

Young children's informal mathematical signs and symbols: emergent learning and 'intent participation'

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Abstract

This study investigates the emergence of young children's informal mathematical signs and representations in meaningful contexts, and their contribution to children's understandings of the abstract symbolic language of mathematics.

Building on research into children's early mathematical representations (Hughes 1986), it extends research into *children's mathematical graphics* (e.g. Worthington and Carruthers 2003; Carruthers and Worthington 2005; 2006), further developing recent research into pretend play and the cultural foundations of mathematics (Worthington and van Oers 2016) and children's social literacies Worthington and van Oers (in press).

The study draws on cultural-historical and social-semiotic theory (e.g. Jewitt and Kress 2003; Kress 1997; Vygotsky 1986) and research into pretend play (e.g. Rogers 2011; Brooker and Edwards 2010; Harris 2000; Vygotsky 1978, 1966), highlighting children's '*intent participation*' (Rogoff et al. 2003) as a powerful means of learning.

The study conceives of children's mathematical representations as emergent, originating in their need to communicate meaning. Analysis follows an interpretive, social-semiotic paradigm and is supported by computer assisted qualitative data analysis software. Individual representations are analysed using Carruthers and Worthington's taxonomy (2005; 2006; 2013), and identifies dynamic features that later support calculations (Poland et al. 2009; Poland and van Oers, 2007).

The research adheres to BERA's (2011) ethical research guidelines. Participants were consulted and informed at every stage and gave their informed consent and could withdraw if they chose.

Affirming the importance of cultural knowledge, the findings highlight the significance of children's graphical exchanges and indicate progression towards increasingly mature signs and symbols. The findings extend beyond a narrow 'skills based' view of mathematics teaching in early childhood, and have significant implications for early childhood teachers and policy makers.