

# Designing Professional Development

## How can we make PD more effective?

### Leader's Guide

#### GOALS

This tool stimulates and supports discussion on the characteristics, strength and weaknesses of different models for professional development.

#### USERS

System leadership and professional development providers in mathematics. It will also be useful for lead-teachers in mathematics.

#### INTRODUCTION

Everybody understands that the performance of any school system is largely determined by what happens in classrooms, with the professional skills of the teacher as a key determinant – and limitation – in what students achieve. International standards, as set out in the Common Core and related State Standards, have raised the bar for teaching as well as learning. Students can no longer get by with a procedural fluency alone; they need to acquire the expertise, described by mathematical practices, that makes their skills usable for reasoning and solving problems. These cannot be taught by traditional imitative approaches; to help students develop the necessary mathematical autonomy, teachers must enlarge their range of teaching strategies and tactics, in a way summarized as "adaptive expertise". For most teachers, climbing the pathway of professional learning towards this level of expertise requires ongoing support.

Thus a principal goal of professional development is to enable teachers to acquire "adaptive expertise", and deploy it in their classrooms. Though most professional development programs are successful, they are usually evaluated in less costly ways than through observed changes in classroom practice – the most important criterion and the research base used here.

This workshop invites teacher-leaders to think about the purpose of PD, the characteristics of effective PD, and the different models of PD that are commonly used: Training models; Coaching models; Workshop models and Professional Learning Communities. For each model some examples are explored. Such models should not be considered as in competition with one another. Indeed they all have their advantages and disadvantages. A training model in which teachers are given an opportunity to listen to an expert may be useful in learning about a new initiative but is unlikely to lead to profound changes in classroom practice. Coaching models can be very effective, but this approach is very expensive. Courses in which a group of teachers work together can be effective if they contain opportunities to plan, to enact, to observe and reflect on new approaches. The most powerful methods in the long term involve the teachers themselves forming professional learning communities that can sustain them day-by-day.

One such model is introduced in more detail in a related tool: Lesson Study for Professional Development.

#### SESSION OUTLINE

- What are your priorities for professional development in mathematics? 20 minutes
- What is the purpose of PD in mathematics? 10 minutes
- What are the characteristics of effective PD? 15 minutes
- What effective models for PD are there? 30 minutes
- What are the strengths and weaknesses of the different models of effective PD? 15 minutes

## MATERIALS REQUIRED

- This Users Guide, supported by the PowerPoint: 'Designing PD slides.pptx'
- Handout 1: *Aspects of practice that could be a focus for PD*.  
Each set of cards should be cut out and placed in an envelope. One set of cards will be needed for each group of (2-3) participants.
- One copy of each of the remaining Handouts is needed for each participant.

## TIME NEEDED

90 minutes (We also give suggestions as to how extra time, if available, can be used)

## PREPARATION

The workshop leader(s) should carefully work through this Guide, referring to the Handouts. For the core Activity Sequence (below) it covers the same material as on the PowerPoint slides, including the notes below each slide.

Try to anticipate the common issues that participants will have and write down your responses to them, below. The ones shown below are examples taken from trials of this session.

### Common concern

### Suggested responses

Teachers say that the professional development offered by the district is not relevant in helping to get students to learn mathematics.	Work with administrators and teachers to see if a group of teachers can plan and design their own professional development, present it to the principal and have a discussion with other grade-level teachers. Ask them to identify a problem that exists and outline a plan for how to address the problem. Present the plan/suggestion to the principals and the district PD coordinator.
There is not enough time built into the school day for professional development.	Work with principals to see if schedules can be adjusted to accommodate for common planning time where grade-level teachers can work together to address a common issue. Perhaps schools could identify a day agreed upon by the teachers to meet for an hour after school to address the issue the teachers want to solve.
Professional Learning Communities and Coaching are not meeting teachers' needs.	Determine why these models of PD are not satisfactory and determine how the models can be adjusted to make them more effective. For coaching, determine if the scheduled time is enough to make an impact. Determine how all teachers who desire to do so can engage in a coaching model on a regular basis of no less than once a week, a month, or whatever the teachers see as being effective.
The district offers certain PD workshops, and teachers must select from the short list of sessions. How can we help them make sensible choices?	Ask them to identify ways in which they want to enhance their teaching practice to move student learning forward. Suggest which PD workshops are likely to help in this area.

