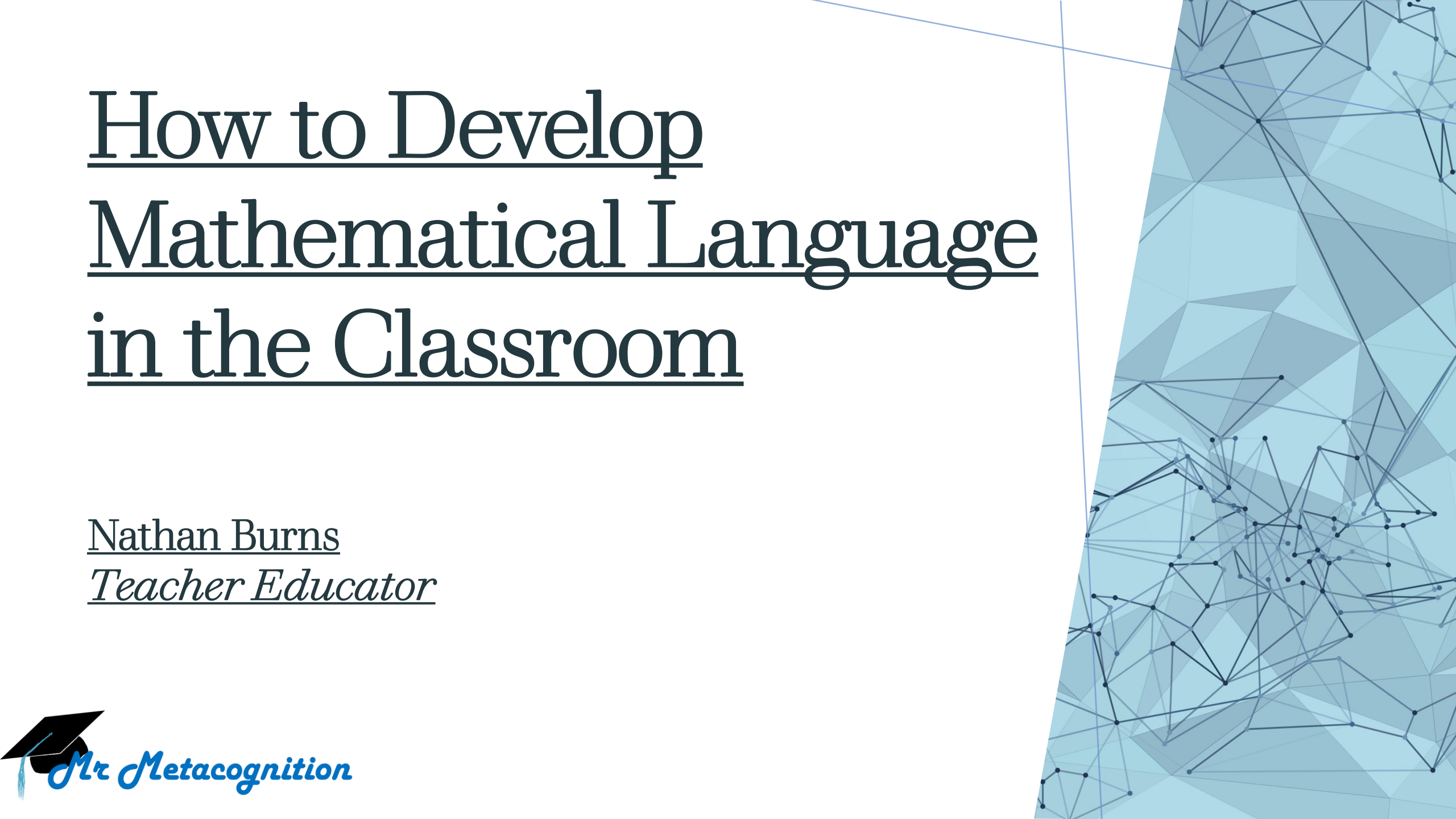
How to Develop Mathematical Language in the Classroom

Nathan Burns
Teacher Educator



Mr Metacognition

Contracting Session

- Will be utilising break-out rooms; so be ready to share ideas!
- Putting ideas and feedback into the chat function
- Opportunity for a Q&A at the end of the session.

