

NCETM: *Collaborative Practice* for Mathematics CPD
Review and preliminary evaluation of work with Pathfinders

1. Introduction

Although the National Centre began operation officially on April 3rd, 2006, since September 2005 on behalf of NCETM, CIMT (Centre for Innovation in Mathematics Teaching) has been working with Pathfinder schools and colleges in a “test of concept” programme which has focused initially on implementing collaborative practice and related networking among institutions. This paper gives the background to models of collaboration and clarifies the methodology being piloted in the Pathfinders and gives early evaluation results.

2. Background: Collaborative Practice Models

There are many models of collaborative practice in operation both in the UK and around the world. This paper gives a summary of the major initiatives and their impact but starts with the preparatory work which influenced the focus and direction of the successful bid for the National Centre.

2.1 Eastern European model

Over the past decade, staff at CIMT have undertaken two major international longitudinal research studies, namely the Kassel IPMA projects (see **references 1 and 2**) and have learned much about effective mathematics teaching from colleagues in Eastern European countries such as Hungary, Poland and the Czech Republic.

More recently, a deeper understanding was gained of these countries' methods of initial and in-service training of teachers (see **reference 3**) which are similar in underlying philosophy to whole-class interactive teaching. They place a strong emphasis on collaborative work where students and teachers learn from, and contribute to, the teaching of others, thus raising standards of pedagogy for all concerned. In addition, it was common for teachers both from within the school and from other neighbouring schools to observe lessons and crucially to take part in the follow up discussion.

Over the past three years staff at CIMT have been experimenting with this approach in the training of student teachers (through multiple placements) and in CPD and have found the model to be very effective. This is reported in **reference 4**.

2.2 Japanese Lesson Study method

Many have credited the steady improvement of Japanese elementary mathematics and science instruction to their teachers undertaking “lesson study”. This is a process in which teachers jointly plan, observe, analyse and refine actual classroom lessons, called “research lessons”. It is a widespread initiative in Japan, comprising

of within-school lessons and public lessons; however only 2 or 3 public lessons are covered in a year. In each case, the lesson study involves:

- groups of teachers thinking about the long term goals of education, but focusing on the goals of a particular subject area, unit or lesson (for example, why do we teach multiplication of fractions, how do we introduce the concept and how do we teach it?);
- they carefully plan the classroom “research lessons” that bring to life the topic and help the longer term aims for the pupils; they might adapt published lessons or use previous lesson plans;
- undertake a detailed study of how the pupils respond to these lessons, including their learning, engagement and interaction;
- revise the lessons plans and teach the lesson again, revising again if necessary.

You can find more detail in **references 5** and **6**, but its impact and its potential use in other countries, notably the USA, was promoted by Stigler and Herbert through the TIMSS (Third International Mathematics and Science Study) results and video evidence (**reference 7**)

2.3 Stigler’s Lesson Lab and other initiatives in the USA

The first lesson study group was formed at the UCLA Lab School in 1993 and this was the start of great interest in this technique for improving practice in schools in the USA. It was not just the work of Stigler (see **reference 8**), which has resulted in a commercial operation for lesson study, funded by the educational publisher, Pearson (**reference 9**) but also educational researchers based at Columbia University (**reference 10** provides detailed information and templates for implementation) and it is estimated that over 30 states now have lesson study groups with over 2000 teachers involved in lesson study.

The model recommended usually has the following stages:

- 1. choose a research theme:** a group of teachers agree a research theme, often school/college-wide and involving student skills or attitudes that the school or college wishes to promote;
- 2. focus the research:** the group chooses a unit of study to focus on and considers the overall research theme in this context;
- 3. create the lesson:** the group selects a lesson or lessons within the unit to concentrate on, using a lesson planning template to plan lessons jointly;
- 4. teach and observe the lesson:** the lesson is taught by a member of the group and observed by the other members; the focus of the observation is on student thinking and responses rather than the teacher’s ability;

5. **discuss the lesson:** the group gets together, usually on the same day, to discuss the outcomes of the lesson and their observations;
6. **revise the lesson:** revisions are made to the lesson, based on the observations and one of the group is selected to teach the lesson again; the process of observation, discussion and revision is repeated if necessary;
7. **document the findings:** at the end of this process, the group produces a report that outlines what they have learnt with regard to the research theme and goal;
8. **present findings:** the group presents its findings to other groups and/or conferences.

