REFINING A LEARNING NETWORK FOR "DOUBLING AND HALVING" AND "ODD AND EVEN NUMBERS"

[1]Nicky Roberts and [2]Heather Mills

[1]University of Witwatersrand and Kelello Consulting, [2]Bishops Preparatory School

Extended abstract

This short paper explores the mathematical connections between three interrelated mathematical concepts: doubling, halving, and parity in a small whole number range (of less than about 30). The parity of a number is whether the number is odd or even; so parity is the "odd or evenness" of a whole number. This paper puts forward a possible learning network for planning teaching interventions relating to these concepts for Foundation Phase classrooms.

Doubling and halving are important mathematical operations, and frequently the first introduction that young children have to multiplication and division. Drawing on the mathematics education literature, we consider the two models for division to be fundamental to how doubling and halving are defined and taught:

- The sharing model (quotitive); and
- The grouping model (partitive).

Using each model we developed definitions for doubling (which are mindful of the two division models) and related definitions for halving. We conceptualize a learning network to be an interconnected circuit of the ideas and connections which children make, or are expected to make, about this mathematical topic. The image of a circuit board, where nodes (points of connection) are clear was found to be useful.

We used our definitions of doubling and halving to be specific about what is meant by parity (what makes a whole number either odd or even). This created at least six conceptual nodes in our proposed learning network:

	Double	Half	Parity
Sharing model	Node 1	Node 2	Node 3
Grouping model	Node 4	Node 5	Node 6

Based on our collective teaching experience and research we thought that a third parity model – a counting model – appears to be present, and in some cases dominant, for very young children. We conjecture that the counting model occurs when mathematical work is conducted in a small whole number range, where counting sequences and a small number of calculations can be rote learnt (and which is frequently the case in many Foundation Phase classrooms). As such this third counting model, introduces a further three nodes for our learning network:

Roberts, N. & Mills, H. (2013). Refining a Learning Network for "Doubling and Halving" and "Odd and Even numbers". (Extended abstract) In Z. Davis & S. Jaffer (Eds.), *Proceedings of the 19th Annual Congress of the Association for Mathematics Education of South Africa*, Vol. 1. (pp. 280 – 281). Cape Town: AMESA.

	Double	Half	Parity
Counting model	Node 7	Node 8	Node 9

The paper attempts to explain each of the nine nodes, and offers a visual structure for organizing them. It then describes our shift to a more detailed learning network which includes both the generalizations that children can be supported to make for each node of the network; as well as highlights the misconceptions some children may develop.

We put forward some teaching ideas which could be used to support this content topic and attempt to reflect on where each idea fits into the learning network. The teaching ideas make use of different equipment and representations including for example Numicon or grid patterns, unifix towers, function machines, children as manipulatives, geoboards and reflection. They also have different purposes and areas of mathematical focus, including for example: games for learning number facts for automatic recall, problem solving activities, connection to measurement contexts, generalizing mathematical ideas and structures for the layout or routine written methods.

It is hoped that this paper provides a relatively accessible starting point for teachers who are trying to visualize how ideas fit together, and 'connect the dots' with regard to the interrelated concepts of doubling and halving and odd and even numbers.

ACKNOWLEDGEMENTS

This paper was made possible as part of the Focus on Primary Maths project. This project is funded by ApexHi and administered by Tshikululu Social Investments. Collegial support and reflection took place involving Heather Mills (Grade 2, The Grove 2012 and Grade 2 Bishops 2013), Liane Karsten (Grade R, The Grove, 2011), Laurelle Fry and Lindy Brien (Grade 2 Bishops, 2013) and Nicky Roberts (Kelello Consulting and University of Witwatersrand).