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

lack of skills
and confidence

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.

proofs?
fractions?
times-tables?

The leaders of our high school system discourage …

Currently Discouraged:

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

Teachers and students are also discouraged.
With all this taken out of maths, you may wonder what is left?

Our system has also introduced these things into maths and sciences…

Introduced:

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

With criteria based marking comes vagueness and inconsistency.

Traditional Marking:

e.g. 7 / 10

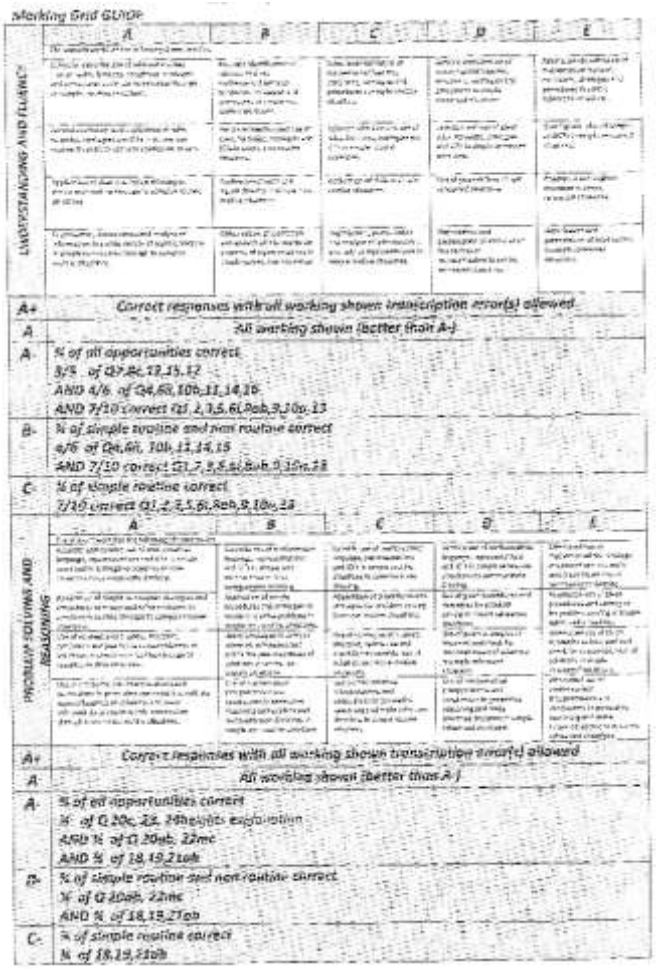
Compare the simplicity and accuracy of traditional marking, with the mind-boggling complexity of introduced criteria sheets.

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:

UNDERSTANDING AND FLUENCY	A	B	C	D	E
	The student work has the following characteristics:				
	Accurate identification of relevant and key mathematical features, conditions, strategies and procedures in simple non-routine through to complex routine situations.	Accurate identification of relevant and key mathematical features, conditions, strategies and procedures in simple non-routine situations.	Suitable identification of mathematical features, conditions, strategies and procedures in simple routine situations.	Suitable identification of mathematical features, conditions, strategies and procedures in simple rehearsed situations.	Attempted identification of mathematical features, conditions, strategies and procedures in simple rehearsed situations.
	Accurate selection and application of rules, formulas, strategies and ICTs in simple non-routine through to complex routine situations.	Accurate selection and use of rules, formulas, strategies and ICTs in simple non-routine situations.	Relevant selection and use of rules, formulas, strategies and ICTs in simple routine situations.	Selection and use of given rules, formulas, strategies and ICTs in simple rehearsed situations.	Use of given rules, strategies and ICTs in simple rehearsed situations.
	Application of clear and logical thinking in simple non-routine through to complex routine situations.	Application of clear and logical thinking in simple non-routine situations.	Application of skills in simple routine situations.	Use of given skills in simple rehearsed situations.	Attempted use of given questions in simple rehearsed situations.
	Organisation, presentation and analysis of information in a wide variety of representations in simple non-routine through to complex routine situations.	Organisation, presentation and analysis of information in a variety of representations in simple non-routine 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 information in simple rehearsed situations.

