



Transforming tasks

Designing tasks where students do the thinking

Workshop 4

Using the 'From procedure to problem solving' strategy



WORKSHOP 01

What is intellectual challenge and why is it important?

WORKSHOP 02

Designing tasks for intellectual challenge Part 1

WORKSHOP 03

Designing tasks for intellectual challenge Part 2

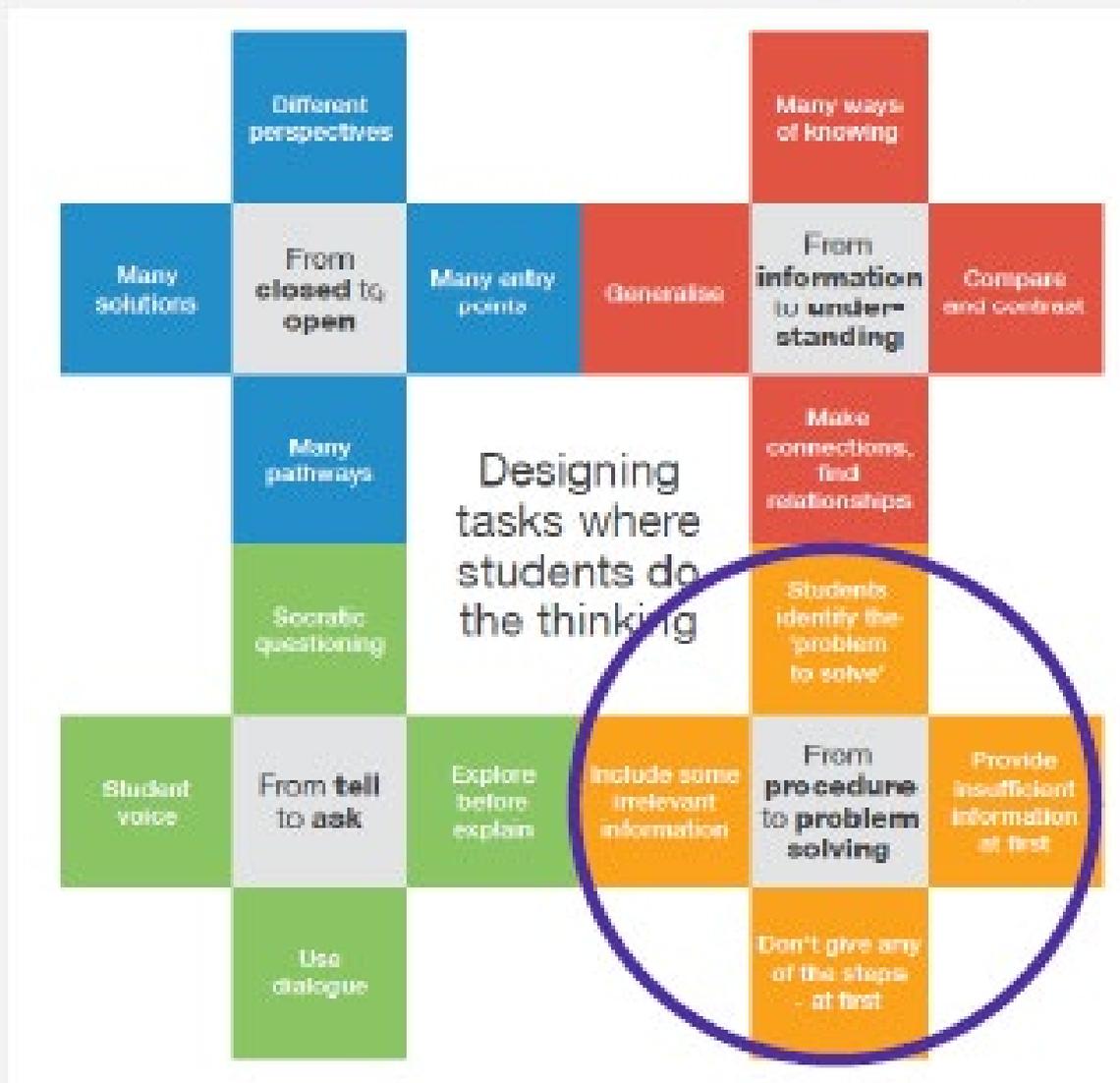
WORKSHOP 04

Designing tasks for intellectual challenge Part 3

WORKSHOP 05

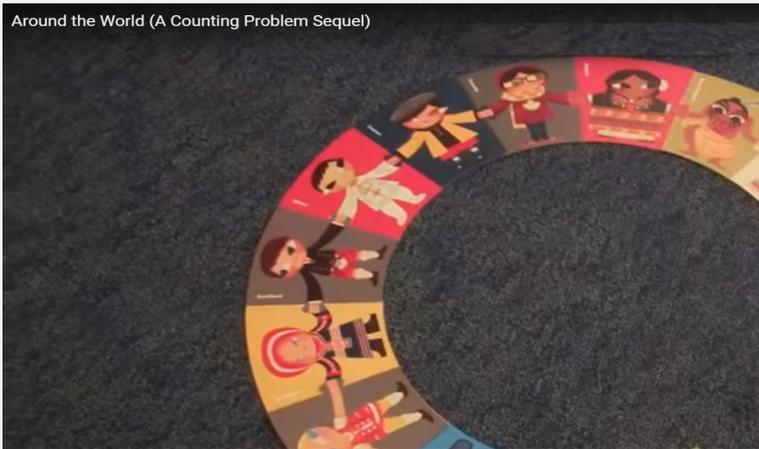
Designing tasks for intellectual challenge Part 4







