

In Queensland, we do many things well.

But when it comes to administering the teaching of mathematics,

we have dropped the ball.

drop in maths standards



teachers sunk in paperwork

Our standards in maths have significantly dropped.
Teachers are sunk in paperwork.
Students lack basic skills and confidence
For example, I have been teaching maths to first
year engineering

students and science students at The University of Queensland.

Very many of these students are not confident with adding fractions

and many do not know their times tables! Almost all students baulk at the idea of writing a proof.

lack of skills and confidence

proofs? fractions? times-tables?



Currently Discouraged:

- memorization
- repetition (practice)
- standard routines
- textbooks
- competition
- final exams
- marking with numbers
- students
- teachers

Introduced:

- writing essays
- assignments
- student directed learning
- statistics
- electronic devices
- criteria-based marking*
- vagueness
- inconsistency

Traditional Marking:

e.g. 7/10

Compare the simplicity and accuracy of traditional marking, with the mind-boggling complexity of introduced criteria sheets.

This is so un-necessary.

Maths already has its own means of evaluation.

These criteria are foreign elements to maths, and much paperwork for teachers.

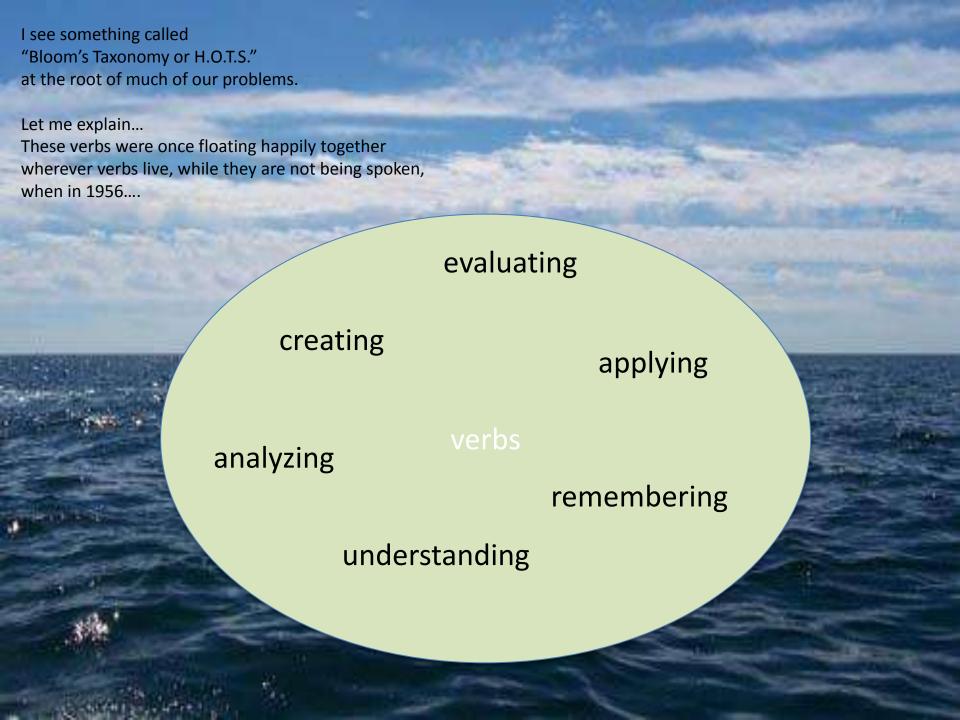
Criteria Sheets:

1	A Million	B	C .	D	E	
ľ	The student work has the following characteristics:					
	Accurate identification of relevant and key mathematical features, conditions, strategies and procedures in simple non-couline through to complex routine separations.	Accurate identification of relocant and key mathematical features, conditions, strategies and procedures in simple one routine situations	Suitable identification of methematical features, conditions, strategies and procedures in simple rooting situations.	Suitable electrification of mathematical features, conditions, strategies and procedures in simple reheased situations.	Attempted identification of methematical features, conditions, strategies and procedures in simple rehearsed situations.	
	Accounts relection and application of rules, forewhat strategies and ICTs in simple non-routine through to complex routine structions.	Accurate selection and use of rules, formulas, strategies and ICTs in simple non-routine strations.	Relevant selection and use of rules, formulas, strategies and ICTs in simple mutine altuations.	Selection and use of given rules, foctoutss, strategies and ICTs in simple robotized situations.	Use of given rules, strategies and iCTs at simple rehearted situations.	
	Application of clear and logical thinking in simple non- reactive through to complex routine situations.	Application of clear and logical thinking in simple non-routine shustions	Application of skills in simple routine situations.	Use of given stiffs in simple rehearsed situations.	Assempted use of given questions in simple rehears situations.	
	Organisation, presentation and analysis of information in a wide vallety of representations in simple non-routine through to cample a routine situations.	Organization, preventation and analysis of information in a variety of representations in simple epis-routing situations.	Organisation, presentation and analysis of information in a variety of representations in simple routine situations.	Organisation and presentation of information in a variety of representations in simple rehearsed situations.	Organisation and presentation of reformation in simple rehearsed situations.	
	A	8	c	D	E	
	The student work has the following characteristics:		1		Charles Continued to	
	Accurate and concise use of mathematical language, representations and ICTs in simple non-routine through to complex mutine situations to communicate thinking.	Accurate use of mathemotical language, representations and 8.Th in striple non-routice structions to communicate thinking.	Suitable use of mathematical language, representations and ACTs in simple proting situations to communicate thinking.	Suitable use of mathematical tangwige, representations and ICTs in simple referenced abundance to communicate prinking.	Antempted use of mathematical learningly of conventions is simple reheared alreations to communicate thinking.	
	Application of simple to complex strategies and procedures to model and solve problems in simple non-routine through to complex routine situations.	Application of simple pracedures and strategies to model and solve problems in simple non-routine situations.	Application of procedures and strategies for proclem solving to simple routine situations.	Use of given procedures and strategies for problem solving in simple rehearted situations.	Attempted use of given procedures and strategies to problem solving in swiple rehearied stratium.	
	Use of strategies to analyse, interpret, synthesise and justify the reasonableness of solutions, in simple non-novine through to complex reutine situations.	Use of strategies to analyse, interpret, syntherion and parity the reasonableness of solutions in simple non-routine situations.	The of strategies to enables, interpret, synthesise and check for reasonableness of solutions in simple routine situations.	Use of given strategies to interpret and check for reasonableness of solutions in simple rebearsed situations.	Actionshed use of given strategies to interpret and check for muschableness of naturions in simple rehearsed situations.	
	Use of mathematical interpretations and conclusions to generalize reasoning and validates appropriatorists of solutions and make informed decisions in simple non- rousine through to compass relatine situations.	The of mathematical interpretables and conclusions to generalize reasoning and validate and make informed decisions in simple non-routine situations.	Use of mishametical oberpretations and conclusions to generalise reasoning and make informed decisions to simple soutine situations.	Use of mathematical interpretations and conclusions to generalise reasoning land make informed decisions in simple reheared plausions.	Attompted use of mathematical interpretation and conclusions to generally reasoning and make informe decisions in Emplo rehearsor attuations.	

	A B C D E					
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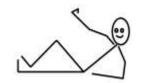
WHY???



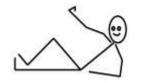
'education' theory



verb		
creating	'higher	order'
evaluating		in 1956, a committee chaired by a psychologist
analyzing		from Chicago called Bloom decided that these verbs have a ranking: from 'lower order to 'higher order'.
applying		This is called Bloom's Taxonomy. and has influenced much of our current system.
understanding		
remembering	'lower order'	



verb	simple	great
creating		
evaluating		
analyzing		But is Bloom's taxonomy true? I say they got the arrow the wrong way.
applying		Tell me if you agree, as I present my re - 'education' theory.
understanding	4	
remembering		



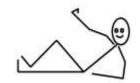
Each of these verbs can be simple or complex:

verb	simple great
creating	
evaluating	
analyzing	
applying	
understanding	
remembering	C-A-T entire musical score

Remembering, can be as simple as ... remembering how to spell the word CAT,

or as great as ...

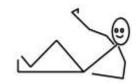
remembering the entire score of a Rachmaninoff concerto or reciting Virgil's *Aenied* in Latin!



verb	simple great
creating	
evaluating	
analyzing	
applying	
understanding	fire burns special relativity
remembering	C-A-T entire musical score

Understanding can be as simple as ... understanding that fire burns,

or as great as ... understanding the theory of special relativity.

