MEI

Mathematics Education Innovation

Over 50 years at the forefront of Mathematics Education

Aims

- To look at the ASK Maths project to see what lessons could be learned

- To look at how cognitive load theory works in the context of GCSE resit & functional skills

- To look at teaching diagnostically

What is ASK Maths?

What is ASK Maths?

Attitudes

Skills

Knowledge

Opportunity Area resit Project in Stoke

- Low aspirations
- Low progression to L3, HE and professions
- Low pay economy

- High number of students not getting grade 4 or above at 16
- High number of students still not getting grade 4 or above at 19
- High levels of disengagement

Expectations of the project

Improve

- confidence
- achievement

Competition

All Students Stoke FE College	All Students Stoke 6th Form	All Students NSCG
College final	College final	College final

Grand Final @ bet365 Football stadium

12 learners from each college

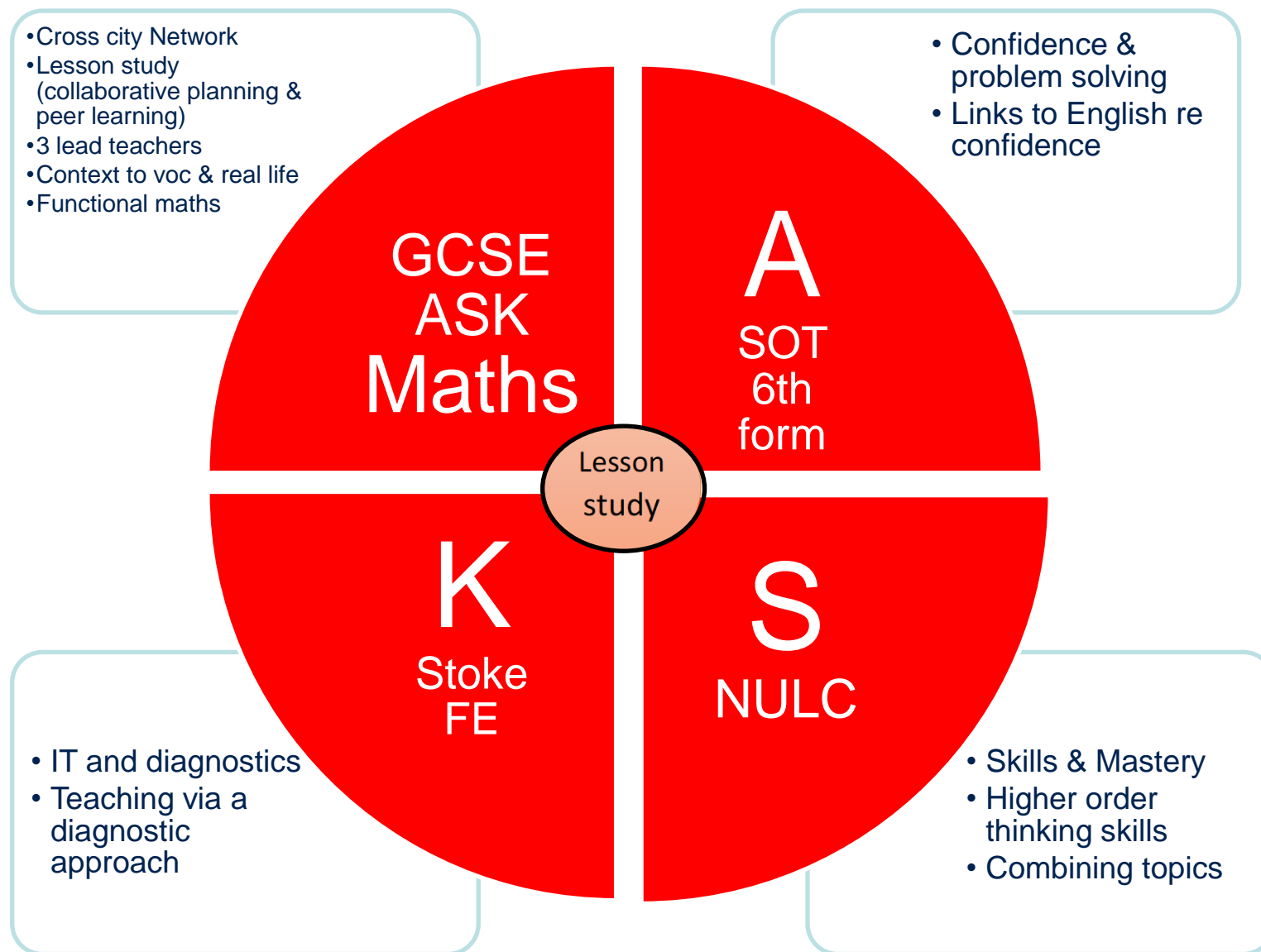**Meet the GCSE re-sit students who have become maths champs!**

