EDUCATION & TRAINING FOUNDATION

CENTRES FOR EXCELLENCE IN MATHS

CENTRES FOR EXCELLENCE IN MATHEMATICS (CFEM)

STEVE PARDOE, RICHARD KIRTLAN, ELIZABETH HOPKER AND ELAINE GATES

EDUCATION & TRAINING FOUNDATION

CENTRES FOR EXCELLENCE IN MATHS

01

ABOUT CFEM

“Maths teaching has been researched more than any other subject”

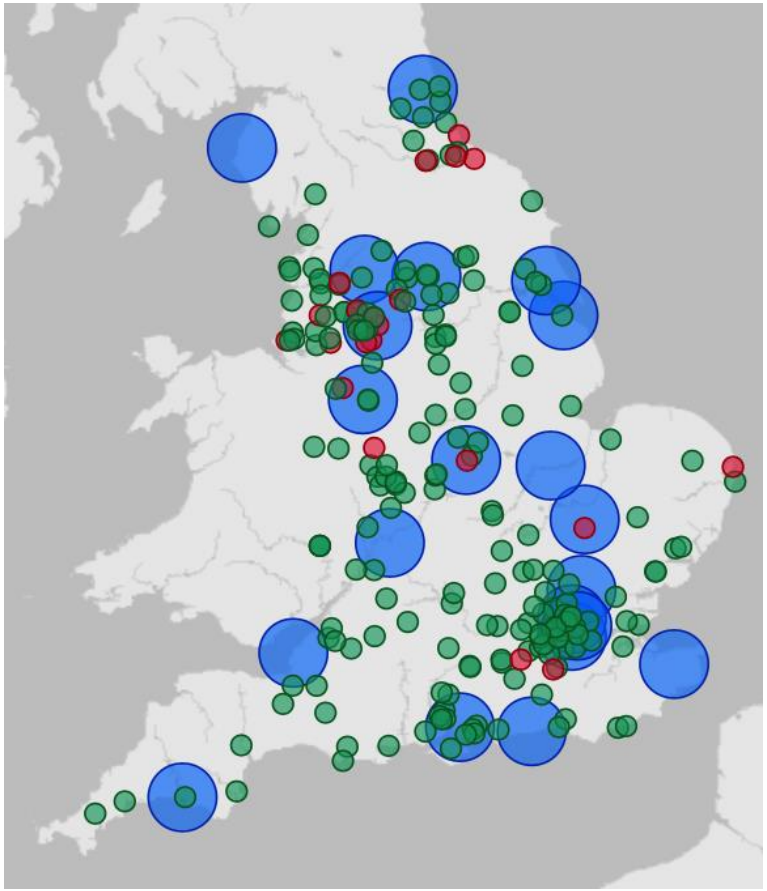
(Jo Boaler)

So …

– Why do we know so little about ‘what works’ in FE maths?

– Why do so many young people in colleges struggle to achieve a level 2 maths qualification?

CFEM NETWORKS



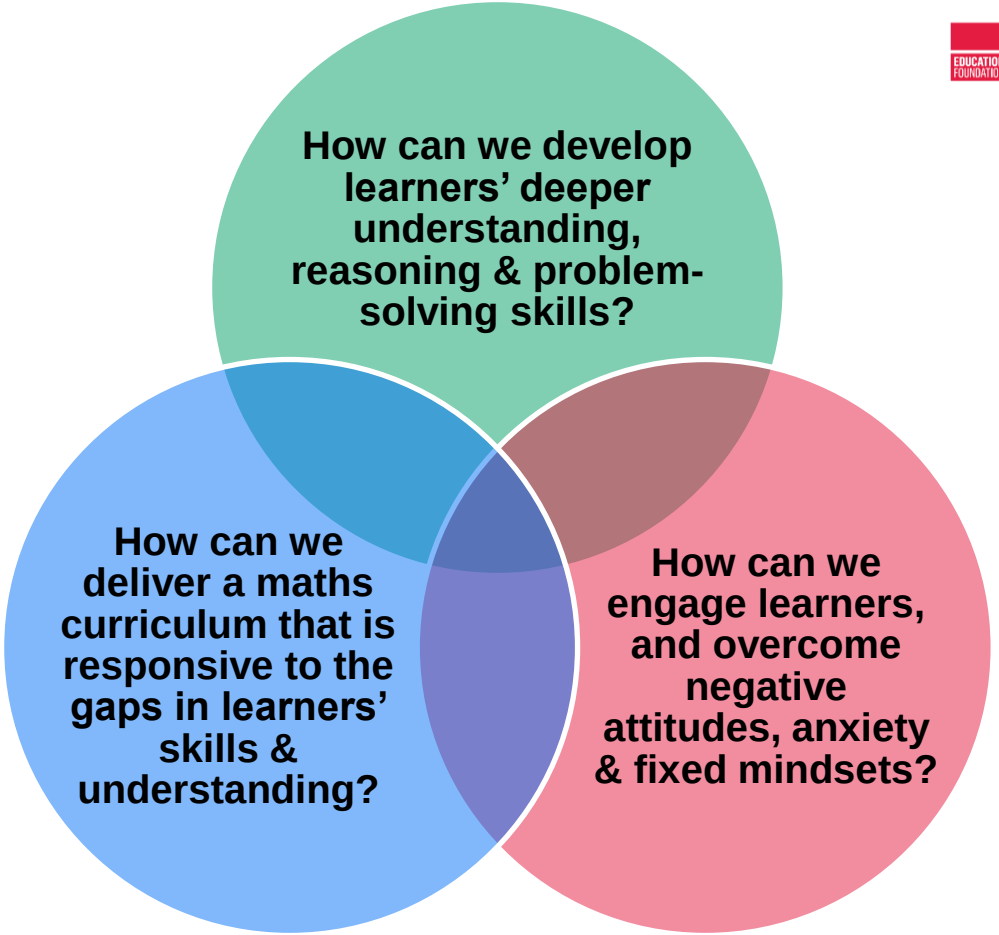
CENTRES FOR EXCELLENCE IN MATHS

Who are CfEM and what has been achieved so far?

- Partners
- Local networks and CPD
- Action Research
- National Trials
- CPD modules created
- Pedagogies and resources that have been successful
- Pedagogy handbooks created

KEY QUESTIONS

CENTRES FOR EXCELLENCE IN MATHS



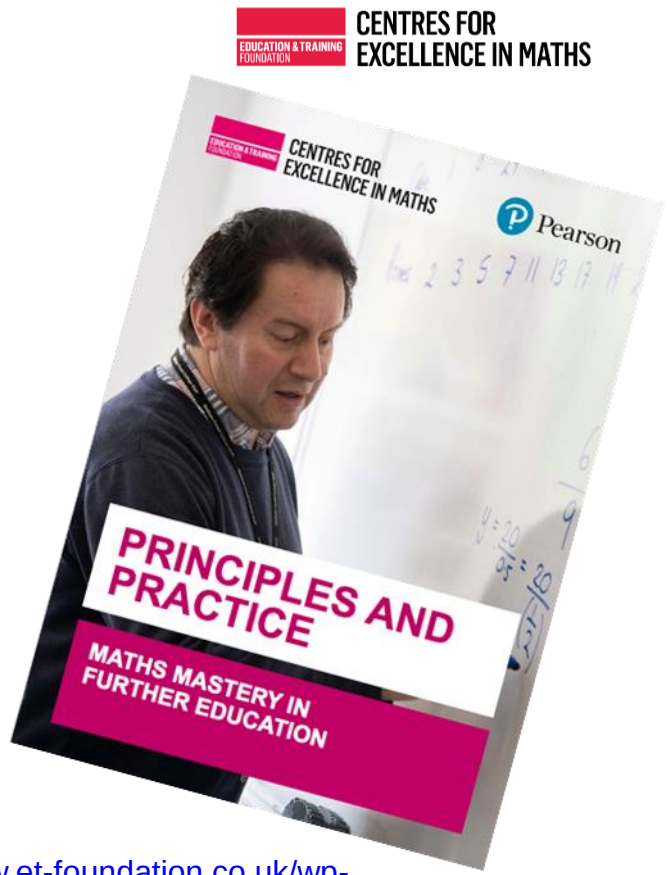
MASTERY TEACHING RESEARCH TRIAL

CENTRES FOR EXCELLENCE IN MATHS

Can improved teaching resulting in improved student attainment be achieved by adopting a mastery approach to teaching GCSE resit classes?

