography (the distance between their schools) or having a common focus.

All the participants are Numbers Count teachers. Some have other roles such as Deputy Head, maths subject leader or SENCo. In the past, we have had teachers working in Primary, Secondary and Special schools.

In some groups the teachers focus on the same thing. If this is the case, they ‘plan, do, review’ together based on shared experiences comparing outcomes and making decisions about next steps for each person/school. However, this isn’t always the case. Where teachers have a different focus they will support each other in their action research cycles. In these scenarios group members

provide a supporting role as a 'critical friend' by questioning actions and prompting each other to be critical of their own actions and findings.

As the lead trainer, I signpost each group towards any research I know would be relevant. It is interesting to note that where groups of teachers begin their action research with a different focus, they are often more willing to adapt their ideas along the way as they are reflecting on the outcomes of others and not just their own research. Where groups are all working on the same focus, this happens less frequently.

Throughout the year we meet as a whole group as part of on-going CPD for Numbers Count teachers. This includes a session which focuses on their collaborative task and is an opportunity to share what is happening or ask for help and ideas. Each of the smaller groups meet together twice a term. The timetable for these meetings is provided through Every Child Counts. However, I have adapted the structure and support materials slightly in light of my own experiences with action research and collaborative group tasks. One member of the group is also experienced in working in this way in her school so we have incorporated structures and ideas that have been successful. For example, I provided a structured planning sheet with key questions to help them decide on a research focus and question. Also, there is an expectation that each group will share the outcomes from their research at the final PD day. In the past, the feedback from the teachers has tended to be a recount of events. Therefore, I provided a structure for feeding back their findings under these headings:

- Rationale
- Research question/s
- Action Research
- Outcomes, including next steps

When visiting the Numbers Count teachers in their schools, the collaborative project is discussed with the link teacher and/or head teacher. Numbers Count teachers' reflections include impact on themselves and also impact more widely in their schools.

Carolyn Wreghitt, Babcock LDP, July 2017

Collaborative Projects – Case Study 3:

Teaching for Mastery Specialist Programme

Teaching for Mastery Specialist Programme and the subsequent teacher research group and mastery specialist visit days.

The aims of the group were:

- To raise the understanding of all involved of the teaching of maths mastery.
- To collaboratively develop a range of knowledge, skills and understanding of all of those involved around the concept of maths mastery teaching.
- For teachers involved to have an opportunity to develop both their own expertise -and the expertise of colleagues within the group and their own schools, when teaching maths lessons, with a specific focus on the core principles of teaching for maths mastery.

The group consisted of one teaching for mastery specialist teacher and twelve colleagues, who were pairs of teachers from across six different primary schools. The group worked together for a period of one academic year. Teachers of maths from across KS1 and KS2 were involved (consisting of partnerships of KS1/KS2 teachers from each of the six different primary schools).

Each group member was expected to: develop their understanding of teaching for maths mastery; be open and honest with the group about areas of their teaching which could be further investigated developed; work together to agree areas to further investigate around maths mastery teaching and "experiment" with these in their own teaching; consistently reflect on their own teaching (and that of other teachers involved).

The work of the group was influenced by the NCETM's range of materials for supporting teaching for mastery. The work of the group was also influenced by NCETM expectations and protocols, the individuals involved and the group leader's own personal experiences.

Evidence of impact was identified through ongoing dialogue and lesson studies; evidence within planning and children's outcomes; assessment data; lesson observations; and evaluation feedback.

Jody Trayte, High View School, July 2017

Collaborative Projects – Case Study 4: Early Years Research Group

This was a working group funded by the Cornwall and West Devon maths hub. A group of twelve reception and year one teachers from six schools attended in pairs, after filling in an application form jointly for a place. We billed this as a research group rather than a course and our understandings of what this might mean were shared with participants from the outset. These initial application forms emphasised the collaborative nature of the project and asked participants what they hoped to gain from attendance and how they might make their partnership work. In addition the number of meetings as well as when and where these took place was decided at the first meeting, as well as some of the content of each meeting and what was to happen in between meetings.