The length of the process varies but it is not uncommon to take up to a year or two. The size of the group also varies but typically involves four to six teachers, as well as an administrator and external expert. The whole process is thought of as a bridge formed by teachers working together and collaborating across the curriculum rather than in isolation.

2.4 UK initiatives and evaluation

The UK has been slower and more cautious in its response to the wealth of activity coming from the USA over the past decade; in particular, the EPPI-Centre's reviews and evaluations on collaborative CPD have been both informative and helpful in shaping ongoing initiatives (see **reference 11**). Although based only on a small number of projects (and mostly in the USA), their conclusions were clear in that collaborative practice CPD was beneficial. Key findings included the following.

Although teachers had initial anxieties about being observed and receiving feedback, the outcomes for teachers were:

- gaining greater confidence,
- having a greater belief in what they could achieve,
- enthusiasm for extending collaboration,
- willingness to change practice and try out new strategies.

It was also noted that:

- there were many problems to overcome before collaborative practice showed its benefits in sustained change,
- time for planning, observing and discussion was a major problem as was access to suitable resources,
- new approaches were embedded gradually and sustained,

- there was increased use of IT for planning and teaching,
- there was increased use of varied strategies for learning,
- teachers should be encouraged to record their development for their own and others' information,
- direct classroom observation (as opposed to using videos of lessons) was a positive factor for success.

The great advantage of collaborative CPD is that it takes place in the teacher's classroom with their learners so it is directly applicable to the issues and problems that the teacher has to face every day. Its impact is immediate.

Much of this has been fed into on-going initiatives now being undertaken by the National College for School Leadership and you can find full details at **reference 12**. It should be noted that their implementation suggests that the focus should be on three pupils of different abilities rather than the whole class.

In the next section, we give a review with early evaluation evidence of work with Pathfinders in their implementation of a *collaborative practice* model in their particular environment. A more detailed evaluation, with detailed quantitative data, will be available on the NCETM web portal in early September.

3. Pathfinders: review and early evaluation

In September 2005, with funding from the Esmée Fairbairn Foundation, a group of pathfinder organisations was formed on a purely voluntary basis from schools which had already been closely involved with CIMT on the Mathematics Enhancement Programme (MEP) or interested schools which had contacted CIMT asking to be involved.

There was a mix of primary, middle and secondary schools and colleges and their task was to undertake a proof of concept study on using collaborative practice as an effective form of CPD.

The collaborative practice model being advocated by CIMT was based on the informal approach seen in many Eastern European countries but was also similar to the more formal Lesson Study practised in Japan and the USA. The suggested methodology for collaborative practice is summarised in the diagram in the Appendix.

The project is being evaluated by Teacher and Pupil Questionnaires, videos of planning, observation and reviews, and by three discussion forums attended by teacher representatives of the institutions involved.

3.1 Protocols

Before schools and colleges started to implement collaborative practice CPD, at the first discussion forum some protocols were established and agreed on.

- Each school/college had to decide what it wanted its teachers and pupils to gain from Collaborative Practice CPD.
- Collaborative Practice CPD should not be confused with monitoring and appraisal.
- Teachers should decide on a focus for each lesson.
- Everyone observing should take notes during the lesson (to aid them during the review session)
- During the feedback:
 - all present should give reviews
 - one person should lead the ensuing discussion
 - the lesson summary form should be completed
 - action points for the future agreed, and copies given to every teacher
- The planning, observation and feedback sessions should be built into the school/college timetable.
- Criteria for observations should come from the teachers themselves and not be imposed, although suggestions and prompts could be made (as on the lesson review sheet provided).

To prevent the dissemination of bad practice, continual evaluation was necessary. Information had to be collected from teachers and learners about whether collaborative practice CPD was making a difference to learning.

There was much diversity in the problems schools and colleges faced initially, how these problems were overcome, the methods of implementation, the personnel involved and the timings of the review sessions. The following summarises feedback from the questionnaires and discussion forums.

3.2 Initial problems

The major factors hindering implementation were finding time for observing and reviewing and obtaining support from the rest of the maths department and from senior management. Where there was opposition from senior management or reluctance from staff, CIMT coordinators visited the organisation to explain exactly what collaborative practice is, its grounding in international research and to persuade them at least to try it out. This was successful in all cases.

