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► **To cite this version:**

Helen Martin. Multiplicative reasoning task design with student teachers in Scottish schools: valuing diversity, developing flexibility and making connections. Eleventh Congress of the European Society for Research in Mathematics Education, Utrecht University, Feb 2019, Utrecht, Netherlands. hal-02423481

HAL Id: hal-02423481

<https://hal.science/hal-02423481>

Submitted on 24 Dec 2019

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Multiplicative reasoning task design with student teachers in Scottish schools: valuing diversity, developing flexibility and making connections

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Keywords: multiplicative reasoning, teacher education, task design.

Introduction

The aim of this poster is to present the development of a synthetic landscape of multiplicative reasoning constructed by student teachers. It explores the implications of working in a way that integrates literature from three different perspectives: maths recovery (MR), cognitively guided instruction (CGI) and realistic mathematics education (RME). The aim is to better understand how working in this way affects the way student teachers interact with learners, the questions they ask, the tasks they design: their capacity to value diversity in literature and develop their flexibility in practice.

There is a pattern of superficial adoption of findings from research in teaching mathematics in Scottish schools that often relies on dissemination of a product where teachers have not been a part of the process of constructing understanding. This often leads to a series of short lived interventions that rarely produce the positive effects expected. In which case, what can we use within teacher education to inform ourselves, our student teachers, our professional colleagues that accepts the natural dilemmas of teaching and might improve professional and ethical decision-making in an ever-increasing political world of curriculum design and change?

To address this question the author alongside a teaching colleague developed and have redeveloped a year 3 undergraduate mathematics education course over the past four years to consider how to better support student teachers entering this environment. They need to be able to adapt quickly to changing priorities using informed professional decision-making. To create the space and time to think more slowly, the course focuses on the key shift in thinking from additive to multiplicative reasoning. The first semester explores additive reasoning working with children aged 4–7 years old and the second semester focuses on multiplicative reasoning working with children aged 8–12 years old. Each semester consists of six 3-hour sessions followed by five weeks in a school. This poster uses the second semester course where the assignment requires student teachers to report on their analysis of the children's multiplicative reasoning.

Theoretical Background

Rather than taking one piece of major research and focusing on this to the exclusion of others we looked at using several significant studies. In this study, alongside the formal curricular guidelines in Scotland, Curriculum for Excellence (Scottish Government, 2009), three different theoretical perspectives are used: Realistic Mathematics Education (Fosnot & Dolk, 2001), Cognitively Guided Instruction (Carpenter, Fennema, Franke, Levi & Empson, 2015) and Maths Recovery (Wright, Ellemor-Collins & Tabor, 2012). The course is designed to consider the benefits and limitations of

each in a complementary rather than a competitive manner. It is by synthesizing ideas from different perspectives that have different foci that student teachers can become much more aware of the similarities and differences: complementary strengths and non-overlapping weaknesses. Similarly, the sessions include tasks focused on student teachers as learners of mathematics, researchers and teachers of mathematics to build a sense of themselves as mathematicians, researchers and teachers.

Methods

This design research (Gravemeijer & Cobb, 2006) takes an iterative approach to studying and refining task design within a mathematics education classroom: to develop our understanding of the embodied process of developing theory *through* practice and the means that are designed to support that learning. The design principles are based on mathematics as a constructive activity (Watson & Mason, 2005) with an emphasis on mathematical practices and a more participatory view of learning and teaching mathematics.

This poster will illustrate the latest cycle of this design research using multimodal data provided by the most recent cohort of 38 students during academic session 2017/18: student teacher's assignments, planning documents, videos and transcripts of task-based interviews with children and images of child jottings to better understand how the design of the course influences the tasks designed by student teachers.

Findings

Preliminary findings indicate that most student teachers have shifted their focus to a more participatory view of learning mathematics, discussing a range of strategies and models used by the children. Some of the student teachers take informed risks, experiment with different pedagogical approaches and are beginning to design their own tasks however very few student teachers understood the underlying structure of number strings (Fosnot & Dolk, 2001).

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