Foireann Forbartha Mata
Maths Development Team

Maths Counts 2017

Lesson Study: Maximising the Impact of Problem Solving in the Classroom

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Maximising the Impact of Problem Solving in the Classroom

Dr. Anne Brosnan
National Coordinator
Maths Development Team

Foireann Forbartha Mata
Maths Development Team

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Engaging Teachers in Lesson Study and Structured Problem-Solving

- Professor Takahashi's Demonstrations
- Live Structured Problem-Solving Lessons
- Interactive Workshops
- Exhibition of Research Lessons

4th ANNUAL CONFERENCE

60 years 年

Celebrating Japan Ireland

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What is Problem- Solving?

Problem solving means engaging in a task for which the solution method is not known in advance

Even if a problem is presented as a real-world story problem, it might not be a problem for a student who already know how to solve it… this is called an exercise!

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Importance of Problem-Solving

Syllabus Objectives

conceptual understanding: comprehension of mathematical concepts, operations, and relations

procedural fluency: skill in carrying out procedures flexibly, accurately, efficiently, and appropriately

strategic competence: ability to formulate, represent, and solve mathematical problems in both familiar and unfamiliar contexts

adaptive reasoning: capacity for logical thought, reflection, explanation, justification and communication

productive disposition: habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence, perseverance and one's own efficacy.

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Importance of Problem-Solving

State Examinations: Examines the success of candidates in meeting each of the syllabus objectives

Coimisiún na Scrúduithe Stáit
State Examinations Commission

PISA & TIMSS: emphasis on problem solving

PISA

TIMSS 2015
20 YEARS OF ACHIEVEMENT TRENDS

Action Plan for Education: reach and consolidate our position in the top performing OECD Countries

ACTION PLAN FOR EDUCATION
2016-2019

Importance of Problem-Solving

Problem Solving for tomorrow's world: prepare our young adults to solve the problems that they will encounter in life beyond school, in order to fulfill their goals in work, as citizens and in further learning

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Problem-Solving is Challenging

Personally

Mathematically

Pedagogically

There are difficulties and demands for teachers and students:

How to develop students' problem-solving abilities and at the same time skills in executing procedures? What is the teacher's role in problem-solving teaching?

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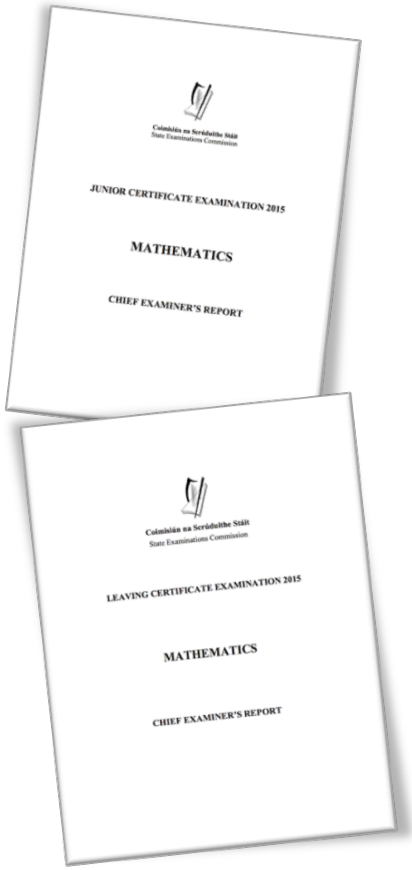
How are we doing?

Chief Examiner's Reports

At both JC and LC, most candidates demonstrated good levels of knowledge and comprehension of basic mathematical concepts.

At JC, candidates usually struggled to complete longer, more involved problems, both of a routine and a non-routine kind.

At LC, a majority of candidates struggled when more involved understanding was required or when the concepts or contexts were slightly less standard.