Around the World (A Counting Problem Sequel)



Secondary

<https://www.youtube.com/watch?v=vPnSQD5ca7M>

Around the World

Give additional information that is not required to do the task.	Students identify the 'problem to solve'	Present a provocation and ask students to determine the problem to solve.
Include some irrelevant information	From procedure to problem solving	Provide insufficient information at first
Provide multi-step problems and do not state all the steps.	Provide only some of the steps	Give a perplexing problem and slowly provide information as needed.

Primary

https://www.youtube.com/watch?v=SrWt_XvWLUk

How to Arrange a Train

Give additional information that is not required to do the task.	Students identify the 'problem to solve'	Present a provocation and ask students to determine the problem to solve.
Include some irrelevant information	From procedure to problem solving	Provide insufficient information at first
Provide multi-step problems and do not state all the steps.	Provide only some of the steps	Give a perplexing problem and slowly provide information as needed.



Socratic Questions

consequences	clarifying	question the question
assumptions	information, reasons, evidence, and causes	inferences and interpretations
concepts		viewpoints or perspectives

R.W. Paul (2006) www.criticalthinking.org



Socratic Questions

Consequences <i>What were the</i> consequences <i>of...</i>	clarify	Question the question <i>Why was</i> question <i>asked?</i>
assumptions	information, reasons, evidence, and causes	inferences and interpretations
concepts		Viewpoints/perspectives <i>What would be the</i> viewpoint <i>of....</i>

How many questions can you generate?

R.W. Paul (2006) www.criticalthinking.org



Reflect on the process

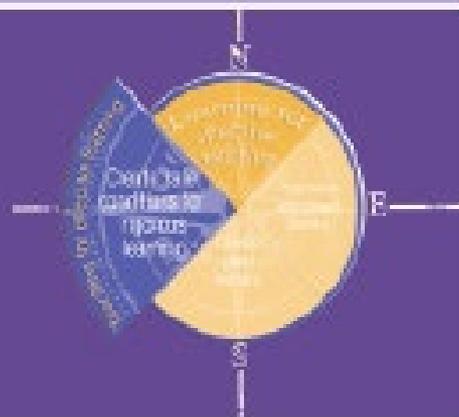
- Plus
- Minus
- Interesting

Plus	Minus	Interesting





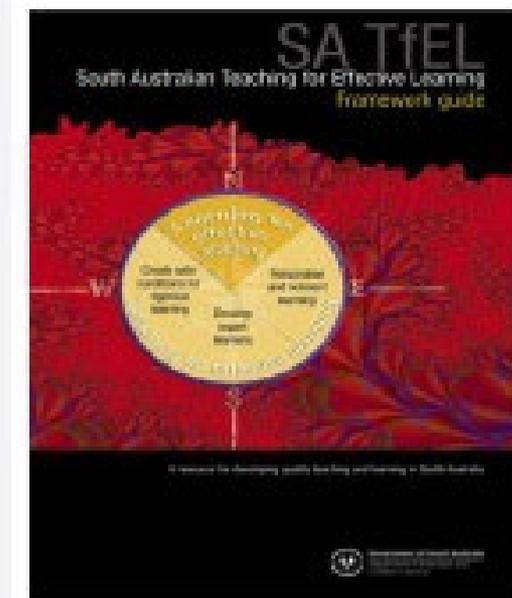
Safety for challenge in learning



Domain 2

Create safe conditions for rigorous learning

- 2.1 develop democratic relationships
the teacher shares power with students recognising it as a fundamental condition for learning
- 2.2 build a community of learners
the teacher creates a culture where everyone inspires and encourages each other's learning
- 2.3 negotiate learning
the teacher responds to students' changing needs and involves them in deciding the direction of the curriculum
- 2.4 challenge students to achieve high standards with appropriate support
the teacher has high expectations and guides each student to achieve his/her personal best





Safety for challenge in learning



Domain 2 Create safe conditions for rigorous learning

- 2.1 develop democratic relationships
the teacher shares power with students recognizing it as a fundamental condition for learning
- 2.2 build a community of learners
the teacher creates a culture where everyone helps and encourages each other's learning
- 2.3 negotiate learning
the teacher responds to students' changing needs and interests when it disrupts the structure of the curriculum
- 2.4 challenge students to achieve high standards
with appropriate support
the teacher has high expectations and guides each student to achieve their personal best

Do my students feel safe to have a go and say 'I don't get it'?

- Do my students have a range of peers they can learn from and with?
- Do my students know how to adapt tasks or set learning goals to *really* suit them?
- Do my students see challenge as positive and necessary in their learning, and know they can improve with effort, practice and resilience?



TfEL Framework guide

Questions

Did students feel safe to have a go and say 'I don't get it'.

Did students have a range of peers they could learn from and with?

Did students know how to adapt tasks or set learning goals to *really* suit them?

