Introduction

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The POEM Conference

The sixth Perspective on Early Mathematics learning between the poles of instruction and construction (POEM) conference was held in Bari, Italy 20–21 May 2024. The first conference at Frankfurt am Main, Germany, in 2012. POEM was initiated by Götz Krummheuer to provide a space to continue discussions amongst predominantly European early childhood mathematics researchers, about the role of construction and instruction in how young children engage with and learn mathematics. This distinction can be connected to the two approaches to early childhood recognized by Bennett (2005), 20 years ago. The first approach focuses on preparing children for school, while the second approach focuses on children developing through play and exploration. Since then the discussions have continued at conferences in Malmö, Sweden, in 2014, Karlsruhe, Germany, in 2016, Kristiansand, Norway, in 2018 and in Gothenburg, Sweden, in 2022. Therefore, every other year, POEM brings together researchers within the field of early childhood mathematics education to exchange current research findings and to collaborate and discuss new ideas. The latest iteration of the conference was held for the first time in Italy, at the Department of Education, Psychology and Communication Sciences of the

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University of Bari Aldo Moro. The conference gathered more than 50 researchers and included 22 presentations.

The POEM conferences remain small, with participants being those who had previously participated or those who asked to be invited. The smallness of the conference provides adequate time for discussions of each presentation. Presenters are asked to prepare a conference paper which is distributed to all the participants with an expectation that it will be read before the conference. After each conference a book has been published by Springer, in which the presenters expand on their presentations, based on the conversations which were held at the conference. The subsequent book chapters were all peer reviewed.

The conference also had two keynote speeches presented by Professors Anna Baccaglini-Frank (University of Pisa, Italy) and Associate Professor Iliada Elia (University of Cyprus). Anna Baccaglini-Frank's lecture focused on a topic gaining considerable attention in early childhood mathematics education, that of how multi-touch technology can support the development of number sense in preschool-aged children. As can be seen in her chapter in this book, she described how different apps, each of them designed to develop a specific aspect of number sense through dynamic, embodied interactions. Her lecture was based on two research studies that explored the connection between the development of number sense and the use of the fingers. In both studies, this relationship is closely tied to specific digital apps (Fingu, Ladybug Count, and TouchCounts), and how the teacher or the researcher as an educator mediator, supported the construction of number sense. Thus, the approach taken in this chapter was one of highlighting the instructional approach to young children's learning of mathematical understandings.

Iliada Elia discussed early geometrical thinking and learning, from different research perspectives. In her keynote, she reflected on the significance of culturally responsive pedagogy and the importance of contextualizing mathematical experiences within children's everyday lives. Elia advocated for empowering teachers to listen deeply to children's mathematical expressions, positioning children not merely as learners but as co-constructors of mathematical knowledge. Her lecture can be considered as promoting understandings about the importance of young children's construction of mathematical knowledge.

The call for papers included several themes, which could be responded to from either the construction or instruction approach which was the underlying aim for having early childhood mathematics researchers discuss differences and similarities in their research. The themes were:

- Mathematics learning, development, teaching, instruction and education in the early years
- Early Childhood Education and Care practices and contexts for mathematics learning
- Early childhood teachers' professional development
- Children's perspective and the role of play in early mathematics education
- Theoretical perspectives on early mathematics education
- Methodological views in research on early mathematics education

The chapters included in this volume, followed a structured review process. Both an internal reviewer and an external reviewer to the book were asked to review each chapter. The external reviewer was a researcher with recognized expertise in the field of early childhood mathematics education. Reviewers were asked to provide detailed feedback to the authors, who were then given the opportunity to revise their manuscripts accordingly. After the revisions, when needed, a further round of revision was requested. This process ensured the scientific quality and coherence of the contributions, while also respecting the individual perspectives and research approaches of the authors.

The Chapters in the Book

From the latest POEM conference, the kind of papers which were accepted from presentation was expanded from being purely empirical-based to also include developmental papers. This was in part a recognition of the collaboration work being done particularly in Italy, but also in other places between researchers and teachers to engage young children in mathematical thinking and doing.