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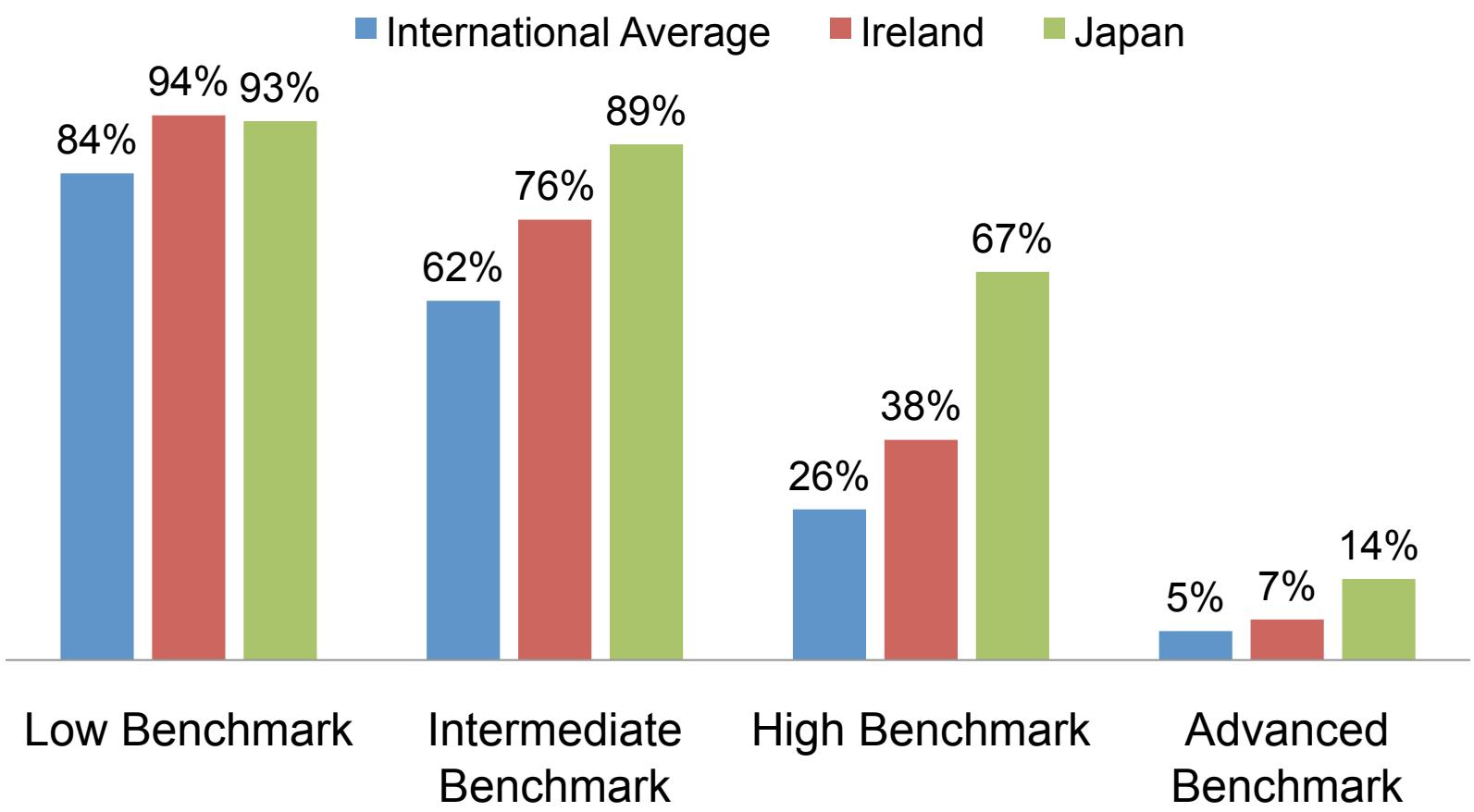
How are we doing?

TIMSS 2015 20 YEARS OF ACHIEVEMENT TRENDS

Trends In Maths & Science Study (TIMSS 2015)

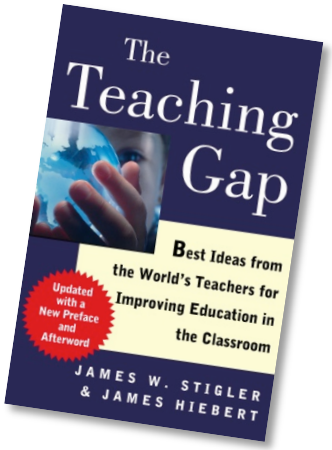


Japan: How do they do it?

