Abstract

This century is an age of information, where complex data are widely available and accessible. Statistical information and arguments impact on decision making, and the ability to reason statistically, to make sense of, and reason about statistical information has become increasingly important. Researchers advocate developing critical, flexible reasoning with data from the beginning years of school. Young children begin school with powerful mathematical ideas, including data and probability sense that should be nurtured in meaningful learning contexts. Some aspects of knowledge and reasoning that contribute to young children making sense of data have been identified. Prior research however has tended to focus on individual statistical concepts rather than statistics as a distinct problem solving process, and positions children's learning as deficit. Accordingly, little is known of children's existing prior-to-school knowledge and reasoning competency and capacity and how this may inform pedagogical and content knowledge for statistical learning in the classroom. Furthermore, there is a curriculum imperative for understanding young children's beginning statistical reasoning, as *Statistics and Probability* is one of the three content strands in the newly introduced Australian Curriculum: Mathematics (ACARA, 2013).

The aim of this qualitative study was to explore the knowledge and reasoning young children brought to data handling activities within the classroom learning context in their first term of formal schooling. Statistics is essentially a new discipline developed in the twentieth century, which has drawn from, but is not founded in mathematics. Disciplinary distinctions between mathematics and statistics are important when considering the concepts and reasoning which are distinctly statistical and what this means for beginning statistical learning. This study defined core statistical concepts that emphasise the critical role of *data context* and *task context* in engaging statistical knowledge and reasoning, and the central role of inductive reasoning in statistical problem solving.

A design-based research method, informed by the Models and Modeling perspective (Lesh & Doerr, 2003) was adopted as an appropriate theoretical and methodological approach for eliciting statistical reasoning in young children. Data modeling activities initiated by picture story books were implemented to trigger core statistical processes as children engaged in statistical problem solving. The picture

books served to contextualise the data for the modeling problems, and were embedded in the design of the task context. The study explored young children's responses to the initiating picture story books, and their use of knowledge and reasoning as they found solutions to the modeling activities. Data were collected with 5 year old children in their first term of primary school in a classroom setting. Video and audio taping of whole class and small group work, children's models as representations of their problem solutions, researcher field notes, journal and teacher-researcher discussions were analysed theoretically and thematically.

The study found that young children brought inductive reasoning and a range of intuitive and prior-to-school knowledge to make sense of data and find solutions to data handling problems. The modeling problems engaged generating, selecting and measuring attributes, organising and representing data, and analysis and inference through interaction with data representations. The study also revealed that as task contexts, data modeling activities provide young children with conceptual access to statistical ideas and stimulate statistical reasoning processes. Children used their existing knowledge and reasoning skills to reason and make sense of data. In addition, the use of engaging picture story books to initiate and contextualise data for a modeling problem influenced the context knowledge children drew from to make sense of data.

This study identifies that young children have competency and capacity to participate in statistical practices and that task conditions and characteristics can instigate, mediate and support the statistical knowledge and reasoning young children reveal. The study recommends further research on the role of picture story books in the task design of data modeling activities. In addition, future research should address engaging young children's prior-to-school knowledge and reasoning skills, particularly their intuitive knowledge, as powerful resources that can be applied to reasoning statistically to make sense of data.