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Supporting the Professional Learning of School Leaders and Teachers

Supporting Student Engagement with CBA 1: Mathematical Investigation

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Meet the Team

- Applied Mathematics @OideAppliedMath
- Computer Science @Oide_CompSci
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Keep in Touch

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SCAN ME

https://tinyurl.com/oidemaillist

Overview

19:00- 19:30	Introduction – An Overview of CBA1
19:30 - 20:05	Supporting Student Learning Prior to CBA 1 and Exploring Student Experiences
20:05 – 20:10	Supporting Student Learning during CBA 1
20:10 – 20:25	The Features of Quality and Exploring the Teacher Experience of CBA 1
20:25 – 20:30	Reflections

Key Message

Supporting teachers to nurture student autonomy, critical thinking, and problem-solving skills through purposeful preparation for and engagement during CBA 1: Mathematical Investigation

Padlet

By the end of this session, you will have:

- Explored strategies that promote investigative and problem-solving learning experiences, empowering students to engage authentically and confidently in the CBA process.
- Applied the Features of Quality to ensure consistent assessment approaches and shared understanding of CBA 1 within the mathematics department.
- Reflected on your current practices and identified areas for professional growth to ensure students are benefitting from the CBA process

CBAs help us to…

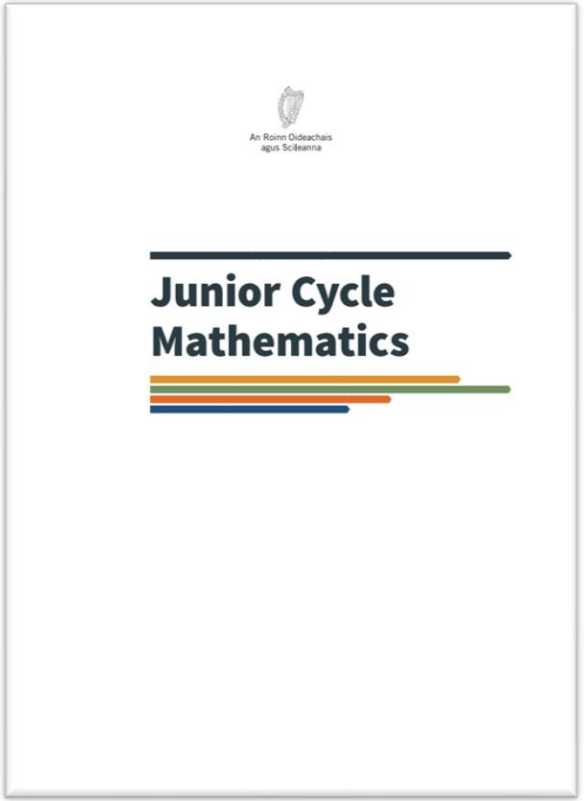
- Foster formative assessment and student autonomy at Junior Cycle
- Developing in students, skills like problem-solving, collaboration, and reasoning
- Prepare students for authentic, student-centred learning at Senior Cycle
- Develop students' ability to articulate learning and tackle open-ended tasks
- Support transition to a world that values application of knowledge over rote learning

CBA 1 in Junior Cycle Mathematics

A Mathematical Investigation:

"Students will, over a three-week period, follow the Problem-Solving Cycle to investigate a mathematical problem."

(Junior Cycle Mathematics Specification, p.22)