The chapters represent a varied approach to mathematics education in early childhood, which includes the first year of schools as well as Early Childhood Education and Care (ECEC) institutions, such as kindergartens and preschools. The majority of the studies were qualitative, but with a few studies including statistical analyses of quantitative data, such as Gasteiger and Benz and Vee et al.

In this book, many of the chapters discuss the planning and implementation of interventions, in which specially-developed activities or games were used with children, generally with the aim of understanding their mathematical sense making. For example, in Italy, Casi et al. had developed a version of the game Memory to evaluate children's use of spatial language. The rules of the game proved quite difficult for the children to follow as it required them to logically work out what cards to remove based on the answers they received for different questions. In Germany, Reuter and Benz used a well-known book as a starting point for having children reason about how much food was eaten by a caterpillar during the weekdays compared with the weekend, with a focus on comparisons of amounts. Activities were also designed and implemented to determine children's reasoning, such as by Markken et al. who investigated children's reasoning about fairness by designing an activity in which a number of biscuits had to be shared with some stuffed animals. In a similar study in Germany, Wiggelinghoff and Peter-Koop investigated understandings about division with remainders of students in their first year of school. The children were interviewed about their solutions to different division problems, with remainders to see how the concrete materials used to illustrate the problems affected the kinds of responses the children gave. These examples, illustrate the different mathematical foci that were the focus of the investigations.

Also in Italy, DiPaola et al. developed a game that could contribute to kindergarten children's understandings about natural numbers. This game had several parts

and supported children to develop an understanding of how the ordering of quantities and the use of digits to represent those quantities could be used to solve certain problems. In Sweden in a study by van Brommel et al., 6-year-old children's representations of their solutions to a combinatorics problem were analysed. The responses showed that the majority of the children were able to adopt a systematic approach to finding all the solutions, although a few children misunderstood the problem.

Although the majority of the work was about how children learnt or used specific mathematics, there were also investigations that focused on how children interacted with others. For example, Acar Bayrakta and Brandt investigated how a multilingual child watched and made use of the interaction between his grandmother and his older brother in regard to engaging in block play. Similarly in Switzerland, Ott et al. describe a study with a multilingual kindergarten child and how they used different languages and other linguistic resources to communicate in the kindergarten and with a parent about the placement of eggs in an egg carton. Both studies highlight how children engage with mathematics in multiple contexts and can learn and chose the ways that they want to communicate their understandings.

As was the case with Reuter and Benz, Mellone et al. used a story as a basis for an activity with 5–6-year olds. In Mellone et al.'s case the aim of the activity was to stimulate children's interactions in relationship to proportional amounts. This task was more open-ended that of Reuter and Benz, as it prompted a more inquiring interaction, rather than one which focused on how children reasoned towards finding a specific response. These two studies show how similar materials, in this case stories, can be used to support different kinds of interactions.

In other chapters, the focus was on how mathematical understandings developed across time or relied on children being introduced to specific critical aspects of a concept so they increased their understanding of that concept. For example, as a result of work with teachers, Robotti and Boscolo developed a learning trajectory for children from kindergarten to Grade 2. They looked at how children gained understandings about particular aspects connected to the processes and products of measuring. In a Norwegian study, Bjørnebye focused on how one child engaged with a set of activities that required them to use different representations, including with their body, to identify and gain the key aspects of visual patterns. In contrast, Lüken wrote in her chapter about the non-patterns that German children produced when playing with different concrete materials and everyday objects. The identification of the features of the non-patterns is discussed in relationship to how they could inform understandings about children's development of pattern understandings. In a study of 7-year old children posing and solving two step arithmetic problems, Fosse et al. examined differences in the representations of the problems in relationship to mathematical modelling. Although a very limited number of examples were analysed, the child who was able to conflate two potential rounds of the modelling cycle into one problem solution, did so at the loss of the everyday context in which the problems were set. This has insights into developing children's understanding of two-step problems in everyday contexts.