In one secondary school, two reluctant part-time members of staff were paid for attending planning and feedback sessions although eventually they wanted to be involved once they realised how valuable this form of CPD could be.

3.3 Planning

Several schools began the cycle of observation and reflection with a collaborative planning session but others could not find the time so staff taught their normal lessons or used, for example, the MEP Lesson Plans (freely available on the web). The positive impacts of shared planning were that it gave support and confidence to inexperienced teachers (especially NQTs) and generated trust and the feeling of being part of a team from the start. Teachers were able to pool their ideas on how to teach a certain topic and took collective responsibility for the lesson that followed.

One secondary school regarded the planning as being such an important part of the model that they intend to use departmental meetings for planning lessons, rather than discussing administrative tasks.

A drawback which emerged from the general discussion was that collaborative planning might inhibit individual creativity: a strategy or activity which might have had a positive effect when undertaken by one teacher might not have the same expected effect when delivered by someone else. This led one department to make sure that in future their lesson planning would be more specific and detailed.

In another secondary school, after the group of 4 mathematics teachers had contributed their ideas and planned the lessons, the person who would teach the lesson was chosen (by tossing a coin etc). This encouraged greater creativity in the planning as well as a shared responsibility for the lesson.

3.4 Making Time

Although finding time for collaborative practice was the main issue in all pathfinders, CIMT staff who were supporting the institutions were surprised by the creative solutions found to this issue.

A variety of strategies were used to find time for observation and review:

- using the Year 11 mock exams to free teachers so that they could observe Y7 and Y8 classes;
- using internal and external cover (in the latter case, money was used from the CPD budget which would normally fund externally run CPD courses);
- using AST's coaching time;

- using teaching assistants to supervise individual learning;
- using deputy heads and heads to take classes;
- combining classes in the school hall;
- using disaggregated 'Baker' days for collaborative practice CPD across the whole school.

Initially it was hoped that PPA time would facilitate the initiative but in practice it had actually been a hindrance, although one Primary school put all its teachers' PPA time together on a Friday afternoon and organised enrichment and development sessions for pupils (e.g. football coaching, music, drama, gardening, etc.)

This is one issue that will need further investigation, particularly for implementation in colleges, where the solutions presented above would not be so readily applicable.

3.5 Using Video

Video was used as a tool not only to allow teachers who could not be physically present to see a lesson, but also to enhance the review. In one school, teachers were given a DVD of the lesson to take home that same day and study in detail, and they were then able to show clips to demonstrate points of learning during the later discussion.

Video also helped inexperienced teachers, who were often so traumatised by the experience of being observed that they could not remember what exactly happened in their lesson, to gain useful insights. Even experienced teachers learned from watching themselves in action.

Teachers who had used video were able to give some advice on its use, e.g. having a microphone at the front of the class and occasionally zooming in on important board work and pupils' individual work, as well as on pupils who are making contributions from their desks. The ideal situation would be to have two people videoing (IT technicians could be involved, or able IT pupils could do the videoing and editing as one of their projects) but this was not thought to be feasible in the majority of schools/colleges.

Some negative aspects also emerged. A video takes a long time to watch and also to edit if the teachers involved are not expert in using technology and does not add a great deal to the review session if it is held straight after the lesson. Another point of view was that if timings were noted on the lesson review notes, there was no need to edit, just run the video through to the required times.

A further disadvantage of video was that it in some cases inhibited both teachers and learners; a normally lively teacher or class might be more subdued than usual, or pupils who liked being the centre of attention played up to it. However, the more

often video was used, the more teachers and learners became used to its presence and eventually forgot about it.

3.6 Observations

Some schools/colleges used the lesson observation sheets provided and some adapted them or used their own methods of note-taking. One maths coordinator who had used the CIMT lesson review sheets thought that the fact that effective teaching strategies were listed on the sheet ensured that teachers used these strategies more often. In two schools, monitoring as part of performance management was also undertaken at the same time. However, it was generally agreed that this was not a good way to build up trust among teachers and that collaborative practice CPD should be an entirely different entity from monitoring. In any case, if schools were seen to be self-evaluating effectively using this model, pressure from OFSTED would wain.