CBA 1 Timeline: An Overview

Students engage in CBA 1 over a three-week period during class time

Teachers assign initial grade descriptors using the Features of Quality

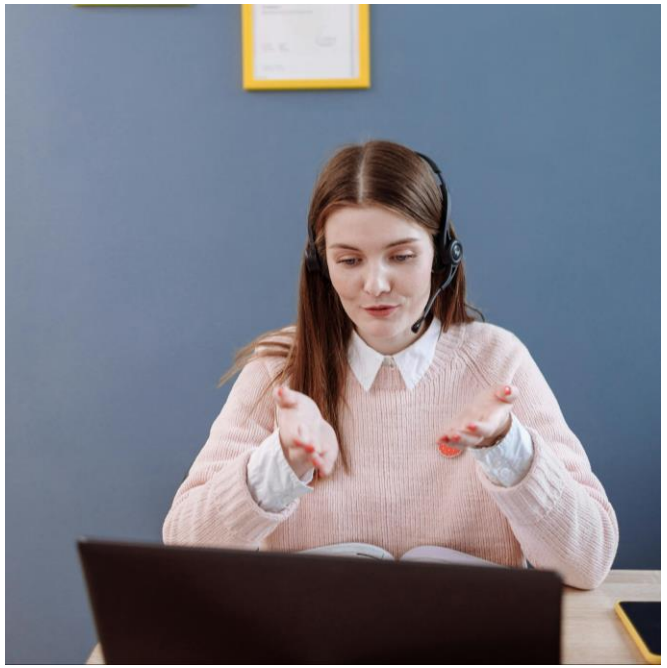
SLAR meeting is conducted within one month of students finishing the CBA

Descriptors are amended if necessary, then awarded and feedback is given to students

Breakout Rooms

Ensuring active participation and authentic engagement in CBA1. What are the...

Opportunities?



Student Common Themes?

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Supporting Student Learning before CBA 1

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Problem Solving Toolkit:

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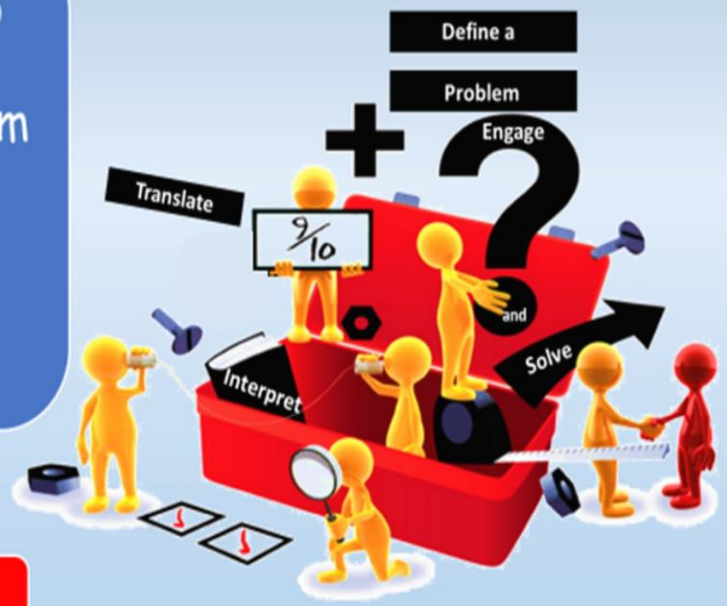
Define a problem

What do I want to know? What do I already know? Form a conjecture, specialise/reduce, restrict/extend, stress/ignore



Engage and Solve

Spatial/Graphical Reasoning, List, Draw, Work backwards, Eliminate, Sort, Classify, Estimate, Compare, Organise, Vary, Try extreme cases, Work systematically

Translate

Tools, Concrete Materials, Tables, Diagrams, Formulae, Check for hidden assumptions

Interpret

Summarise, Explain, Justify, Reason, Generalise, Prove, Judge the Validity, Convince, Predict, Draw conclusions, Mathematical Solutions, Real World Solutions.

Wooclap

5mins

Go to **wooclap.com** and use the code **PDAEDR**

What strategies do I currently use to help students make connections between Maths and their interests?

https://app.wooclap.com/PDAEDR?from=instruction-slide

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Teaching and Learning Strategies to Support Students in Engaging with the Problem-Solving Process

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1. I see, I think, I wonder …..

- Activates curiosity.
- Builds the “Define a Problem” skill
- Encourages mathematical reasoning
- Links to “Translate” stage of the process
- Promotes ownership of learning
- Inclusive of all learners

2. Linking Toolkit

A linking toolkit helps students to …

- Clarify their thinking.
- Make informed choices.
- Make connections across strands
- Take ownership of their work.
- Reflect more effectively.

My Maths Toolkit – Translating My Problem into Maths

Use this checklist to help you figure out which maths ideas, tools, or calculations might help you explore your real-world problem. Tick the b
explore the suggested approaches!

Data and Information

Does my problem involve collecting, comparing, or looking for patterns in data?