School board members think that teacher time out of the classroom is wasted - and cannot be afforded.	Make them aware of the demands that achieving higher standards require of teachers. The Parents Meeting tool can be used to enable the board to experience this change in the nature and range of K-12 math in the 21st century

## ACTIVITY SEQUENCE

### Title Slide

(Revised version: Summer 2016)

*You may like to customize this slide and/or the last one with your own institutional and contact details. Please leave the copyright attribution, however.*

*Possible comments below are in plain text. Suggestions are in italics.*

*Users will, of course, adapt as necessary – though we recommend sticking with this activity sequence the first time or two.*

### Slide 1

Mathematics Assessment Project



**Designing Professional Development for Math Teachers**

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### Workshop outline

I guess we have all delivered a lot of professional development. This session is about its design.

Here are the questions we will attempt to answer during this session. *Read the slide.*

*What are your priorities for professional development in mathematics? (20 minutes)*

*What is the purpose of PD in mathematics? (10 minutes)*

*What are the characteristics of effective PD? (15 minutes)*

*What effective models of PD are there? (30 minutes)*

*What are the strengths and weaknesses of the different models of effective PD? (15 minutes)*

### Slide 2

**Workshop Outline**

- What are your priorities for professional development in mathematics?
- What is the purpose of PD in mathematics?
- What are the characteristics of effective PD?
- What effective models of PD are there?
- What are the strengths and weaknesses of the different models of effective PD?

### What are your priorities for PD in math? (20 minutes)

Before we discuss the different models we may use for professional development in mathematics, it is worth spending some time trying to identify what are your priorities for PD in mathematics.

### Slide 3

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**What are your priorities for PD in math?**

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On each table, place an envelope containing the statement cards from **Handout 1**. Ask participants to work in pairs or small groups.

On the table we have provided a number of statements that describe possible ‘titles’ for professional development sessions. Discuss these and try to organize the titles into two sets, according to whether you think that they are important or not a priority for PD right now. Use the blank cards to add some priorities of your own.

Select two topics of highest priority and be prepared to justify why these are highest priority to the whole group.

Allow 10 minutes for the pairs to discuss. Then invite pairs to present their ideas: allow a further 10 minutes for this.

#### Slide 4

### What are your priorities for PD in math?

You have a set of cards containing possible topics for a professional development course.

Aligning lessons to students' individual learning needs	Developing norms and routines for classroom discourse and work
Setting long- and short-term learning goals for students	Designing single lessons and sequences of lessons
Learning how to teach mathematical modeling	Designing effective mathematical tasks for students
Learning about the progression of a topic in a commonly used textbook	Working with parents
Current changes in the curriculum	Understanding how math is used in the world around us
How to lead whole-class discussions	Eliding and interpreting students' reasoning
Understanding and using formative assessment	Learning how to teach a difficult concept
Assessing student progress	Building respectful relationships with students
Specifying and reinforcing productive student behaviors	Asking questions that promote students' reasoning
Setting up and managing collaborative discussions	Using students' cultural, and personal backgrounds as resources for instruction

- Organize the cards into two groups:
  - **Most important** for PD right now
  - **Not a priority** for PD right now
- If you think any important topics are missing, then add these using blank cards.
- Select **two topics of highest priority** and be prepared to justify why these are highest priority to the whole group.

### What is the purpose of PD in mathematics? (10 minutes)

We are now ready to move forward to consider what is the purpose of professional development in mathematics.

#### Slide 5

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### What is the purpose of PD in mathematics?

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PD often appears to separate teachers’ subject knowledge (‘what to teach’) and pedagogy knowledge (‘how to teach’) into separate domains.