The materials or assessment materials that are provided to young children were also investigated in some chapters. For example, Manolino et al. analysed the value of Cubarithim for blind students learning how to do two column addition problems. Although the material provides some possibilities for manipulation that can support doing two column addition, the authors raise issues about how the material can also hinder children's learning. In another paper by Marx et al., the process was described for developing a digital resource to support young children's understandings about part/whole. The focus was on what could be learnt about how digital resources could be collaboratively designed by people with different professional backgrounds, in particular mathematics educators and software developers. Furness et al. identified the mathematics in the game design processes of preservice teachers. Although the games mostly focused on understandings about counting and problem solving, other mathematical understanding could potentially be developed by the children playing the games, highlighting the support that teacher educators might need to develop in their ECEC teacher education courses.

Evaluations of assessment materials that could be used with young children in the normal course of ECEC were also discussed in two chapters. Gasteiger and Benz looked at whether two everyday activities in ECEC, reading a story and playing a game, about placing eggs in egg cartons, could be used to assess young children's number knowledge. They found that the children's understanding identified in the assessments based on these everyday activities gave similar results to those of more formal tests. Assessment activities that were based on everyday activities seemed to fulfil the needs expressed by ECEC educators to find out about the mathematics that the children in their care knew. Ringvold and Skorpen also evaluated three different sets of assessments of young children's knowledge of cardinality that were based on observations. They evaluated observation assessments from different perspectives to determine the different aspects that they could fulfill. Two of the assessment had originated in Norway while the third one was from Germany. As they did not examine the assessment being used in ECEC, they considered that cultural differences may have limited their evaluations.

Apart from children, there was also some studies that focused on the knowledge of preservice teachers. Along with the study of Furnes et al.'s study about preservice teachers' games, in Germany, Sprenger investigated school students and preservice teachers' knowledge of quadrilaterals to see if they shared the same misunderstandings. The results showed that understandings of quadrilaterals increased with age but there were still some preservice teachers who were not able to identify appropriate quadrilaterals from a set of shapes. Vee et al. undertook a mixed method study on the views of preservice teachers in Norway and Sweden about how to use digital tools to support children's engagement with mathematics. The differences in the survey results across countries were minimal, suggesting that even though there were different public discussions about young children's use of digital devices, these seemed to have had a limited effect on how preservice teachers considered they should be used.

As can be seen from this brief synopsis of the chapters in the book, early childhood mathematics education in Europe is flourishing. It also shows that there are a

number of overlaps in approaches and foci, regardless of the country in which studies are undertaken. This provides rich possibilities for further research discussions.

What Is Missing for the Next POEM Conference?

The studies described in this book do not include much focus on very young children, as there had been in earlier POEM conferences. Lüken's study is the exception as it included three 1-year olds and 17 2-year olds, as well as older children. Although there are now more studies about mathematics education in the first few years of school, at the next conference it would be interesting to also consider how very young children relate to mathematics, given that in many countries curricula for ECEC do not exempt these children from engaging with mathematical ideas.

The other possibility that could be considered to be missing is that of cross-country or cross-cultural studies. As noted in the previous section, there are overlaps in interests and foci but there was only one study, Vee et al., that involved a cross-country analysis. Perhaps one of the possibilities that could be promoted for the next conference is that of doing research across contexts.

When POEM was first established the main aim was for researchers to engage in discussions about instruction and construction in relationship to young children engaging with mathematical ideas. Most of the chapters that were originally presented at the sixth POEM conference were based on how children engaged with activities designed and implemented by teachers and could be considered as related to how instruction connected to children's learning and using mathematics. Lüken's chapter is the only one which investigated what children did when playing without clear instructions, although the researcher had chosen what materials should be made available to the children. It may, thus, be the only study which investigated what mathematics children show when they explore in their play and, thus, construct their own understandings.

It seems that with the turn to focus on the teacher's work and the focus on intervention studies, there has been a turn away from exploring what children can do by themselves based on their own interests. Having more understandings about children's own explorations is likely to better inform the work of teachers and the design of intervention studies. It is only when the two poles of instruction and construction are brought together that young children's learning can be improved in relationship to early childhood approaches based on Bennett's (2005) social policy pedagogy approach as well as the preparation for school.

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Reference

Bennett, J. (2005). Curriculum issues in national policy-making. *European Early Childhood Education Research Journal, 13*(2), 5–23. https://doi.org/10.1080/13502930585209641