☐ Yes ☐ Maybe ☐ No

Try: Tables, bar charts, pie charts, line graphs, scatter plots, averages (mean, median, mode), surveys or class data

Tools: Spreadsheet, graph paper, Google Sheets

Number, Ratio and Proportion

Am I comparing quantities, prices, or rates?

☐ Yes ☐ Maybe ☐ No

Try: Percentages and discounts, ratios or unit rates, addition, subtraction, multiplication, division, estimation and rounding

Tools: Calculator, spreadsheet

Probability and Chance

Am I exploring likelihood, risk, or predicting outcomes?

☐ Yes ☐ Maybe ☐ No

Try: Experiments or simulations, two-way tables or tallies, fractions, decimals, or percentages to show probability, compare expected vs actual results

Reflection Prompts – Making Sense of Your Maths Journey

Once you've explored the toolkit, take a moment to reflect on your approach. These prompts will help you plan your next steps and think critically about your mathematical investigation.

01 Connect to Maths Ideas

Which parts of my problem connect to the maths ideas in the toolkit above? Which section felt most relevant to what I'm investigating?

02 Choose Your Tools

What tools will help me show my findings clearly? Will I use graphs, tables, diagrams, or digital tools like spreadsheets?

03 Plan Your Calculations

What calculations will help me answer my question? Do I need to find averages, work out percentages, or measure areas?

04 Think Ahead

What could I try next if I get stuck? Who can I ask for help? What alternative approaches might work?

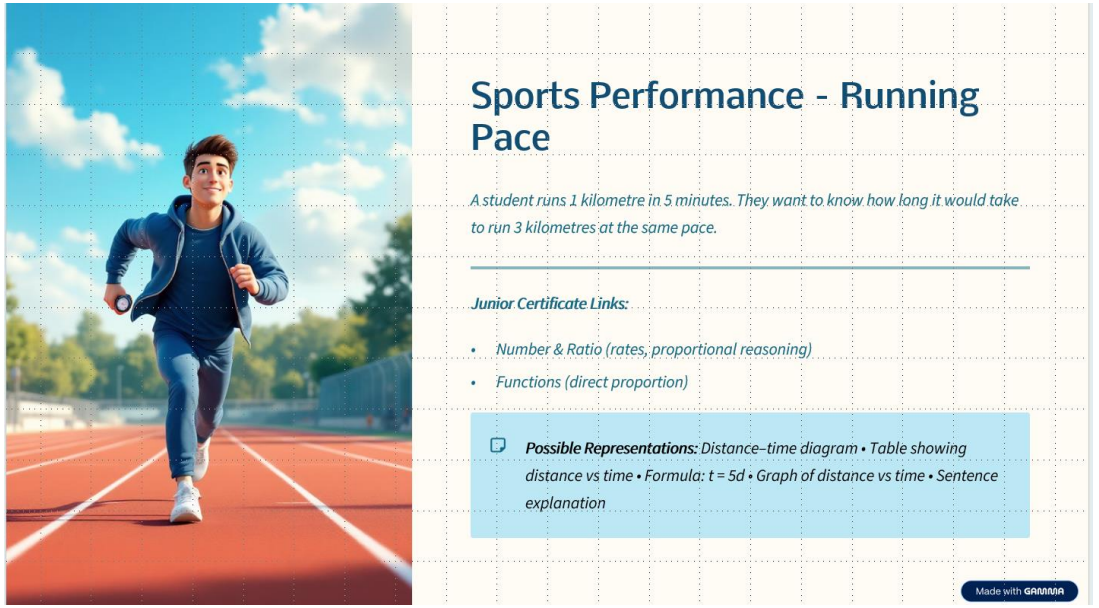
Remember

Real-world problems rarely fit into just one maths category. You might use **data analysis**, **measurement**, and **money calculations** all in the same project. That's what makes maths so powerful — it connects ideas to help us solve meaningful problems!