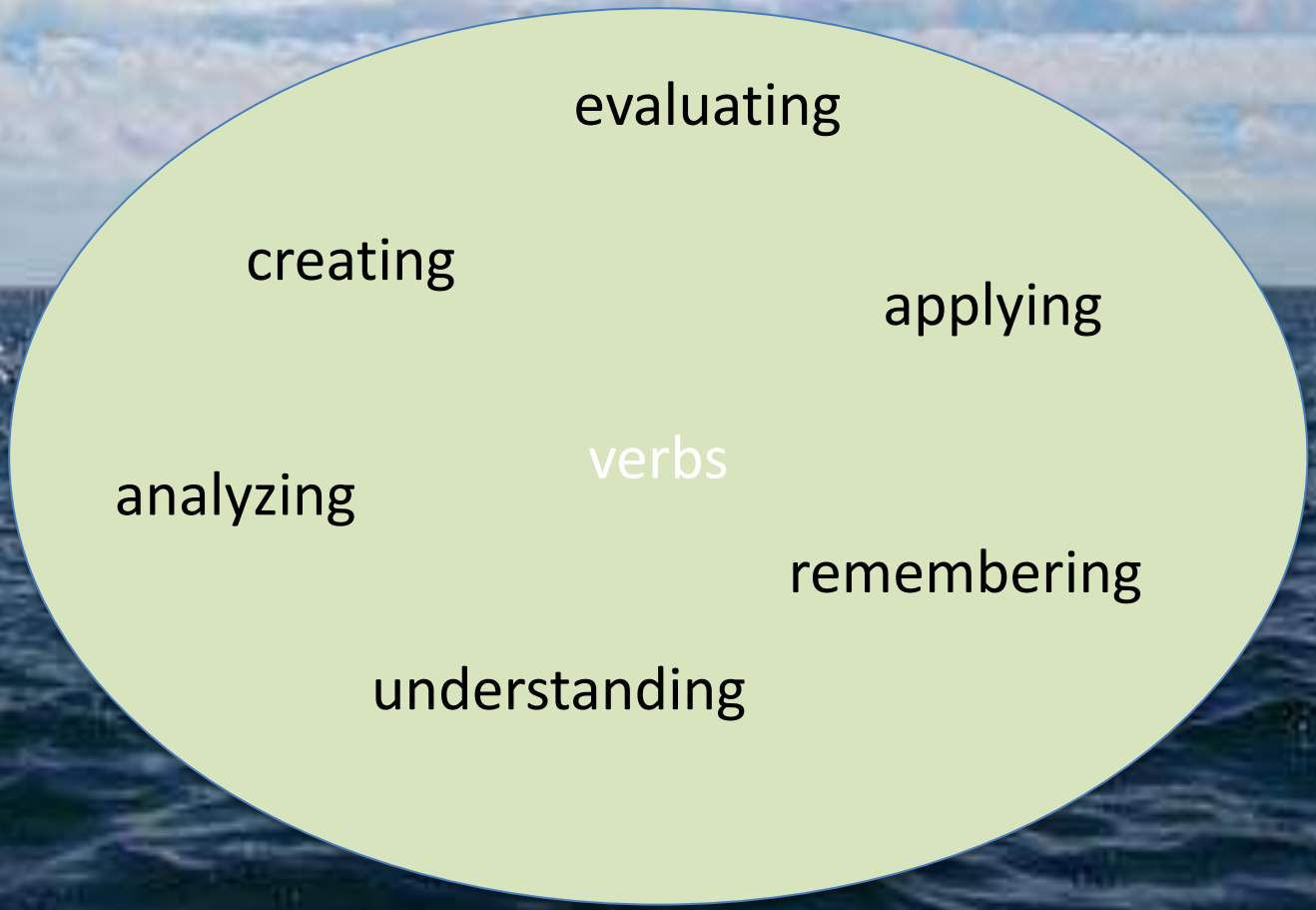
PROBLEM SOLVING AND REASONING	A	B	C	D	E
	The student work has the following characteristics:				
	Accurate and concise use of mathematical language, representations and ICTs in simple non-routine through to complex routine situations to communicate thinking.	Accurate use of mathematical language, representations and ICTs in simple non-routine situations to communicate thinking.	Suitable use of mathematical language, representations and ICTs in simple routine situations to communicate thinking.	Suitable use of mathematical language, representations and ICTs in simple rehearsed situations to communicate thinking.	Attempted use of mathematical terminology or conventions in simple rehearsed situations 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 procedures and strategies to model and solve problems in simple non-routine situations.	Application of procedures and strategies for problem solving in simple routine situations.	Use of given procedures and strategies for problem solving in simple rehearsed situations.	Attempted use of given procedures and strategies for problem solving in simple rehearsed situations.
	Use of strategies to analyse, interpret, synthesise and justify the reasonableness of solutions, in simple non-routine through to complex routine situations.	Use of strategies to analyse, interpret, synthesise and justify the reasonableness of solutions in simple non-routine situations.	Use of strategies to analyse, 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 rehearsed situations.	Attempted use of given strategies to interpret and check for reasonableness of solutions in simple rehearsed situations.
	Use of mathematical interpretations and conclusions to generalise reasoning and validate appropriateness of solutions and make informed decisions in simple non-routine through to complex routine situations.	Use of mathematical interpretations and conclusions to generalise reasoning and validate and make informed decisions in simple non-routine situations.	Use of mathematical interpretations and conclusions to generalise reasoning and make informed decisions in simple routine situations.	Use of mathematical interpretations and conclusions to generalise reasoning and make informed decisions in simple rehearsed situations.	Attempted use of mathematical interpretations and conclusions to generalise reasoning and make informed decisions in simple rehearsed situations.