It was suggested that whether the lesson was planned collaboratively or not, each observer should be given the lesson plan beforehand so that they knew roughly which point in the lesson had been reached at any time.

The effect on learners was discussed and it emerged that on the whole they were happy to be observed by other teachers, in particular, those learners who struggle with mathematics felt important because other teachers were interested in them. It was agreed that the model should focus as much on how learners learn as on how teachers teach.

3.7 Lesson Review

The reviews took place varied from directly after the lesson to a fortnight later, but it was thought that the interval between observation and review should not be more than 6 days. The pathfinders used lunch breaks, twilight sessions or time allocated for departmental meetings for the review phase. Ideally, it should be about 10–15 minutes after the lesson to allow for collection of thoughts and perusal of notes. Where lessons had been videoed, naturally time was needed to enable staff who were not present at the lesson to watch the video.

Most teachers were reluctant to criticise their colleagues and even in unsuccessful lessons the majority of observers tried to be positive. At the same time, it was pointed out that unless ineffective strategies were highlighted there would be no progress. Some NQTs felt unable to give feedback to senior teachers and senior teachers did not value feedback from NQTs but learning to give and accept criticism in a constructive way became easier as time went on.

Most teachers thought that reflections on the lesson was the most valuable part of the model and many interesting and surprising ideas and insights had emerged from

them, affecting not only an individual teacher but the whole department and in some cases the whole organisation. e.g. the teachers in one maths department realised that they were all too controlling and stifling in their lessons and did not allow enough opportunities for open discussion among pupils, so they decided that they would try to build this aspect into their lessons in future. Other action points were to change the material which had been used in the lesson, or to involve or give more support to certain pupils, or to make links to other concepts or to find real-world applications or use suggested IT programs to enhance future lessons.

One disadvantage of paired grouping emerged during the review phase – limited feedback and discussion. In one school, an NQT had been paired with a teaching assistant and although both gained something from the experience, the NQT felt that she would have benefited more from a larger group discussion. In many organisations, paired groupings were all that could be managed in the timetable but such places were encouraged to work towards making their groups as large as possible. In the short term, pairs should intermingle, so that a variety of experiences could be shared.

It was suggested that reviews should also be videoed, as many important points arose from them and should be made available to teachers who had not been involved or, in the case of secondary schools and colleges, to other subject departments.

One important aspect agreed on by everyone was that there must be some focus arising from the feedback sessions to take forward to the next lesson. The cycles of planning, observation and review must build on one another to make some progress rather than being stand-alone sessions which were interesting at the time but had no lasting effect on teaching and learning.

3.8 Outcomes

All the teachers who took part in the collaborative practice sessions were very positive about the experience, even if the lessons they had given or observed were not entirely successful, and were enthusiastic about continuing the model because teachers were now involved in discussions about effective pedagogy rather than making judgements on one another. One maths department which was already effective and where good teaching was already in evidence wanted to spread this good practice within their department (to make good teachers great teachers) and to other subject departments and thought that the collaborative practice model of CPD was ideal for this. In one school, the most negative teacher at the start eventually became the most supportive and initial resistance to the model on the part of senior management seems to have disappeared. Organisations and Maths Departments were able to build up a file of findings to inform new teachers and other subject departments. In several instances, teachers now wanted to be observed so that they could try out something new and have it evaluated by the whole 'team'.

There are other important points to note:

- To be effective, the collaborative practice sessions should be regular and ongoing and feedback should be obtained not only from teachers but also from pupils. Teaching and learning should be seen to be improving slowly but steadily, however small the steps, otherwise collaborative practice CPD is not worth doing.
- The methodology has been successful in involving all teachers and seems an effective way to reach those “hard to reach” teachers who show little or no interest in other forms of CPD. They recognized that participating in this form of CPD is fun and does enhance their professionalism.
- Classroom assistants, HLTAs, student teachers, SAS students, 6th form helpers, etc. should also be involved in the planning, observing and review cycles so that they feel part of the 'team' and have the opportunity to give input from a different perspective.
- Primary Schools in the project were able to implement the model more effectively than the secondary schools and colleges because in the former case, the whole school was collaborating and the initiative was backed by the Head Teacher, whereas in the latter only the maths department was involved. In addition, the relationships among staff tended to be better in primary schools as they were more used to helping each other and there was more trust among staff.
- Although there were instances where learners 'played up to the camera', the majority were pleased to be involved in the training of their own teachers and either did not think it affected their learning or thought it enhanced their learning because of more effective teaching strategies and ideas. They certainly were happier to have teachers they knew being in their classroom than having a stranger taking the place of their teacher.