In the 1980s, Shulman proposed a new domain that spans the two, called *Pedagogical Content Knowledge* (PCK). This subject-specific knowledge includes a deep knowledge of the curriculum, students, and the selection and organization of the learning experience.

Too often, PD experiences for teachers still seem to assume that generic programs are enough. Math-specific PD is actually quite rare in many schools.

You may wish to consider which elements of PCK your teachers are most in need of right now.

#### Slide 6

### What is the purpose and content of PD?

The diagram consists of two overlapping circles. The left circle is yellow and labeled 'Math Content Knowledge'. The right circle is red and labeled 'Pedagogical Knowledge'. The overlapping area in the center is shaded purple and labeled 'Pedagogical Content Knowledge'.

- **Curriculum:** Goals for learning; organizing learning sequences; making connections between topics; recognizing progress.
- **Students:** Understanding how students learn math and common obstacles to learning (e.g. ‘misconceptions’).
- **Teaching:** Recognizing what effective teaching looks like, and designing, selecting and sequencing tasks and activities that further the content and process goals.

Here is *A Provisional Framework for Proficiency in Teaching Mathematics* produced by Schoenfeld and Kilpatrick in 2008.

Read the slide

- \* Knowing school mathematics in depth and breadth
- \* Knowing students as thinkers
- \* Knowing students as learners
- \* Crafting and managing learning environments
- \* Developing classroom norms and supporting classroom discourse as part of “teaching for understanding”
- \* Building relationships that support learning
- \* Reflecting on one’s practice

This framework focuses on the aspects of performance required for proficient teaching of mathematics. It was developed some years before Schoenfeld’s current TRUmath framework.

**Slide 7**

**A Framework for Teaching Mathematics**

- Knowing school mathematics in depth and breadth
- Knowing students as thinkers
- Knowing students as learners
- Crafting and managing learning environments
- Developing classroom norms and supporting classroom discourse as part of “teaching for understanding”
- Building relationships that support learning
- Reflecting on one’s practice

(Schoenfeld and Kilpatrick, 2008)

A common assumption is that PD is all about the ‘expert’ persuading teachers to change their beliefs and practices in certain ways. An alternative model is illustrated in this slide.

Here, professional development raises awareness of teachers’ existing practices and beliefs and offers alternatives for comparison.

Teachers ‘take on’ new practices and, over time, reflect upon the outcomes.

Beliefs and practices slowly evolve as they do this. In this model, teachers are actively engaged in action research into their own practice.

This is the approach that research suggests is most effective.

**Slide 8**

**Practices, Learning Outcomes, Beliefs**

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graph TD
    A[Professional Development] --> B[Change in teachers' classroom practices]
    B --> C[Change in student learning outcomes]
    C --> D[Change in teachers' beliefs and attitudes]
    
