



Inspiring Teaching: learning lessons from Maths and Science

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I want to learn!

I can learn!

Fostering curiosity

The most exciting phrase to hear in science,
the one that heralds new discoveries,
is not Eureka!, but rather,
“hmmm... that’s funny...”

Isaac Asimov





































































































Mind Reader?

Choose any two digit number, add together both digits and then subtract the total from your original number...

<http://www.flashlightcreative.net/swf/mindreader/>

Now look up
your answer on
the chart and
find the relevant
symbol.

Now concentrate
on the symbol...

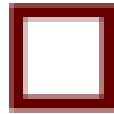
99		79		59		39		19	
98		78		58		38		18	
97		77		57		37		17	
96		76		56		36		16	
95		75		55		35		15	
94		74		54		34		14	
93		73		53		33		13	
92		72		52		32		12	
91		71		51		31		11	
90		70		50		30		10	
89		69		49		29		9	
88		68		48		28		8	
87		67		47		27		7	
86		66		46		26		6	
85		65		45		25		5	
84		64		44		24		4	
83		63		43		23		3	
82		62		42		22		2	
81		61		41		21		1	
80		60		40		20		0	

Mind Reader?



99	☃	79	☃	59	♈	39	♎	19	♈
98	☯	78	♋	58	☾	38	♏	18	□
97	♈	77	♋	57	♎	37	♏	17	♎
96	♈	76	☀	56	♎	36	□	16	☼
95	🔔	75	🔔	55	☼	35	☾	15	♏
94	♋	74	☾	54	□	34	□	14	♏
93	♏	73	♎	53	♏	33	♋	13	☯
92	♋	72	□	52	♈	32	☼	12	☃
91	♋	71	♏	51	♏	31	😊	11	☯
90	♏	70	☀	50	📖	30	♏	10	♈
89	☼	69	♎	49	☯	29	☯	9	□
88	♈	68	☀	48	☃	28	☼	8	♏
87	□	67	☯	47	♏	27	□	7	♏
86	♏	66	☾	46	✚	26	♏	6	☾
85	📖	65	♏	45	□	25	♋	5	☯
84	♏	64	☾	44	🔔	24	♋	4	😊
83	☼	63	□	43	♈	23	🌊	3	📖
82	♋	62	♏	42	♏	22	♏	2	😊
81	□	61	🔔	41	♏	21	☾	1	♈
80	♎	60	♏	40	□	20	♋	0	😊

Mind Reader?



Pair products

Choose four consecutive whole numbers.

Multiply the first and last numbers together.

Multiply the middle pair together.

What do you notice?



Who, what, when, where, why?

Take it in turns to ask one of these w-questions about the object below.



What happens if you stand on your head?

Decide in pairs or threes who you agree with, or suggest an alternative...

“If you stand on your head, your feet will lose blood”

“Your brain will get more blood than your feet”

“Your heart will pump much more strongly”

“There will be no difference”

Low threshold, high ceiling tasks

Teacher's role:

- To choose tasks that allow students to explore new areas of mathematics / science
- To give students the time and space to explore
- To bring students together to share ideas and understanding, and draw together key insights

Valuing Thinking

What learning behaviours do we value and how can we encourage them in our classrooms?

Higher Order Thinking

- Working systematically
- Looking for connections

- Conjecturing
- Explaining





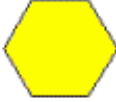











- Generalising
- Justifying








What's it worth?

Each symbol has a numerical value.

The total for the symbols is written at the end of each row and column.

