

Spontaneous mathematical focusing tendencies: theoretical and methodological considerations

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E-CER scope

The examination of spontaneous mathematical focusing tendencies has been a burgeoning area of inquiry in the EARLI community for the past 20 years. Since 2005, when Hannula and Lehtinen first described children's individual differences in spontaneous focusing on numerosity (SFON), education and psychology researchers worldwide have pursued research to better understand spontaneous mathematical focusing tendencies, broadening this topic to other aspects of mathematics, including additive and multiplicative relations, Arabic number symbols, and patterns; and conditions that influence these tendencies.

There is now ample empirical evidence from experimental studies, real-world observations, and educational interventions that these spontaneous mathematical focusing tendencies are related to, and may influence, the development of mathematical skills. Even though the reciprocal nature of spontaneous mathematical focusing tendencies and mathematical skills has emerged in a few studies, the specific causal mechanisms have not been clearly identified yet. A proposed mechanism for the association between spontaneous mathematical focusing tendencies and mathematical development is an increase in children's self-initiated practice of existing mathematical skills in their everyday lives – as a higher spontaneous mathematical focusing tendencies, influences on them, and their relations with mathematical development and each other remain extant questions that need addressing.

The E-CER would aim to address one central obstacle to the effective pursuit of these questions. The current research on spontaneous mathematical focusing tendencies relies on a wide range of methods for measuring spontaneous mathematical focusing. Many of these methods require carefully controlled conditions, while others aim to provide more ecologically valid, but possibly less controlled, observations. The disparate nature of methods



for measuring spontaneous mathematical focusing tendencies has a dampening effect on the ability to accumulate consistent information on the fundamental questions described above.

The E-CER would center these methodological priorities, especially in how they relate to the nature of spontaneous mathematical focusing tendencies and their contributions to mathematical development. By bringing together the main contributors in the field, all of whom are developing measures of different spontaneous mathematical focusing tendencies, the E-CER would aim to develop a coherent framework for the conceptualization and measurement of spontaneous mathematical focusing tendencies. In doing so, the E-CER aims to develop a common set of experimental and observational tasks, which would serve as foundations for future studies.

E-CER Members

Jake McMullen is Associate Professor of Mathematics Education at the Department of Teacher Education, University of Turku. His research focuses on individual differences in mathematical development and learning environments aimed at promoted flexible mathematical skills and knowledge, including spontaneous mathematical focusing tendencies. He, along with fellow E-CER members Minna Hannula-Sormunen and Lieven Verschaffel, edited a recent special issue of Mathematical Thinking and Learning on spontaneous mathematical focusing tendencies.

Minna Hannula-Sormunen is Professor of Education at Department of Teacher Education, University of Turku. Her research focuses on early and later mathematical development and how it can be supported at day-care, preschool, and school contexts, by games, as well as in everyday surroundings. She teaches university students in early education and primary school mathematics and develops online in-service trainings for teachers and professionals and different learning environments for children and students.

Camilla Gilmore is Professor of Mathematical Cognition at Loughborough University, UK, and co-director of the Centre for Mathematical Cognition. Her research is focused on understanding how mathematics skills develop with particular attention to early years development.

Melissa Libertus is Associate Professor in the Department of Psychology and a Research Scientist at the Learning Research & Development Center at the University of Pittsburgh (USA). Her research interests center around the question of how children learn math and what



role parents play in shaping children's acquisition of math skills. She is particularly interested in foundational number skills such as children's ability to approximate numbers and how these foundations help children acquire mathematical abilities. She uses behavioral methods, experimental and observational research designs, and neuroscience techniques (EEG/ERP, fMRI) to study these questions.

Michèle Mazzocco is Professor of Developmental Psychology at the Institute of Child Development at the University of Minnesota. Her research focuses on individual and developmental differences in numerical cognition in children and adults; how individual differences in children's numerical, linguistic, and executive function skills interact to influence mathematics achievement in the early school years; and relations between features of informal early instructional materials (e.g., games, books, toys) and young children's emerging number concepts.

Wim Van Dooren is Professor at the Faculty of Psychology and Educational Sciences (KU Leuven, Belgium). He teaches educational psychology, mathematics education, and statistics courses to students in educational sciences and to students in speech therapy and audiology sciences. His main research interests include mathematical problem solving, numerical cognition, conceptual change, and education in other STEM related disciplines (statistics, physics, astronomy).

Jo Van Hoof obtained the degree of Doctor in Educational Sciences at the University of Leuven, Belgium in 2015 and currently works as a senior researcher at the University of Turku, at the department of Teacher Education. The main topic of her research is learners' mathematical development.

Lieven Verschaffel is full professor at the Center for Instructional Psychology and Technology (CIP&T) at the University of Leuven, Belgium. His main research domain is psychology of mathematics education, and, more specifically, early and elementary mathematics learning and teaching. Together with other CIP&T members, he investigated various aspects of children's spontaneous mathematical focusing tendencies during the past decade.

Arnaud Viarouge is an Associate Professor of Developmental Psychology in the Laboratory for the Psychology of Child Development and Education (LaPsyDé), at the University of Paris. His work focuses on the development of mathematical cognition. Specifically, his current



studies investigate the role of preverbal numerical abilities, as well as more domain-general abilities, in the development of math learning."