How can rich mathematical resources support learners to deepen their mathematical understanding of number?

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Suggested theme: Number mastery

Deep mathematical learning, rich mathematical resource, representations, relationships, structures

Introduction

Following the implementation of recent curriculum reforms in England (DfE, 2012), the UK government through its network of Maths Hub has been encouraging primary schools to adopt a mastery approach for the teaching of mathematics. For assessment purposes, teacher exemplification materials have been issued to schools which provide examples of lower primary students *working towards the expected standard*, *working at the expected standard* and *working at greater depth*. Nevertheless, school inspectors report that many teachers are struggling to teach their pupils at greater depth where appropriate. Indeed, "deepening learning of pupils who grasp ideas quickly" is listed as a priority for both primary and secondary schools (Jones, 2017). Hence this research project was timely, exploring ways of using a selection of the rich mathematical resources designed by NRICH to support schools to teach primary mathematics at greater depth by investigating the following research question:

> *How can rich mathematical resources support learners to deepen their mathematical understanding of number in the primary classroom?*

Theoretical Framework

The literature reveals that rich tasks tend to have a range of common characteristics which include their accessibility for most students as well as their suitability to extend some students where appropriate, their capacity for encouraging discussion and their potential for exploring a variety of different approaches towards one or more solutions (including Ahmed, 1987 and Piggott, 2011). Nevertheless, the literature also argues that offering students a rich task is a necessary yet perhaps insufficient condition for deep mathematical learning to take place; it also highlights the importance of the classroom teacher for maximising the potential of rich tasks (Hayes, Mills, Christie, & Lingard, 2006). Therefore, working with classroom teachers was a key aspect of our research design.

Moving on to consider the literature addressing 'deep' mathematical learning, it appears that there are a wide range of interpretations of its meaning. Acknowledging this issue, Drury and

Jacques (2018) review three mathematics education research papers which contain the word 'deep' in their titles. Their findings form the basis for their *lexicon of deep mathematical learning* which feature representation, relationships and structures as common terms across the papers. Hence, our project drew upon those three terms to inform our data collection and subsequent analysis for exploring deep mathematical understanding during a series of professional development days with primary classroom teachers.

Our Approach

Although the proposed scale of the original multiple case study was affected by school closures forced by the Covid pandemic, the NRICH team successfully completed data collection visits to teachers in two different schools within the same London borough. A case study "investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 1984, p. 23). A school-based case study approach ensured that the research design could focus on collecting the range of qualitative data required to address our research question regarding the depth of learning using rich resources. The schools were part of a wider, year-long NRICH-led professional development programme (PDP). Each school attending the PDP was invited to participate in the project. four schools registered their interest and joined the case study.

Data collection and outcomes

Three data collection visits were planned to each of the participating schools across the academic year. Each research visit was intended to include a lesson observation during a mathematics lesson using an NRICH resource linked to the arithmetic strand of the curriculum, followed by a teacher interview exploring their decision-making both before and during the lesson. However, school closures took place during the data collection phase and their impact restricted the data collection to single visits to two of the project schools. Due to the exploratory nature of this project, a grounded theory approach was adopted for the subsequent data analysis.

Relation of the chosen conference theme

As discussed during the introductory paragraph, this research project is most closely aligned with the mastery strand of the topic conference. However, it could also be argued that it has strong connections with number sense and flexibility too.

References

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