At the first meeting, after some high-quality input from a national speaker on early years mathematics, participants were supported in coming up with their own research questions. Participants were given the sentence stems "I am interested in finding out … to what extent …" or, "… in what ways …" and completed these in pairs. Participants were also given an exercise book that was to be used as a reflective journal and we discussed how these might be used. It was encouraging to see these journals referred to in subsequent meetings. We invited a member of each school's SLT to attend part of this meeting. Disappointingly only half the schools brought someone. Overall we met four times as a whole group over six months. In between, the teachers were released to meet to: read research; plan what to work on; and write up a reflective diary. Some guidance was given on how this time might be spent and they were encouraged to take this time together.

After the first meeting the group conveners visited the teachers in school and met with a member of the SLT. Participants brought video clips of their children to share at further meetings. These focused on a significant moment they had observed that revealed a key finding in terms of their research question. At the final meeting, the knowledgeable other that had made an input to the first session made a further input and each school gave a 5 minute presentation on their key findings. At the request of the group members, an SLT member was invited to this final session, and finally 4 attended along with the Assistant Director of the NCETM.

The initial research questions steering the whole group developed by the group convenors for the NCETM work group planning framework were as follows:

- In what ways might international research on effective early years mathematics inform our practice?
- To what extent do principles of 'teaching for mastery' support effective mathematical development in reception and year one?
- To what extent are 'big ideas' in early years mathematics a useful tool in planning for progression?

We were aiming to deepen and develop reception and year one teachers' knowledge and confidence in teaching mathematics, with particular attention to the learning and teaching of number; to raise awareness of international research into early years' mathematics and to empower reception and year one teachers in juggling Early Years pedagogy with national pressure to 'raise the bar' in

terms of mathematical attainment. Ideally this was to be a cross-phase project that aimed to address some of the current gaps in knowledge between reception and year one teaching and learning.

The group involved two group conveners and six pairs of teachers from six schools who met over six months; the group will continue in some form over another academic year, with the agreement of the teachers, and maybe link up with the new group beginning in the new academic year. The teachers were: eight reception teachers, two year one teachers and two teachers with mixed reception/year one classes.

The group members were expected to: participate actively in the whole group meetings; meet in between with their partner teacher; undertake readings; and carry out research and film extracts of this in their classroom. We prioritised participation by taking part in shared tasks from which ideas were fed back to the group. The group was deliberately kept small as we felt that participation in terms of talking out loud to the whole group and asking questions was more likely to happen.

Key stage one and reception teachers supported each other well in how to work on the research questions back in school. Different pressures were discussed and acknowledged. Finally every school gave their presentation jointly by choice.

Dr Sue Gifford from Roehampton University set the project up with a discussion of the role of subitising and pattern work in predicting later mathematics success and this strongly influenced discussions and the work the group undertook in their classrooms.

The main factor influencing the way the group worked was time. There was also more than one person steering the group. The whole group meetings were flexible enough to respond to the needs of the group members.

During the final meeting, participants made many references to the impact of the project on their teaching. The group leader made a decision to type these up as evidence of a growth in knowledge and experience. The final meeting contained an element of how participants might collect their own evidence of impact on their children. Our collection is still happening. The participants have their reflective journals to refer to and we plan to interview three volunteers about their experience and the impact on their future work in the autumn term. We also plan to collate video snippets and quotes to perhaps put online.

Helen Williams, Independent Mathematics Consultant, July 2017

Collaborative Projects – Case Study 5: Lesson Study on teaching formal written methods with understanding in years 3 and 4.

This was a Lesson Study project across six schools. As a group of schools, we had experimented with Lesson Study over a number of years and had anecdotal evidence of its effectiveness. We decided to look at the process in more detail to learn which elements were most important in developing teachers understanding. This came at a time when all of the schools in the group were rethinking the teaching of calculation and the subject leaders identified subtraction and division as the most problematic for the teachers in their schools to teach with a deep understanding. Each school agreed to carry out a Lesson Study cycle in either year 3 or 4, focusing on either subtraction or division. We had an agreed focus on using manipulatives *alongside* written strategies to investigate the impact of *enacting* alongside *recording* as a way of deepening pupils' understanding of these calculation operations.