“Why?” we all scream.
WHY???

I see something called
“Bloom’s Taxonomy or H.O.T.S.”
at the root of much of our problems.

Let me explain…
These verbs were once floating happily together
wherever verbs live, while they are not being spoken,
when in 1956….



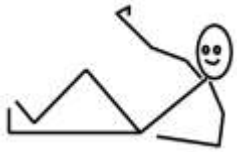
‘education’ theory

verb	
creating	‘higher order’
evaluating	
analyzing	
applying	
understanding	
remembering	‘lower order’

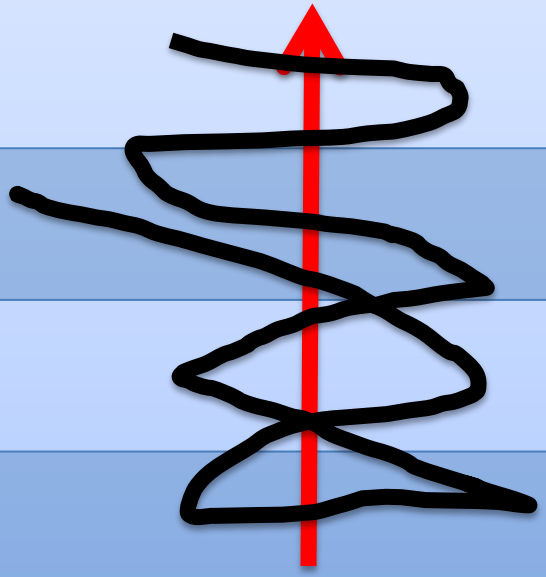
… in 1956, a committee
chaired by a psychologist
from Chicago called Bloom
decided that these verbs have a ….. ranking:
from ‘lower order to ‘higher order’.

This is called Bloom’s Taxonomy.
and has influenced much of our current system.

re - ‘education’ theory



verb	simple → great
creating	
evaluating	
analyzing	
applying	
understanding	
remembering	

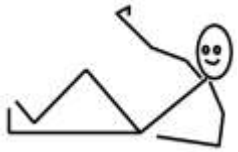


But is Bloom’s taxonomy true?

I say they got the arrow the wrong way.

Tell me if you agree, as I present my re - ’education’ theory.

re - ‘education’ theory



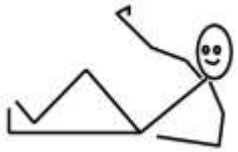
Each of these verbs can be simple or complex:

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!

re - ‘education’ theory

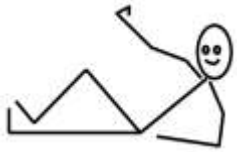


verb	simple → great
creating	
evaluating	
analyzing	
applying	
understanding	fire burns ..... special relativity
remembering	C-A-T ..... entire musical score

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

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

re - ‘education’ theory



verb	simple → great
creating	
evaluating	
analyzing	
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