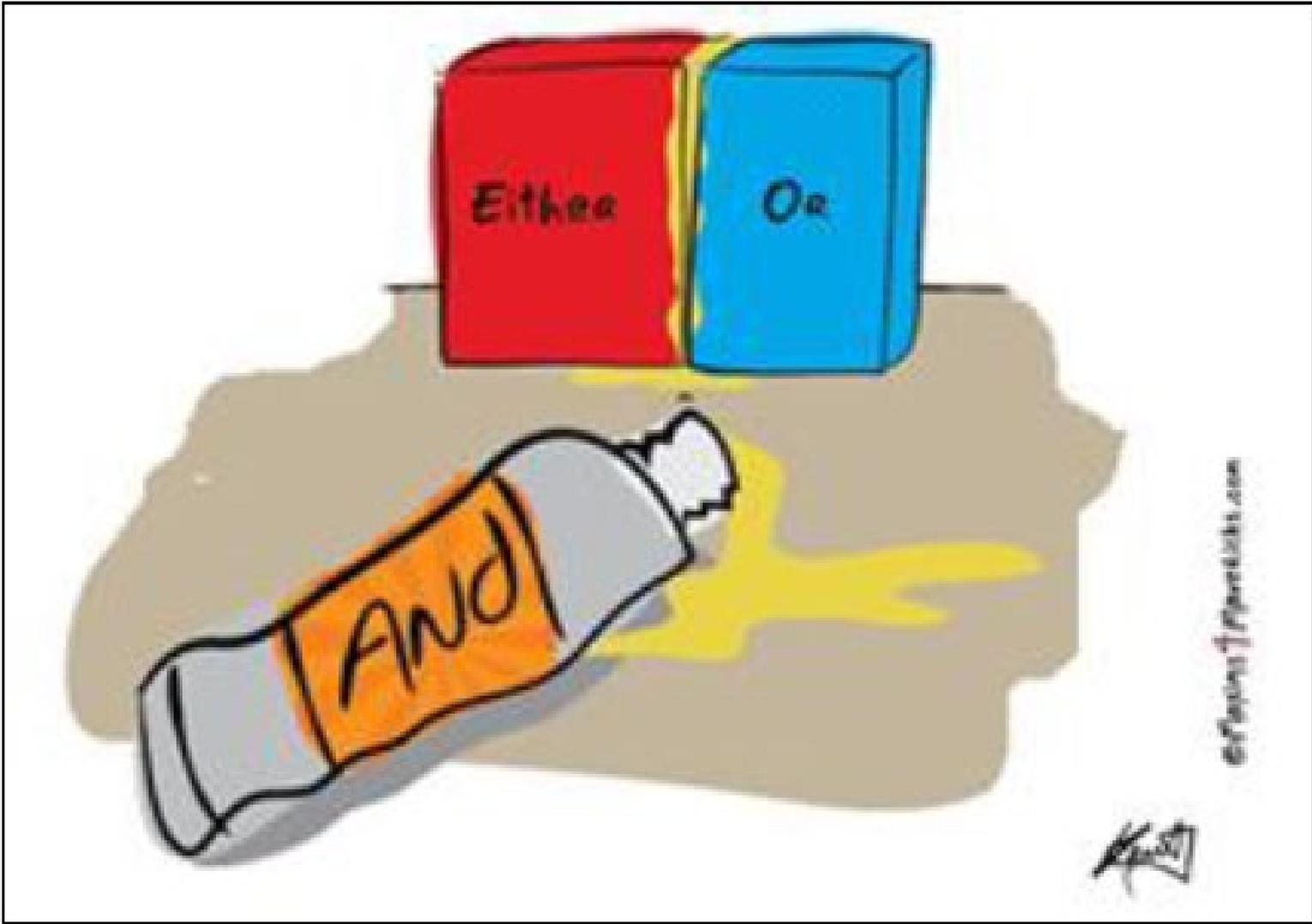
Did students see challenge as positive and necessary in their learning, and know they can improve with effort, practice and resilience?



3

Making the connection





Commitment to action

Transform a task using a 'Tell to ask' technique and try it with your students.

Come back prepared to discuss:

- What you noticed?
- What was the student response?
- Any questions raised for you?





Reflections

1. Which technique did you try?

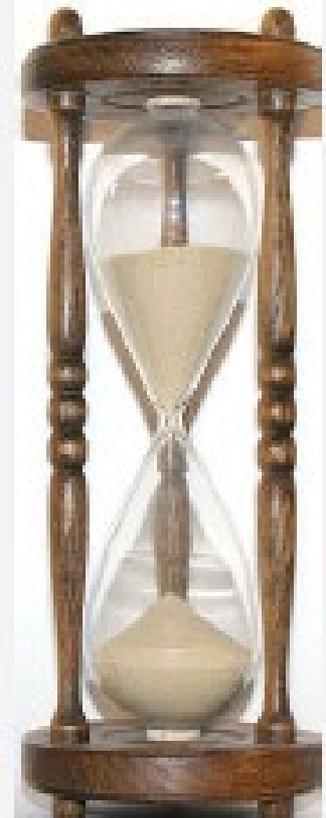
Describe what you did. **How was this different** from your previous practice?

2. What happened?

How did the students **respond**?

3. What did you **learn**?

What might you **change** next time?



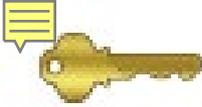
What kind and level of thinking?