This group already had some experience of Lesson Study and had been considering ways to move towards formal written methods **with understanding.** All subject leaders involved had interviewed pupils and realised that many were able to 'do' the calculation accurately but could not explain why they were doing what they were doing. We wanted to work together so as subject leaders we could have in-depth discussion about what we were seeing and how Lesson Study was supporting teacher learning. We were particularly interested in how manipulatives supported a move from a procedural approach to a conceptual approach.

The project ran over 18 months with subject leaders facilitating three lesson study cycles and a termly meeting to draw together evidence and draw out key themes. Subject leaders in each school were working with year 3/4 teachers in their own schools.

Subject leaders met initially to develop a shared understanding of current research around teaching subtraction and division. We read articles and chapters from books. We experimented together with the use of manipulatives and the language we might use in teaching these operations. We also read lots of articles on Lesson Study and shared our current understanding and recent learning.

We also met together termly throughout the project to reflect on the learning in each school and draw out common themes. Subject Leaders also facilitated Lesson Study within their schools, ensuring teams had time to plan research lessons together and to draw out learning as a 'knowledgeable other'.

Year 3/4 teachers were expected to plan, observe and reflect on research lessons together, with the support of their subject leader. They were also required to read articles linked to either subtraction or division (whichever they chose to work on).

The group (teachers and subject leaders) was influenced by articles and research about the use of manipulatives to teach calculation. They also used chapters from recommended books.

Subject leaders also used the national document, 'Great professional development that leads to great pedagogy: nine claims from research'

We worked under the framework of the national themes research framework with three key phases: implementation, innovation, impact. This was part of a national project and as the project lead, I attended termly meeting with other project leaders where we discussed aspects of collaboration, which were working well and those that weren't.

We used pupil and teacher perception surveys and calculation tests at the start of the research, which were repeated at the halfway point and at the end.
We also used semi-structured interviews with the year 3/4 teachers involved in the project to unpick how their subject knowledge and pedagogy were changing.

All teachers and subject leaders involved in the project kept learning journals to capture thinking throughout the project. These developed over time and teachers began to adapt how they were using their journals with some using different colours to distinguish between narrative and evaluative statements.

Debbie Weible, Oldway Primary School, July 2017

Collaborative Projects – Case Study 6: Pre-teaching and assigning competence in Key Stages 1 and 2.

Pre-teaching was one of the teaching practices, used by some teachers in two previous action research projects, which appeared to have a positive impact on participating children. It involved short sessions (around ten to fifteen minutes) usually immediately prior to a lesson, in preparation for the lesson. It was hypothesised that pre-teaching was effective because it supported children to participate and be competent in maths lessons and this seemed like an area that needed further investigation.

We looked for available research into both pre-teaching and assigning competence. For pre-teaching we located one personal account from an American teacher but no research and found a little research on assigning competence, mainly by Cohen et al (1994), cited by Boaler (2016). An action research project was the obvious next step to find out more.

Schools were invited to participate. The invitation included the following information about the structure of the project:

We are inviting schools to apply to be part of this research project. Each participating school will need to identify two teachers who are interested in researching this area and are prepared to try things out, reflect on their observations and share their thinking with other teachers and advisers. They may already be trying out pre-teaching or have yet to explore what it has to offer; teachers with either experience can be involved.

The details for the project are as follows:

- *The action research will be classroom based and involve case studies. Each teacher will choose three children to focus on with closing the gap (and therefore pupil premium) one of the key drivers.*
- *It is essential that both teachers in each school participate fully in all elements of the project. Full involvement includes:*
    - *Attending the launch day: 29th Sept 9:30 – 1:30*
    - *Working together, with support from a maths adviser, to run at least four rounds of collaborative lesson research. Each cycle will involve the two teachers:*
        - *planning together pre-teach sessions and how these will be linked to the maths lesson through assigning competence for the focus children from both of their classes*
        - *running the pre-teach session(s) and observing their colleague run their pre-teach session(s)*
        - *reflecting together on the pre-teach sessions*
        - *participating in their colleague's maths lesson following the pre-teach session (focussing on assigning competence)*
        - *talking to the focus children from the colleague's class following the lesson*
        - *reflecting together on the impact of assigning competence and agreeing next steps.*
    - *Continuing to work on pre-teaching and assigning competence between the collaborative lesson research cycles.*