3. Represent It – Round Robin

Can help to…

- **Deepen student understanding** of the problem by viewing it from different mathematical perspectives.
- **Recognise connections** between representations (visual, numerical, algebraic, verbal).
- **Develop reasoning and communication skills**, explaining how one mathematical form links to another.
- **Gain confidence** in choosing the most effective tools for solving a problem

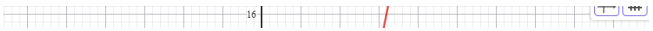


3. Represent It – Round Robin

A student runs 1 kilometre in 5 minutes. They want to knc
kilometres a

Possible Re

- Distance
- Table sh
- Formula:
- Sentence explanation



2. Table of Distance vs. Time

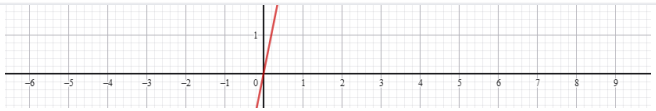
3. Formula

5. Sentence Explanation

At a constant pace of 5 minutes per kilometre, running 3 kilometres takes

$$3 \times 5 = 15$$

minutes.



4. Explain, Justify, Interpret, Generalise

Spot the mistake

- Show students a worked solution containing an error and ask them to 'spot the mistake'

Same or Different?

- Show students two different solutions to the same problem and ask are they the same or different?

Explain it to a First Year

- Ask students to describe their solution process in simple language, pictures, or steps that a 1st-year could follow.

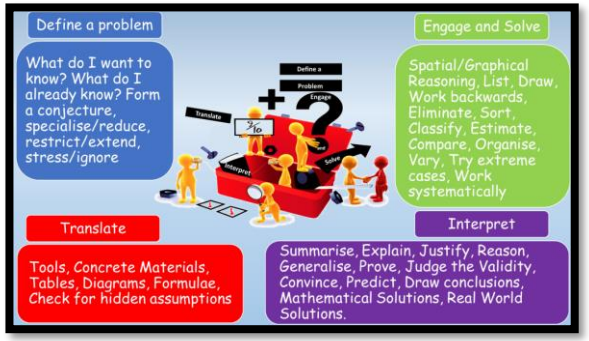
"What if"

- Ask students 'what if' questions to help them move beyond a singular case ... eg. What if the lengths were doubled, would this change your solution?

Breakout Room – Explore & Discuss

5 mins

- Have a look at the suggested T&L activities for helping students build skills to engage with the problem-solving process
- With the Junior Cycle classes you have this week in mind, could you use some of the suggested activities within your lessons to support students in building the skills necessary to engage with the problem-solving process?



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Supporting Student Learning during CBA 1

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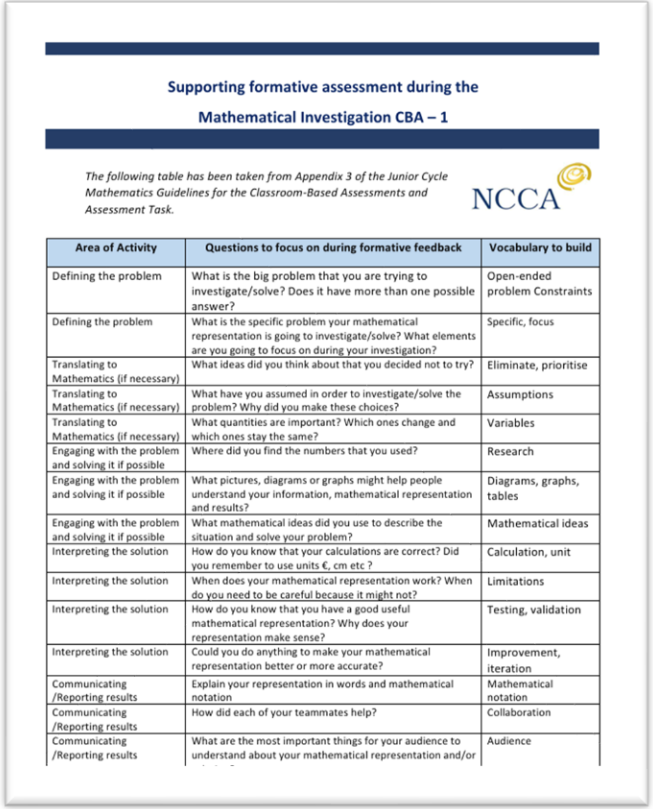
Teacher as Facilitator – CBA 1 in Action

- Shift from instructor to coach
- Use open-ended, formative questions
- Encourage student autonomy
- Provide support, not direction
- Reflect on your own facilitation



Supporting formative assessment during the Mathematical Investigation CBA – 1

The following table has been taken from Appendix 3 of the Junior Cycle Mathematics Guidelines for the Classroom-Based Assessments and Assessment Task.

