Possibilities of the Interdisciplinary Maths Classroom

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What can maths offer interdisciplinarity?

“some subjects just can’t be integrated nicely”

“the STEM students tend to struggle more at integrating their disciplines”

“the social sciences and humanities are so much easier to link together”

“interdisciplinarity is like mixing paint: some disciplines mix to make exciting new colours, others mix to make sludge”

What can maths offer interdisciplinarity?

Maths *does* have a place in interdisciplinarity

Dependent on how we present and conceptualise mathematics as a discipline

Interdisciplinarity

taking the **perspectives** and **habits** from one academic discipline beyond the typical disciplinary bounds, to combine with approaches from other disciplines

*What does it mean to **think** and to **do** as a member of a particular discipline?*

Interdisciplinarity within the Classroom

Evidence of classroom teachers supporting the development of disciplinary perspectives and habits

"Think like a **historian**"

analyse sources, question interpretations, seek context

"Act like a **sociologist**"

explore behaviour, consider ethics, assess reliability of research

"Talk like a **geographer**"

respect cultures, be precise, use correct terminology

What does it mean to
*think like a **mathematician**?*

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*think like a **mathematician**?*

following rules, computing answers, using the tools of maths

Instrumental Vision of Maths

noticing patterns, defining relationships, generalising rules

Relational Vision of Maths

from Richard Skemp's 1976 *Understanding in Maths*

Logarithms

as taught through the **instrumental vision of maths**

$$\log_b(a) = c \iff b^c = a$$

memorising facts

$$\log_a(xy) = \log_a x + \log_a y$$

following rules

$$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$$

$$\log_a x^p = p \log_a x$$

habits and perspectives of maths?

mathematicians memorise facts and follow rules

Logarithms

as taught through the **relational vision of maths**

$2^3 = 8$ *wondering*

$\log_2 8 = 3$ *defining relationships*

connecting existing knowledge

$2^2 \times 2^3 = 2^5$ → $a^m \times a^n = a^{m+n}$

noticing patterns

abstracting rules

$\log_2 32 = 5 = \log_2 4 + \log_2 8$ → $\log_a(xy) = \log_a x + \log_a y$

habits and perspectives of maths?

mathematicians wonder, define relationships, connect existing knowledge, notice patterns, abstract rules

What does it mean to *think like a **mathematician**?*

following rules, computing answers, using the tools of maths

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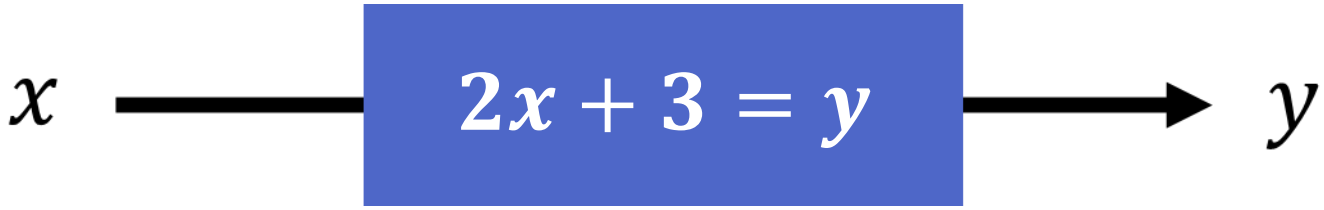
Maths within Interdisciplinarity
The Mindset Function

$$f(x) = y$$



$1 \rightarrow 5$
$2 \rightarrow 7$
$37 \rightarrow 77$

a way that mathematicians think…
spotting patterns, abstracting structures, defining functions

