Decolonising math and science education

C. K. Raju

School of Mathematical Sciences
Universiti Sains Malaysia
web:ckraju.net

The basic question

- Science and math are believed to be universal.

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- Science and math are believed to be universal.
- So, is there anything to decolonise?

The thesis

- Present-day (Western) science and math are not universal.

The thesis

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- We need to

The thesis

- Present-day (Western) science and math are not universal.
- We need to
- eliminate the superstitions from Western math and science.

- superstitions in science and math?

Making knowledge theologically correct

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- Bologna was to make the knowledge from Toledo theologically correct.

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- This was done in two ways, through
- false history (making origins theologically correct), and
- reinterpretation (of non-Western knowledge to align it with theology)

A simpler case

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- Let us start with an easy case.

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A simpler case

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- Let us start with an easy case.
- Is astrology science or superstition?
- What is the difference between science and superstition?

Not *what* you believe, but *why*

- (a) Refutability

Not *what* you believe, but *why*

- (a) Refutability
  - Science refutable

Not *what* you believe, but *why*

- (a) Refutability
  - Science refutable
  - superstition involves blind trust.

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- (b) piling on hypotheses

Not *what* you believe, but *why*

- (a) Refutability
  - Science refutable
  - superstition involves blind trust.
- (b) piling on hypotheses
  - Any lie can be defended by telling a thousand more.

An example

The myth of Einstein

- Everyone knows the equation

An example

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- $E = mc^2$

An example

The myth of Einstein

- Everyone knows the equation
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- meaning

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The myth of Einstein

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- meaning
- Einstein = male chauvinist (squared)!

Corrected understanding of relativity

- Correcting credits for relativity corrects the theory.

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- FDE not ODE: One must use functional differential equations (FDE) instead of ordinary differential equations (ODE)

How do you decide?

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- What method do you use?
- Correct method: read Einstein, Poincare, me. Test the theory.
  - Because math is made difficult, university education keeps people scientifically illiterate.
- Usual method: Guess whom to trust.

Actual process of acceptance

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- Then a famous Westerner copied it ("Atiyah's hypothesis" 2005-2006).
- Then I got an award (2010).

What was the process?

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- (Scientific) illiterates deciding truth by trusting those who have exploited them for centuries.
- Similar to those who believe in astrology.

False gods of science

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- This false history used by Macaulay to change education system.
- Still used to maintain it.

Main thesis

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- Trusting the West more dangerous than trusting astrologers.

Example of superstition in science

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- How do you know there are "laws" of physics?
- Is this a refutable belief?
- Not refutable, hence not a scientific belief.
- Yet taught as the first lesson in science to children.

A theological belief

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- Aquinas said, God rules the world with eternal laws.
- Newton thought he was a prophet and those laws were revealed to him.

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- (whether or not you accept al Ghazali)
- Hence, used to attack Islam as unscientific, e.g. *Guardian* on Islam.

"Eurocentrism" or a strategy for soft power

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- E.g. Stephen Hawking.

Example 2

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Content of Newtonian physics

- That was about the word "laws"
- What about the content of Newtonian physics?
- People say science is about experiment.
- But when the theory fails, they tell stories!

Newtonian physics vs everyday experience

- Newtonian physics is (a) reversible, (b) mechanistic.

Newtonian physics vs everyday experience

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- stories about thermodynamics and "free will".
- Theology comes in at even this level of reconciling science with experience.
- Alternative: eliminate the theology from physics. (FDEs).

Waiting for Western endorsement

- So, shall we wait for Western endorsement of this?

Why Newton's "laws" failed

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- The calculus developed in India with one epistemology.
- It was imported in Europe in 16th c. for its practical value for navigation.
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- Hence made time metaphysical.

Mathematics as eternal truth

- On Western theology

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- God rules the world with eternal laws

Mathematics as eternal truth

- On Western theology
- God rules the world with eternal laws
- which he wrote in the language of math
- just because math contains eternal truths.

Math and mathesis

The origin of mathematics

- Word “mathematics” originates from mathesis.

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- mathesis means learning.
- Plato explains: all learning is recollection
- of eternal ideas in the eternal soul, and
- mathematics best suited to it, since it contains eternal truths.

Infinity, metaphysics and set theory

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- which could not be physically summed (it would take infinite time).
- The Western solution was to handle infinity metaphysically.
- That is what set theory enables.
- Set theory comes at the beginning of math teaching today.

Formal math as metaphysics

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- and does not allow empirical methods of proof.
- Hence, it is metaphysical.