NCCA

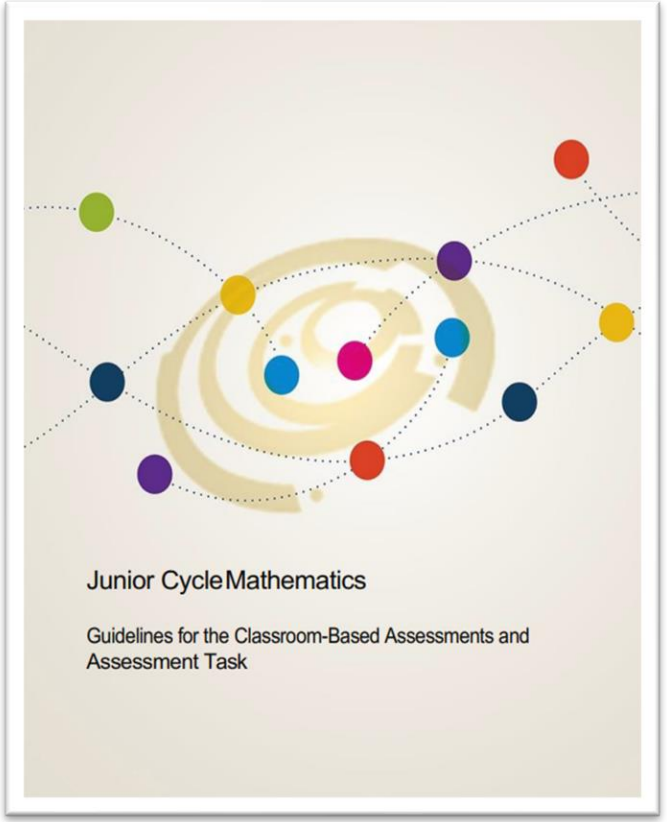
Area of Activity	Questions to focus on during formative feedback	Vocabulary to build
Defining the problem	What is the big problem that you are trying to investigate/solve? Does it have more than one possible answer?	Open-ended problem Constraints
Defining the problem	What is the specific problem your mathematical representation is going to investigate/solve? What elements are you going to focus on during your investigation?	Specific, focus
Translating to Mathematics (if necessary)	What ideas did you think about that you decided not to try?	Eliminate, prioritise
Translating to Mathematics (if necessary)	What have you assumed in order to investigate/solve the problem? Why did you make these choices?	Assumptions
Translating to Mathematics (if necessary)	What quantities are important? Which ones change and which ones stay the same?	Variables
Engaging with the problem and solving it if possible	Where did you find the numbers that you used?	Research
Engaging with the problem and solving it if possible	What pictures, diagrams or graphs might help people understand your information, mathematical representation and results?	Diagrams, graphs, tables
Engaging with the problem and solving it if possible	What mathematical ideas did you use to describe the situation and solve your problem?	Mathematical ideas
Interpreting the solution	How do you know that your calculations are correct? Did you remember to use units €, cm etc ?	Calculation, unit
Interpreting the solution	When does your mathematical representation work? When do you need to be careful because it might not?	Limitations
Interpreting the solution	How do you know that you have a good useful mathematical representation? Why does your representation make sense?	Testing, validation
Interpreting the solution	Could you do anything to make your mathematical representation better or more accurate?	Improvement, iteration
Communicating /Reporting results	Explain your representation in words and mathematical notation	Mathematical notation
Communicating /Reporting results	How did each of your teammates help?	Collaboration
Communicating /Reporting results	What are the most important things for your audience to understand about your mathematical representation and/or	Audience

(Appendix 3, Assessment Guidelines)

Features of Quality

At an **appropriate moment in their learning, students should be familiarised with the Features of Quality** which will be used to judge the quality of their Mathematical Investigation"

(Assessment Guidelines, p.14)



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Supporting the Professional Learning of School Leaders and Teachers

Exploring the Teacher Experience & Features of Quality

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Assigning Provisional Grade Descriptors

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Review the work from start to finish

Begin with Yet to Meet Expectations

Is there evidence "on balance" to support the awarding of this Descriptor?