```

Effective PD doesn't attempt to change beliefs through persuasion from the outside, but by allowing teachers to reflect on their own experiences from the inside.

(Guskey, 2002)

In a recent study of 1300 educators on effective professional development, teachers identified the following as the ideal PD experience.

It should be:

- Relevant
- Sustained over time
- Delivered by someone who understands my experience
- Interactive
- Treats us as professionals

**Slide 9**

**The ideal PD experience – by teachers:**

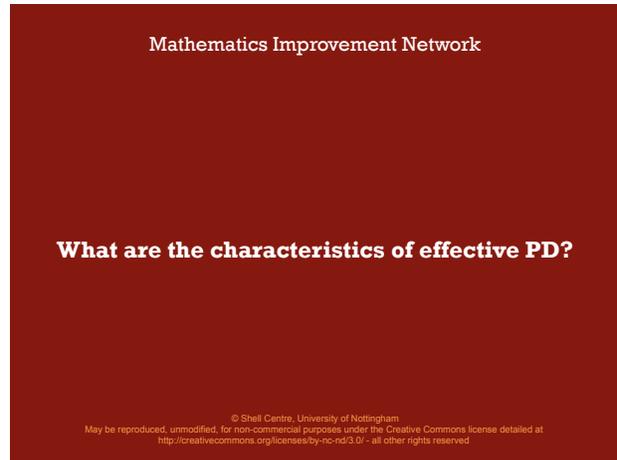
<p><b>Relevant</b></p> <p style="font-size: x-small;">"I can use the materials in my class now."</p>	<p><b>Sustained over time</b></p> <p style="font-size: x-small;">"PD needs to be something you work on for a semester or a year."</p>
<p><b>Delivered by someone who understands my experience</b></p> <p style="font-size: x-small;">Presenter explains how materials have helped to enhance her teaching practice and student learning. "Fellow teacher in the classroom is best."</p>	
<p><b>Interactive</b></p> <p style="font-size: x-small;">"Hands-on strategies for us to participate in"</p>	<p><b>Treats us as professionals</b></p> <p style="font-size: x-small;">"We are treated as adults rather than children."</p>

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**What are the characteristics of effective PD?  
(15 minutes)**

We are now going to consider the characteristics of effective professional development in mathematics.

**Slide 10**



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**What are the characteristics of effective PD?**

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Researchers have identified a number of characteristics that lead to great PD.

*Read each one carefully.*

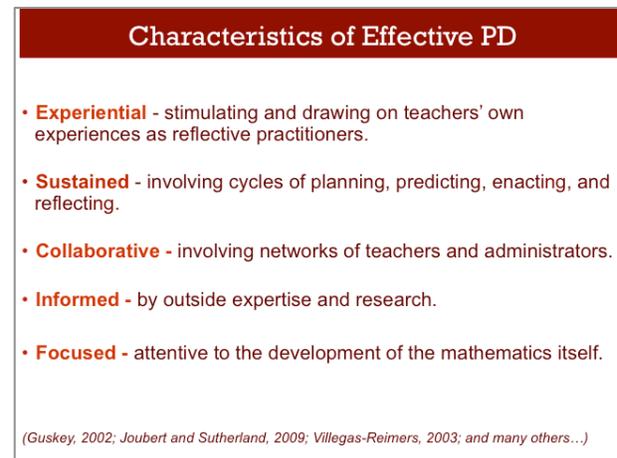
I'm sure many of you see similar things in this list to what you identified as important priorities of PD.

Does anyone have a question or a comment about anything on this list?

Describe to your neighbor a PD experience that fits these characteristics.

*Allow 10 minutes for this discussion.*

**Slide 11**



**Characteristics of Effective PD**

- **Experiential** - stimulating and drawing on teachers' own experiences as reflective practitioners.
- **Sustained** - involving cycles of planning, predicting, enacting, and reflecting.
- **Collaborative** - involving networks of teachers and administrators.
- **Informed** - by outside expertise and research.
- **Focused** - attentive to the development of the mathematics itself.

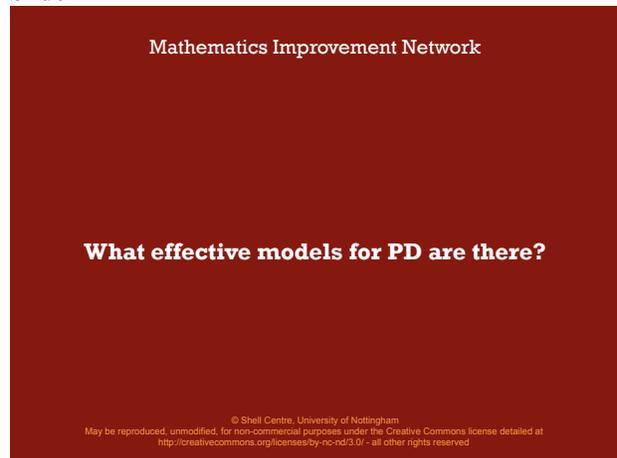
(Guskey, 2002; Joubert and Sutherland, 2009; Villegas-Reimers, 2003; and many others...)

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**What effective models for PD are there?  
(30 minutes)**

We are now going to look at four different models for professional development.

**Slide 12**



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**What effective models for PD are there?**

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This slide lists four models of PD that are frequently used.

**1. Training models** are usually one-time events. An ‘expert’ ‘delivers’ a session, everyone discusses it and then departs. These are rarely effective in the longer term. We will not discuss these further.

**2. Coaching models** can work well, but are labor intensive. This involves a coach working with a teacher over time, planning, observing and refining teaching skills.

**3. Workshop courses** that run over extended periods can be very effective, if they follow the principles discussed above.

**4. Professional learning communities** involve a group of teachers working together over time to tackle issues that are held in common. Very powerful.

We’ll now consider these and offer a few examples.