Level of thinking

Kind of thinking

Critical and creative thinking continuum	GENERAL CAPABILITY EDUCATIONAL OBJECTIVES					
	Original scenario	Level 1 At the end of Year 10, of adults	Level 2 At the end of Year 11, of adults	Level 3 At the end of Year 12, of adults	Level 4 The end of Year 14, of adults	Level 5 At the end of Year 18, of adults
Inquiring, identifying, a purposeful subject by character and their	Focus questions	one focused and exploratory questions (relevant personal, physical and spiritual)	open questions to identify and clarify issues, assumptions, implications of their work	open questions to explore and challenge issues and work	open questions to clarify and compare information and guide to build and challenge	open questions to probe questions and to analyse complex issues
	Identify and clarify information and ideas	Identify, summarise, clarify, paraphrase and describe a situation or situation	Identify and explain information and ideas from source materials	Identify, summarise and select evidence to distinguish from a range of sources	Identify and clarify relevant information and analyse ideas	Clarify information and ideas from a range of sources to analyse underlying challenging issues
Evaluating and justify information	gather some information or explore a complex source	explore information based on similar or contrast ideas from different sources	analyse, compare and interpret data and explain, based on a changing range of sources	analyse, compare and explain issues from a range of sources	critically analyse information and evidence leading to a clear, well-justified and reasoned	critically analyse independently sourced information to determine its accuracy and reliability
	Imagine possibilities and consequences	use imagination to think of other things to see ways and possibilities to solve a problem or situation	Identify possible ways to solve a problem and justify them	explore in detail, ideas to solve a problem and justify them	generate ideas in terms of what solutions in a range of ways to solve a problem	Identify possible solutions and justify them based on the range of underlying goals
Generating ideas, problem solving	Consider alternatives	generate alternatives and evaluate them to explore a given situation or problem	generate and compare, evaluate ideas to solve a problem or problem	explore alternatives using creative thinking strategies to solve a range of situations	generate alternatives and compare approaches to solve a problem, challenge existing ideas and generate alternative solutions	generate alternatives and evaluate them, leading to a clear, well-justified and reasoned
	Developed and justify a solution	analyse ideas and justify them from source materials when posing a problem	explore options and justify possible solutions when posing a problem or problem	explore ideas with a range of options when solving a problem or posing a problem	analyse and justify the ideas to identify the most effective solution and to justify their solution	analyse possibilities, and identify and justify the most effective solution when posing a problem or problem
Reflecting on thinking processes	Think about thinking (metacognitive)	Describe what they are thinking and give reasons why	DESCRIBE THINKING strategies used in given situations and/or tasks	REFLECT ON HOW AND WHY the processes used in some situations	REFLECT ON SITUATIONS, THEIR COMPLEXITY, RELEVANT INFORMATION AND HOW THEY CHOOSE TO MANAGE	REFLECT ON HOW AND WHY the processes used in some situations
	Reflex on processes	Identify the steps and describe the steps in the thinking process	Outline the steps and explain the advantages and disadvantages of the thinking process	DESCRIBE PERSONAL INFORMATION from investigation and explain and justify parts of their	analyse and justify the thinking process and justify the thinking process and justify the thinking process	analyse and justify the thinking process and justify the thinking process
Applying what they have learned to manage situations	Transfer knowledge (into new contexts)	transfer information from one setting to another and justify why learning	USE RELEVANT FROM A previous experience to inform a new one	transfer relevant information, skills and/or to solve a problem	apply knowledge gained from one context to another, complex context	justify reasons for decisions when transferring information to solve an effective context
	Apply knowledge and reasoning	apply the thinking skills to solve various higher level situations	Identify relevant skills in similar or related specific situations	analyse and apply appropriate reasoning and creative strategies for particular situations	analyse situations in a complex, changing and evolving to justify a clear conclusion or outcome	justify their thinking and making evidence informed
Evaluating procedures and outcomes	Draw conclusions and design a course of action	draw their thinking about possible courses of action	Identify alternative courses of action or possible conclusions when presented with new information	draw on their knowledge evaluate evidence when making a choice of action or drawing a conclusion	analyse ideas or actions, and evaluate the quality of their own thinking and/or that of others	effectively the components of a designed course of action and evaluate the quality of their thinking
	Evaluate procedures and outcomes	draw information and compare into the values of their situation	explore and justify their own information and justify their own to solve	explore and justify their own and outcomes	analyse the effectiveness of their products, performance, methods and/or the effectiveness of their own solutions, explain where they have failed	evaluate the effectiveness of their products, performance, methods and/or the effectiveness of their own solutions, explain where they have failed





Let's be clear – this is not a 'bag of tricks'.

Intentionality matters.

Intentionality changes a 'trick' into a key strategy.

Know what
you want to
achieve.



Dan Meyer Three Act Maths



Act 1 - Introduction

Act 2 - Main body of the lesson

Act 3 - Resolve the problem

- Reflection

-“Setting up the sequel”





Act 1

Introduction

What questions
come to mind?



