

Maulfry Worthington: Doctoral research (VU University, Amsterdam)

Doctoral supervisor: Bert van Oers.

Draft title of doctorate: [The genesis of mathematical semiosis in early childhood.](#)

Aims

The aim of this research is to trace the emergence of children's notations they use to communicate mathematical ideas in their pretend play and other social contexts, to identify cultural and social influences and how these contribute to children's developing semiotic modes and to their mathematical thinking. The trajectories of children's signs are traced, showing their relationship with other multimodal literacies and the role of grammaticisation (usage-based language acquisition). New analysis shows how young children's *beginnings* with intentional marks move via *transitional* signs to *formal* numerals and operators. For the first time the relationship between young children's informal signs and those of the standard signs of the established mathematics culture is shown, the children's marks and signs developing over time to reveal their advancing mathematisation.

Background

This research is based on a Vygotskian, cultural-historical perspective and informed by a social- semiotic perspective of young children's appropriation, creation and understanding of symbolic tools, with consideration of their communicative potential (Vygotsky, 1978). It builds on previously conducted research by Carruthers and Worthington (during almost two decades) with children from 2 – 8 years of age, showing how children's own symbols and visual representations support their developing understanding of the abstract symbolic 'written' language of mathematics.

Data

Using longitudinal, ethnographic case studies of children of 3-4 years of age, I have gathered data in an inner city maintained nursery school in the south west of England. The study focuses especially on children's free and spontaneous social pretend play.

Data include written observations, photographs of the children's play and graphicacy and original examples; scrapbooks with visual data from the children from home and nursery; field notes made during research visits; notes from informal discussions and interviews with the teachers, and home visits including informal discussions with children and parents. Analysis is supported by means of 'computer assisted qualitative data analysis software' (CAQDAS) with the advantage of more systematic and objective analysis of the textual data and a high degree of validity and reliability. Analysis of the visual data is within an interpretative paradigm drawing on research into multimodality and cultural features.

The findings are expected to add to our understanding of the ways in which children explore, make and communicate meanings through signs and texts to support their symbolic development of mathematics over time. They are expected to show the power and potential of rich pretend play, contributing to a deepening understanding of children's mathematics and their natural and meaningful beginnings of the symbolic language of mathematics.

Acknowledgments.

Sincere thanks are extended to headteacher Elizabeth Carruthers, the staff, children and parents of Redcliffe maintained nursery school, Bristol, for generously sharing the children's rich play and mathematical thinking.

Doctoral papers:

1. Worthington, M. and van Oers, B. (2016) Pretend play and the cultural foundations of mathematics. *European Early Childhood Education Research Journal*, 24 (1), 51-66.
2. Worthington, M. and van Oers, B. (2017). Children's social literacy practices and the emergence of graphic symbols in pretence. *Journal of Early Childhood Literacy*. 17(2), 147-175.
3. Worthington, M. (submitted). The development of mathematical abstraction in the nursery.
4. Worthington, M. (submitted). Intertextuality and mathematisation in young children's inscriptions.