*Flexibility: Each of these models, particularly 3 and 4, merits longer discussion if time is available.*

*You may choose to consider all three models in this session, or leave some for later.*

*You will find Model 2 (next), Model 3 ( Slide 16), Model 4 ( Slide 21) with the final section on strengths and weaknesses at Slide 25*

## Slide 13

### Different models of PD

#### 1. Training models

Transmission of information by an ‘expert’

#### 2. Coaching models

Coach and teacher work together one-on-one.

#### 3. Workshop courses

Courses mediated by a provider, that offer teachers opportunities to explore ideas in their own classrooms and report back.

#### 4. Professional learning communities

Teachers take over responsibility for setting their own research goals and collaboratively and systematically study them in their own classrooms.

## 2. The coaching model

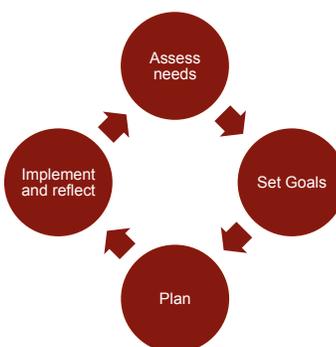
This is a simplified form of the coaching model.

- The teacher and a coach work together to **assess** current progress and identify an area of pedagogy or content knowledge in which the teacher needs to improve.
- Together they **set specific goals** for improvement, for example, to improve questioning.
- They then **plan** how this may be done.
- The coach observes the teacher as he or she **implements** the plan and afterwards they **reflect** together on what happens.

This cycle is repeated until the teacher feels comfortable teaching the new skill/concept or lesson genre.

## Slide 14

### The Coaching Model



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### *The video clip takes 8 minutes*

Now we are going to watch a clip of a coach working with a teacher<sup>1</sup>. As you watch the video, try to identify the factors that make a coach effective, or ineffective. You may consider that not all aspects of this video sequence show effective behavior.

*Afterwards discuss participants' reactions to the clip.*

*Encourage participants to list the factors that they believe make a coach effective. For example, they may suggest that an effective coach:*

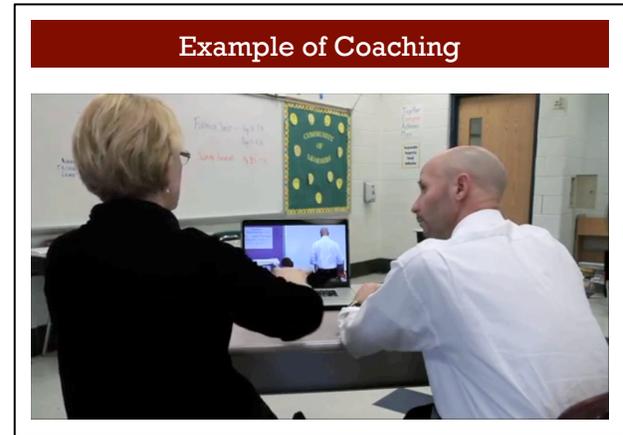
- *Is seen as a co-teacher, not an evaluator*
- *Supports the teacher's specific pedagogical needs*
- *Provides insightful and specific advice*

One-to-one coaching models are, however, very expensive.

*Go to the next Slide, OR*

*To go straight to the section on strengths and weaknesses, go to Slide 25.*

### Slide 15



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### 3. Workshop course model

*If your schedule permits, exploring this model merits a session on its own. We indicate in the notes the activities that can usefully be extended.*

These are courses, mediated by a provider, that offer teachers opportunities to explore ideas in their own classrooms and report back.

This slide shows some of the principles for designing an effective professional development course for teachers.

Look through this list, think of courses you have taken, and identify which of these features were present in those courses.

*Allow time for participants to absorb and discuss the slide.*

### Slide 16

**Workshop courses**

- Coherent, linked series of experiences.
- Mediated by an experienced teacher - leader.
- Elicits theory and design principles, not just activities.
- Uses research-based resources (videos, lesson plans)
- Offers opportunities for teachers to try out ideas in the classroom and report back.
- At least two from each school participate so that discussion is fostered between sessions.
- Expectation that teachers will share their learning with others in their own school through replicating the experiences ("The Cascade Model")