In Japan ***Lesson Study*** has been used to develop students' problem-solving skills in maths

Outstanding performance in TIMSS 1995 gained international interest & curiosity

Stigler and Hiebert (1999): *The Teaching Gap* used the phrase **"structured problem-solving"** to describe Japanese mathematics lessons



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Lesson Study

Why has *Lesson Study* generated such widespread interest internationally?

It is a successful, professional development practice

It encourages teachers to develop their own communities of practice

It develops effective teaching approaches to structured problem-solving

Provides a model for large scale, sustainable professional development

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Unpacking Japanese *Lesson Study*

In Japan Lesson Study is used across many subjects.
In maths it is based around a structured problem-solving research lesson

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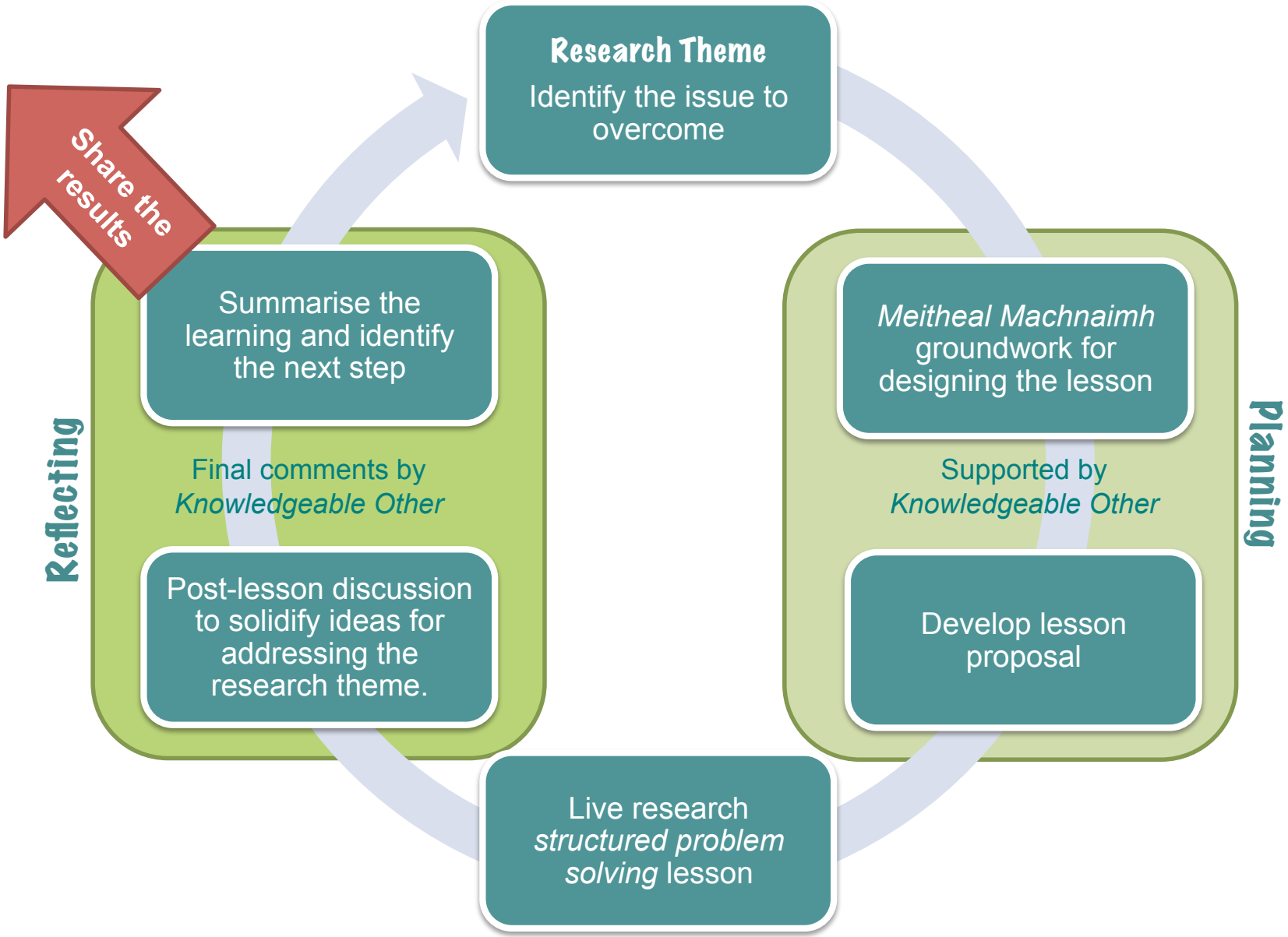
The *Lesson Study* Cycle