North Staffordshire's three biggest colleges have joined forces for the project and hope to target more than 5,000 teenagers over the next two years

stokesentinel.co.uk

https://create.kahoot.it/details/ask-maths-3ds-cross-city-final/15a6ff90-4cce-44bf-a976-abb36726df05
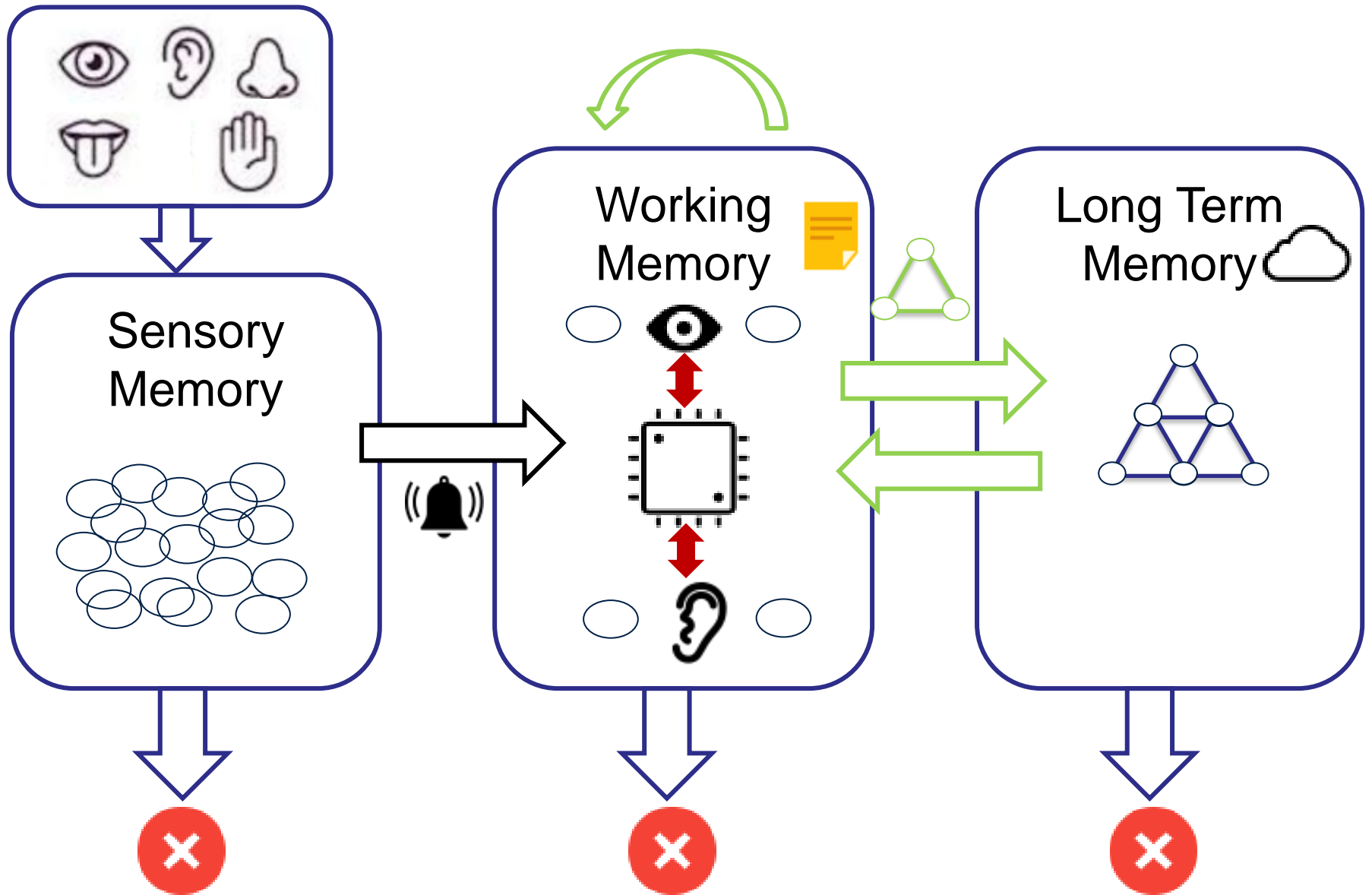
Competition