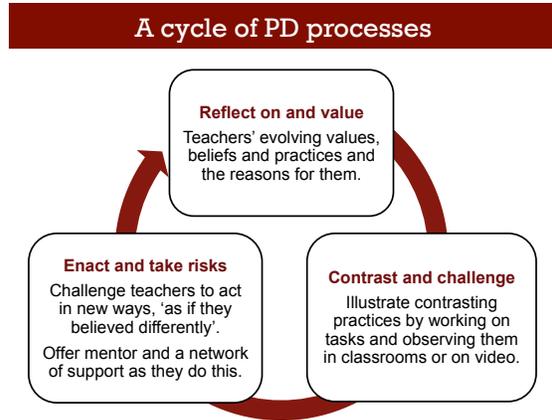
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<sup>1</sup> Video extract from 'Divergent Questioning in 8<sup>th</sup> Grade Math' from TeachingChannel - <https://www.teachingchannel.org/videos/professional-development-teacher-evaluation>

**Slide 17**

It is very important that the methods used in a PD course are consistent with its message. We don't lecture teachers on how to avoid lecturing students! Here's one process that works well:

- Begin by allowing teachers time to reflect on their existing practices and beliefs. Teachers often wish that they could teach differently, but are constrained by the circumstances and pressures of their school and students. This needs exploring.
- Second offer them activities and videos that show contrasting practices. This creates a contrast and challenge.
- Then encourage teachers to take these ideas and try them out in their own classroom.
- Finally, teachers report back and reflect on what happened to their evolving beliefs and practices.



**Reflect on and value**

Stage one of this cycle of processes, 'Reflect on and value' may be achieved in the following way.

Teachers evolving values beliefs and practices may initially be elicited through questionnaires or card sorts, such as the one shown in this slide.

*This is Handout 2, provided here for reference only, may be used in an extended or separate session on this model.*

**Slide 18**

**Where are teachers starting from?**

- Teachers reflect on their beliefs and practices.
- They discuss the obstacles that often prevent them from working in the ways they would wish.

Mathematics is best learned through practice.	Mathematics is best learned through discussion.	Mathematics is a creative subject. Learners learn best by creating their own questions and methods.	Learners learn mathematics best by working through carefully constructed exercises.
It is better to spend time on fewer questions and solve them in more than one way, even if this slows the session down.	I always feel in a hurry when I teach mathematics. There is so much to cover in the time.	Learners learn mathematics best when they work on their own.	Learners learn mathematics best when they work collaboratively.
Learners are at such different levels of competence that I have to allow each one to work at their own pace.	I try to teach the whole group at once and keep them at the same pace.	Mathematics is a network of ideas.	Mathematics is a hierarchical subject.
I find out which parts of mathematics learners already understand and don't teach those parts.	I start teaching mathematics from the beginning, assuming they know nothing.	It is best to begin teaching mathematics with easy problems, working gradually up to harder ones, otherwise learners make mistakes and lose confidence.	It is best to begin teaching mathematics with complex problems, or learners won't appreciate why mathematics is necessary.
I try to avoid learners making mistakes when learning mathematics.	I encourage my learners to make and discuss mistakes when learning mathematics.		

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## Contrast and challenge; Enact and take risks

**Handout 3** provides an outline of a well-developed example of an extended workshop professional development course. The activities listed here are all available on the website: <http://map.mathshell.org/pd>

Each of these resources includes discussion material and video of lessons that will provide a contrast and challenge.

A course like this was used with schools across a district over a period of one year, with meetings two months apart.