KEY PRINCIPLES OF MASTERY TEACHING

1. Teaching that allows students to develop an **understanding of mathematical structure**.
2. Valuing and building on **students' prior learning.**
3. Prioritising **curriculum coherence & connections**.
4. Developing both **fluency & understanding of key ideas.**
5. Developing a culture in which **everyone believes everyone can succeed**.



https://www.et-foundation.co.uk/wp-content/uploads/2020/03/CfEM_Mastery_Handbook.pdf

Elizabeth (Liz) Hopker, Centre Lead at Newham Centre for Excellence in Maths

Experience of FS Maths, GCSE and Core Maths

Prior to the CfEM programme, worked on OTLA projects and within the AoC PEG networks, as well as completing QTLS.

Work on CfEM programme since the beginning as Advanced Practitioner, Action Research Lead, PD lead, and more recently Centre Lead.

Additionally, a Core Maths Teacher Advocate for the AMSP

Elaine Gates, Centre Lead at East Surrey College for Excellence in Maths

Experience of FS Maths, GCSE and Core Maths as well as English, ESOL and Teacher Training

18 years of experience in the post 16 maths sector

Involved in the CfEM Action Research projects for 3 years.

Formerly an English Specialist

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NEWHAM COLLEGE LONDON

02

BAR MODELLING TO BRIDGE SKILLS GAPS FROM FS LEVEL 1 TO GCSE

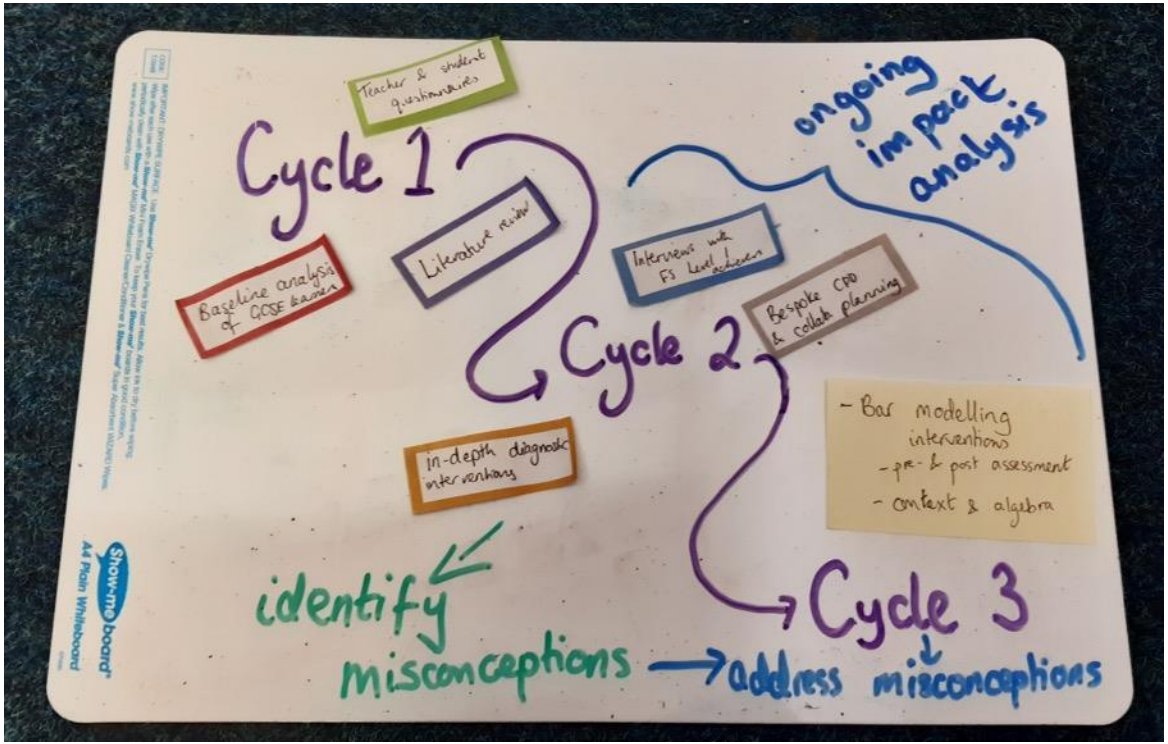
PROJECT 1 - USING MASTERY BASED APPROACHES TO IMPROVE THE PROGRESS OF FS LEVEL 1 ACHIEVERS TOWARDS GCSE GRADE 4: IDENTIFYING SKILLS GAPS AND MAPPING ACROSS SKILLSETS THROUGH BAR MODELLING, VARIATION AND COLLABORATION

- 6 teachers from Newham, Lambeth, CONEL and Westminster Kingsway Colleges
- All colleges deliver both FS and GCSE
- Creating resources and strategies to support progress of learners in a GCSE maths classroom from different qualification backgrounds
- Around 40% of our learners had previously achieved FS Level 1

SBC LAMBETH COLLEGE
The College of Haringey, Enfield and North East London
wkc Westminster Kingsway College
NEWHAM COLLEGE LONDON