3.9 Preliminary Evaluation Data

The available data is currently limited but of sufficient sample size to report preliminary findings on some of the key questions in the teacher evaluation. Teachers were asked to grade a number of factors from their collaborative practice CPD on a scale of 1 (very negative) to 5 (very positive). The mean values and standard deviations of these factors are summarised below:

Factor	Mean	<i>Standard Deviation</i>
Enjoyment	3.65	0.70
Mathematical value	3.88	0.70

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Pedagogical value	4.24	0.66
Motivational value	3.88	0.99
Lasting effect on teaching	3.82	0.81
Professional development rating	4.00	0.87
Effect on pupil's learning	3.47	0.86

In the Teacher Questionnaire, participants were also asked:

“What do you think are the pros and cons of collaborative practice CPD compared with external courses?”

Here are representative responses:

POSITIVES

Focus on our own needs rather than irrelevant needs

Immediate feedback and implementation

Stronger department, working together

More specific to school and departmental needs

Real sharing of ideas

Seeing new ideas implemented

All resources “in house”

Working together in a non-threatening environment

Reaches all teachers

Minimises disruption to classes – little or no supply cover needed

Discussing teaching and learning with fellow professionals

Good to talk and share ideas

Focus on good practice in department (often better than outside can provide)

NEGATIVES

Logistics

Difficulty in organising and finding time

Giving quality time to review

Staff anxiety about being (critically) observed by peers

Time taken away from other things

Internal embarrassment and fear of criticism

There were far more positive comments than negative ones.

We also provided a Pupil Questionnaire one question was:

“Do you think it is a good idea for teachers to see each other's lessons?

Please give a reason for your answer.”

There was a 100% YES to the first part of the question and here some representative responses:

It helps teachers to learn.

It gives teachers ideas to try out in their class.

Pupils can get to know other teachers.

If teachers have to cover a lesson, they know the class and how they learn.

They find out the different ways that pupils learn

They find out different ways to manage behaviour.

They see how other teachers explain different concepts.

They can see what level we are all at, our weak and strong points, so if they ever teach me they will know how to help me learn.

The can find out ways to make us learn and how to make maths lessons fun.

Pupils behaved better so I enjoyed the lesson more.

If our teachers watches other lessons, she can teach us what she sees.

Because if our teacher is away, we can be sure that we always have a good teacher.

It was a better lesson than usual.

