Reasoning through Talk

What is reasoning, and how is it developed by students discussing their mathematical thinking in the classroom?

What is reasoning?

Reasoning is the drawing of inferences or conclusions from known facts. As John Mason describes, it's about using 'the discourse of if... then..., and of making assumptions and drawing conclusions.'

According to the national curriculum, all pupils should be able to 'reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language'.

The NCETM's Essence of Teaching for Mastery says that an underpinning principle of mastering maths is that 'Mathematical learning behaviours are developed such that pupils focus and engage fully as learners who reason and seek to make connections'.

In the secondary maths classroom, reasoning is often developed by allowing students to discuss and explore their ideas.

How can talk in the classroom promote reasoning?

Communication is necessary for students developing their mathematical reasoning: purposeful talk can be part of that.

In learning **to** talk, students learn to effectively articulate their mathematical thinking. And in learning **through** talk, students deepen their own understanding and collaborate with their peers. Reasoning is a key skill that all students are entitled to develop. By creating opportunities for all students to engage in extended dialogue and authentically listen, they will develop the skills they need to contribute and thrive.

What does the 2023 Ofsted report, 'Coordinating Mathematical Success' say about reasoning?

> ***[Secondary] Schools should make sure that pupils have sufficient opportunities to practise reasoning, explaining and problem-solving.***
>
> **Recommendations section**

> ***Teachers emphasised the fact that mathematics is 'a communication subject'.***
>
> **Secondary section, paragraph 81**

> ***Some leaders had identified lack of fluency in procedures and lack of language and comprehension as barriers to reasoning and wider problem-solving.***
>
> **Primary section, paragraph 23**

> ***Familiar sets of questions were almost routine: 'What do you notice?' 'What's the same and what's different?' and 'Convince me'. Many teachers used questioning deftly throughout lessons to check whether pupils were ready to learn the material, to check their understanding and to encourage their reasoning.***
>
> **Primary section, paragraph 35**

What does the previous Ofsted research review, quoted in 'Coordinating Mathematical Success' say?

> ***Practice helps pupils to understand and remember mathematical knowledge. [...] Type 2 [practice] is more exploratory. It requires pupils to explain relationships, prove that they understand them and describe their reasoning.***
>
> **Summary of the research review relevant to pupils' practice**

What are Research and Innovation Work Groups?

Research and Innovation Work Groups (RIWGs) are professional development projects which take place at a local level, and enable teachers to collaborate with colleagues from other schools to explore local issues and needs. They also contribute expertise and knowledge to the wider Maths Hubs Network, and can influence other Network Collaborative Projects.

RIWGs exploring oracy enable teachers to learn more about how it contributes to developing students' ability to reason mathematically. Oracy RIWGs take place across the country, and teachers should contact their local Maths Hub to find out what's available in their area.

What do participants say?

> ***Providing a clear structure for oracy has given my students the confidence and freedom to talk about maths.***
>
> **Hannah Chilton, secondary maths teacher and participant in Oracy Research and Innovation Work Group**

> ***High-quality dialogue in maths can lead to deeper understanding of mathematical concepts and processes. The teacher has a role in developing student dialogue through modelling, scaffolding and creating opportunities for extended talk.***
>
> **Abby Cotton and Kathleen McBride, Oracy Research and Innovation Work Group Leads**

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