PROJECT 1 - USING MASTERY BASED APPROACHES TO IMPROVE THE PROGRESS OF FS LEVEL 1 ACHIEVERS TOWARDS GCSE GRADE 4

What we did

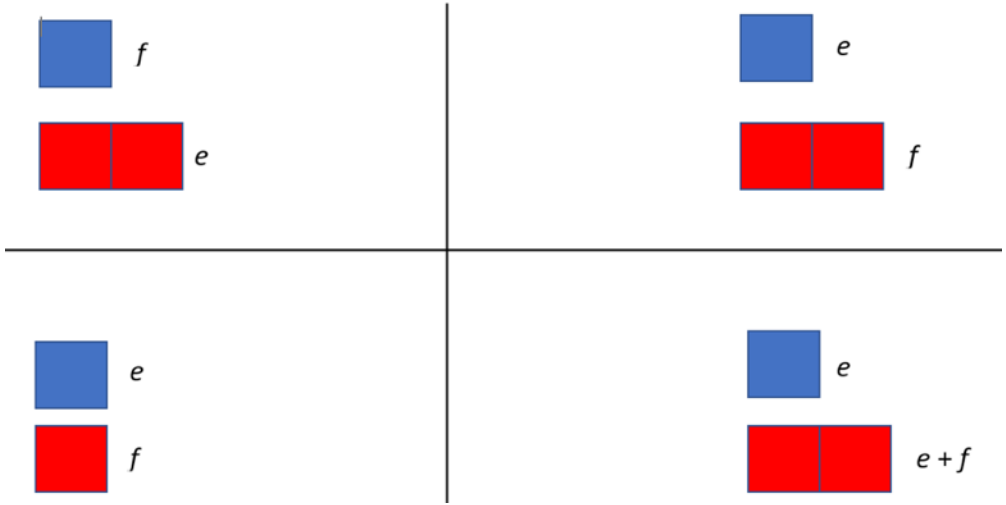


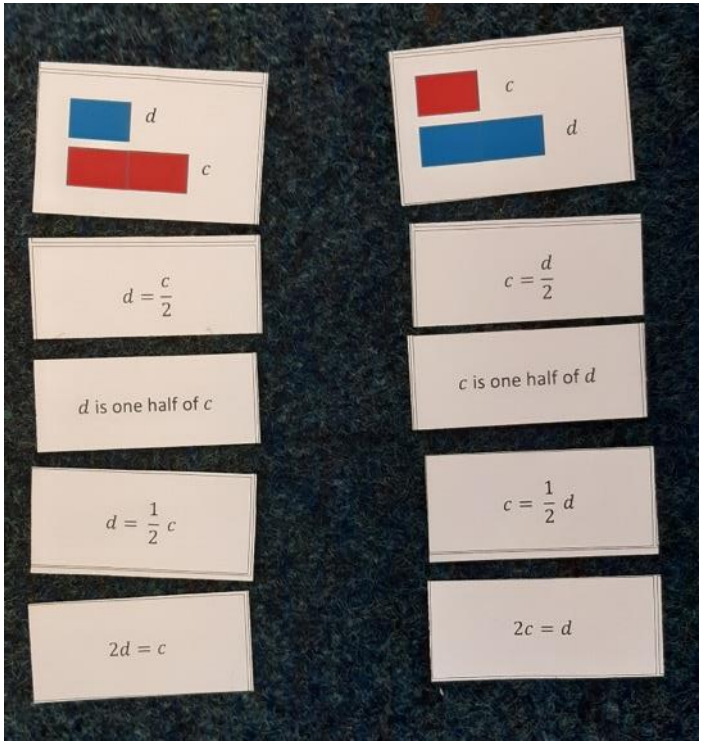
- FS Level 1 achievers stronger but continued struggles identified in:
  - Algebra
  - Ratio & proportion
  - Problem-solving
- Bespoke CPD, collaborative discussions, teacher reflection = essential
- Cycle 3 in more detail…

CYCLE 3 – GETTING TO GRIPS WITH BAR MODELLING – STARTER TASKS

Which bar model is the correct representation of the expression?

e is one half the size of *f*





CYCLE 3 – CONFIDENCE CHECK AND SHARING OF METHODS

Which is (was) easiest to do? If you successfully completed these questions, please prepare to present your successful method to the class

6. Sadia's car has enough petrol to travel 50 miles.
She spends £25 on petrol and now has enough to travel 165 miles.
How much does petrol cost per mile for Sadia's car?

A £4.60 **B** £2.17 **C** 22p **D** 15p

Show your working out:

6. Sadia's car has enough petrol to travel, 50, miles.
She spends £30 on petrol and now has enough to travel m miles.
How much does petrol cost per mile in pounds for Sadia's car, in terms of m?

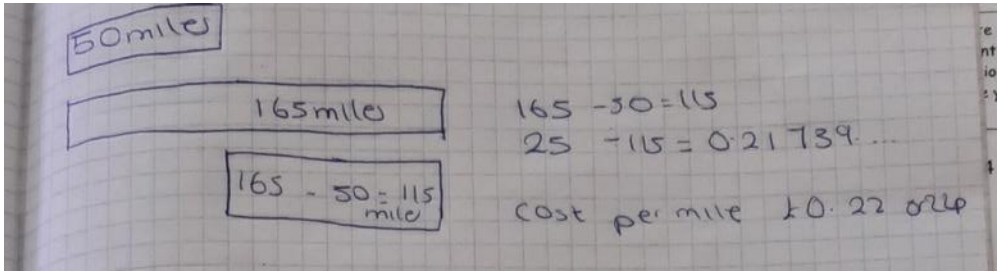
A $\frac{m-50}{30}$ **B** $\frac{50-m}{30}$ **C** $\frac{30}{m-50}$ **D** $\frac{30}{m}$

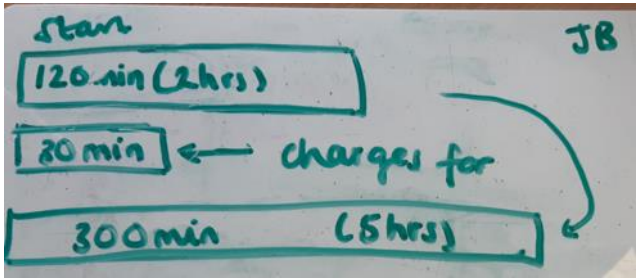
Show your working out:

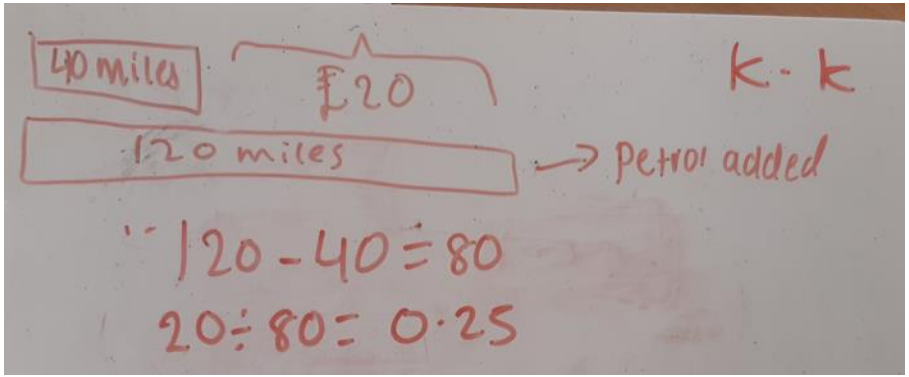
Questions adapted from: **MEI proposed contextualised GCSE assessment question**

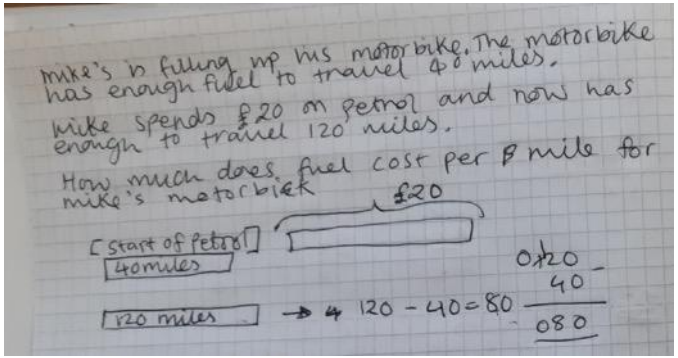
CYCLE 3 IN MORE DETAIL – HAVE A GO!

Sadia's car has enough petrol to travel 50 miles.
She spends £25 on petrol and now has enough to travel 165 miles.
How much does petrol cost per mile for Sadia's car?
Use bar modelling to answer this question



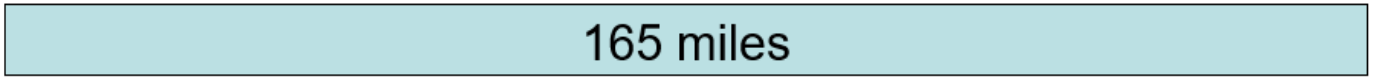




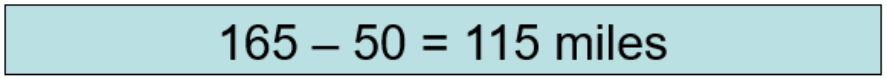


CYCLE 3 – STEP CHANGES, COLLABORATIVELY PLANNED, QUESTIONING TECHNIQUES

Sadia's car has enough petrol to travel 50 miles.
She spends £25 on petrol and now has enough to travel 165 miles.
How much does petrol cost per mile for Sadia's car?
Use bar modelling to answer this question



