Mathematics curriculum and qualifications post-16: changing our default









Our default view: one mathematical pathway

 Mathematics readily offers a systematic ordering of concepts, based on generalisation and abstraction.



Our default view: one mathematical pathway

International Instructional Systems Study (old - 2011)





What if it wasn't just about being ahead or behind?

- Sophistication in mathematical thinking: comparing, synthesising different declarative knowledge and procedures, changing perspective (Watson, 2010), reasoning, evaluating.
- <u>does not have to be</u> coupled with progression in concepts.



CM teachers' intentions:

"I want them to have learnt scepticism."

Prioritise "neither a better understanding of mathematics nor an understanding of real world contexts, but instead **students' confidence and sense of agency** over mathematics, including an emergent belief that **mathematics should, and can, make sense**."



Golding, J., Smith, C., & Blaylock, M. J. (2018).

Ontario (2007) Grades 9-12 Pathways by destination



Same mathematics....

"solve problems involving the areas of rectangles, parallelograms, trapezoids, triangles, and circles, and of related composite shapes, in situations arising from real-world applications"

Mathematics for College Technology, Grade 12

Sample problem: Your company supplies circular cover plates for pipes. How many plates with a 1-ft radius can be made from a 4-ft by 8-ft sheet of stainless steel? What percentage of the steel will be available for recycling?

Foundations for College Mathematics/

Mathematics for Work and Everyday Life, Grade 12

Sample problem: A car manufacturer wants to display three of its compact models in a triangular arrangement on a rotating circular platform. Calculate a reasonable area for this platform, and explain your assumptions and reasoning.



Recognising that people know maths

- Education is also about children and young people, and adolescents develop increased **awareness of self and others**.
 - People are different, and
 - 1. Our variability can be is studied using mathematical and data tools.
 - 2. We can learn to balance complementary sources of expertise
 - CM teacher: add mathematical nuance where students (sometimes) bring domain knowledge



Influencers 1



Recognising that people know maths differently

 Education is also about children and young people, and adolescents develop increased awareness of self and others.

Influencers 2

Mathematics is a human activity

The same mathematics can be represented and communicated in different ways What tools support and convince you? What can you choose to convince others? What are the key ideas? The key variations?



Klein: Education requires psychological not systematic presentation



Real world maths

- Adolescents develop increased awareness of wider social, physical, economic, cultural world. Can pose and answer questions in contexts that they can imagine and have some knowledge about.
- IISS analysis: "Where curricular differentiation exists, the use of real-world contexts is seen as a vehicle for making sense of basic mathematics for younger students, but this seems not to be considered relevant for older students or for more advanced mathematics. " (Smith & Morgan, 2016)
- Is understanding how mathematics is used in the world motivating for all students? Is it relevant learning for all students?



International Baccalaureate

	Higher Level	Subisidiary Level
Applications and Interpretation : enjoy the practical application of mathematics to real life situations	19%	37%
go on to further study in	biology, the human sciences and business	
Analysis and Approaches: exploring real and abstract applications, enjoy problem solving and generalisation	7%	37%
go on to further study in	mathematics, engineering, physical sciences, economics.	economics, geography and chemistry





Mathematics curriculum and qualifications post-16 <u>will be characterised by</u> selection, or not, of more abstract concepts.

But this is not the only dimension in which knowledge changes. 16-18 year olds can learn to use:

More sophisticated mathematical thinking

Increased awareness of self and others

Awareness of wider social, physical, economic, cultural world

Propositions:

- 1. These progressions are currently invisible in England's curriculum documentation.
- 2. Core Maths could be a full A level.
- 3. 16-18 year olds should not be repeating the 14-16 GCSE syllabus.



References

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FIGURE 5

The evolution of gender gaps in literacy and numeracy⁸⁶

A gender gap is a measure of the effect of being female on the standardised test scores, given as a proportion of 1 standard deviation for the respective test population, where a + value shows females having higher scores. The gender gap measure is estimated by a regression analysis for each of the six tests (literacy and numeracy at each of the three ages).



The increase in the numeracy gender gap from age 15 to age 26/27 is plausibly related to choices concerning postcompulsory education.



Borgonovi, F., Choi, A., & Paccagnella, M, 2021. The evolution of gender gaps in numeracy and literacy between childhood and young adulthood. Economics of Education Review, 82, 102119. P 5. See https://doi.org/10.1016/j. econedurev.2021.102119 (accessed 30 July 2024).