    - *Attending five, one and a half hour cluster meetings spread across the year (approximately one each half term). These will bring teachers from the different schools together in small groups and could take place after school or during afternoons, depending on what suits the teachers and schools; this will be agreed at the launch meeting.*
    - *Keeping a reflective journal throughout the project.*
    - *Using video/audio taping to inform the case study, capturing the impact of the project on learners and learning.*
    - *Contributing to a feedback meeting, which will take place in June 2017; this will include being videoed talking about the impact of the research.*
- *As well as supporting the lesson study cycles in school, the maths adviser linked to your school for the project will visit at the start of the project to support the collection of qualitative and quantative data.*
- *Teachers involved also need to be willing to be part of research themselves, as we will be looking at this project from a research angle in our team. We will be asking the teachers to complete questionnaires, recording discussions and collecting reflections at significant points during the year. We will provide both the teachers and children with journals as part of the project.*
- *To support your school in maximising the benefit of being involved in this project we will offer an after-school briefing for all of your staff lasting half an hour, at the end of our first visit. We hope that this will allow more staff to become engaged in thinking about this area and will provide the starting point for the participating teachers to share aspects of the project which we hope will continue on a regular basis throughout the year.*

We set up the project initially involving 19 schools and 43 teachers, who were committed to improving outcomes for low attaining children in receipt of pupil premium. Two teachers from each school were identified to participate in the project and they taught classes ranging from Y1 to Y6. Head teachers were invited to participate in a live webinar so that they were fully informed about the project.

Five mathematics advisors supported the project across the whole of the 2016/7 academic year. During the year, two schools ceased involvement due to personal circumstances of the teachers involved and there were two changes to teachers involved due to maternity leave.

The project started with the research question:

How can we support all children to access age-appropriate mathematics and be active and influential participants in maths lessons through effective use of pre-teaching and assigning competence?

which became:

How can pre-teaching and assigning competence be used to effectively support children to **access age-appropriate mathematics** and **be active and influential participants in maths lessons?**

The teachers engaged in action research to explore different ways to use pre-teaching and assigning competence and to identify how these can be used to have a positive impact on learners, in particular in their participation in maths lessons and their ability to be influential during the lessons.

Whilst the focus for the project and the research question was presented to the teachers, the decisions about who the focus children should be, how, what, where and when to do pre-teaching and how to assign competence in maths lessons were all made by the teachers, as these were the aspects being researched, and they were the focus of the collaborative discussions that took place in schools, in local cluster meetings and within the whole group meetings.

As advisers, we had our own research question which was:

How can we support teachers to develop their own practice through action research?

We were interested in seeing whether teachers would make changes to their practices and beliefs as a result of engaging in action research (see Swan 2011).

At the start of the project, teachers and advisers together collected data in different forms; this included observations of the focus children in a mathematics lesson, talking to the focus children about maths and doing some maths with the children.

During the project, all participating teachers actively tried out different ideas that they thought would be useful or that they identified they wanted to try for pre-teaching and assigning competence in mathematics lessons with their three focus children. They reflected on the impact on the children of the change in their practice and wrote about this in their journals and logs, sharing their experiences in the cluster groups, which an adviser facilitated.

The school-based pairs of teachers worked with an adviser to plan for collaborative lesson research. This followed a model closely linked to CLR in Japan, with the live research sessions within each CLR cycle planned for in detail. Planning ran over a number of sessions across a period of weeks and teachers read related research papers between planning meetings. Planning included anticipating children's responses and planning for how to deal with different responses. The live research sessions were observed and analysed afterwards with the planning group discussing the impact of the teaching decisions, at the planning stage, on the learning.

The final cycle of CLR took place in one school with all the teachers observing. The lesson had been planned by the teacher and the advisers and the plan had been shared and interrogated at the cluster meetings so that each teacher had an understanding of the plan and could contribute to anticipating children's responses and how to deal with them.

The team of advisers provided relevant research, as well as supporting subject knowledge during the intensive planning for collaborative lessons, questioning teachers about the decisions they were making for example with regard to numbers that were chosen. They also facilitated the discussions at all levels, supporting teachers to reflect on their changing practice and how it affected the children's learning.