- Motivating for staff and students
- All included, categories for grade 1, 2 & 3 students
- 3500 students took part
- Being successful at maths for the first time
- Competitiveness engaged many students
- They had fun

MEI Mathematics Education Innovation

- Cross city Network
- Lesson study (collaborative planning & peer learning)
- 3 lead teachers
- Context to voc & real life
- Functional maths

GCSE
ASK
Maths

A
SOT
6th
form

- Confidence & problem solving
- Links to English re confidence

Lesson study

K
Stoke
FE

S
NULC

- IT and diagnostics
- Teaching via a diagnostic approach

- Skills & Mastery
- Higher order thinking skills
- Combining topics

Skills

Cognitive load – how it works in GCSE resit

Sensory Memory

Working Memory

Long Term Memory

Focussed 15

- Emma Bell-Grimsby Institute
- https://www.et-foundation.co.uk/blog/cfem-blog-the-focussed-15-at-grimsby-college/
- Research based
- What a typical grade 4 student can do
- Makes connections
- Allows for fluency and deeper understanding.

Focussed 15

- Types of number
- Using number
- Simple probability
- Ratio
- Measures
- Rounding and approximation
- Perimeter, area and Volume

- Proportion
- Simplify and solve
- Percentages
- Angle properties
- Representing data
- Solve and graph
- Averages and spread
- Transformations

Retrieval spreadsheet

84 questions

Each with 7 slightly different versions

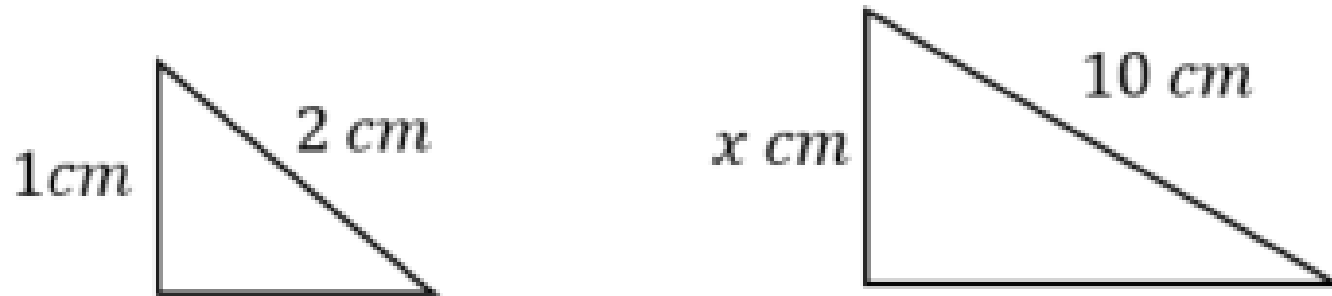The woman is 1.6m tall. Estimate the height of the house