Mr Metacognition

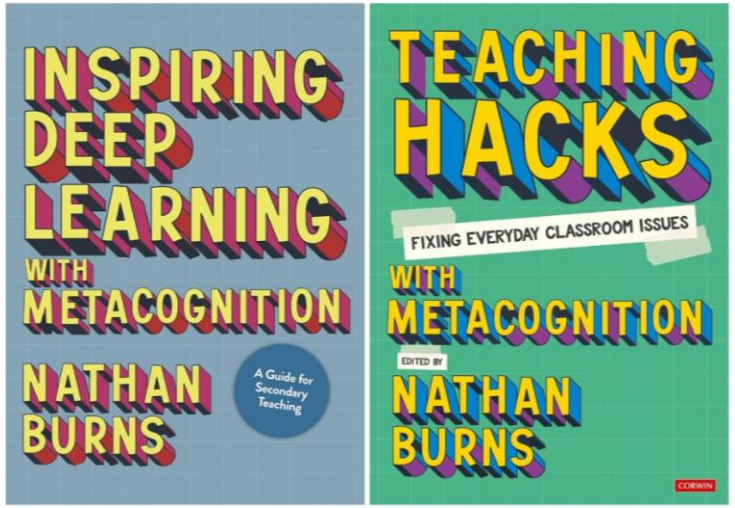
Session Aims

- Consider the importance of Mathematical language
- Review the difficulties that students may face
- Discuss a range of approaches to develop Mathematical language in the classroom

Mr Metacognition

Who Am I?

- Nathan Burns
- Former Head of Maths/Pastoral Lead/MAT Lead
- Metacognitive researcher and author
- Full time training provider and consultant



Mr Metacognition


Ciao!
Привет!
مرحبا
你好子
Hello!
¡Hola
Hello!
Ciao.
你好子
¡Hola
Hello!
مرحبا
Hello!

MATHS

The Impact of Language

The right-angled triangle was placed onto a coordinate grid repeatedly to form the diagram on the right. Find the coordinates of the labelled points.

Mr Metacognition

The Impact of Language

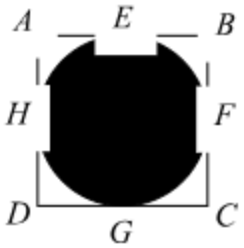
Find the equation of the line perpendicular to the line $y=2x+3$ and passes through the point (4,11)

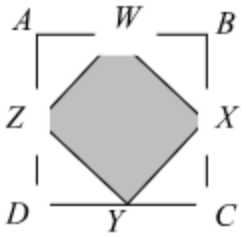
Where does the line cross the x and y axis?

Mr Metacognition

The Impact of Language

Here is a diagram of a black circle inside a white square and a diagram of a small grey square inside a white square.
The two white squares are the same size.





$AB = 8x$.

The sides of the square are tangents to the circle at the points E, F, G and H.
W, X, Y and Z are the midpoints of AB, BC, CD and DA respectively.

Work out the ratio of the area of the black circle to the area of the white square to the area of the grey square. Give your answer in its simplest form.

Mr Metacognition

WRM

Measurement (Measure and Length)						
Reception	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
measure	compare	standard units	millimetre mm	kilometres km	decimal notation	conversion
wide(er)		estimate	perimeter	rectilinear figure	scaling	miles
narrow(er)		order		area	metric units	formulae
compare		record results			imperial units	parallelograms
long(er)(est)		centimetre cm			inches	triangles
short(er)(est)		metre m			compound shape	feet
length					irregular shapes	
					square centimetres	
					square metres	

Measurement (Height, Weight and Capacity)						
Reception	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
height	mass	kilogram kg			cubic centimetre	cubic metre
long(er)/short(er)	volume	gram g			pounds	cubic millimetre
tall(er)/short(er)		quarter full			pints	cubic kilometre
weight		three quarters full				gallons
capacity		litres l				stones
heavy/light		millilitres ml				ounces
heavier than		temperature				
lighter than		Celsius				
big/bigger/biggest						
full/empty						
more than						
less than						
half/half full						

Mr Metacognition

AQA

AQA
Realising potential

Command words

Command words are the words and phrases used in exams and other assessment tasks that tell students how they should answer the question. These are presented in alphabetical order based on the **key word**, not necessarily the first word.

