Contents

FOREWORD

Science during the preschool years has been a neglected aspect in the science education literature. Although every student at one point is a preschool child, only 12 of the 6017 articles that the Thomson ISI Web of Science lists for the four science education journals in its database have "preschool" as an identifier (as of February 2011). Already a decade ago, the authors of *Re/Constructing Elementary Science* (Roth et al. 2001) note that in some jurisdictions there are no formal science education experiences planned for primary school. Yet, two of the co-authors of this volume as well as a small number of other scholars around the world (e.g., M. Fleer) know that there is exist both interest in and needs for more effort to develop curriculum and teacher education programs for the preschool years.

We perceive one of the major problems for a proper treatment of science in the preschool years to come from the reigning epistemology. Despite the tremendous work that he has done for understanding child development, the Swiss psychologist Jean Piaget also has hindered the evolution of an understanding that is better suited in understanding young children in the context of their own world. Thus, Piaget viewed children through the lens of mature science and therefore tended to record what children cannot do. Moreover, from a constructivist perspective, science concepts are abstract, requiring levels of thought that Piaget theorized to emerge only later in the life of a student. It is from this perspective understandable to argue science education to begin later rather than earlier.

A very different perspective derives from the work of cultural-historical activity theorists, who, since Vygotsky, have assumed that any higher cognitive function existed *in and as social relation first.* Once we accept this perspective, there is no limit to how early we may begin to involve children not in mere play but in forms of relations that subsequently exist as the higher psychological functions. A recent publication showed that already at the age of two and three years, societal relations exist in which classifications of color are enacted (Roth 2011a). Another study shows that even children as young as about 1 year participate in activities where biological features are made relevant (Roth and Pozzer-Ardenghi in press). Cultural-historical activity theory therefore constitutes an appropriate framework

for analyzing preschool children's participation in science learning experiences. As we show in this book, the theory also provides an appropriate framework for planning and enacting preschool teacher training and for planning curriculum both at the local level and through international collaborations.

The purpose of this book is to articulate a cultural-historical activity theoretic perspective on learning science generally and on learning science during the preschool years specifically. This perspective is a concrete example of a materialist dialectical approach, which is concerned with understanding phenomena in movement, that is, it is concerned inherently with (individual, historical) development, learning, and growth.

Our collaboration began when two of the authors Maria Inéz came for two extended stays to Victoria, Canada, to work with Michael. Chapters 4 through 6 are the result of this collaboration, which involved a lot of collective data analysis in our research laboratory and subsequent writing and discussing. The collaboration was extended during repeated stays of Michael in Ioannina, Greece, with Katerina, including a stay during the LIGHT workshop that is the focus of chapter 9. During those stays, we took time to work through theoretical issues, which Katerina immediately implemented practically in her work with the pre-service teachers in her program. The remaining collaborative work took place via email, which allowed us to work together on developing the chapters in the way presented here.

Earlier versions of chapter 4 and chapter 5 had been published in *Cultural Studies of Science Education* (Goulart and Roth 2010) and *Journal of Curriculum Studies* (Goulart and Roth 2006), respectively. We thank the publishers for the possibility to include the substantially revised versions in this book. An earlier version of chapter 6 had been included in *Participation, Learning, and Identity: Dialectical Perspectives* (Roth et al. 2005), to which we hold the copyright.

In this book, we sometimes quote from texts written in languages other than English. In this case, the translations are our own, though these are generally checked against a published translation whenever available.

January 2012
Brisbane, QLD, Australia
Belo Horizonte, Minas Gerais, Brazil
Ioannina, Greece