<http://threeacts.mrmeyer.com/watertank/act1/act1.mov>

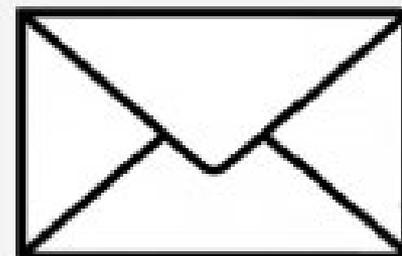


Act 1

Reflect on the **teacher** actions.

Sort the different actions in order of delivery.

Discuss the possible impacts of his different actions on students.



Act 1

Reflect on the **teacher** actions

1. Share the video.

Take a look at this....

2. What questions do you have? (No judgment about quality).

3. Who else is interested in this question?

(Count).

Value all of the questions.

4. Sort into 2 groups:

- questions that require mathematical thinking
- questions that don't.

'I hope that we get to them all. We'll come back to this list later in the session'. (Dan Meyer)

5. Identify the question you want the students to work on today.

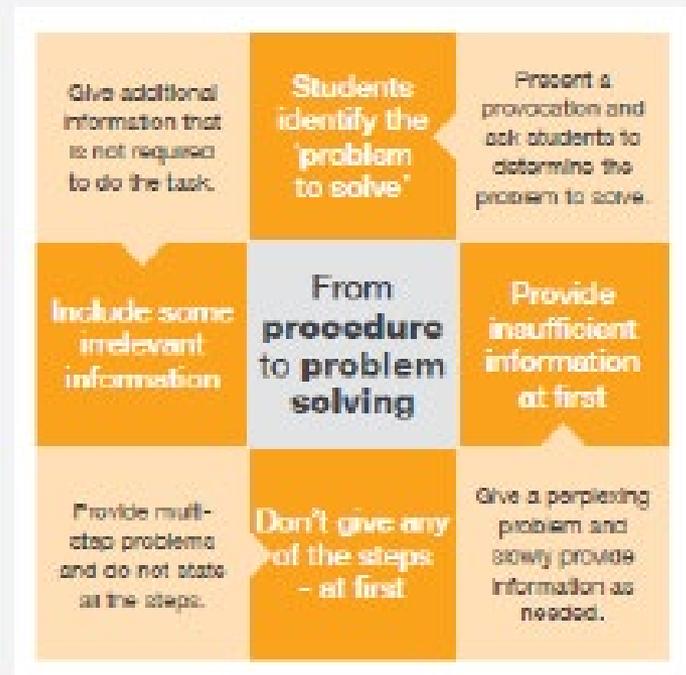
6. Promote estimation:

What's too quick? Too slow? Best guess?





Where does the introduction connect?



Act 1

What do you notice?

What do you wonder?

Students identify the 'problem to solve'

Present a provocation and ask students to determine the problem to solve.

From problem solvers...
...to problem **finders**





Students determine the problem



www.ted.com/talks/dan_meyer_math_curriculum_makeover?language=en

Where can I find more ideas?

dy/dan
less helpful

Posts
Comments
Get Posts by E-mail



The Three Acts Of A Mathematical Story

May 11th, 2011 by Dan Meyer

2013 May 14. Here's a [brief series](#) on how to teach with three-act math tasks. It includes video.

2013 Apr 12. I've been working this blog post into curriculum ideas for a couple years now. They're all available [here](#).

Storytelling gives us a framework for certain mathematical tasks that is both prescriptive enough to be *useful* and flexible enough to be *usable*. Many stories divide into three acts, each of which maps neatly onto these mathematical tasks.

Act One

Introduce the central conflict of your story/task clearly, visually, viscerally, using as few words as possible.

With *Jaws* your first act looks something like this:

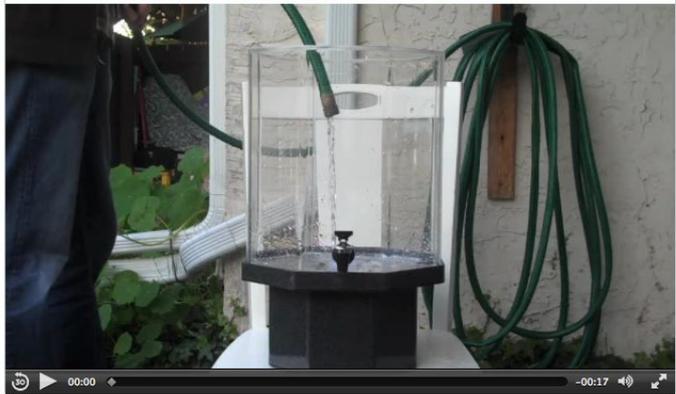
101questions SEARCH CREATE TOP 10 PROFILE SIGN OUT