Mr Metacognition

Additional Language Problems...

On Saturday, some adults and some children were in a theatre. The ratio of the number of adults to the number of children was 5:2

Each person had a seat in the Circle or had a seat in the Stalls.

$\frac{3}{4}$ of the children had seats in the Stalls.

117 children had seats in the Circle.

There are exactly 2600 seats in the theatre.

On this Saturday, were there people on more than 60% of the seats? You must show how you get your answer.

Mr Metacognition

Discuss

Where have your students faced the barrier of Mathematical language?

How have your students been limited?

How have your students been impacted?

Mr Metacognition

Why Does it Matter?

'The League's lack of an army explains its failure in the 1930s.' How far do you agree with this statement? Explain your answer. [10]

Mae dysgu'r iaith Gymraeg yn agor drws i ddiwylliant newydd.

Trafodwch mewn tua 200 o eiriau.

Gallech chi ddewis cyfeirio, er enghraifft, at:

- y cyfryngau a thechnoleg
- cerddoriaeth Gymraeg
- yr Urdd, eisteddfodau a mentrau iaith
- theatr Gymraeg

[20]

Mr Metacognition

Why Does it Matter?

- An inability to understand the language used limits the ability of students to accurately determine a Knowledge of Task
- Greater language challenges = greater cognitive strain
- Typically, language provides an *unhelpful* challenge
- Reduce metacognitive and self-regulatory capacity (cognitive ignorance)
- Increases Mathematical anxiety
- Reduced the depth and quality of Mathematical discussions
- Limits oratory development in the classroom
- Reduce opportunities for discussion and effective Mathematical questioning

Mr Metacognition

Share in the Chat

What key reason is most significant for you?

Mr Metacognition

A Conglomeration of Ideas

- Focus of this webinar is less on *strategies* and more on *opportunities* to explicitly teach language.
- Many can be easily adapted to suit the class, context and year group.
- Based upon own practice, research and observation of others
- Opportunity to share ideas from your own classroom!

Mr Metacognition

Key Word Quizzing

Last lesson	Last week
Last month	Last term
Define...	

Mr Metacognition

Homework Definition Tests

Definition Test – 30 Questions

Term	Definition
1. Sole Trader	
2. Partnership	
3. Autonomy	
4. Public Limited Company	
5. Discrimination	
6. External Recruitment	

Mr Metacognition

TES

Key Word Jar



Keys to Literacy

Mr Metacognition

Definition Books/Glossary



Glossary

Evaluate - to find the value of a mathematical expression

Event - a set of outcomes to which a probability is assigned

Expression - a variable or combination of variables, numbers, and symbols that represents a mathematical relationship

Factor - when two or more integers are multiplied, each integer is a factor of the product. "to factor" means to write the number or term as a product of its factors.

First Quartile - For a data set with median M, the first quartile is the median of the data values less than M

Frequency - the number of time an event occurs within a specific time period

Geometric Figure - any combination of points, lines, planes, or curves in two or three dimensions

Graph - a pictorial device used to show a numerical relationship

Gratuities - something given voluntarily or beyond obligation usually for some service (tip)

Identity Property of Zero - the sum of any number and zero is that number

Example $2+0=2$

Inequality - a mathematical sentence that compares two unequal expressions using one of the symbols $<, >, \leq, \geq, \neq$

Inferences - the act or process of deriving logical conclusions from premises known to be true

Integers - (1) a number expressible in the form $\frac{a}{1}$ or $\frac{-a}{1}$ for some whole number a; (2) the set of whole numbers and their opposites

Interquartile Range - A measure of variation in a set of numerical data, the interquartile range is the distance between the first and third quartiles of the

Evaluate - to find the value of a mathematical expression

Event - a set of outcomes to which a probability is assigned

Expression - a variable or combination of variables, numbers, and symbols that represents a mathematical relationship

Factor - when two or more integers are multiplied, each integer is a factor of the product. "to factor" means to write the number or term as a product of its factors.