JuniorCYCLE for teachers

Features of Quality – Mathematical Investigation

Features of Quality are the criteria used to assess the level of student achievement in a Classroom-Based Assessment (CBA). Described below are the Features of Quality for the Mathematical Investigation.

	Yet to Meet Expectations	In Line with Expectations	Above Expectations	Exceptional
Defining the Problem Statement	Uses a given problem statement and with guidance breaks the problem down into steps	With guidance poses a problem statement, breaks the problem down into manageable steps and simplifies the problem by making assumptions if appropriate	With limited guidance poses a problem statement and clarifies/simplifies the problem by making reasonable assumptions, where appropriate	Poses a concise problem statement and clarifies and simplifies the problem by making justified assumptions, where appropriate
Finding a Strategy or Translating the Problem to Mathematics	Uses a given strategy	Chooses an appropriate strategy to engage with the problem	Justifies the use of a suitable strategy to engage with the problem and identifies any relevant variables	Develops an efficient justified strategy and evaluates progress towards a solution where appropriate; conjectures relationship between variables where appropriate
Engaging with the Mathematics to Solve the Problem	Records some observations/data and follows some basic mathematical procedures	Records observations/data and follows suitable mathematical procedures with minor errors; graphs and/or diagrams/ words are used to provide insights into the problem and/or solution	Records observations/data systematically, suitable mathematical procedures are followed, and accurate mathematical language, symbolic notation and visual representations are used; attempts are made to generalise any observed patterns in the solution/observation	Mathematical procedures are followed with a high level of precision, and a justified answer is achieved; solution/observations are generalised and extended to other situations where appropriate
Interpreting and Reporting	Comments on any solution	Comments on the reasonableness of the solution where appropriate and makes a concrete connection to the original question, uses everyday familiar language to communicate ideas	Checks reasonableness of solution and revisits assumptions and /or strategy to iterate the process, if necessary, uses formal mathematical language to communicate ideas and identifies what worked well and what could be improved	Deductive arguments used and precise mathematical language and symbolic notation used to consolidate mathematical thinking and justify decisions and solutions; strengths and/ or weaknesses in the mathematical representation/ solution strategy are identified

Sourced from Junior Cycle Mathematics Guidelines for the Classroom-Based Assessments and Assessment Task, November 2019.
Teachers should refer to the Assessment Guidelines during the CBA and SLAR meeting. The Assessment Guidelines are available at www.curriculumonline.ie.

NO
Award the previous Descriptor

YES
Check for evidence in the next Descriptor

Play (k)

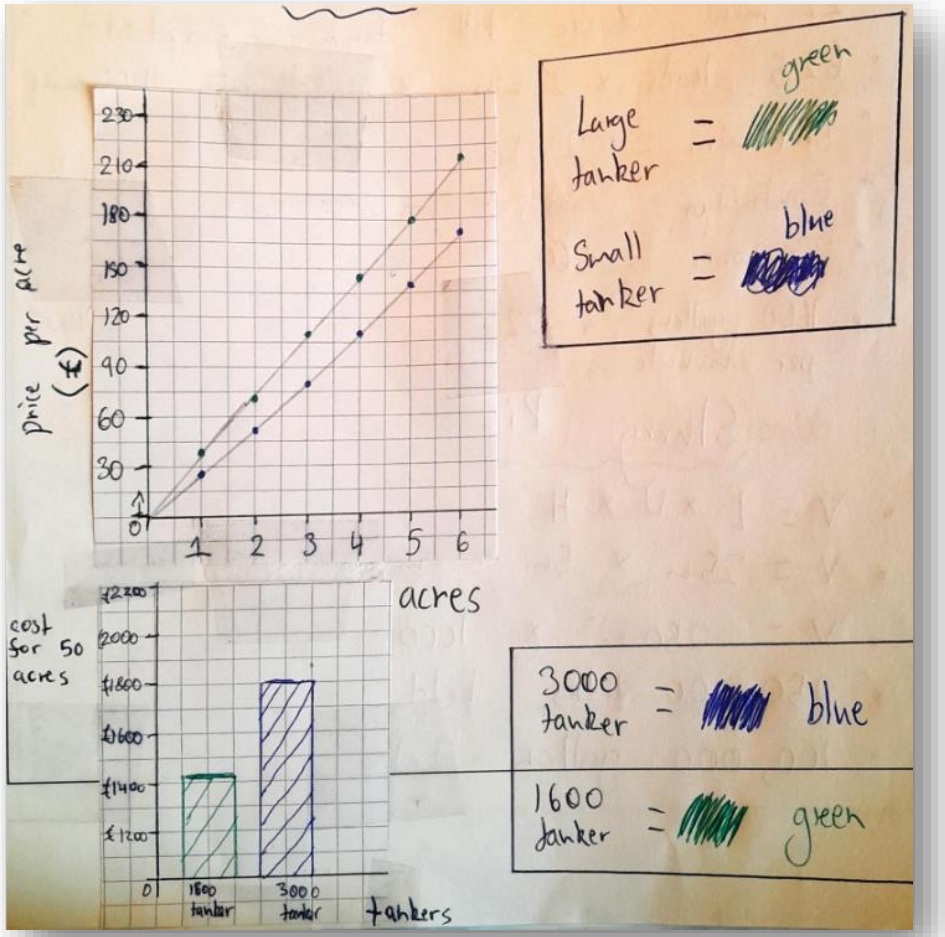
Source: JCT Webinar: Preparing for CBA1 Mathematical Investigation and SLAR meeting