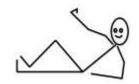


verb	simple great
creating	
evaluating	
analyzing	
applying	from $3 + 4 = 7$ to applying macro-economics $3 \text{ dogs} + 4 \text{ dogs} = 7 \text{ dogs}$ to manage an economy
understanding	fire burns special relativity
remembering	C-A-T entire musical score

Applying can be as simple as ...
applying the fact that 3+4=7 to conclude that
3 dogs and 4 dogs make 7 dogs,

or as great as...

applying macro-economic theory to manage a national economy



verb	simple great
creating	
evaluating	
analyzing	1, 2, 3,? wartime cryptography
applying	from 3 + 4 = 7 to applying macro-economics 3 dogs + 4 dogs = 7 dogs to manage an economy
understanding	fire burns special relativity
remembering	C-A-T entire musical score

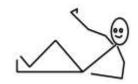
Analyzing can be as simple as ...

analyzing what comes next in the sequence:

"1, 2, 3, ___?"

or as great as ...

deciphering wartime cryptography.



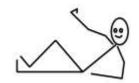
verb	simple great
creating	
evaluating	Coke vs Pepsi? medical systems
analyzing	1, 2, 3,? wartime cryptography
applying	from 3 + 4 = 7 to applying macro-economics 3 dogs + 4 dogs = 7 dogs to manage an economy
understanding	fire burns special relativity
remembering	C-A-T entire musical score

Evaluating can be as simple as ...

or as great as ...

choosing between the tastes of Coke and Pepsi,

an in-depth comparison of medical systems.



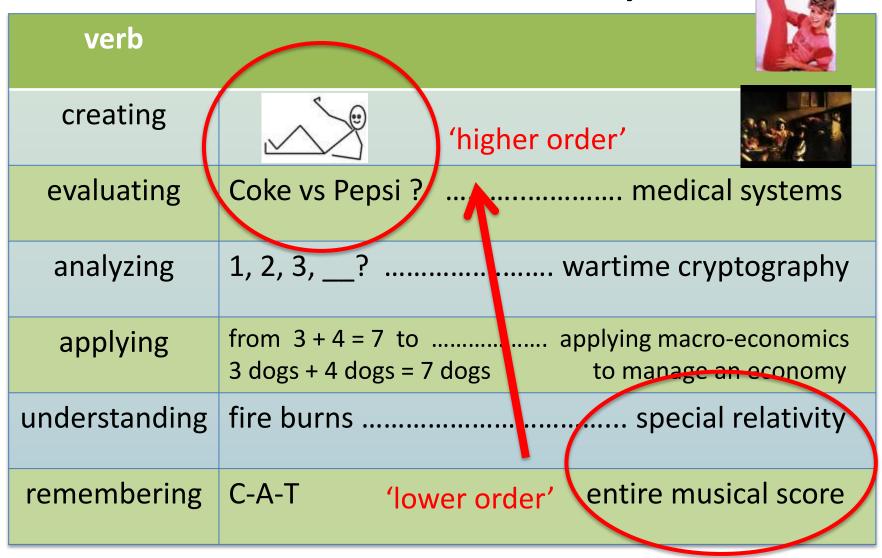
verb	simple great
creating	
evaluating	Coke vs Pepsi? medical systems
analyzing	1, 2, 3,? wartime cryptography
applying	from 3 + 4 = 7 to applying macro-economics 3 dogs + 4 dogs = 7 dogs to manage an economy
understanding	fire burns special relativity
remembering	C-A-T entire musical score

Finally, *creating* can be as simple as ... creating a stick figure

or as great as ...

Caravaggio's Chiaroscuro

'education' theory



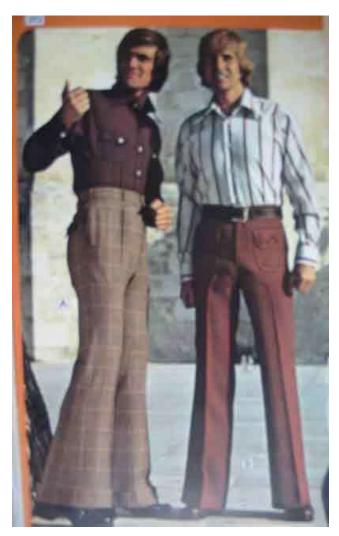
Followers of Bloom's Taxonomy will feel inclined to say that

creating the stick figure and choosing between Coke and Pepsi are greater accomplishments than memorizing Virgil's *Aenied* or understanding special relativity.