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Research Theme
Identify the issue to overcome for this particular Lesson

Goal Setting: Critical to Lesson Study

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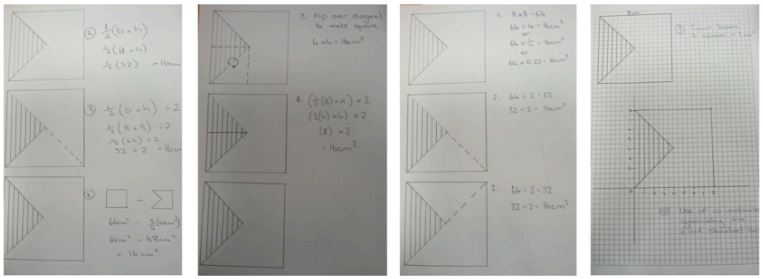
Meitheal Machnaimh
groundwork for designing the lesson

Planning the Research Lesson



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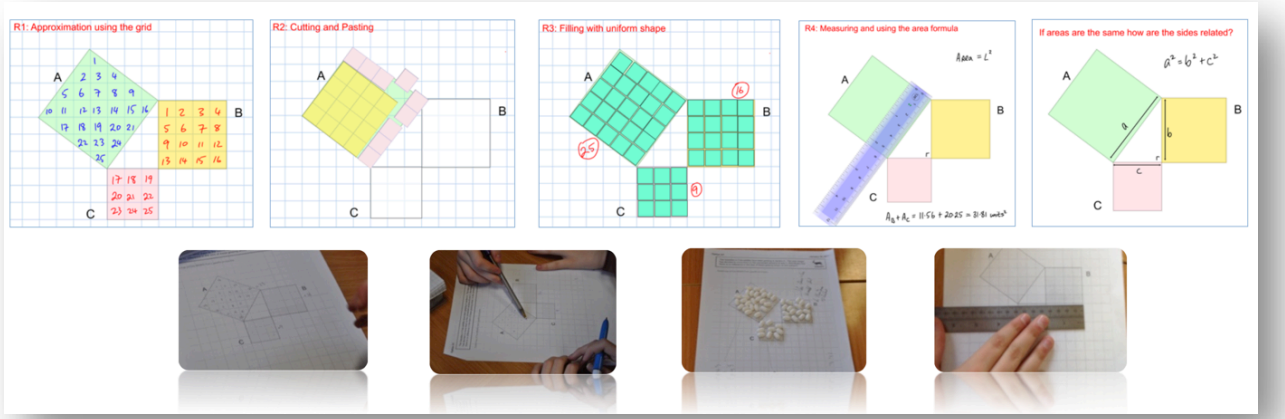
Live research *structured problem solving* lesson

Teaching and observing the research lesson



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A *Structured Problem-Solving* Lesson

Presenting the problem

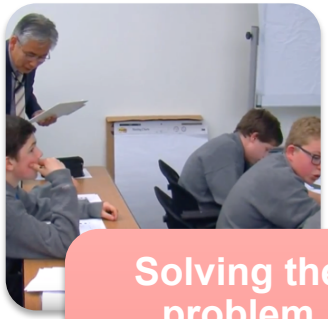
hatsumon

Review previous lesson.

Teacher carefully introduces the problem.

Encourage the use of prior knowledge.

10 minutes



Solving the problem

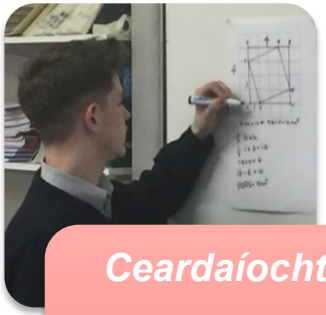
kikanshido

Students work individually or in group.

Students explain solution method using diagrams, calculations and mathematical sentences.

Teacher encourages and notes solutions.