Water Tank Filling

by Dan Meyer

65 35
questions skips

Prologue Download More



Act One

blog.mrmeyer.com/2011/the-three-acts-of-a-mathematical-story/

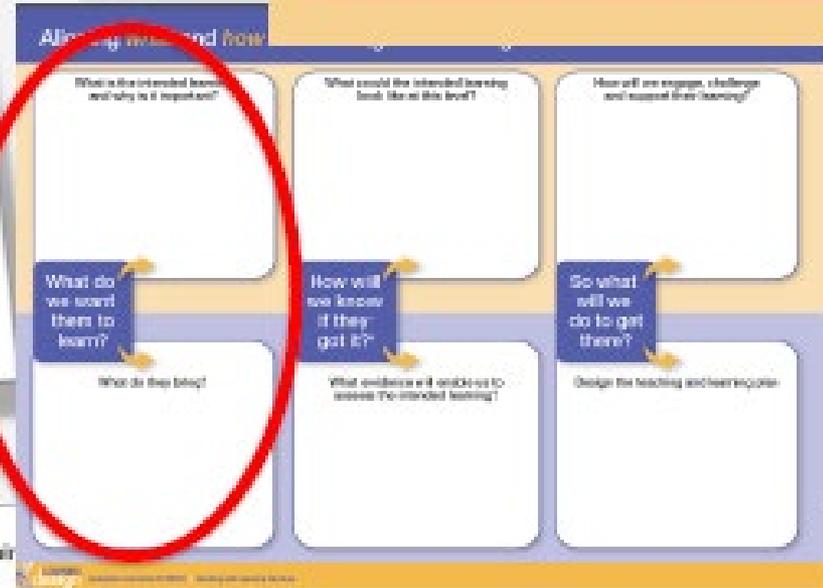


BUT.... be intentional



Justice alert

Who struggles to feel a sense of belonging?



Act 2 Solving the problem

Part 1:

What information/
resources do you
need?



1 (cubic centimeter) = 0.0338140227 US fluid ounces

[More about calculator.](#)





Act 2

When you have the information...



Part 2:
How might you work this out?

What could you try?

Which techniques align?

Give essential information that is not required to do the task.	Students identify the 'problem to solve'.	Present a problem and ask students to determine the problem to solve.
Include some irrelevant information.	From procedure to problem solving.	Provide insufficient information at first.
Provide multi-step problems and do not state all the steps.	Don't give any of the steps at first.	Give a puzzling problem and slowly provide information as needed.





Procedure to problem solving techniques

1. What might be the **intention** or purpose of these techniques?



2. What **student actions** do they encourage? Which **skills** do they build?





NAPLAN test questions

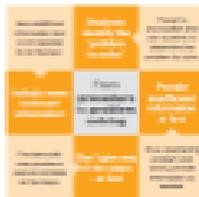
opportunity

Fluency

- routine questions
- recall and remember

Fluency plus

- non-routine questions
- requires persistence/resilience
- multi-step
- requires reasoning/problem solving





Supporting students to become expert problem solvers



The BTL tool - history years 3-4

Year 3	Year 4
<ul style="list-style-type: none">Identify the main events in a historical text.Identify the main characters in a historical text.Identify the main setting in a historical text.Identify the main cause and effect in a historical text.Identify the main purpose of a historical text.	<ul style="list-style-type: none">Identify the main events in a historical text.Identify the main characters in a historical text.Identify the main setting in a historical text.Identify the main cause and effect in a historical text.Identify the main purpose of a historical text.





Design Thinking How Might We?

How – Provides confidence that the solution exists.

Might – Knowing our ideas **might** work, or they might not. Either way **we will learn**.

We – Collaboratively we can **build on each other's ideas**.



Tom Barrett (Notosh) Introduction to Design Thinking

Act 3

“The resolution and the sequel”

Dan Meyer

Reflect on the process

- Did it work?
- Was it the best way?

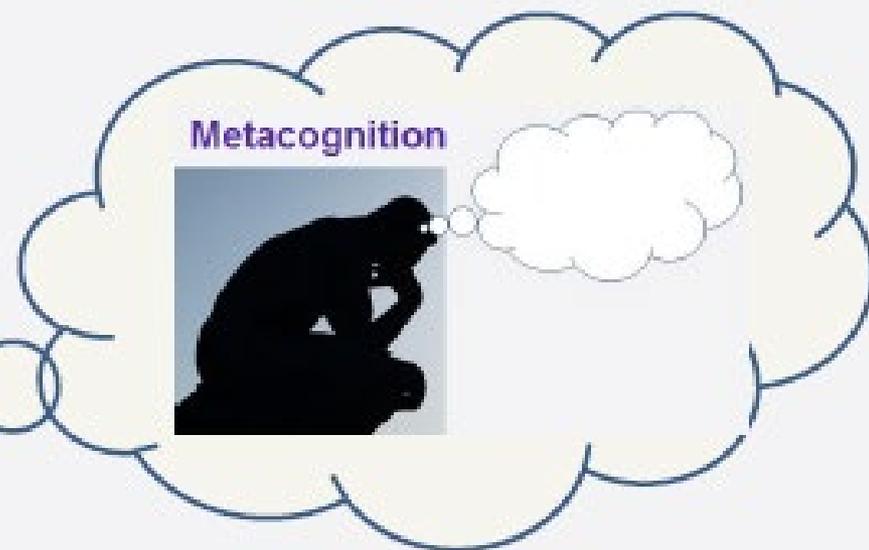
Reflect on the outcome

- What did we learn?
- How can we use this?





Metacognition



Reflecting on your
learning





Metacognition

- Based on extensive evidence
- High impact for very low cost
- **+8** months additional progress
- Particularly effective for low achieving and older students
- More effective when taught in collaborative groups.

