The Role of Mastery in Nurturing Young Mathematicians

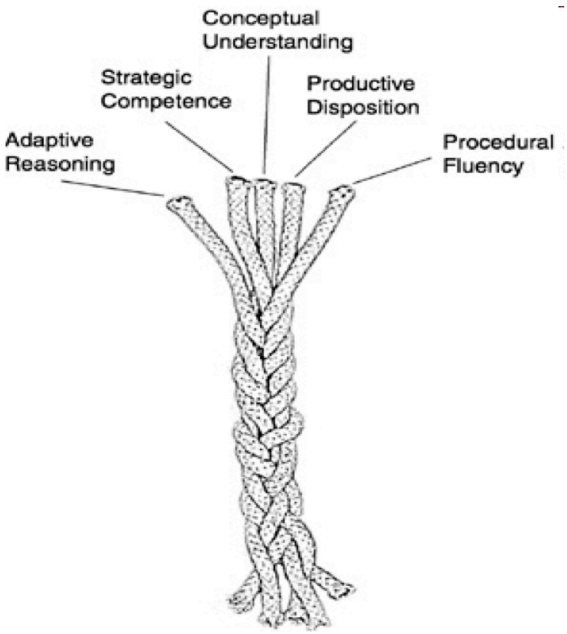
In the current climate where ‘mastery’ and ‘mathematics’ often occur in the same sentence, we have been exploring what mastering mathematics means to us at NRICH. In July 2015, we invited people to send their thoughts on the following questions:

• Can you ever become a master of something?
• Are we talking about ‘proficiency' in the current conversations, rather than mastery?
• Does mastery, as it seems to be defined by NCETM (2014a), include the depth of problem solving and dispositions that we would expect all learners to be developing?

In this article, we would like to update you on our thoughts and proposed future actions.

First and foremost, the NRICH team welcomes the mastery debate. We feel that it has resulted in renewed interest in the teaching and learning of mathematics across all key stages. It is interesting to note that whilst the new National Curriculum (DfE, 2013) clearly specifies its three aims of developing fluency, reasoning and problem solving in mathematics, it does not specifically refer to a ‘mastery’ approach. We appreciate that the current mastery approach encompasses two key aspects of mathematical learning, conceptual understanding and procedural fluency, which we agree are essential for nurturing young mathematicians.

However, at NRICH we wonder whether the current mastery approach rigorously addresses each of the following five essential aspects for developing young mathematicians: conceptual understanding; procedural fluency; strategic competence; adaptive reasoning and productive disposition (Kilpatrick, Stafford & Findell, 2001). The interwoven and interdependent nature of these five essential aspects are powerfully captured by the following image:



Adding it up (Kilpatrick, Swafford and Findell, 2001, p.115)

This model clearly demonstrates that if a mastery approach mainly focuses on conceptual understanding and procedural fluency, it may be insufficient for developing the potential of young mathematicians. We wonder whether the current mastery approach focuses sufficiently on 'productive disposition' and truly encourages pupils to develop an appreciation of mathematics as a 'useful, worthwhile activity' (Kilpatrick et al, 2001).

Ofsted recently reported that 'the degree of emphasis on problem solving and conceptual understanding is a key discriminator between good and weaker provision,' (Ofsted, 2015). The current paucity in provision can result in classrooms where 'many pupils spend too long working on straightforward questions, with problem solving located at the ends of exercises or set as extension tasks so that not all tackle them,' (Ofsted, 2015).

At NRICH, we believe that Ofsted's concerns regarding problem solving should be addressed by the mathematics education community. We envisage working with other stakeholders, building on the existing problem solving materials (DfE, 2013; NCETM, 2014b; NCETM, 2015) to address each of the five aspects required to nurture young mathematicians. It is important that such resources should include a focus on developing a productive disposition towards mathematics, especially resilience when learners are faced with a challenge. For example, our Developing Habits of Mind resources (see https://nrich.maths.org/11409) reflect our belief that 'students learn better when they are curious, thoughtful, determined and collaborative.'

To conclude, NRICH proposes a collaborative approach towards addressing problem solving in mathematics. We invite interested stakeholders to join our discussions. As an outcome, we anticipate supplementing existing problem-solving materials with additional resources addressing the teaching, learning and assessment of problem solving in mathematics.

References

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