10 minutes



Ceardaíocht

Neriage

Students present their own solution at the board (Bansho) in a pre-decided order.

Students to understand other solutions.

Whole class discussion on similarities and differences.

20 minutes

Highlight and summarising

Matome

Summarising and reflection on solutions and learning.

Extension task.

5 minutes

(45 minutes lesson)

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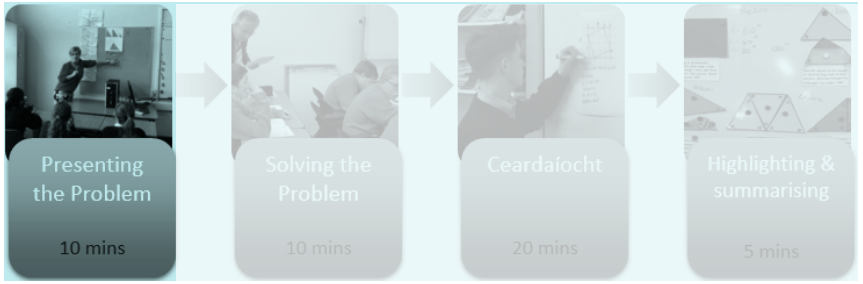
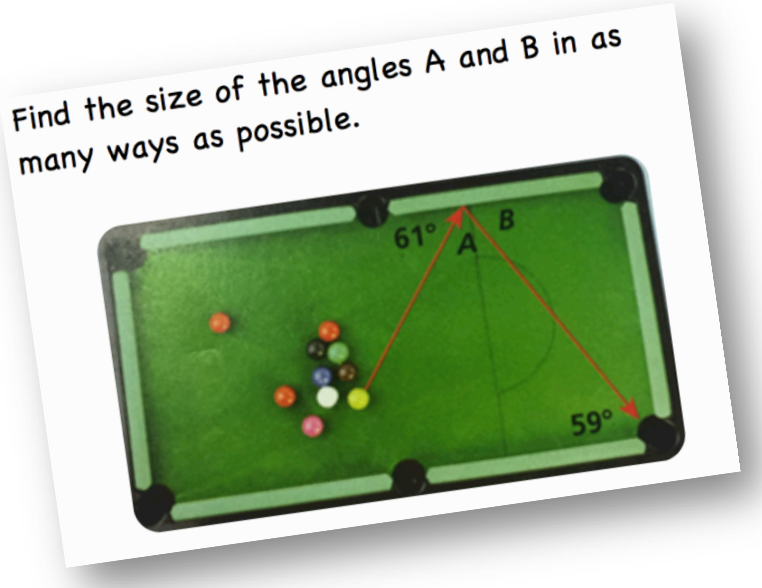
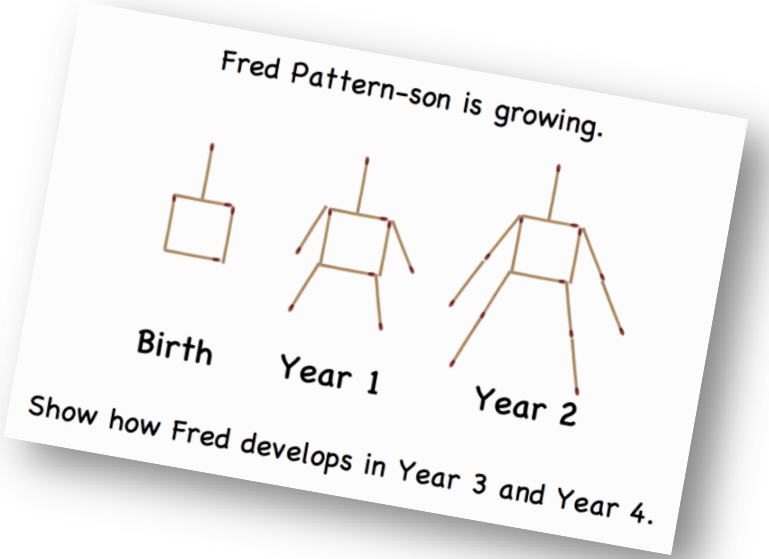
Hatsumon



A Japanese maths lesson is designed around solving a single problem to achieve a single objective in a topic.