Metacognition



<http://australia.teachingandlearningtoolkit.net.au/toolkit/meta-cognition-and-self-regulation/>

Making connections

- **S**ort out the important information
- **T**hink about how you might solve the problem
- **A**ction – carry out the plan and check with your estimation of the answer
- **R**eflect on the effectiveness of the strategy

Give additional information that is not required to do the task.	Students identify the 'problem to solve'	Present a provocation and ask students to determine the problem to solve.
Include some irrelevant information	From procedure to problem solving	Provide irrelevant information at first
Involve multi-step problems and do not state all the steps.	Don't give any of the steps - at first	Give a perplexing problem and slowly provide information as needed.





Transfer to a different context

<https://www.youtube.com/watch?v=dDD67ydGEac>



Students identify the 'problem to solve'

Present a provocation and ask students to determine the problem to solve.

Science ASSIST

AUSTRALIAN SCIENCE TEACHERS ASSOCIATION
Promoting our profession: enriching science teaching

ASSIST AUSTRALIAN SCHOOL SCIENCE INFORMATION SUPPORT FOR TEACHERS AND TECHNICIANS

Magnetism and electrostatics - Year 4 CLE

<http://assist.asta.edu.au/>



Transfer to a different context

Neil Atkin



<http://neilatkin.com/category/science/>

Three Act Science – Alternative approaches to Science Teaching

1. Lack of initiative
2. Lack of perseverance
3. Lack of retention
4. Aversion to word problems
5. Eagerness for formula



What are you wondering?



Students identify the 'problem to solve'

Present a provocation and ask students to determine the problem to solve.

Becoming 'problem finders'

<http://neilatkin.com/2015/05/03/three-act-science-alternative-approaches-to-science-teaching/>



Act 1 Provocation – identifying the problem

Act 2 Main body of the lesson – what would be the teacher action?

Give students information that will require to do the task	Students identify the 'problem to solve'	Present a provocation and ask students to determine the problem to solve.
Include some irrelevant information	From procedure to problem solving	Provide insufficient information at first
Provide multi-step problems, and do not state all the steps.	Don't give any of the steps at first	Set a repeating problem and slowly provide information as needed.



Act 2

Consider the **student** actions

Students identify the necessary information.

Students identify the steps they could take to solve the problem.



Group 1:

Pretend you are a **burglar**. Read the story and underline the five most important points for you.

Group 2:

Pretend you are a **real estate agent**.

Read the story and underline the five most important points for you.

Give additional information that is not required to do the task.

Include some irrelevant information





Why would you 'include irrelevant information' in a task?

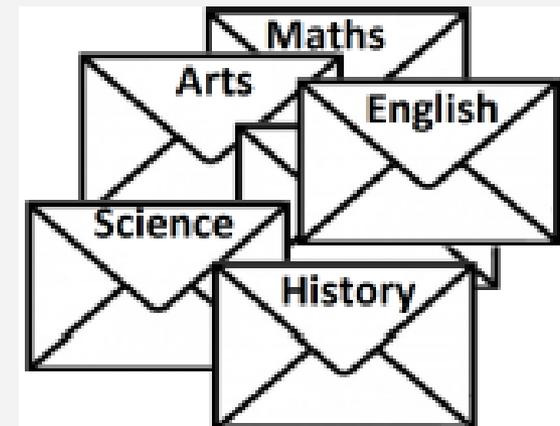
Why wouldn't you?

Give additional information that is not required to do the task.

Include some irrelevant information



Match the pairs



Identify:

- the before - 'a procedure'
- the after - 'problem solving'

Which of the techniques was used to transform the task?

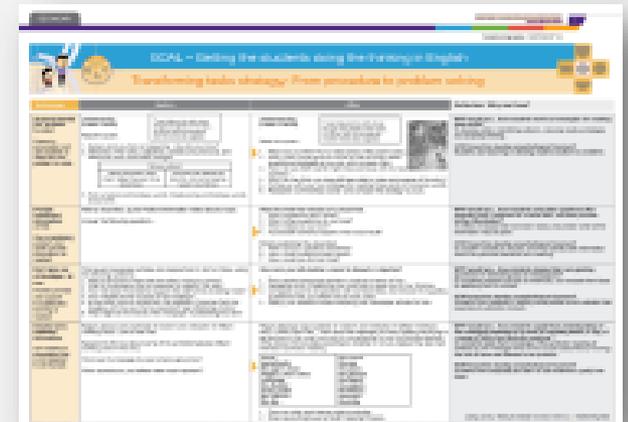
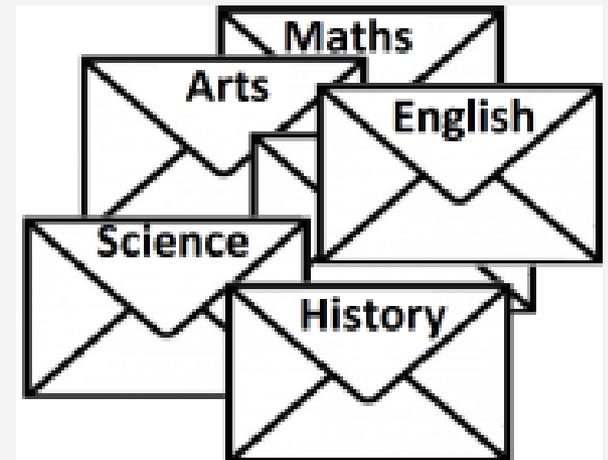




Compare your ideas.

Do you all agree?

How might you have transformed the task differently?