Breakout Room 3 - SLAR Meeting

Match this Mathematical Investigation to the Features of Quality.

List one piece of formative feedback you would give the student.

How can we improve students' reflective skills on their own work?

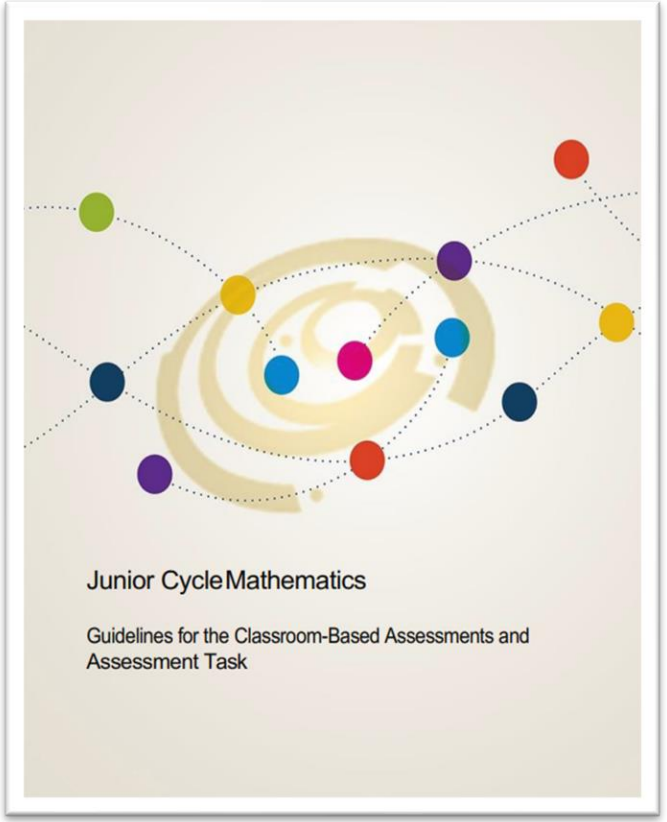


10 mins

Features of Quality

"Providing effective feedback is a crucial step in using the Mathematical Investigation to support learning in Mathematics. Students will be informed of the Descriptor they have been awarded once the SLAR meeting has taken place, and its outcomes have been processed. However, effective feedback goes beyond the naming of the Descriptor awarded. Feedback on the strengths of the student's work, and on areas for improvement can be used to support their future learning."

(Assessment Guidelines, p.23)



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Conclusion

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Reflection:

Reflecting on this evening's webinar, what is one strategy that you will try in your classroom this week, that you think will help prepare your students to engage with the Mathematical Investigation?

Think of a recent lesson. How might you adapt it to better support students in developing the skills necessary for the Mathematical Investigation? What is one change you could make to this lesson?

Feedback: