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Foreword

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FOREWORD

The authors in this Special Issue of *The Mathematics Enthusiast* make an important contribution to the knowledge base in mathematics education. They examine a body of research on a significant issue. They review what we know and make suggestions about what we need to know. They move the field forward by taking the time to look back and learn.

Specifically, the authors examine the literature on prospective elementary teachers' (PTs) mathematical content knowledge in several domains: whole-number concepts and operations, fractions, decimals, algebra, and geometry and measurement. They situate their review in three time periods: historical (prior to 1998), current (1998–2011), and a view to the future (from 2012 on).

The warrants for doing this review are many, but the most concerning is the *ongoing* problem of the limited mathematical content knowledge of PTs. Coupled with the recent adoption in the United States of more rigorous mathematics in the *Common Core State Standards* (<http://www.corestandards.org>), the stakes are high. An example from a recent lesson I taught on measurement illuminates how dire the situation really is. *Area* is a topic that is addressed in some depth in the standards for third grade in the Common Core. I was teaching a model lesson on measurement to a group of somewhat high-achieving fourth graders. The standard asks that students *apply the area and perimeter formulas for rectangles in real world and mathematical problems* (Common Core State Standard MCC4.MD.3). An assumption of understanding from third grade is obvious, but I questioned if the understanding was there. I drew a simple 5×7 rectangle on the board and asked the

students to name the figure and to tell me what the numbers meant. One young man suggested that “you can multiply and you get the area.” Another child disagreed and said, “No, that’s the perimeter.” After some discussion, the class agreed that you multiplied to get the area, but **not one student** could tell me *why* we multiply or *what the 5 and the 7 stood for*. I showed a video of the lesson to the PTs in my methods class and stopped at the point of asking the “why” questions. Only one PT raised her hand indicating she thought she could answer the questions. They all agreed if they were teaching the class they probably would have been satisfied if the students knew to multiply to calculate area. This is simply not acceptable. If we are to improve the mathematical content knowledge of elementary students, we must improve the mathematical content preparation of their teachers. We need to stop and take stock of what we know about this issue and what we need to know. The articles in this volume provide an important first step in this direction.

Another concern to me is who may actually read this work. There is no doubt it should become a dog-eared document for Ph.D. students working on research on mathematical content knowledge of PTs, or a wonderful resource for various mathematics education doctoral courses. My hope, however, is that it would become a regular part of course packets for graduate teaching assistants and part-time instructors teaching mathematics content courses for elementary teachers, and that it would actually find its way to the desks of faculty teaching those courses. Wouldn’t it be helpful if the instructor of a Geometry for Teachers course understood that there is solid research showing that many PTs aren’t able to articulate basic differences in quadrilaterals (see “Mathematical Content Knowledge for Teaching Elementary Mathematics: A Focus on Geometry and Measurement,” this volume) or that PTs generally do not understand the difference in

partitive and quotative division problems and are much more likely to use partitive models in division situations (“Mathematical Content Knowledge for Teaching Elementary Mathematics: A Focus on Whole-Number Concepts and Operations,” this volume)? We know that journals such as *Teaching Children Mathematics* provide superb examples of research into practice for elementary teachers that impact teaching. The work in this volume could have a similar effect on instructors of mathematics content courses for elementary teachers. Unless that happens, unless this knowledge is shared with all the stakeholders, much of what we have learned and that is so aptly reviewed in this volume will not have a real bearing on the mathematics education of prospective or practicing elementary teachers. I encourage you to read and to *share*.

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