The work of the group was influenced by research. The focus on assigning competence and pre-teaching came from previous action research projects. Further influences came from:

- Complex Instruction: Equity in Cooperative Learning Classrooms Cohen et al 1994
- Why I Prefer Pre-Teaching to Remediation for Struggling Students Minkel 2015
- Japanese Collaborative Lesson Research – Takahashi, Fujii and Keiichi
- Pedagogy: various including Skemp, Swan, Askew, Foster
- Mathematics: various including Nunes, Gattegno, Lai and Murray

There were many layers of collaboration built into the project:

- The teachers collaborated in their school pairs; the idea of pairs was intentional so that everyone had someone to talk to on an everyday basis.
- The pairs of teachers collaborated with a 'knowledgeable other' (maths adviser)
- The teachers collaborated in cluster groups supported by the adviser
- The teachers collaborated as a whole group, meeting together three times during the project
- The maths advisers collaborated together through team meetings and via e-mails.

Teachers reflected on the impact of their action research in a journal. Later they were provided with a log, as the shape of the project developed, to keep track of their work. The thinking of the teachers in the cluster groups and their willingness to engage in unpicking their thinking and reflecting on their own understanding influenced the way the groups worked together.

The CLR sessions were hugely influential in creating the climate where everyone felt they could say what they think and had something to offer. The level of detail in planning gave safe opportunities, allowing everyone to feel that we were getting inside the mathematics as well as finding ways to support and involve disengaged children. The research lesson was recorded in a research proposal. The terminology *research proposal* was used instead of *lesson plan* in an effort to focus on the action research ethos of the project rather than on a performance or judgmental ethos. The live sessions allowed the teachers to think hard about the effect of decisions they made when planning and teaching and so encouraged them to be reflective based on evidence from the children rather than hunches or established beliefs.

There was a tension sometimes between collaboration and the role of the adviser as 'knowledgeable other'. This became most evident in the first cycles of CLR when some teachers expected the adviser to say what should be in the plan, spoke about the live sessions as 'being observed by the adviser' and waited for the adviser to lead the following discussion. Over the time of the project there was a shift and collaboration was better understood by the end.

Evidence of the impact of the collaborative project has been captured in a number of ways.

- Video of the children talking about the impact on them
- Video of the teachers talking about the impact on the children and on them
- Questionnaires from:
    - children involved
    - children who worked with the children involved and were influenced by them
    - teachers – before and after
- Observations of children in maths lessons
- Case studies – completed by the teachers on one of their focus children
- Assessment data from Y2 and Y6 children
- Reflections by teachers at the end of the project – both in writing and on video

Findings have been published in a report: Supporting children to be active and influential participants in mathematics lessons through effective use of assigning competence and pre-teaching final report July 2017

Ruth Trundley, Helen Eversett, Stefanie Burke and Helen Edginton Babcock LDP July 2017

Collaborative Projects – Case Study 7: Using journaling to support the use of Maths No Problem materials in Year 1

This project focused on the implementation of mastery pedagogy, to support the use of Maths No Problem materials across our MAT, with a particular focus on journaling. This included using research on journaling, researching other schools and practice, experimenting with what it looks like and manageability in our classes and reading the literature (mainly NCETM) on what it might look like or demonstrate so we could critique our work. Half-termly meetings were used to review whole group needs and development points and incremental coaching in class to support pedagogy. This involved me (trust maths lead) as coach with teachers in their own classes, working on an element of pedagogy they wanted to develop, which came from things we discussed as a group, from the MNP two-day mastery essentials training, from videos they had watched on the MNP online materials or something I noticed and suggested they may want to develop. In the lesson, I would ask the teacher questions to coach them through a specific part of the teaching sequence or part of the questioning or modelling in that lesson and if the teacher wanted me to I would model part of that and they would then use this again later in the lesson. We reviewed the lesson at the end and then looked at how to develop another aspect for the next session. Coaching sessions were for all six teachers half-termly.

The groups was aiming for successful implementation of MNP materials, greater understanding of a mastery pedagogy including success in teaching the whole class together at broadly the same pace whilst providing both greater depth for 'rapid graspers' and adequate support for those who needed longer to grasp. For the purposes of this project we identified 'rapid graspers' as being those who were quick to understand a concept; they could not just solve problems quickly, but could also show various ways of finding the answer and explain how and why they got that answer (not just talking through a procedure). The project was hoping to show teachers how we could ensure that children had grasped the concept and were not just quick at finding answers (and therefore appeared to be a 'rapid grasper').