Maths within Interdisciplinarity
The Mindset Function

believing ability is fixed → negative learning behaviours
believing ability can be improved → positive learning behaviours

$$f(x) = y$$

$belief$ $mindset$ $learning\ behaviour$

$$\boldsymbol{mindset} = attitudes, values, goals$$

$$Carol\ Dweck's\ Growth\ Mindset$$

Maths within Interdisciplinarity
The Mindset Function

$belief$ → $mindset$ → $learning\ behaviour$

pattern spotting

relationship defining

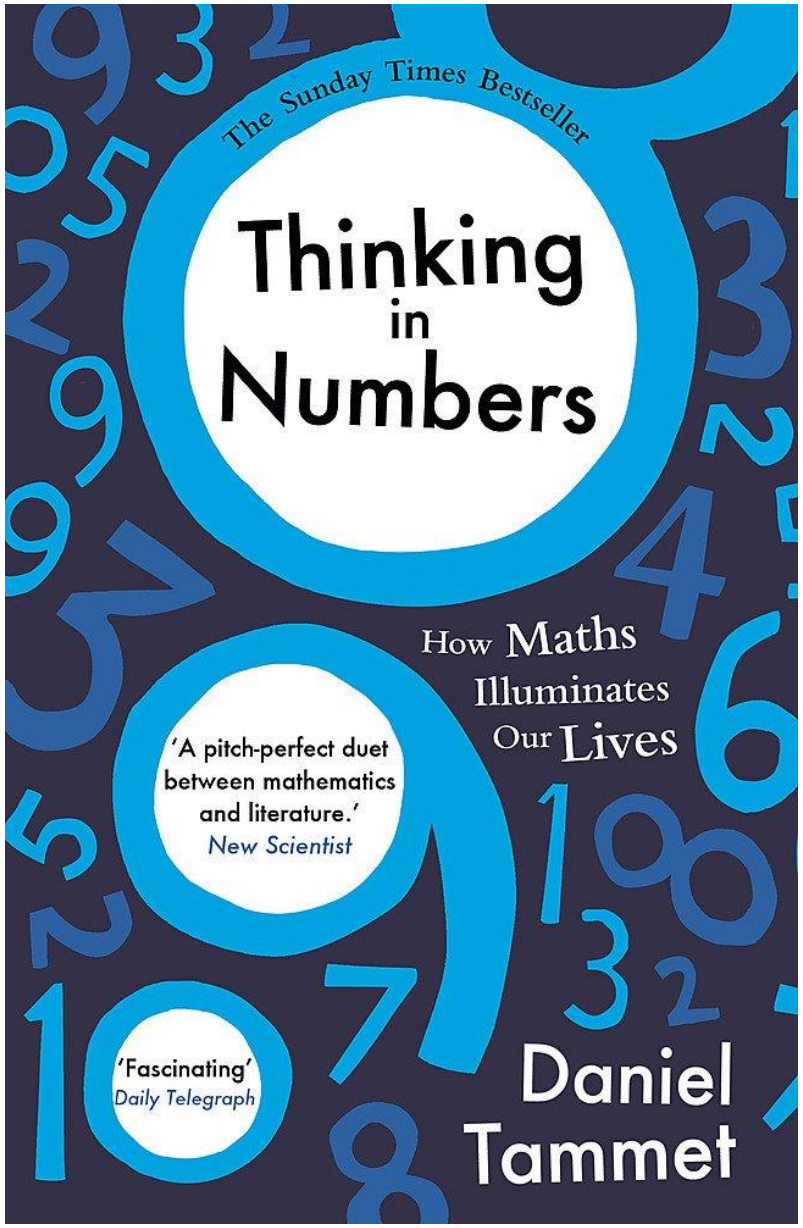
generalised structure

rule abstraction

$$\boldsymbol{mindset} = attitudes, values, goals$$

instrumental vision of maths → negative learning behaviours

relational vision of maths → positive learning behaviours



mathematical methods of proof used to strengthen political and legal arguments

new ways of thinking about the numerical meaning of *zero* influencing the works of Shakespeare

mathematical thinking illuminating astronomy, divinity, poetry, inequality, linguistics and so much more

What can maths offer interdisciplinarity?

testing theories

generalising structures

wondering

noticing patterns

representing data

numerical computation

connecting existing knowledge

problem solving

abstracting rules

defining relationships

rigorous proof

habits and perspectives of maths which are of potential great value to interdisciplinary thinking

Our appreciation for and use of mathematics within interdisciplinary study depends on the presentation and conceptualisation of ***how mathematicians think and what they do****, starting in the classroom and well beyond into interdisciplinary research*

Thank you for listening

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