Have a go

- Think of a procedural task.
- Transform it into a problem solving situation using one or more of the different techniques.





What kind and level of thinking?

Level of thinking

Kind of thinking

Critical and creative thinking continuum		GENERAL CURRICULAR INTENTIONS (GCI) 2014					
		Level 1 At the end of foundation Year 1 students	Level 2 At the end of Year 2 (Students)	Level 3 At the end of Year 3 (Students)	Level 4 The end of Year 4, students	Level 5 At the end of Year 5, students	Level 6 At the end of Year 6, students
Inquiry thinking - requires a quality relationship	Pose questions	ask factual and explanatory questions based on general concepts and experiences	pose questions to identify and clarify issues, and discuss information from multiple sources	ask questions to explore that challenge about the world	ask questions to clarify and explore information available to solve real-world problems	ask questions to probe assumptions and challenge simple ideas	ask questions to critically analyse complex ideas and identify gaps
	Identify and clarify information and ideas	identify and describe familiar information and ideas during a discussion or investigation	identify and explore information and resources from a range of sources	identify and explore and describe early information from a range of sources	identify and clearly present information and provide ideas	clearly present information and ideas from a range of sources	clearly present information and ideas from a range of sources
	Organise and process information	gather simple information or describe through play	organise information based on similar or different ideas from several sources	draw, compare and integrate facts and opinions from a wide range of sources	analyse content and combine related information from multiple sources	critically analyse information and ideas according to criteria used to create the content	critically analyse information and ideas according to criteria used to create the content
On solving issues, decisions and actions	Imagine possibilities and consequences	use imagination to create or describe ideas and actions that might be different	build on what they know to create ideas and possibilities to solve problems that are similar	expand on known ideas to create new and imaginative possibilities	combine ideas for solving a range of problems	analyse possibilities, create and describe ideas for solving a range of problems	evaluate and describe complex, challenging ideas, strategies and processes
	Consider alternatives	suggest alternative and creative ideas to approach a given situation or task	identify and compare simple alternative ideas, options, plans or solutions	explore alternatives using creative thinking strategies to propose a range of alternatives	identify alternatives when faced with a problem or situation, choosing existing ideas alongside alternative solutions	generate alternative solutions, evaluate and describe ideas, including when information is limited or conflicting	generate or describe options to modify ideas, understand alternative strategies
	Test solutions and put them in action	create and test simple solutions to a given situation and when doing these have fun	test simple options and create simple solutions when solving tasks that are fun	experiment with a range of options when solving problems and using ideas that are fun	experiment and continuously identify the most effective solution when put into action	generate possibilities, and identify and describe the most effective solution when solving these situations	experiment and create sophisticated, testing solutions and create sophisticated, testing ideas, including including complex ideas that are fun
Self-reflective thinking and processes	Think about thinking (metacognition)	recognise what they are thinking and give reasons why	describe thinking strategies used to solve problems	analyse an experience when the problem is self-generated	analyse or synthesise, make choices, recognise progress and make adjustments to ideas	evaluate assumptions in their thinking and make alternative options	give reasons to support their thinking and describe applying alternative ideas, including when faced with problems
	Reflective process	identify the main elements of the thinking process	explain the detailed sequence of a task that has been completed	identify pertinent information in an investigation or experience and describe what it was	identify and justify the existing thinking process they have used	evaluate and justify the reasons behind making a particular problem-solving strategy	reflect on what and how the components of a complex or challenging problem-solving strategy
	Transfer knowledge into other contexts	connect information from one situation to another when solving new tasks	use information from a previous experience to inform a new task	transfer and apply information to new settings to solve problems	apply knowledge gained from one context to another unrelated context	justify decisions about what transferring into new situations and different contexts	identify, describe and justify the relevance of knowledge to new contexts
Planning, problem solving, a strategy, reasoning and processes	Apply logic and reasoning	verify the thinking used to solve problems, implications	verify reasoning when making an action in specific situations	identify and apply appropriate reasoning and thinking strategies for problem-solving	evaluate when there is a second reasoning and evidence to justify a claim, conclusion or support	verify gaps in reasoning and missing elements in information	verify reasoning used in making and applying solutions, and the extent of resources
	Draw conclusions and design a course of action	make their thinking about possible course of action	identify alternative courses of action or possible conclusions when presented with new information	draw on prior knowledge and use evidence when making a course of action or course of conclusion	evaluate their own design, test alternatives, make adjustments when solving a range of action	differentiate the components of a complex course of action and describe strategies when solving problems	use prior and new knowledge to analyse and describe complex information to inform a course of action
	Evaluate processes and outcomes	draw, explain the idea and justify with the evidence of facts or ideas	describe when the idea is explained and they are not satisfied	explain and justify ideas and solutions	evaluate the effectiveness of ideas, processes, performance, methods and sources of information against given criteria	explain alternatives and justify ideas, methods and sources of facts, and account for a process and anticipated outcome against criteria that have changed	evaluate the effectiveness of ideas, products and performance and highlight sources of evidence to further develop solutions against criteria that have changed

Commitment to action

Transform a task using a 'Procedure to problem solving' technique, and try it with your students.

Come back with an artefact (for example video, work sample, pictures etc.) that showcases your lesson.

Where does the task you have transformed fit on the Critical and creative thinking continuum?