165 – 50 = 115

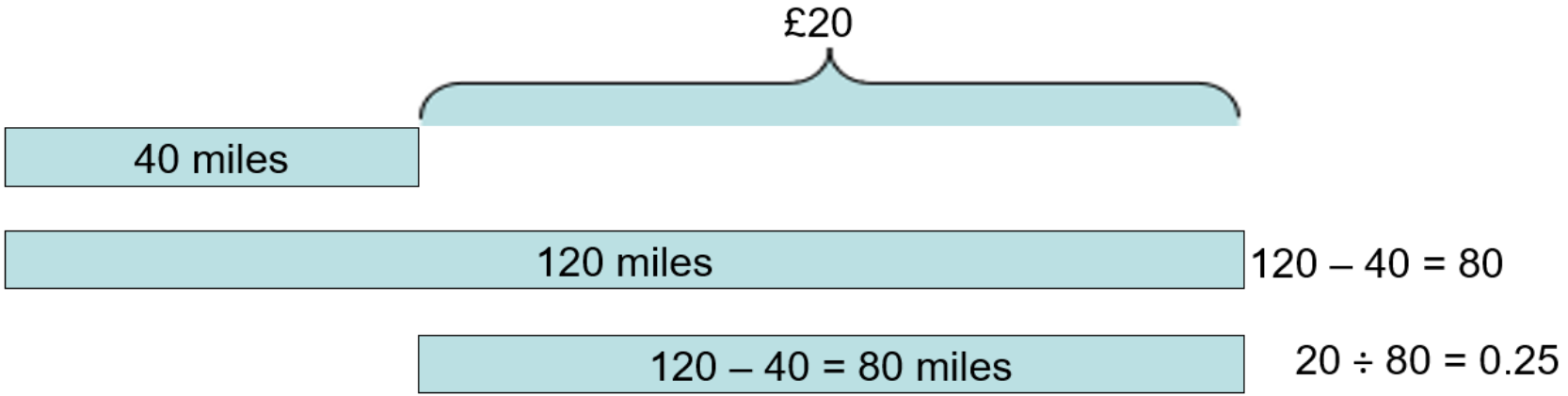


25 ÷ 115 = 0.21739…

Cost per mile is £0.22 or 22p

CYCLE 3 – STEP CHANGES, COLLABORATIVELY PLANNED, QUESTIONING TECHNIQUES

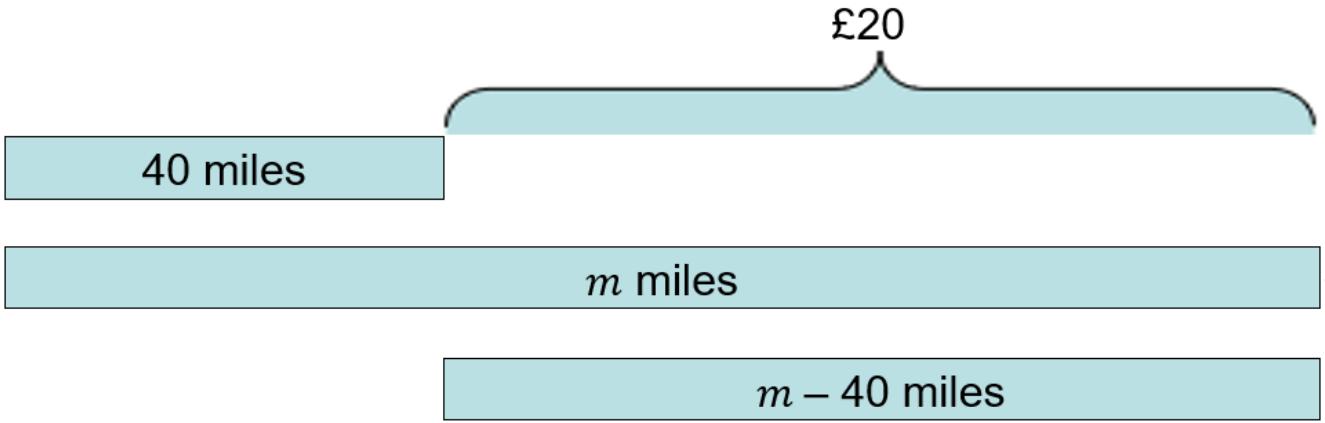
Mike is fuelling up his motorbike. The motorbike has enough fuel to travel 40 miles.
Mike spends £20 on petrol and now has enough to travel 120 miles.
How much does fuel cost per mile for Mike's motorbike?
Use bar modelling to answer this question



Cost per mile is £0.25 or 25p

CYCLE 3 – STEP CHANGES, COLLABORATIVELY PLANNED, QUESTIONING TECHNIQUES

Mike is fuelling up his motorbike. The motorbike has enough fuel to travel 40 miles.
Mike spends £20 on petrol and now has enough to travel *m* miles.
How much does fuel cost per mile for Mike's motorbike?
Use bar modelling to answer this question

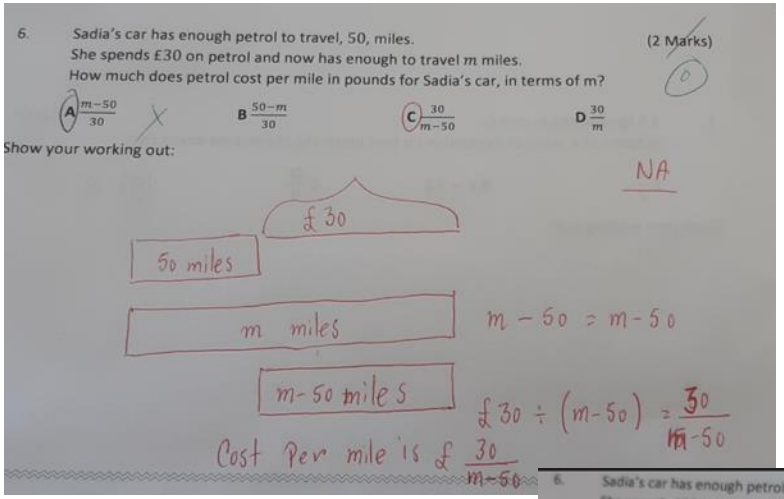


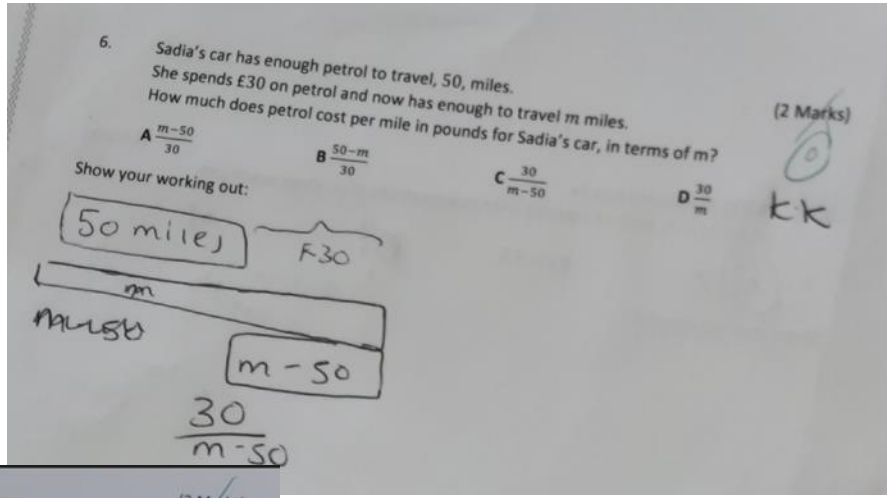
$m - 40 = m - 40$

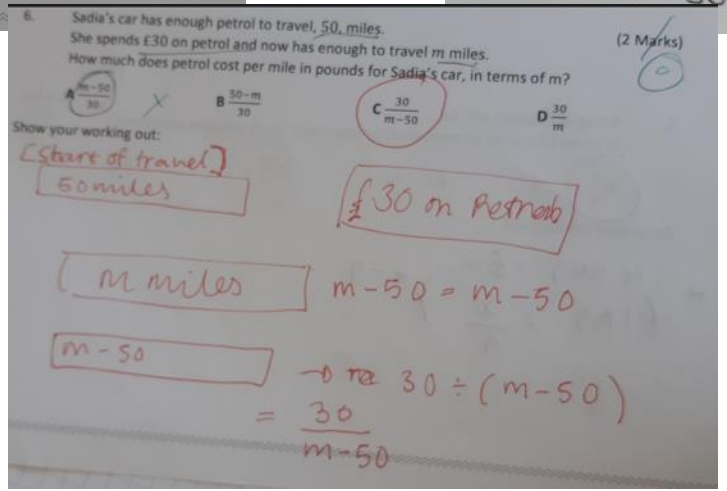
$20 \div (m - 40) = \frac{20}{m-40}$

Cost per mile is £$\frac{20}{m-40}$

CYCLE 3 – TRYING AGAIN AND SHARING THEIR OWN METHODS







WHAT WAS THE IMPACT?