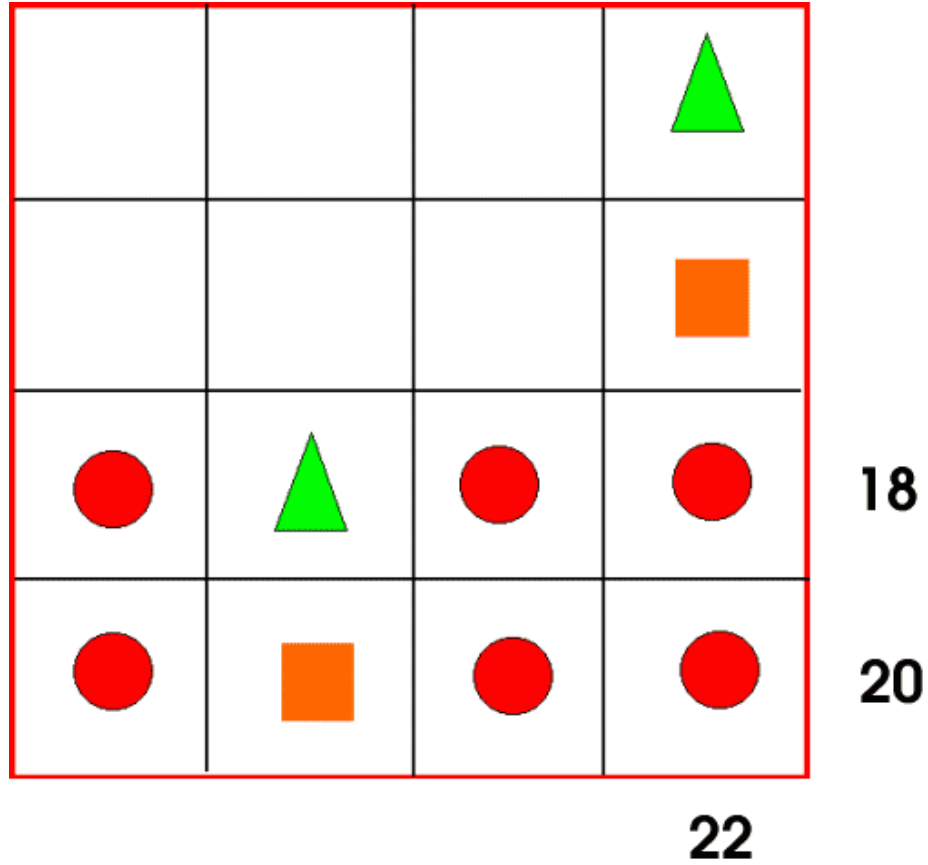
Can you find the missing total that should go where the question mark has been put?

				28
				30
				18
				20
?	30	23	22	

28

30



				28
				30
				18
				20
?	30	23	22	

What will make the roller coaster work?



Higher Order Thinking

- Working systematically
- Looking for connections

- Conjecturing
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- Generalising
- Justifying

What happens if it goes missing?

What would happen if parts of an eagle were missing?

- Tail
- Beak
- Legs
- Eyes
- Feathers

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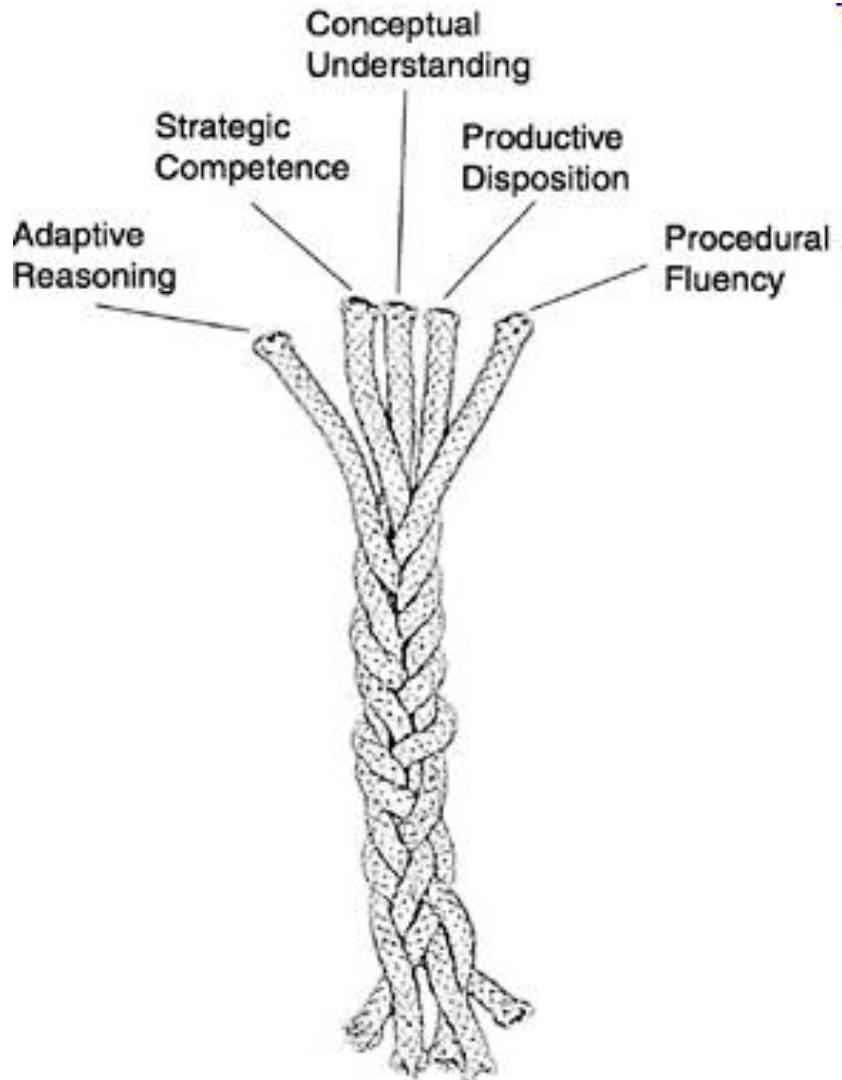
Some underlying principles