Parents were informed about the project and each school held a session for parents to come in and be taught the same lesson their children had been taught that day and teachers highlighted where the support was for learners, how manipulatives were a feature of every lesson for all children and how journaling worked. They were shown the sort of activities and challenges that children were expected to do if they had completed the workbook and teachers explained how this ensured depth rather than acceleration to new content so that parents were reassured.

The group was made up of six Y1 teachers (two NQTs, two in their second year of teaching and two experienced teachers) plus me as MAT Maths lead and a seventh Y1 teacher joined in January. We met six times (half-termly) over the course of a year. Y1 teachers were invited to attend the meetings but they were not compulsory and they gave up their time after school to attend meetings (often in the same week as other meetings) as they felt the sessions were useful and helped develop their practice in class. Plus, they valued the time to work together and share ideas and resources and best practice they developed (especially looking at each other's journals)

The group members were expected to research their practice, experiment with pedagogy in class and take risks, try different approaches to journaling (times in lesson, whole lessons, prompts to support, strategies to promote depth etc.), and actively participate in group discussions, sharing their work and findings, journals and pedagogy, things they had tried, with honesty. Not all participants made equal contributions to discussions; some were more dominant than others, notably those who had more teaching experience and were more confident in maths. At the start of each meeting everyone was encouraged to reflect on something they had changed as a result of the last session and the resulting impact; this ensured that even the less confident contributed. Peer critiquing journals in pairs and then independently also encouraged all to be active participants.

The group's work was informed by the trust maths lead visits to other schools, videos from MNP website, NCETM articles on journaling, professional maths journal articles on other schools using similar approaches, links to resources and articles and blogs on Twitter, EEF research on mastery, Debbie Morgan's slides and mastery section of NCETM website, input from our mastery specialist and ideas from his practice, as well as from his pedagogy input from his training

Group cohesion was important; very quickly establishing a culture of trust, not judgement and an acceptance that it was okay to take risks. Being in lessons and jumping in to ask the learners questions, team teaching and joint planning so there was shared ownership and a realisation from the group early on that they were innovators who could pave the way for future teachers so they had license to take risks and experiment. Meetings held after school so no cover pressure and group members signed up to develop resources and share ideas as the year went on. They would put ideas forward of things they could use to help them e.g. a bookmark to keep page open and also of prompts to support journaling when workbook complete. As a group, they decided what would go on the bookmark (in the meeting) and one teacher typed that up and shared via email with everyone else. Other resources and all minutes and agendas were collated in a google drive file for Y1 teachers that I set up but that they added to as the year went on with prompts, photos of work, photos of children working, videos of children explaining, articles or blogs they had read. I would signpost everyone to any new materials teachers had added in each meeting. Some teachers owned this and contributed to it more than others and those were the teachers that had more success in the project. I have decided to work with two of the teachers in a more tailored and focused way next year in addition to this project continuation for the first half term (being organised and led by me anyway – I hope they will still meet after this) because these two teachers have experimented but their pedagogy needs more support and the collaborative nature of the group will still help but they also need to now be accountable in order to take ownership.

Minutes of all our meetings were shared with all participants, maths leads in each school and Heads of Academy so that all could see what we had discussed and what we had agreed we would change in our lessons as a result so this was followed up in future lesson observations and work scrutiny. We took photos of journals over the course of the year so we could see starting points and where we are now and these have been retained so we can use them to remind ourselves of expectations at the start of next year and also to show year groups who are new to starting MNP next year of what it could look like. We kept their critiquing of each other's journals to show their own progress in this area. Y1 end of year data (TA) showed more children working at or above the expected standard for

Y1 than last year. Much impact is anecdotal and reflected in things like speaking to the children about their maths.