Q2

$$\frac{4}{5} \times \frac{2}{3}$$
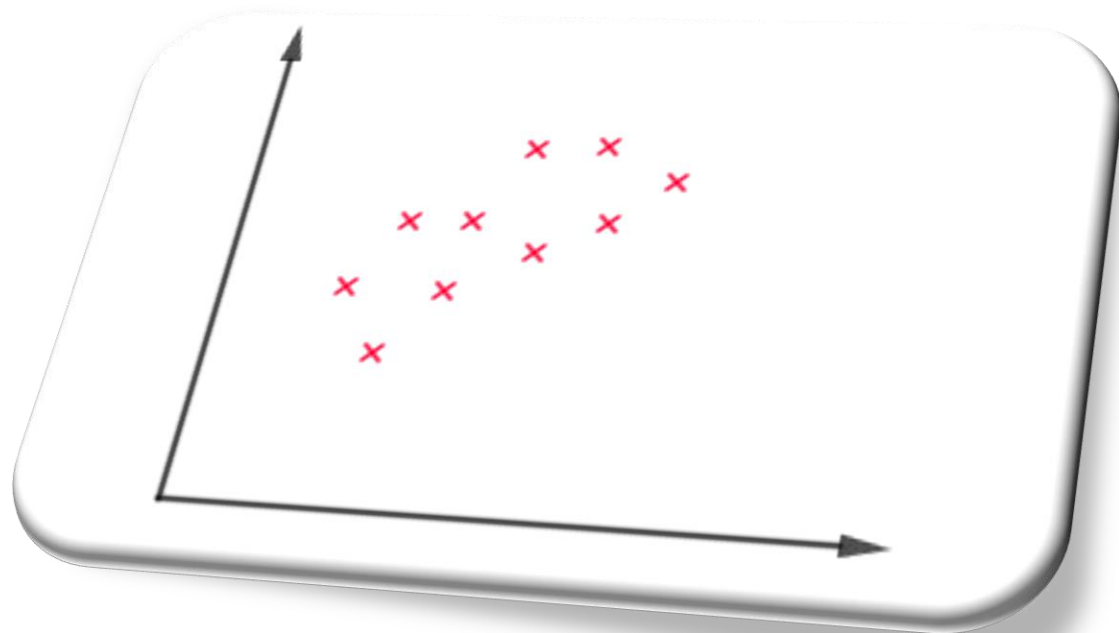
Q3

Work out 87 × 25 without a calculator

The two triangles are similar.
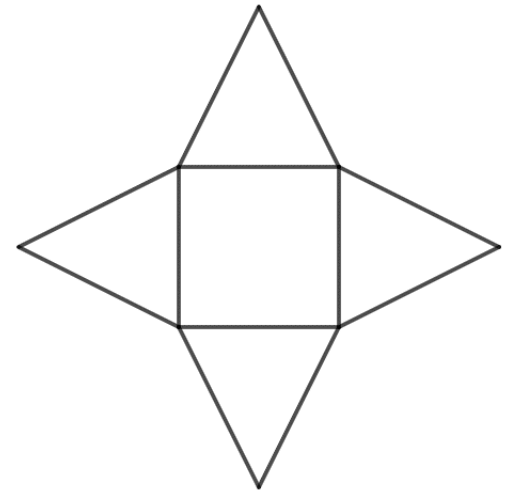
What is the length marked x?

Q5

What type of correlation?