First Quartile - For a data set with median M, the first quartile is the median of the data values less than M

Frequency - the number of time an event occurs within a specific time period

Geometric Figure - any combination of points, lines, planes, or curves in two or three dimensions

Graph - a pictorial device used to show a numerical relationship

Gratuities - something given voluntarily or beyond obligation usually for some service (tip)

Identity Property of Zero - the sum of any number and zero is that number

Example $2+0=2$

Inequality - a mathematical sentence that compares two unequal expressions using one of the symbols $<, >, \leq, \geq, \neq$

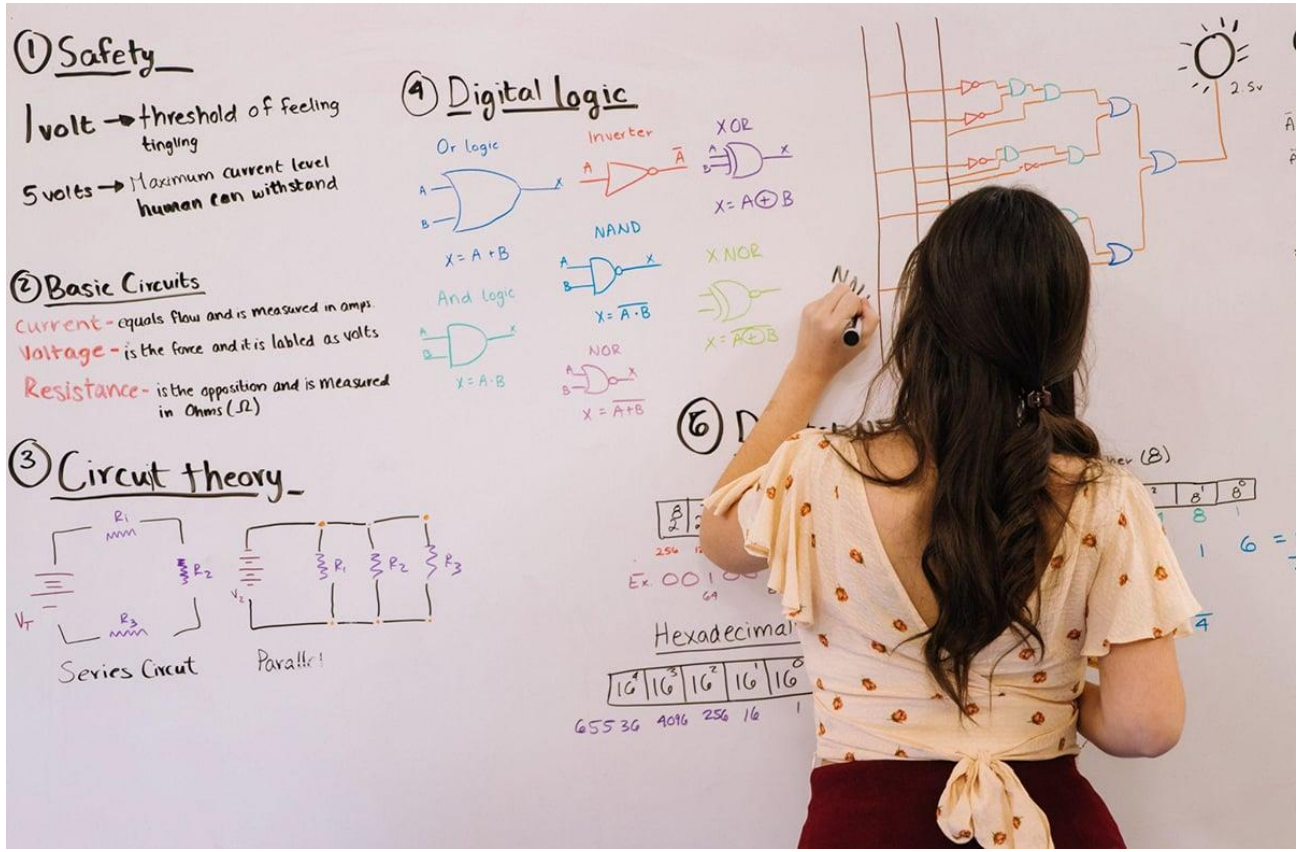
Inferences - the act or process of deriving logical conclusions from premises known to be true

