"I Did it in My Head": Investigating Children's Mathematical Thinking

Kate Quane
University of South Australia
kate.quane@unisa.edu.au

Carolyn Bruhen
University of South Australia
carolyn.bruhen@unisa.edu.au

Mathematical thinking has multiple definitions, including a means to "describe mathematical growth" (Rasmussen et al., 2005, p. 52) and as a function of mathematical processes and operations (Burton, 1984). Liljedahl (2021) describes mathematical thinking as "messy" requiring risk-taking (p. 72), and "difficult" (p. 87). Mathematical thinking can be described as an invisible and individualized "self-sustaining process" that is a form of self-communication (Sfard, 2008, p. 81). Liljedahl (2021) much publicized work on thinking classrooms in mathematics makes the association between thinking and learning. Given this sentiment, we seek to understand the processes that students engage when thinking mathematically with the work of de Bono (1971) proving instrumental in describing thinking processes.

This paper reports on research conducted in a small regional South Australian School where the entire school population (N = 36) was divided into two classes. The multi-phase research used participants' drawings, their written descriptions, and interviews about their drawings. Children were withdrawn from class to complete a drawing and semi-structured interview. A drawing prompt was read to each childing, outlining the requirement for children to "draw themselves doing mathematics" with further instructions stating that children needed to include their face and that the focus of the drawing could be any aspect of mathematics (Quane et al., 2021).

Our findings highlight that there were varying degrees of invisible thinking from students from not being able to articulate their thinking "I can't really describe it" or "I don't really know how to explain it", to students who gave an indication that they were thinking but providing little or no description or explanation. Additionally, students used a range of "porridge words" (de Bono, 1971) to describe their mathematical thinking. Further analysis of the occurrence of invisible thinking revealed that students use invisible thinking in several ways which when examined closely provide clues to educators regarding how to support students to improve how they communicate their mathematical thinking.

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