Q6

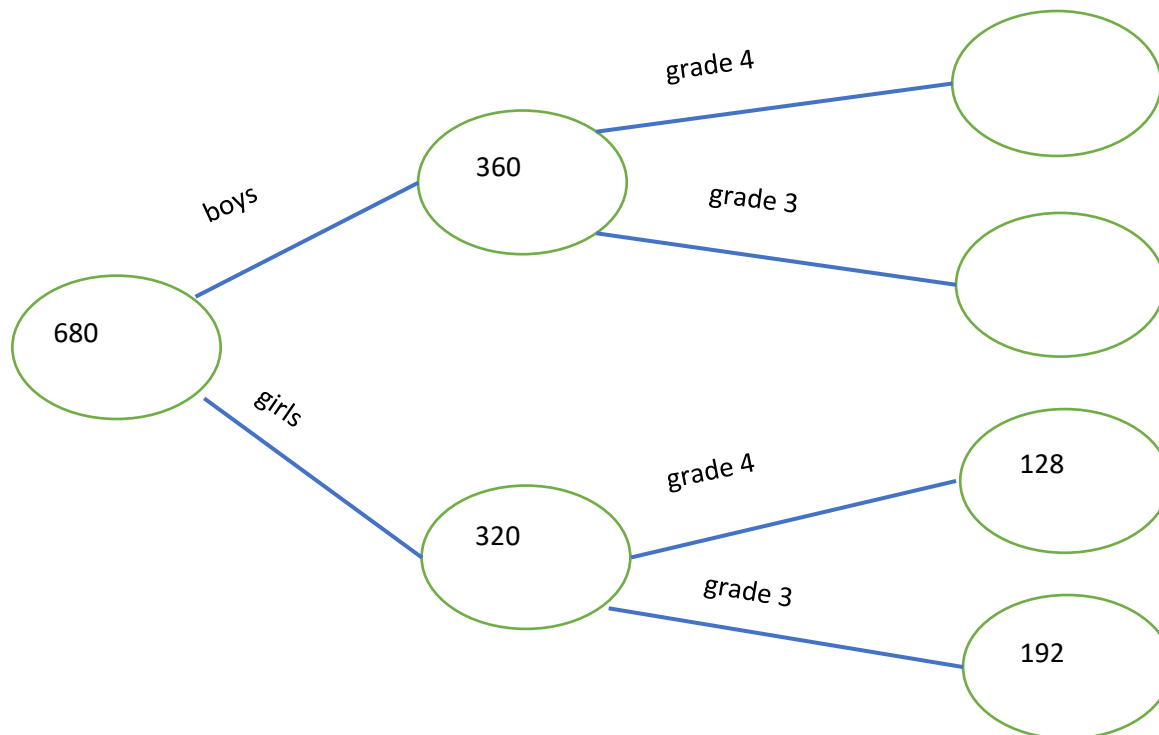What is this shape the net of?
a) Triangular prism
b) Tetrahedron
c) Square based pyramid
d) Cone

In a college students sat a mock GCSE maths exam. 30% of boys got a grade 4.

Complete the frequency tree.

How might you use the retrieval spreadsheet?

- 84 questions
- Each question with 7 slightly different versions
- 28 weeks
- 21 questions a week
- 588 questions

7 questions

Q3 Use index notation.

W1	$2^3 + 3^2 =$
W2	$4^2 + 3^3 =$
W3	$1^3 + 2^4 =$
W4	$3^2 + 1^2 =$
W5	$5^2 + 2^3 =$
W6	$4^2 + 2^5 =$
W7	$3^2 + 4^2 =$

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8
Qa	1	1	1	1	1	1	1	22
Qb	2	2	2	2	2	2	2	23
Qc	3	3	3	3	3	3	3	24
Qd	67	4	4	4	4	4	4	4
Qe	68	5	5	5	5	5	5	5
Qf	69	6	6	6	6	6	6	6
Qg	70	70	7	7	7	7	7	7
Qh	71	71	8	8	8	8	8	8
Qi	72	72	9	9	9	9	9	9
Qj	73	73	73	10	10	10	10	10
Qk	74	74	74	11	11	11	11	11
Ql	75	75	75	12	12	12	12	12
Qm	76	76	76	76	13	13	13	13
Qn	77	77	77	77	14	14	14	14
Qo	78	78	78	78	15	15	15	15
Qp	79	79	79	79	79	16	16	16
Qq	80	80	80	80	80	17	17	17
Qr	81	81	81	81	81	18	18	18
Qs	82	82	82	82	82	82	19	19
Qt	83	83	83	83	83	83	20	20
Qu	84	84	84	84	84	84	21	21

Each question appears for 7 weeks

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8
Qa	1	2	3	4	1	2	3	4
Qb	5	6	7	8	5	6	7	8
Qc	9	10	11	12	9	10	11	12
Qd	13	14	15	16	13	14	15	16
Qe	17	18	19	20	17	18	19	20
Qf	21	22	23	24	21	22	23	24
Qg	25	26	27	28	25	26	27	28
Qh	29	30	31	32	29	30	31	32
Qi	33	34	35	36	33	34	35	36
Qj	37	38	39	40	37	38	39	40
Qk	41	42	43	44	41	42	43	44
Ql	45	46	47	48	45	46	47	48
Qm	49	50	51	52	49	50	51	52
Qn	53	54	55	56	53	54	55	56
Qo	57	58	59	60	57	58	59	60
Qp	61	62	63	64	61	62	63	64
Qq	65	66	67	68	65	66	67	68
Qr	69	70	71	72	69	70	71	72
Qs	73	74	75	76	73	74	75	76
Qt	77	78	79	80	77	78	79	80
Qu	81	82	83	84	81	82	83	84

Each question appears once every 4 weeks

Teaching diagnostically

Teaching diagnostically is crucial when trying to develop and meet the needs of students from a variety of schools and experiences.