Professor Takahashi





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Kikan-shido

While students work on the problem the teacher engages in *kikan-shido*, "between desks walking" which involves a purposeful checking and monitoring which students are using which strategy to solve the problem based on a seating plan.

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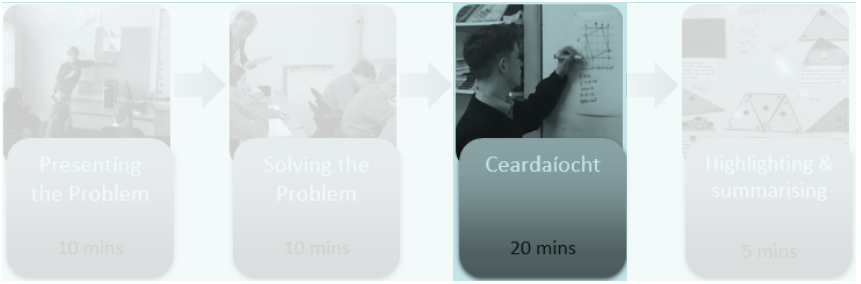
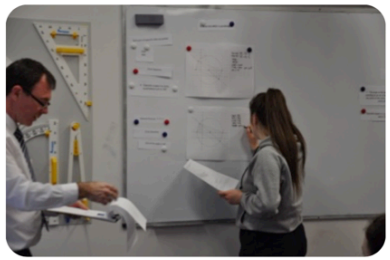
Bansho & Ceardaíocht

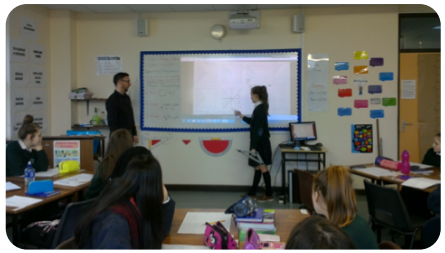


Because the goal of the structured problem-solving approach is to develop students' understanding of mathematical concepts and skills, a teacher is expected to facilitate mathematical discussion for students to achieve this goal.

Professor Takahashi







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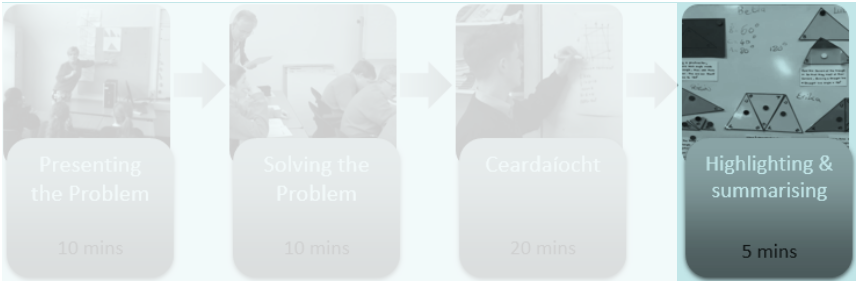
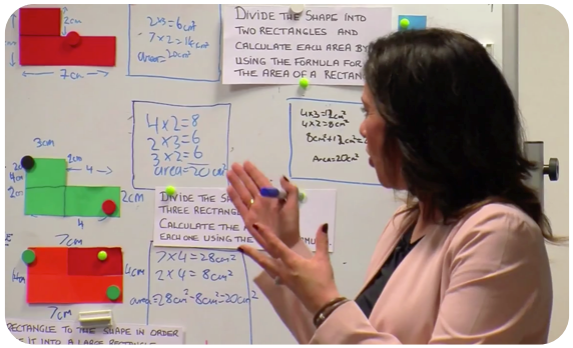
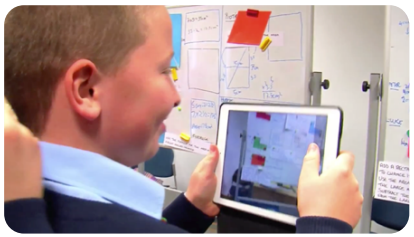
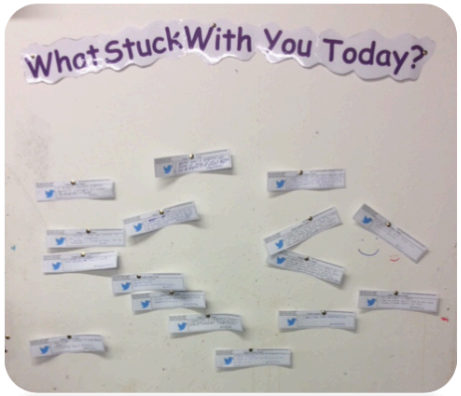
Matome



Highlighting and Summarising is used to guide students to higher levels of mathematical sophistication. Students reflect in writing on what they have learned during the lesson.