Overall percentage change of scores pre-assessment to post-assessment	Context increase % change	Algebra increase % change
GCSE Grade 3 achievers - 16-19	**25.0**	**38.8**
FS L1 Achievers - 16-19	**33.8**	**91.0**

Average scores overall	Context pre	Context post	Algebra pre	Algebra post	Con Cha %	Alg Cha %
Average Score FS L1 Achievers - 16-19	7.4	9.9	4.5	8.6	**33.8**	**91.0**

- Mixed response for learner views - 4/5 would or might use bar modelling even when confident with another method
- Effective for group work, visualisation skills, ratio questions
- Lower ability learners more willing to engage
- All teachers to carry on!

Key recommendations:

- **Identify skills gaps and address misconceptions**
- **Sharing of learner work**
- **Ensure CPD is provided to boost reflection time, confidence, teacher skills and mindset changes**
- **Use bar modelling consistently, earlier on and with more time**

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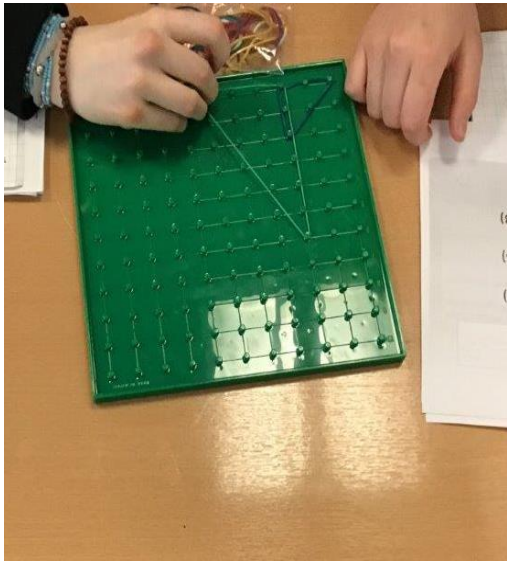
CENTRES FOR EXCELLENCE IN MATHS

03

USING MANIPULATIVES

USING A CPA APPROACH

- 4 teachers from CTK, East Surrey College, Shooters Hill College and South Thames College
- Using physical manipulatives to boost student engagement in post-16 GCSE Maths



GEOBOARDS

ALGEBRA TILES

ALGEBRA TILES

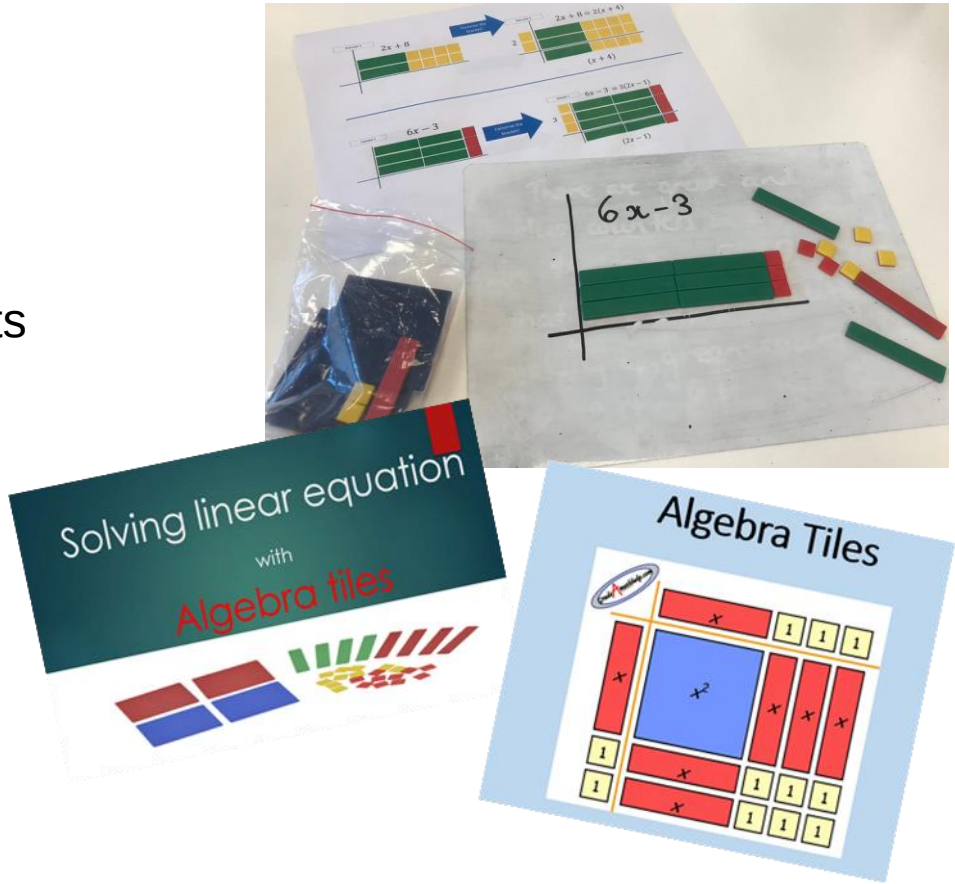
The lessons

Designed 3 mini-teach Activities

1. Linear Equations
2. Expanding / Factorising single brackets
3. Expanding / Factorising quadratics

These were short (30 min) PPT led activities

Each tutor delivered each lesson across the 4 colleges



THE FEEDBACK

Teachers

- *I enjoyed learning to use Algebra Tiles*
- *Really enjoyed trialing the resources & knowing its ok if it went wrong*
- *Historically maths has always been much more practical its only recent thinking that makes using manipulatives an abstract idea*
- *High needs students did very well*

Students

- *They helped me concentrate and helped me stay focused*
- *The colours helped especially to distinguish between positive & negative*
- *They helped me understand because its much more in front of you than just trying to work it out in your head*
- *They helped me concentrate a little*

Going forward

- *Work to bridge between using the tiles and answering exam questions (sketching)*
- *Less dictatorial sequences – learn through exploration*
- *Use from start of year : Use in FS*