On the handout, notice that each meeting contains a key question, a series of activities and a challenge to accomplish before the next session. This involves teaching a lesson and being prepared to report back on it.

*In an extended or separate session, you may like to work through one of these meetings. This activity takes about 30 minutes.*

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## Reflect on and value - again

*Completing the "process loop" (Slide 17), teachers report back on their experiences of a PD session. This may be organized in the following way:*

- *Ask them to take turns at interviewing each other in pairs, using some pre-prepared questions, such as those on **Handout 4**. Ideally, this should take about 20-30 minutes.*
- *Then ask each pair to summarize the issues that have arisen that they wish to share with everyone.*
- *These are then discussed as a whole group.*

*Issues are bounced back: Has anyone else had an issue like this? What did you do about it?*

*Go to the next Slide, Model 4, OR*

*To go straight to the section on strengths and weaknesses, go to Slide 25.*

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## Slide 19

### The MAP professional development workshops

- **Formative assessment**
  - How can I respond to students in ways that improve their learning?
- **Concept development**
  - How can I help students develop a deeper understanding of Mathematics?
- **Problem solving**
  - Do I stand back and watch, or intervene and tell them what to do?
- **Questioning**
  - How can we ask questions that improve thinking and reasoning?
- **Working collaboratively**
  - How can students learn from discussing mathematics?
- **Reflecting on learning**
  - What have we learned?
  - How can we share this with colleagues?

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## Slide 20

### Teachers report back on their experiences

- Teachers interview each other on what happened in the classroom.
- Their views are synthesized and reported to the whole group.
- General issues are discussed by everyone.
- The leader asks teachers to help each other overcome difficult issues.

#### Sample interview questions

- What were your fears and expectations?
- How did you plan for the lesson?
- How did you introduce and organize the lesson?
- What happened during small group work?
- What happened during whole class discussions?
- What did you learn from this experience?
- What general issues have arisen for you?

#### 4. Professional learning communities (PLC)

A PLC is a group of teachers that meet regularly together to improve their professional knowledge and pedagogy.

It often functions as a form of action research - to question, and improve teaching. Teachers agree on the goals they are seeking to achieve.

Meetings are seen as collaborative and supportive. Teachers do not feel as if they are being judged.

They use evidence from lessons, assessments and professional literature to examine possible ways forward.

And to ensure that the group does not 'recycle ignorance' or 'reinvent wheels' – they are stimulated by contributions from outside 'experts'.

#### Slide 21

##### Professional Learning Communities

- **School-based**
  - Based in a single school or a cluster of schools.
- **Goal driven**
  - Focused on agreed, specific, common goals.
- **Collaborative inquiry**
  - Regular meetings among teachers.
  - Supportive, non-judgmental.
- **Evidence-based**
  - Lesson observations, student work, assessment data, professional literature are used to improve practice.
- **Challenged from outside**
  - Contributions from outside 'experts' provide a wider perspective.

#### Japanese lesson study

A powerful example of a PLC is the Japanese model of lesson study.

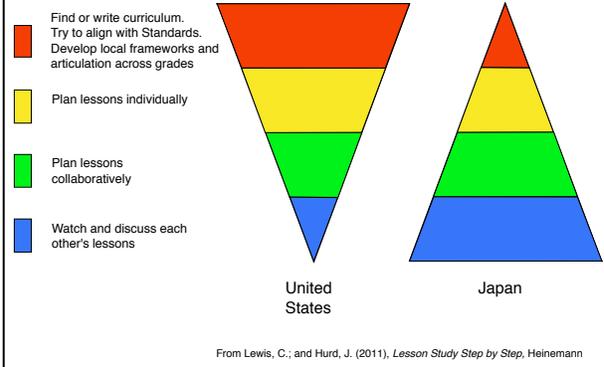