Teacher's role: move from presentation to exploration of students' ideas, involving them in the exploration.

Student's role: more active, realising that learning depends on readiness to express and discuss ideas, not on spotting right answers.

Teachers spend more effort framing questions to explore issues critical to development of students' understanding.

(Black & Wiliam, Inside the Black Box)



Five strands of mathematical proficiency

NRC (2001)

Adding it up: Helping children learn mathematics

Conceptual understanding -

comprehension of mathematical and scientific concepts, operations, processes, and relations

Procedural fluency -

skill in carrying out procedures flexibly, accurately, efficiently, and appropriately

Strategic competence -

ability to formulate, represent, and solve mathematical problems, and to plan and implement inquiry into scientific questions.

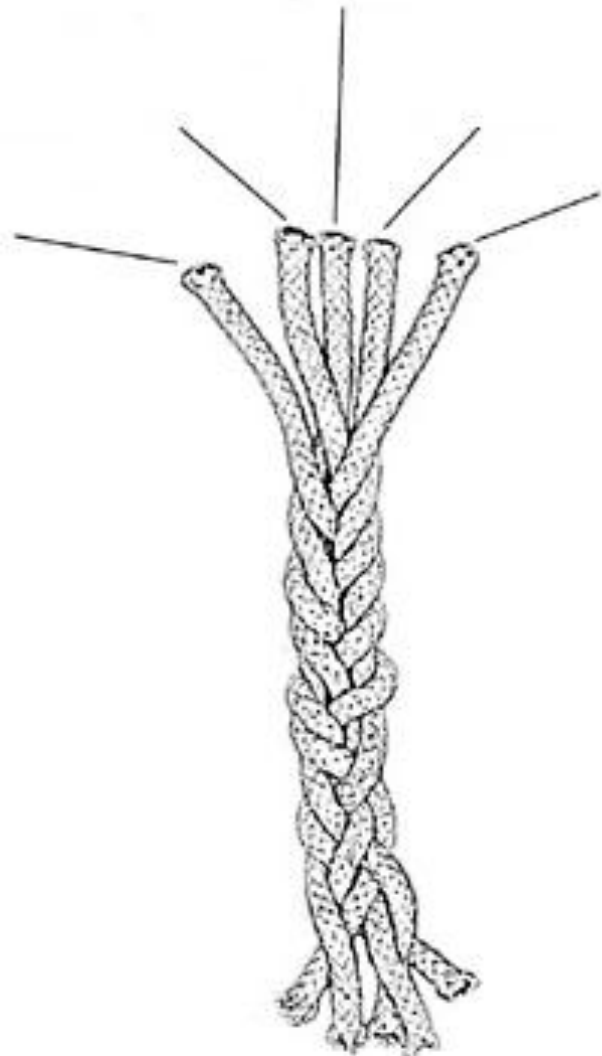
Adaptive reasoning -

capacity for logical thought, reflection, explanation, and justification

Productive disposition -

habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

Which are the five most important strands in your subject?



I don't expect, and I don't want, all children to find mathematics an engrossing study, or one that they want to devote themselves to either in school or in their lives. Only a few will find mathematics seductive enough to sustain a long term engagement. But I would hope that all children could experience at a few moments in their careers ... the power and excitement of mathematics ... so that at the end of their formal education they at least know what it is like and whether it is an activity that has a place in their future.

David Wheeler