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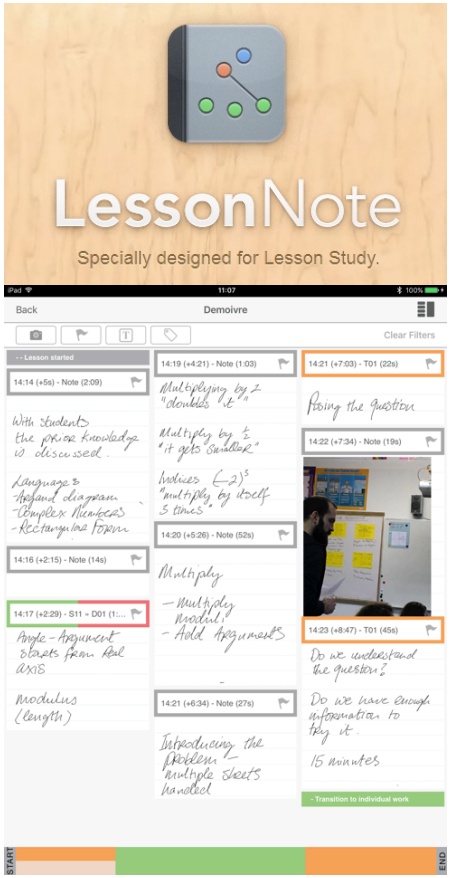
Observing the research lesson



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Post-lesson discussion to solidify ideas for addressing the research theme.

Focus is about the research lesson itself, in particular students' learning and ways in which lesson can be improved

Why *Lesson Study*?

Research on successful teacher professional development suggests:

Teachers learn best by doing (teaching maths) and building their own understandings rather than being told what to do.

Royce (2010)

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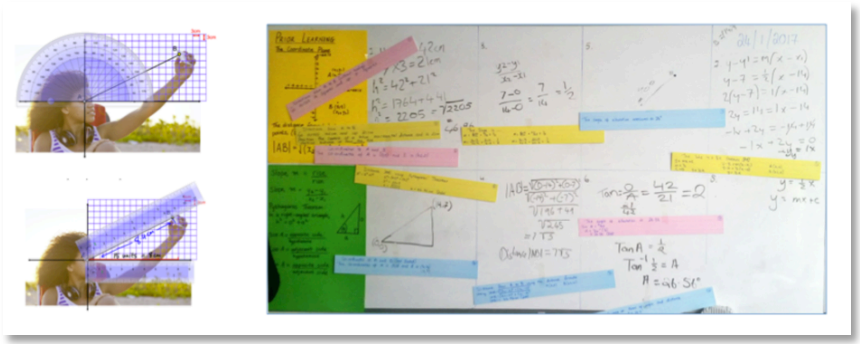
Why *Lesson Study*?

I have been using structured problem-solving since last year and find it really positive as it helps to build students' confidence. I have found that once students understand they have the ability to solve problems without me showing them a specific technique, they really embrace the challenge. They try to find solutions and are keen to know what other students did.

Teacher involved in Lesson Study



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Our Journey…

Engaging teachers in Lesson Study

2014-2015

Project Maths Development Team Launches Lesson Study nationwide with RDOs facilitating research groups in Education Centres. Lesson Study showcased through workshops at **Maths Counts 2015**

2015-2016

10 PTAs trained to act as Lesson Study facilitators. 100 teachers from 45 schools participate in Lesson Study research groups. Online Lesson Study forum made available to participating teachers. **Maths Counts 2016** has live demonstration lessons and workshops.