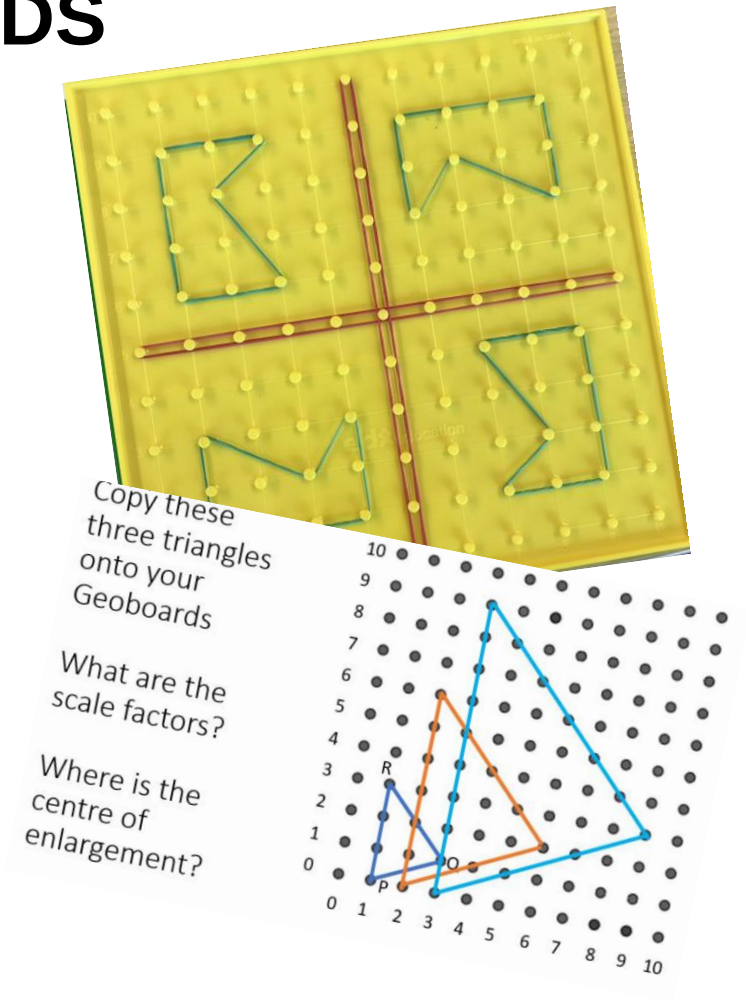
GEOBOARDS

The Lessons

Designed 4 lessons

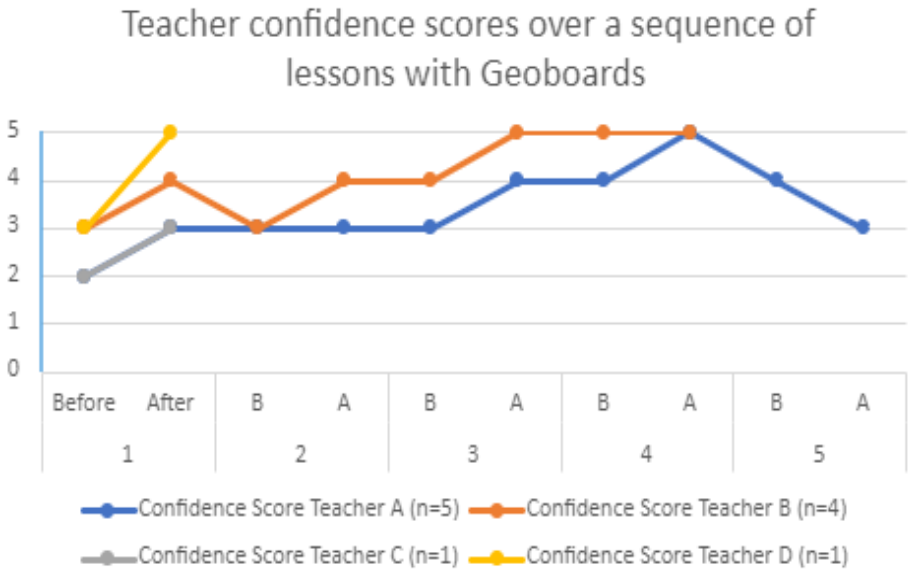
1. Straight line graphs
2. Transformations
3. Pythagoras Theorem
4. Area & Perimeter

Each tutor delivered each lesson across the 4 colleges



THE FEEDBACK

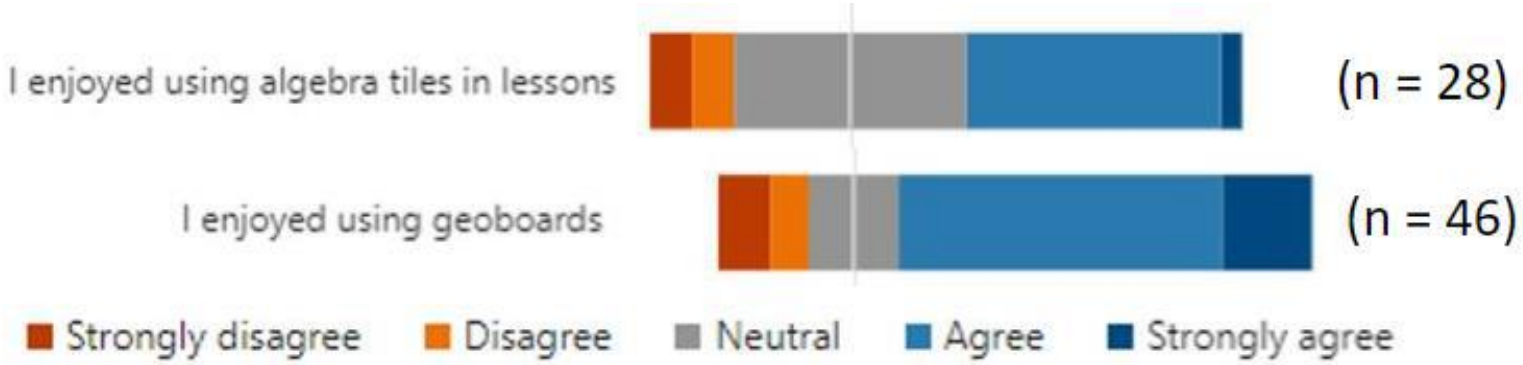
Teachers



Tutors felt better about being able to use the Geoboards as part of a full lesson rather than just a task

As they used the Geoboards typically confidence grew although 1 of the groups had a difficult lesson in 1 topic which resulted in a slight knock to the confidence of Teacher A

THE STUDENTS



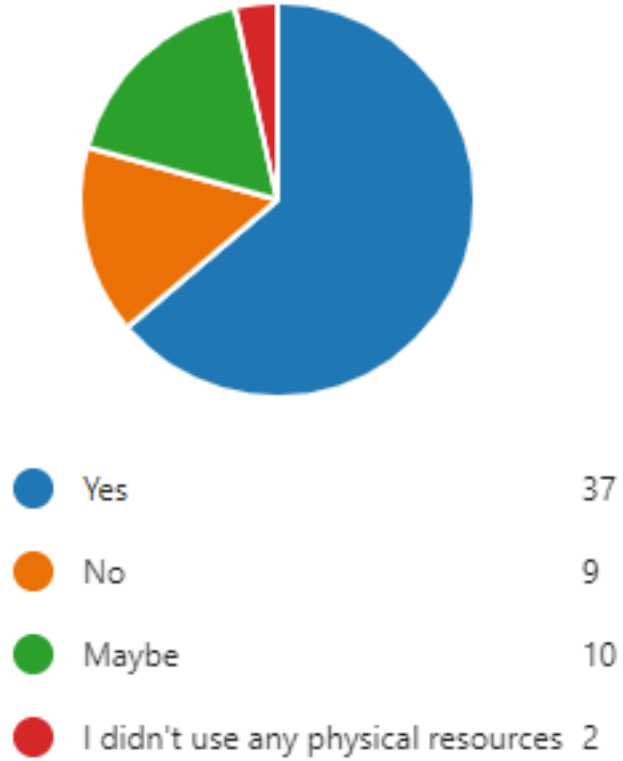
"I found the geoboard very useful and productive. It helped me to understand and make sure I am measuring correctly" correctly"(class discussion, AR Cycle 2)

"fun and they help with understanding, helped Visualise the shapes and the shapes and distance"
(class discussion, AR Cycle 2)

GOING FORWARD

- **Time to plan**
- **Time to think about embedding**
- **Increase “Open” activities that promote student-led learning**
- **Increased staff confidence means increased benefit to students & positive engagement**

Student survey : Would you like to use manipulatives again?



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CENTRES FOR EXCELLENCE IN MATHS

NEWHAM COLLEGE LONDON

04

USING CPA FOR DEEPER UNDERSTANDING BELOW GRADE 3

PROJECT 2 - DEEPENING UNDERSTANDING OF PERCENTAGES WITH STUDENTS BELOW GCSE GRADE 3: USING CONCRETE PICTORIAL ABSTRACT APPROACH AND REAL LIFE EXAMPLES. (AR LEAD – REBECCA ATHERFOLD)

- 5 teachers from Southwark, CWC and Newham Colleges
- Some colleges deliver FS, some only deliver GCSE
- High level of enrolments of below GCSE grade 3 (2020 ~2/3 enrolled with below Grade 3 at Southwark)
- Fulfilling moral obligation to make sure students leave more numerate & more equipped to deal with every day maths
- Trying to impact on progress: 40% ‘go backwards over the following two years’ MiFEC – Interim Report 4, 2020

City of Westminster College

SOUTHWARK COLLEGE

NEWHAM COLLEGE LONDON

PROJECT 2 - DEEPENING UNDERSTANDING OF PERCENTAGES WITH STUDENTS BELOW GCSE GRADE 3: USING CPA APPROACH AND REAL LIFE EXAMPLES. (AR LEAD – REBECCA ATHERFOLD)

What we did

Developed the CPA approach, mini SoW and lessons with manipulatives to support the following crossover objectives:

- To recognise the % symbol and the meaning of 'percent'
- Recall and use equivalences between fractions, decimals and percentages
- Solve problems using equivalences of fractions, decimals and percentages in different contexts
- To express one quantity as a percentage of another.
- To calculate percentages of amounts
- To calculate 5% and 10% of amounts – without using a calculator
- To use 5% and 10% to work out other percentages
- To calculate % increase and decrease
- To work with percentages greater than 100%

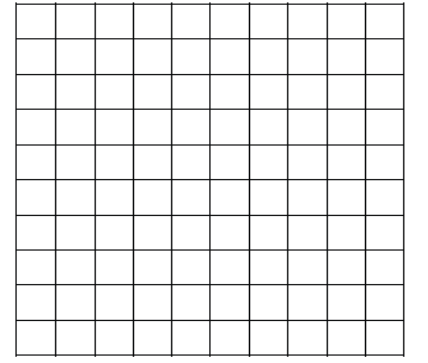
CENTRES FOR EXCELLENCE IN MATHS

Percentages 1

Friday, 08 July 2022

50%

What does this mean?
How would you represent it using a bead string or a hundred grid?