Integers - (1) a number expressible in the form $\frac{a}{1}$ or $\frac{-a}{1}$ for some whole number a; (2) the set of whole numbers and their opposites

Interquartile Range - A measure of variation in a set of numerical data, the interquartile range is the distance between the first and third quartiles of the

Mr Metacognition

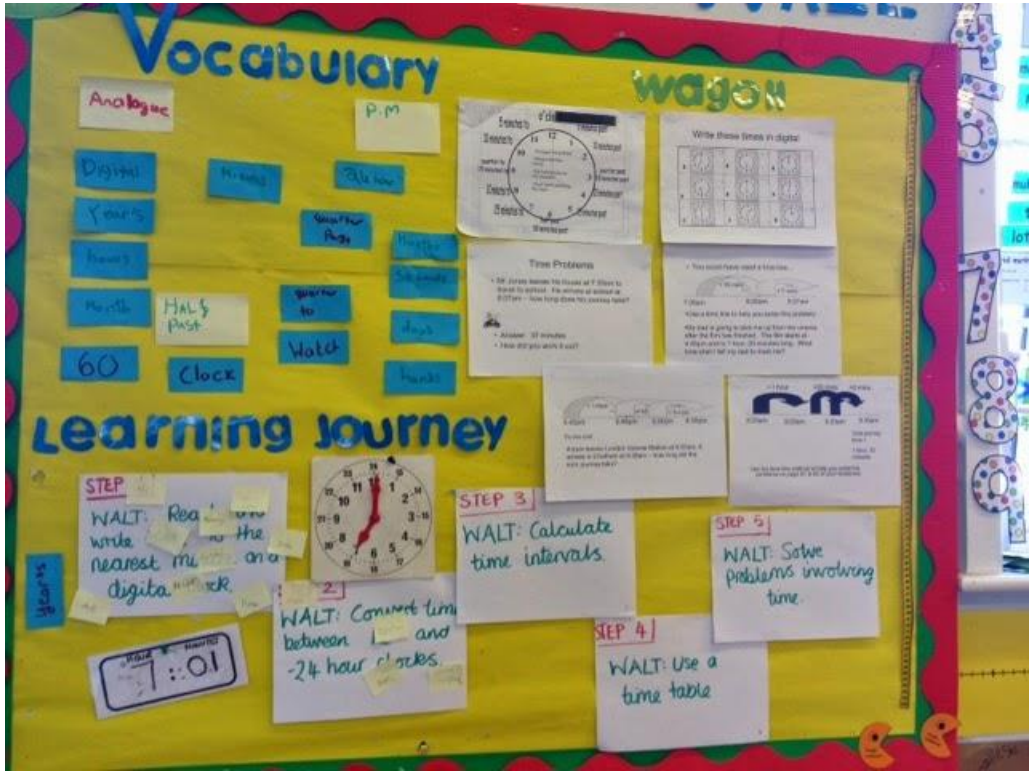
Whiteboard Definitions



VISME

Mr Metacognition

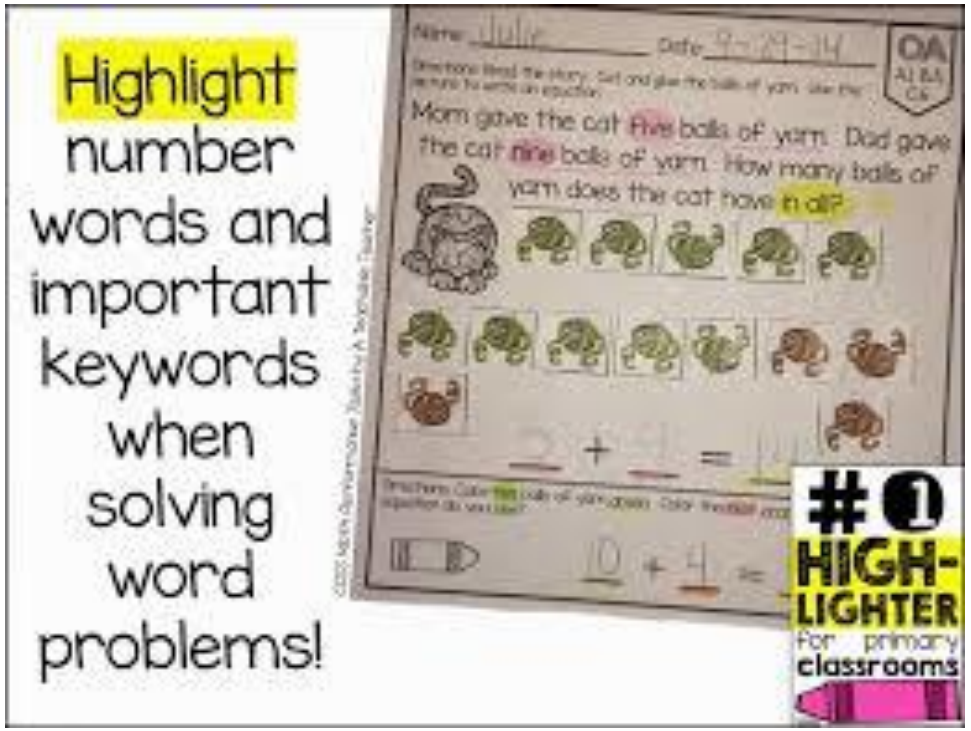