What assessment methods could you use without it being a formal test?

Https://www.menti.com/opyv3z73ar

Go to **www.menti.com** and use the code **4970 0562**

Andy Noyes (NANAMIC, 2021)

Recommendation 14: Teaching and learning approaches that address the specific contexts, constraints and affective issues in FE need to be researched, developed and widely disseminated across the sector.

Recommendation 15: Mathematics teachers in FE need to be supported to develop a rich pedagogical toolkit that enables them to adapt teaching and learning to meet diverse students' needs.

Recommendation 17: Research on approaches to the 'embedding' of mathematics into vocational learning and the impact of different practices needs to be commissioned.

- Always, sometimes, never true
- Investigate and present
- Brainstorm what you know about
- Be the teacher, mark this 'mock students work', feedback
- Tell me what you can and can't do
- Asking questions
- Rate yourself on….
- Draw a mood board of mathematics
- Relay

Billy has answered the following maths questions.

Check Billy's work and comment on any mistakes.

Billy's answers

Expand $5(b + 3)$

$5b + 3$

Fully factorise $2x^2 + 6x$

$2(x^2 + 3x)$

$x = 2$ what is $3x^2$

36

Questioning

Clever questioning and sequencing of resources can help diagnose what supports students require

Pitfalls of questioning

- Asking questions with no apparent purpose
- Asking too many closed questions
- Asking several questions all at once
- Poor sequencing of questions
- Asking 'Guess what is in my head' questions
- Focusing on just a small number of learners
- Ignoring incorrect answers
- Not taking answers seriously

Diagnostic questioning

- Questions are planned, well ramped in difficulty
- Open questions predominate
- Probing follow-up questions are prepared
- There is a sufficient 'wait time' between asking and answering a question
- Learners are encouraged to collaborate before answering
- Learners are encouraged to ask their own questions

Multiple choice diagnostic questions

Answer this as if you are a GCSE resit student

Work out

$$\frac{2}{3} + \frac{1}{4}$$

A $\dfrac{3}{7}$ B $\dfrac{11}{12}$ C $\dfrac{2}{12}$ D $\dfrac{3}{12}$

Work out

$$\frac{2}{3} + \frac{1}{4}$$

A $\dfrac{3}{7}$ B $\dfrac{11}{12}$ C $\dfrac{2}{12}$ D $\dfrac{3}{12}$

A   because 2+1 is 3, 3+4 is 7

B   I just guessed

C   3x4=12 2+1=3 So=3/12

D   4x3=12 and 2x1=2 so the answer is 2/12

Work out

$$\frac{2}{3} + \frac{1}{4}$$

A $\dfrac{3}{7}$ B $\dfrac{11}{12}$ C $\dfrac{2}{12}$ D $\dfrac{3}{12}$

Which is the most frequent answer?

Work out

$$\frac{2}{3} + \frac{1}{4}$$

A $\dfrac{3}{7}$ B $\dfrac{11}{12}$ C $\dfrac{2}{12}$ D $\dfrac{3}{12}$

Which is the most frequent answer?

B then A then C then D

Is this a good diagnostic question?

Lesson

- Trial lesson developed for probability
- Pre topic evaluation used for teachers to find out what they know already
- Improved levels of discussion
- Improved questioning from teachers
- Improved engagement from students

Desmos lesson link

https://student.desmos.com/join/jgmh6b

Go to student.desmos.com
and type in:

JGM H6B

Summary

- Teach more diagnostically
- Combine topics
- Make more use of exam questions
- Use retrieval practice