What does each bead or square represent as a fraction or decimal?

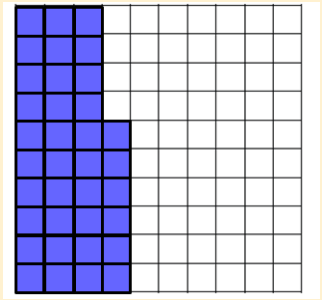
Percentages 1

Friday, 08 July 2022

Same or different?

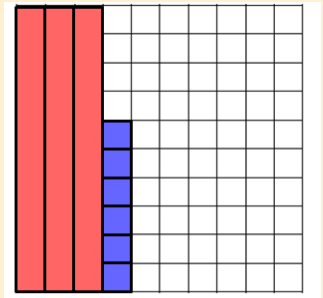
0.36

$\frac{36}{100}$



‘Three tenths and six hundredths’

‘Thirty-six hundredths’



$\frac{9}{25}$

36%

	$\frac{1}{10}$	$\frac{1}{100}$
One	Tenths	Hundredths
0	3	6

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Percentages 2

Friday, 08 July 2022

How to express one quantity as a percentage of another?

Write 25 out of one hundred

How can we show this using manipulatives?

Bar modelling

Fraction ➡ Decimal

$\frac{25}{100} = 0.25$

Decimal ➡ Percentage

$0.25 \times 100 = 25\%$

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Percentages 2

Friday, 08 July 2022

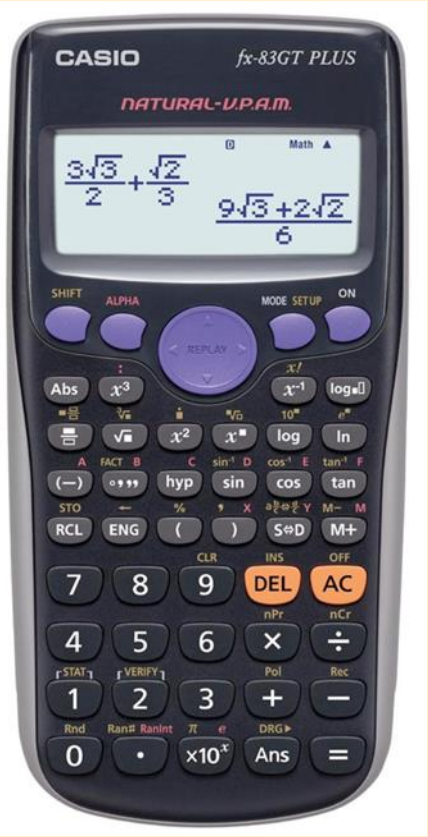
Convert the following fractions to percentages using a calculator:

1) $\frac{1}{4}$

2) $\frac{2}{5}$

3) $\frac{3}{8}$

4) $\frac{7}{20}$



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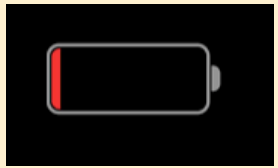
Percentages 3

Friday, 08 July 2022

Have you seen any percentages today?



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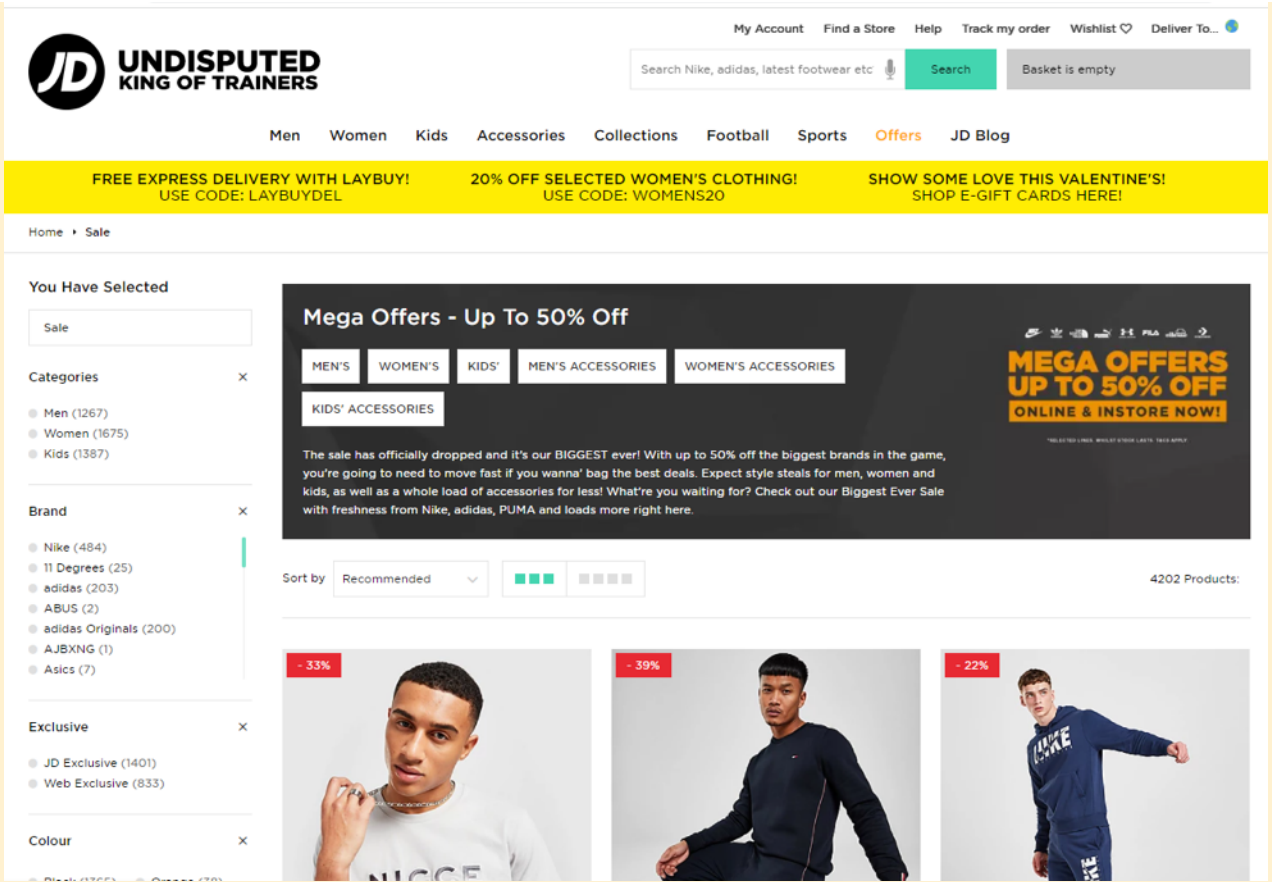
Percentages 3