No wonder it's bad for maths. Anyway it just doesn't fit to our real experience. Bloom's Taxonomy is not true. They got the arrow the wrong way around.

fashions of 'education' theory

1970's: the new math



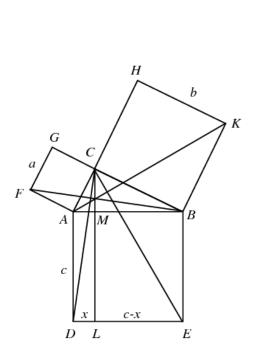


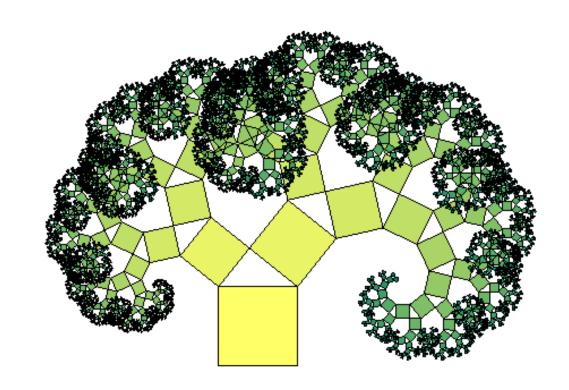
Why have I put pictures of Olivia in leg warmers into the slides? Because Bloom's taxonomy was the educational fashion of the 1980's and 1990's. Education theory, compared to maths, is a speculative discipline, with constantly changing ideas from one year to the next.

In the 1970's there was 'the new math'. Is went over like a lead balloon. Some people call Bloom's taxonomy 'the new new math'. Guess what, we in QLD are still stuck in the 1980's. We are all still wearing leg warmers. (I know – it's embarrassing.)

1980 - 90's: the new new math, H.O.T.S. or math reform

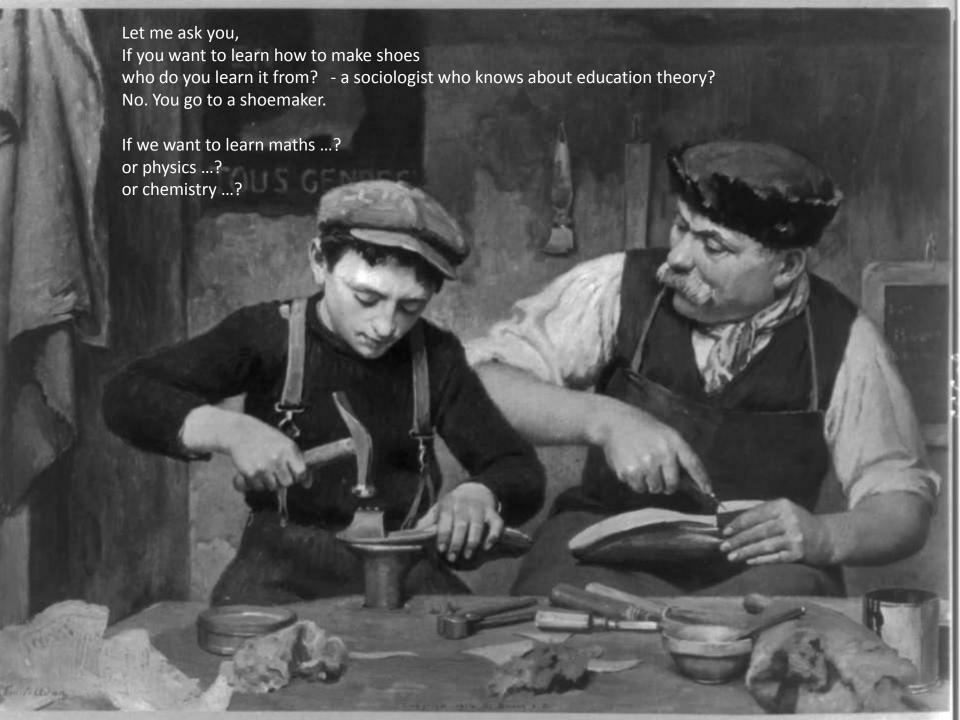
mathematics





Mathematics, on the other hand may grow, but also remains constant.

It is about timeless truths which will never change.



Let's make life better

People, lets make life better for students and for teachers.

I know there is lots of good out there,

and I believe we can do it.