Effective Working Walls



Muddle Through the Middle

Mr Metacognition

Effective Highlighting



The Primary Pack

Mr Metacognition

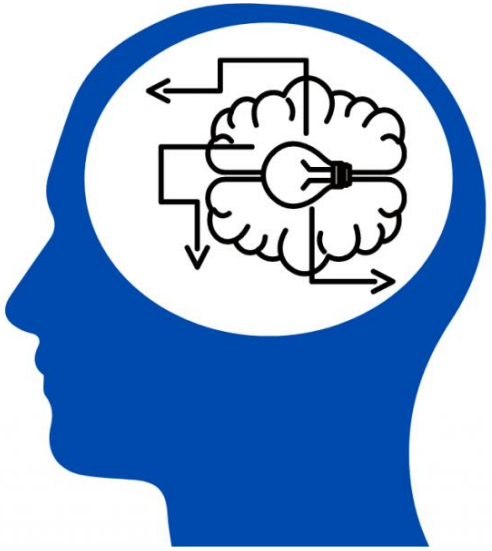
Teacher Exposition



Dreamstime

Mr Metacognition

Develop a Wider Schema/Mental Model



Phillip Stezel

Mr Metacognition

Write, then Answer



India Today

Mr Metacognition

Pose, Pause, Pounce, Bounce

1. Pose



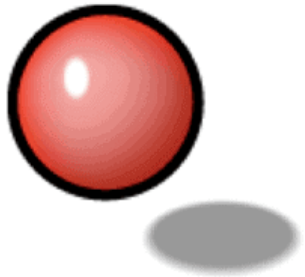
2. Pause



3. Pounce