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Biased metaphysics

- This metaphysics is religiously biased.
- E.g. all systems of Indian philosophy accept empirical as a means of proof.
- (*Pratyakṣa* is the first *pramāṇa*).
- If formal math is universal, all Indian philosophy must be discarded
- (includes Advaita Vedānta, Nyāya-Vaiśeṣika, Sāmkhya-Yoga, Cārvaka/Lokāyata, Buddhist, Jain.)

Formal math not universal

- Formal math based on proof.

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- Formal math based on proof.
- Proof based on logic.

Formal math not universal

- Formal math based on proof.
- Proof based on logic.
- (Deductive) logic not universal.

Logic not universal

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- Buddhist catuṣkoṭi (logic of 4-alternatives)
- Jain syādavāda.
- Quantum logic.

Math as religiously biased metaphysics

- Thus, formal math is religiously biased metaphysics.

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Math as religiously biased metaphysics

- Thus, formal math is religiously biased metaphysics.
- Biased against all Indian systems of philosophy, and
- also biased against Islam, as I have explained elsewhere.

A doubt

- So, where is the religious belief in 2+2 =4?

Normal math vs formal math

- First, there are two types of math.

Normal math vs formal math

- First, there are two types of math.
- Normal math, and

Normal math vs formal math

- First, there are two types of math.
- Normal math, and
- formal math.

Normal math vs formal math

continued

- Normal math is what you use for everyday practical purposes

Normal math vs formal math

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- Normal math is what you use for everyday practical purposes
- such as commercial transactions.

Normal math vs formal math

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- Normal math is what you use for everyday practical purposes
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- I have no problems with it. I advocate practical math.

Normal math vs formal math

continued

- Normal math is what you use for everyday practical purposes
- such as commercial transactions.
- I have no problems with it. I advocate practical math.
- Formal math is what is taught in university. I reject it.

- $2+2=4$ not universal.

- $2+2=4$ not universal.
- On a computer chip $1+1=0$.

- $2+2=4$ not universal.
- On a computer chip $1+1=0$.
- Or $1+1=1$.

$2+2 = 4$

in daily life

- 2 stones + 2 stones (+ break stone) = 5 stones

2+2 = 4

in daily life

- 2 stones + 2 stones (+ break stone) = 5 stones
- 2 big fish + 2 small fish = 4 big fish?

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- 2 big fish + 2 small fish = 4 big fish?
- Solution: weigh the fish. 2 big fish + 2 small fish = 3.67 kg fish

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in daily life

- 2 stones + 2 stones (+ break stone) = 5 stones
- 2 big fish + 2 small fish = 4 big fish?
- Solution: weigh the fish. 2 big fish + 2 small fish = 3.67 kg fish
- 2 gold bars + 2 gold bars = 3.960 kg = 4 kg?

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- In normal math we stop with some precision.

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- A few grams OK for fish.

- So, we cannot just talk of 2, for it might be 2.0.
- In normal math we stop with some precision.
- A few grams OK for fish.
- A few micrograms OK for gold, etc.

- Formal math demands infinite precision.

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- Formal math demands infinite precision.
- Since West thought math is eternal truth, perfect, etc.
- Infinite precision only possible metaphysically.

- If you accept finite precision

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- as in computer arithmetic

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- If you accept finite precision
- as in computer arithmetic
- the rules of arithmetic will change:
- E.g. associative "law" will fail.

The solution

- Eliminate the superstitions and religious bias

The solution

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- in university mathematics and physics.

Calculus without limits

- Calculus is at the base of hard science.

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- Today taught using "limits".

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Calculus without limits

- Calculus is at the base of hard science.
- Today taught using “limits”.
- ”Limits” are a Western metaphysical impositions.
- So, calculus should be taught without limits
- using the epistemology with which it developed.

The experiment

- This solution has been tried out

The experiment

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- on 1 group in CUTS, Sarnath

The experiment

- This solution has been tried out
- on 1 group in CUTS, Sarnath
- and 4 groups in USM, Penang.

Advantages

- It makes math easy,

Advantages

- It makes math easy,
- by eliminating the religious bias in it

Advantages

- It makes math easy,
- by eliminating the religious bias in it
- gives a better math

Advantages

- It makes math easy,
- by eliminating the religious bias in it
- gives a better math
- physics

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- It makes math easy,
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- gives a better math
- physics
- and history.

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- by eliminating the religious bias in it
- gives a better math
- physics
- and history.
- Details in my books, papers, and blog. (http://ckraju.net/blog)