2016-2017

33 PTAs trained to act as Lesson Study facilitators and 116 teachers received 3 day induction in Lesson Study. 250 teachers from 106 schools participate in one of 52 research groups which operate out of schools and Education Centres nationwide. Growth in online forum used for collaboration. **Maths Counts 2017** introduces Live Research Lessons and post-lesson discussions.
22 Interactive Workshops and an exhibition of nationwide Lesson Study.

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Our Journey…

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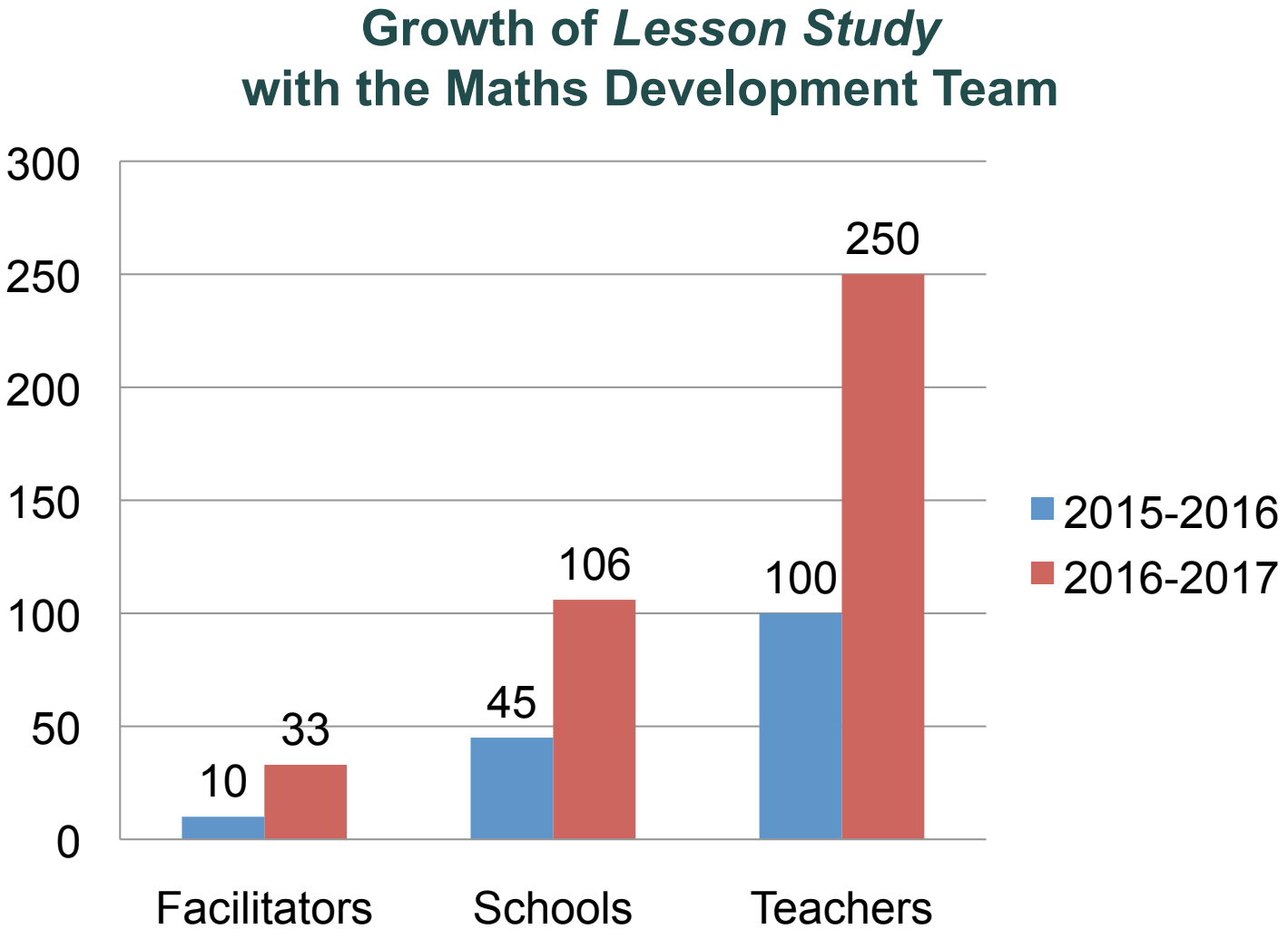

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Going forward…