In Japan, most professional learning takes place through the collaborative planning and observation of lessons. This is rare in the US.

This diagram schematically compares the relative time spent on instructional improvement activities in the US and Japan. As Lewis and Hurd put it:

“Many factors conspire to keep US teachers in the top layer of the triangle... Although these may be needed activities, they do not reveal what actually happens in classrooms. The triangle of US instructional improvement thus stands precariously on its tip; we are trying to improve instruction without actually observing and discussing it.”

#### Slide 22

##### Teachers' activities to Improve Instruction

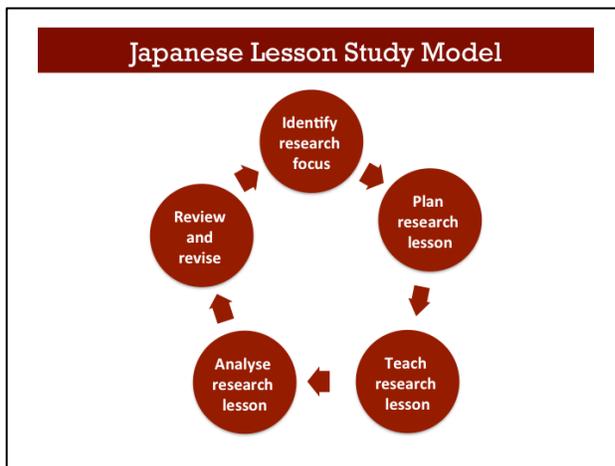


In the Japanese Study Model, teachers, collaboratively, plan:

- The task to be used
- The phases within the lesson and their purpose
- The key questions that will be posed
- The needs of particular students
- Anticipated student responses
- Responses to students' responses
- How 'success' may be recognized

The teacher group then jointly observe the lesson which one of them teaches. After this, they analyze the lesson together focusing on how the lesson met their goals. All aspects of the process contribute to the learning of the group.

Slide 23



This diagram shows one typical example of a professional learning community. Of course there are many variations but this seems to work well.

- **The coordinator.** Most successful lesson study groups have a single coordinator. Their role is to identify and invite participants and assign responsibilities.
- **The school cluster.** Here, three schools form a cluster. These are usually neighbouring schools with which the coordinator already has some relationship.
- **A lead teacher.** This is the person who will organise the research lessons within each school. This lead teacher will identify other colleagues that will also take part in the lesson study. So there will be at least three teachers in each school taking part.
- **An outside 'expert'.** This 'expert' should have knowledge of relevant research and work with teachers.

There is much more to say about Lesson Study than we have time for in this session.

*We have developed a MIN tool  
**Lesson Study for Professional Development**  
which takes these ideas much further and illustrates  
all the stages and responsibilities involved.*

Slide 24



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## What are the strengths and weaknesses of the different models of PD? (15 minutes)

We are now going to consider these questions:

- Which of the characteristics of effective PD each of these models incorporates?
- What do you think are the strengths and weaknesses of the different models of PD?

### Slide 25

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**What are the strengths and weaknesses of the different models of PD?**

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## Conclusion and reflection

With a partner, discuss the questions on the slide.

*Read out the questions on the slide.*

As you discuss these questions make notes on **Handout 5**.

### Slide 26

**Review**

- Which of the characteristics of effective PD each of these models incorporates?
- What are the strengths and weaknesses of each model, in your view?
- How might these models be combined and organized in your schools?
- What immediate questions does this create for you?

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## Thank you

*Customize the final slide with your own contact details.*

### Slide 27

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**Thank you**

**<your contact email>**

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