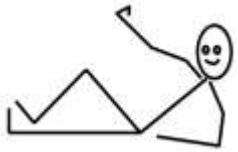
Applying can be as simple as …

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

re - ‘education’ theory



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

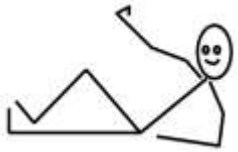
Analyzing can be as simple as …

analyzing what comes next in the sequence:
“1, 2, 3, ___?”

or as great as …

deciphering wartime cryptography.

re - ‘education’ theory



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

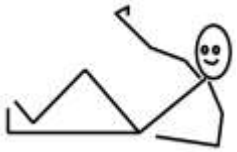
Evaluating can be as simple as …

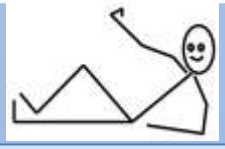
choosing between the tastes of Coke and Pepsi,

or as great as …

an in-depth comparison of medical systems.

re - ‘education’ theory



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

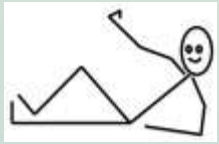
Finally, *creating* can be as simple as …

creating a stick figure

or as great as …

Caravaggio's *Chiaroscuro*

‘education’ theory

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

‘higher order’

‘lower order’

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

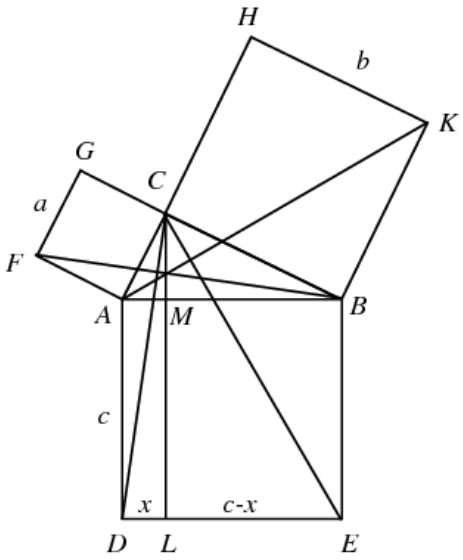
1970's: the new math

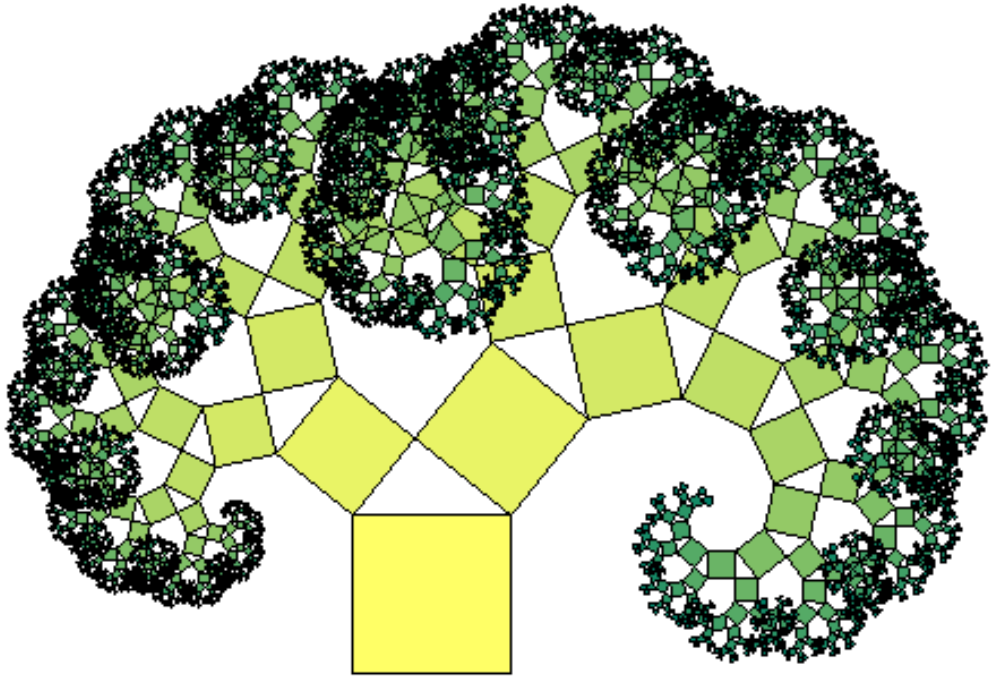
1980 - 90's: the new new math, H.O.T.S. or math reform

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.)