Friday, 08 July 2022



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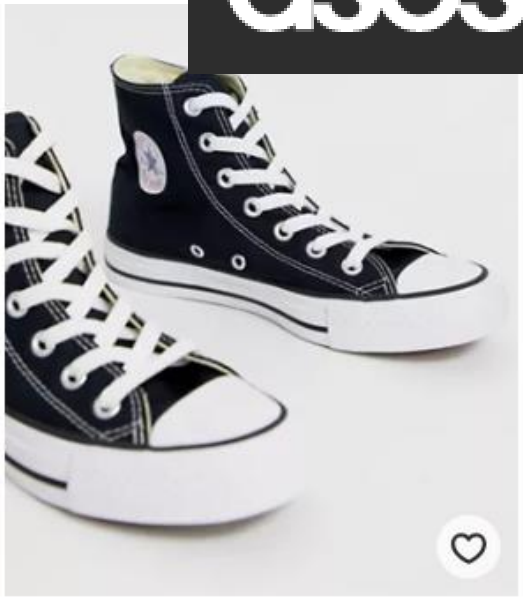

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Percentages 3

3 Greta manages a visitor attraction.
She knows 48 600 people visited the attraction last spring.

Greta says

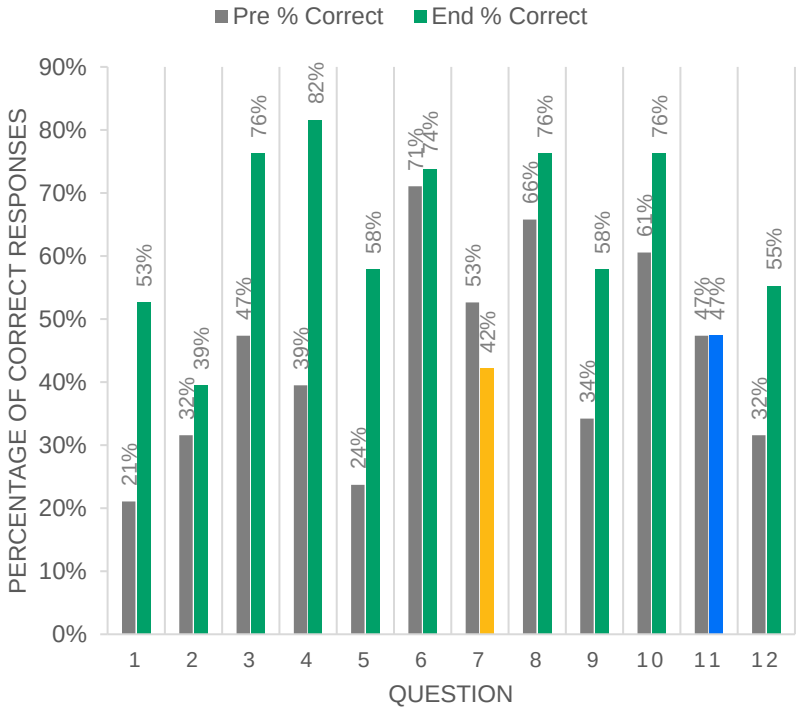
"There has been a 15% increase in the number of visitors this spring compared to spring last year."

(a) Work out how many people visited the attraction in spring this year for Greta.

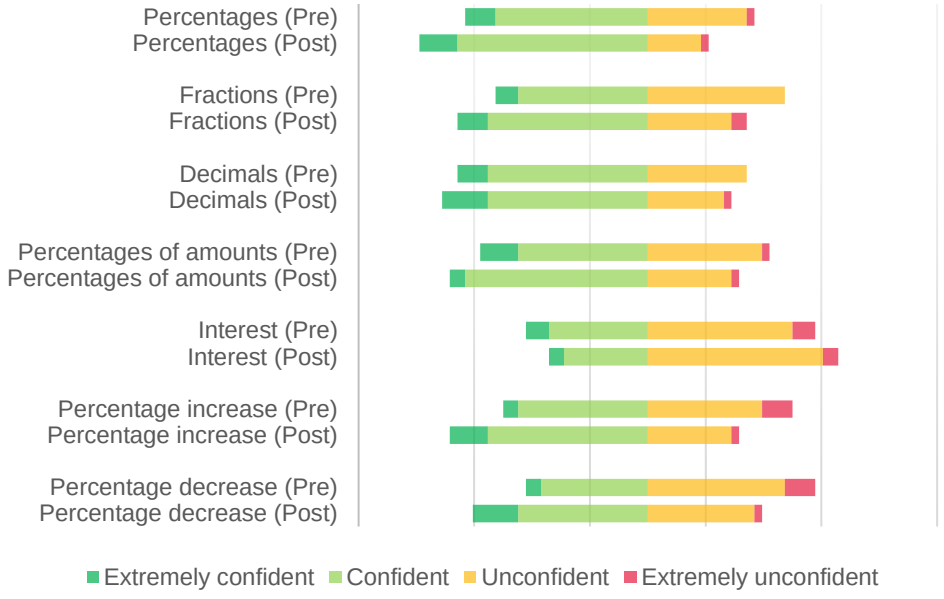
(3)

WHAT WAS THE IMPACT?

CHART TO SHOW PROPORTIONAL COMPARISON OF INTERVENTION EFFECTIVENESS



LIKERT SCALE TO SHOW HOW ATTITUDES TO INTERVENTION TOPICS CHANGED BEFORE AND AFTER INTERVENTION SESSIONS



Student voice

It is nice to have something to do to make things clearer when the teacher is explaining

In the exam I imagined the beads in my head

It was fun

86% of students said that using manipulatives helped their understanding of percentages

Teacher voice

Most of my students never had a chance to use manipulatives and most of them seemed to really enjoy them once I started using them with all my groups.

I saw how manipulatives can be used to support quite complex maths and I saw how different manipulatives can be used to support one concept - giving learners choices

It reminded me of the good practice that I used to do with my classes pre-pandemic

I've become more adventurous in trying new things

All teachers said that they would use manipulatives in the future

CONCLUSIONS AND RECOMMENDATIONS

TEAM AGREEMENT

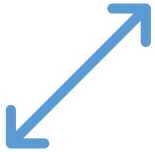
RESOURCES AVAILABLE

SIMPLE

FUN

ADAPTABLE COMPREHENSIVE POWERPOINT

Next steps



Expand out

Expand out – initially to other areas of proportion

Keep

CPD should be continuous

Reduce

Reduce PowerPoint to key slides

EDUCATION & TRAINING FOUNDATION

CENTRES FOR EXCELLENCE IN MATHS

05

SUMMARY … & WHAT'S NEXT

USING MODELS & MANIPULATIVES: KEY POINTS

Using visual models & manipulatives can be effective with GCSE re-sit & Functional Skills learners

But …

– they need to be introduced early in the year & used regularly throughout

– different models & manipulatives may be more appropriate for different levels & learners

– teachers need CPD & preparation time to use them effectively

TEACHING FOR MASTERY IN FE: *MODULAR CPD PROGRAMME*

- Free18-hour face-to-face course (6 x 3hr modules)
- Delivered by CfEM centres to their networks by trained PD leads
- Courses available June 22 & Feb 23
- Addresses the 3 key CfEM questions around:
  - Teaching for mastery
  - Engagement & resilience
  - Responsive teaching
- **Contact your local CfEM centre for more details**

CFEM ONLINE RESOURCE BANK

Teaching & Learning resources

Research evidence

Professional development

Whole College Approach

- Soft launch October 22
- **Full launch March 23**

MAKE SURE YOU'RE PART OF IT!

- **93% of GFE & 6th Form colleges are part of a CFEM network**
  - Is your college one of them?
  - Do you know what's happening locally?
- For more information contact one of our regional maths leads:
  - Richard Kirtlan (North): richard.kirtlan@etfoundation.co.uk
  - Shobhna Fletcher (WM, SW, London/SE): shobhna.fletcher@etfoundation.co.uk
  - Holly Connor (EM, East, London/SE): holly.connor@etfoundation.co.uk
- Or visit: https://www.etfoundation.co.uk/supporting/professional-development/maths-and-english/cfem/

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Thank you

Any Questions?