

Introduction

This monograph is a report on a 4-year-long multisite longitudinal study in which we studied children's thinking and learning about geometric measurement (i.e., length, area, and volume). The Children's Measurement research team, as funded by the National Science Foundation between 2007 and 2012, completed the research reported in this monograph. During that time, our work had two emphases. The first and major emphasis was the study of the developing knowledge of continuous quantity in geometric measurement contexts of children from prekindergarten (pre-K) to Grade 5. The second emphasis was a retrospective accounting of the research methods and processes that we used to clarify and revise learning trajectories (LTs). Members of our research team at the Northeast site worked with the same group of children from pre-K to Grade 2, and members of our research team at the Midwest site worked with another group of children from Grade 2 through Grade 5.

ORGANIZATION OF THE MONOGRAPH

We present our findings with an introductory section and four subsequent sections: (a) background information about our project, including subsections on theoretical perspective, design, and participants in Chapter 1; (b) length in Chapter 2; (c) area in Chapters 3 through 6; (d) volume in Chapters 7 through 10; and (e) reflections on the work as a whole in Chapter 11. Our organization for the monograph follows a geometric progression from length to area to volume. We systematically present research findings to support our primary research questions addressing these three aspects of spatial measurement. We have already published many of the results on length in other venues. These findings, however, are foundational to all the other sections; therefore, we present a summary of our results to support our assumption that a generalizable LT is achievable, along with new findings and perspectives. We then introduce area and volume and present the findings for the early childhood and primary grades in one chapter, as well as the findings for the middle and later elementary grades in another. In the last chapter in each of these sections, we synthesize the findings to present implications regarding a revised LT, first for area and then for volume measurement.

Both the area and volume sections substantiated the usefulness of the LT construct and in addition revealed crucial extensions and refinements of the LTs. Specifically, we clarify how children learn and apply measurement knowledge in the early years (pre-K through Grade 5), in addition to exploring the development of children's cognitive abilities (e.g., spatial thinking, proportional reasoning) in understanding and using measurement strategies. In the monograph's final section (Chapter 11), we reflect on the work as a whole; present perspectives and conjectures on theoretical and methodological issues surrounding our efforts to conduct longitudinal research on LTs; and comment on the relationships among length, area, and volume measurement LTs.