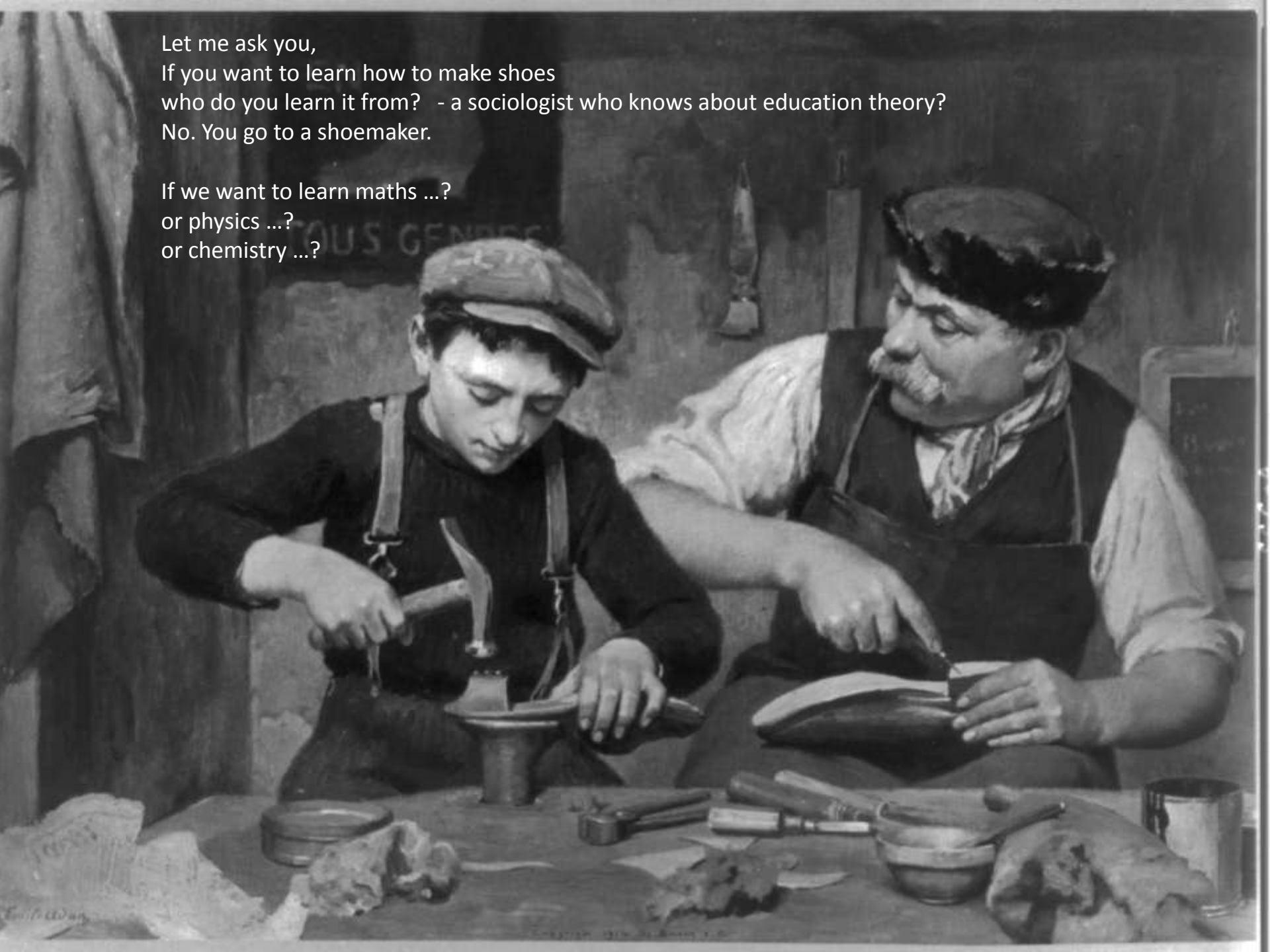
mathematics





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

It is about timeless truths which will never change.


Let me ask you,
If you want to learn how to make shoes
who do you learn it from? - a sociologist who knows about education theory?
No. You go to a shoemaker.
If we want to learn maths …?
or physics …?
or chemistry …?

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.

THANK YOU FOR YOUR ATTENTION