3.10 Networking

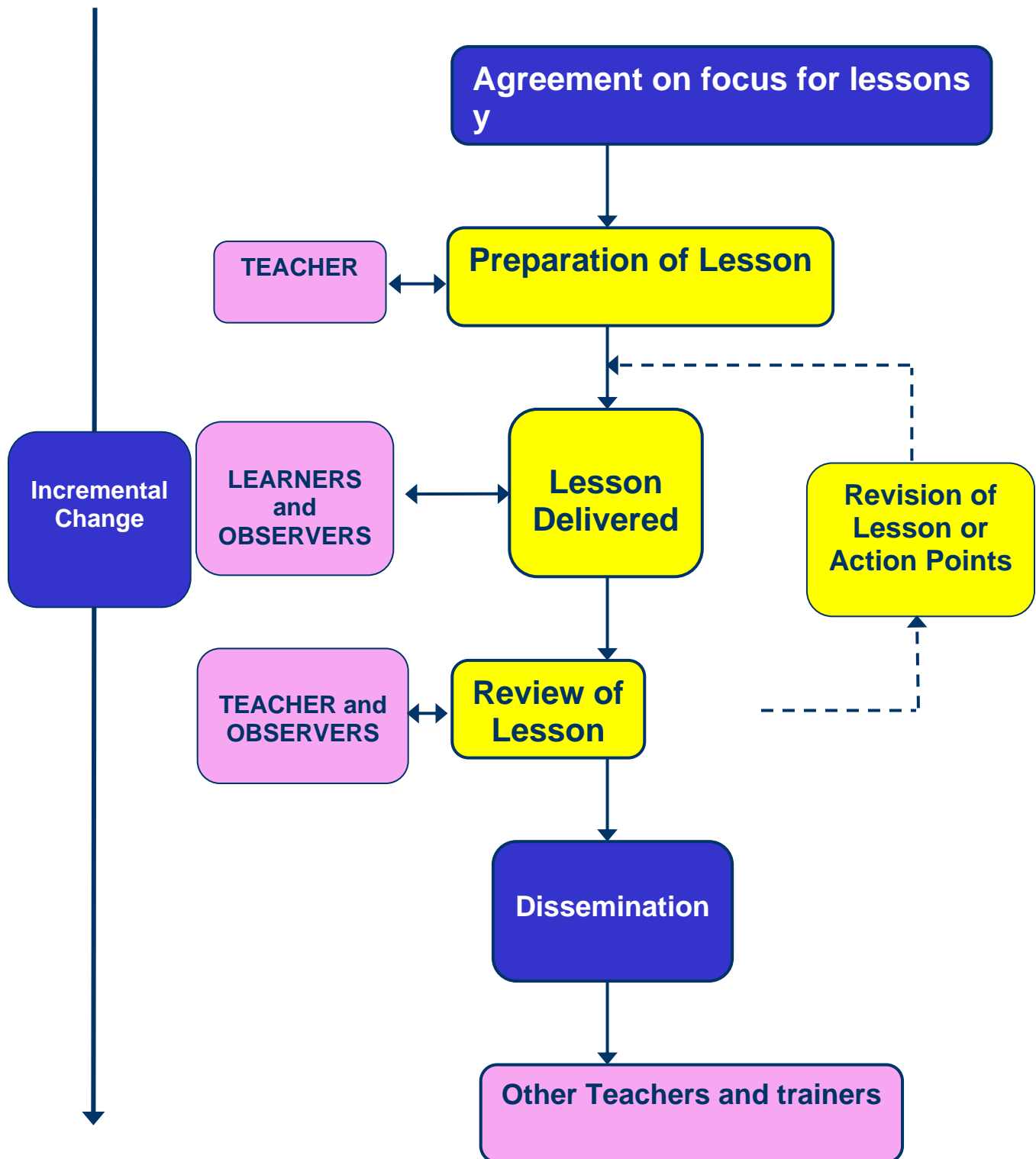
Some Pathfinder schools have instigated a collaborative practice day at their school

and invited other schools in their network to attend, while others have visited schools outside their network and a few had visited schools in other countries. Whatever the situation, professional learning always ensued. Those who had shared such experiences agreed that without networking, professional development would be limited.

4. What next?

It is hoped that *collaborative practice* CPD along the lines described above together with networking will work well to reach **all** schools and colleges to raise standards in mathematics. We recognise that there will be issues and problems in the implementation, particularly the time required for the process, and we look forward to working with schools and colleges to find innovative and creative ways of implementation.

Appendix



References

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7. Stigler, J. and Hiebert, J. (1997) Understanding and Improving Mathematics Instruction: An overview of the TIMMS Video Study. *Phi Delta Kappan*, 79:1, 14-21.
8. Stigler, J. and Hiebert, J. (1999) *The Teaching Gap*. New York: Free Press
9. The lesson lab web site, funded by Pearson is at:
<http://www.lessonlab.com/>
10. The web site below is full of information and help for implementation:
<http://www.tc.columbia.edu/lessonstudy/>
11. The EPPI-Centre web site has the full reports and summaries available at:
<http://www.eppi.ioe.ac.uk>

12. The web site below gives full details as well as proformas for implementation:
<http://www.nssl.org.uk>
13. Detailed lesson plans for all mathematical topics in Primary and Years 7 and 8 can be found at
<http://www.cimt.plymouth.ac.uk/mepres/primary/index.htm>
<http://www.cimt.plymouth.ac.uk/mepres/book7/book7.htm>
<http://www.cimt.plymouth.ac.uk/mepres/book8/book8.htm>
14. The NCSL website has a wealth of material; papers on networking are at
<http://www.nssl.org.uk/networked/networked-introduction.cfm>