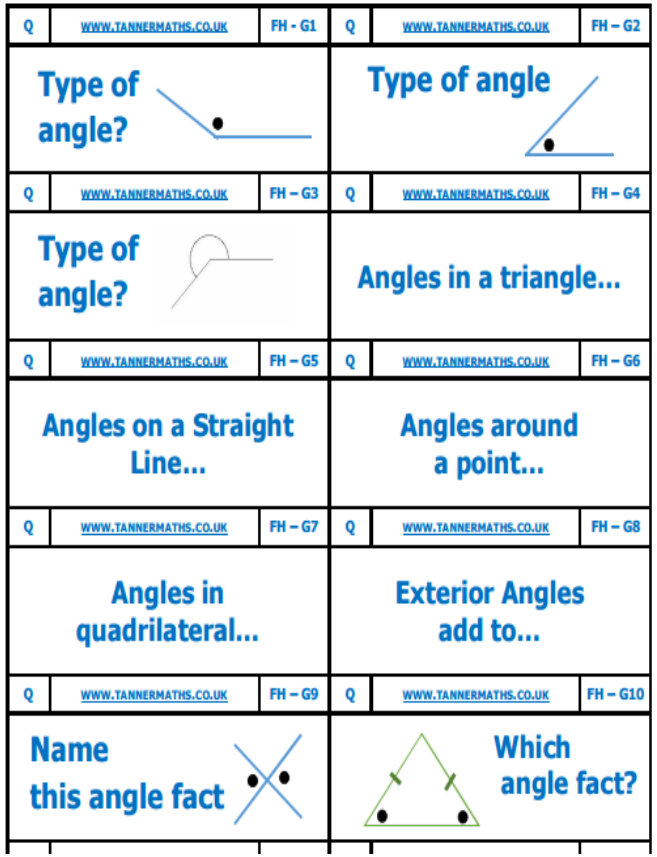
4. Bounce

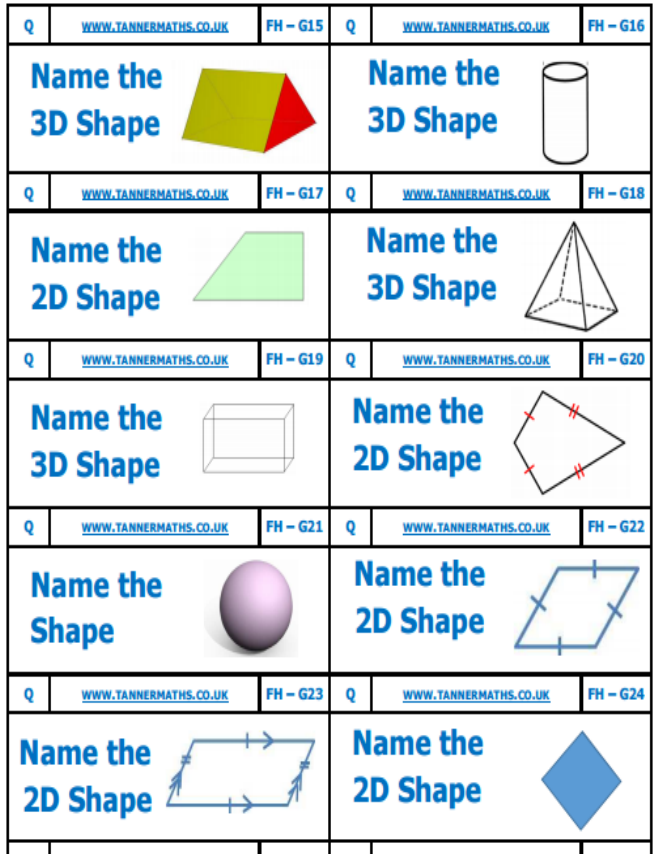


Teacher Toolkit

Mr Metacognition

Flashcards





Tanner Maths

Mr Metacognition



Learn from the Languages

Discuss

Which approaches do you already use?

Which may you use now?

Have you any other ideas to suggest?

Mr Metacognition

Stay In Touch!

Twitter: @MrMetacognition

BlueSky: @mrmetacognition.bsky.social

Email: mrmetacognition@gmail.com

LinkedIn: Nathan Burns

Mr Metacognition