I think that it is difficult to separate out the impact of using MNP and the impact of using the journals as the two have evolved together. However, our journal focus did not come until the summer term and up to that point journals were just being used however teachers saw fit. The impact up to this point was that children were reasoning more on a daily basis, they were showing multiple methods and drawing pictures of their understandings, using key representations and telling stories behind the numbers on whiteboards and when answering workbook questions very articulately up to the end of the Spring Term. The impact of the journaling work has been capturing some of that thought process in one place and ensuring that all children are doing this in every lesson.

Although I did not hold pre-and post-interviews with pupils to measure impact, I was in lessons with the same classes six times over the course of the year and therefore I could observe the impact as the year progressed including how the children were able to articulate clearly in their journals by the summer term. As an experienced teacher, I know that this compares favorably to what our Year 1 children were able to do and the way they were thinking in previous years and I can see this by comparing back to books we have retained from last year's cohort. In future projects, I would be inclined to video a focus group of children in each lesson to see how they approached an anchor task at the start and end of the project.

The project is continuing next year focusing on one specific lesson and where the support and challenge is within the lesson. We are hoping to collaborate on one lesson plan and where the misconceptions are, how to expose these, how to plan in extra support for those who need it and to interrogate the workbook, looking at the variation and why questions have been chosen, how they change, why and what would be the minimum everyone needs to do to understand the concept? Which questions go deeper and why? This will lead to a sustainable model of planning where the teachers can support each other in asking these sort of questions when planning lessons in the future in smaller groups (parallel classes and in the single form entry schools working together with the other single form entry schools).

Maths leads across the MAT have seen how this project has developed and the small steps approach we have taken this year to ensuring the whole group felt safe to take risks, come back and discuss and then be guided by my research into other schools and ideas from them on approaches etc. This has led to the sustainability of the project next year as maths leads replicate this project with other year groups who are new to teaching using MNP materials. They have agendas and minutes to draw on from last year. The incremental coaching is a sustainable part of the project and something that is being developed next year as the Y1 team act as peer coaches so they will go and observe each other teach and identify one element they want to develop and that teacher will be in class with them coaching them through it over a series of two or three sessions.

Not all participants ended up using the journal in the same way but there are similarities to the way they are used. We all agreed the success criteria based on our research from other schools and reading the NCETM article and others about journaling and this gave us some guiding principles but each teacher's journals looked slightly different. Where they were similar was when teachers were working in parallel classes and had clearly planned journaling opportunities together. In two of the

teachers' books journals were used only as an extension for those who had finished the workbook and then were filled with more of the same questions or challenge cards and not the reflective tool we had agreed. All participants had children trying to use the bookmark prompts to develop a reflective approach but these were better developed in some classes than others and when we unpicked this in our critiquing sessions we discovered this was down to teacher expectation, modelling and prompting of what they expected to see and children understanding what was expected when responding to these prompts – something I am keen to follow up on this year for those that didn't have the same sort of journaling. The process of using a journal was evolved over the last term of the project and as a group we agreed to all trial different ways of using it with the key principle that journaling was not just for those who finished the workbook but that everyone should be journaling. Therefore, teachers started to plan when in the lesson to journal and what to ask children to journal about. By the end of the year there was a realization that some sort of modelling and praise for the reflective type of response expected was necessary to get the depth of understanding out of children and this is something that needs to be carried forward to the next term of the project. The success criteria and decisions about how to use the journal were continually changed and modified as we kept sharing what ours looked like, referring back to the article that we took our guiding principles from and discussing what we wanted to see – not just more of the same – we know they can do it from the workbook but we want some sort of explanation or drawing of their understanding of the concept, possible misconceptions, examples and non-examples. This was tweaked over several sessions.

Helena Palmer, All Saints Teaching School Alliance, July 2017

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Appendix: Pre-Task Form

South West meeting July 19th 2017
Learning from the ICME international survey on teachers working and learning through collaboration

Choose one particular collaborative project.

Describe it briefly (so that another maths colleague could make sense of it).

What was the group collaborating for/aiming to achieve?

How many were in the collaborative group and over what timescale did they work together?

What was the make-up of the collaborative group?

(e.g. teachers of KS1 maths, etc.)

What was the role for each of the 'types' of group members?

(i.e. what was each type of group member expected to do?)

Did any ideas from research or practice influence or drive the group's work?

What influenced the way that your collaborative group worked together?

How did you capture) evidence of the impact of the collaborative project/work?