

PREFACE

I recently revisited a classic and exquisitely written textbook for undergraduate mathematics majors. It struck me that when mathematicians write for each other — or for our intellectual heirs — we take enormous pride in the culture and literary traditions of our discipline. Outsiders rarely encounter this side of our subject. Instead, most of what the general student population sees, from kindergarten through the bachelor's degree, focuses on common core standards, formative assessment, summative assessment, and other constructs more commonly associated with accountability than with intellection. Whether students are learning what we're teaching may be an interesting question, but many of us who care about the culture and traditions of mathematics may also wonder whether we're actually teaching it.

In this volume, the third in an important series, experts associated with the WISDOM^e project have examined the way we teach mathematics to young people, what mathematics really is, and the way young people best learn the subject. While it seems obvious that we should link the three questions, one can make a strong case that we don't, at least not with the nationwide consistency required to place our students among the best in the world. All who care about this problem owe sincerest thanks to Professors Bob Mayes and Larry Hatfield for their leadership in being part of its solution.



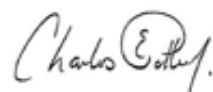
Myron B. Allen
Provost and Professor of Mathematics, University of Wyoming
April 2, 2013

In my preface to the second WISDOM^e monograph, I was thrilled that the contributions focused on developing the relationships necessary to drive a STEM integrated approach to teaching that emphasized teaching in context. Scholars, researchers, and practitioners at all levels are increasingly mindful of the critical importance of STEM integrated learning environments. As this third monograph comes to print, the authors are sharing practical advice for teachers of students at all levels regarding quantitative reasoning (QR) as a pivotal element of a STEM integrated learning environment. Articles from internationally recognized scholars establish the relevance of QR within mathematics and science education, new technologies, place-based pedagogy, and opportunities for positive affective impacts on learning. Led by Dr. Larry Hatfield, our Wyoming Excellence Chair in Mathematics Education, we are proud to share this monograph dedicated to the potential impact of QR knowledge and skills on academic and career success. I hope you enjoy this volume!



Kay A. Persichitte
Dean/Professor, College of Education, University of Wyoming
March 28, 2013

When Dr. Robert Mayes, our Professor of Education and Director of the Georgia Southern University Interdisciplinary Institute for STEM Education (I²STEM^e), proposed co-hosting the International STEM Research Symposium with the University of Wyoming's Dr. Larry Hatfield, we were committed within the first few minutes. The need to further STEM education is a nation-wide effort, but the critical need to integrate the disciplines into a cohesive learning environment almost always goes unmentioned by individuals outside of our STEM scholars. The success and continuation of the WISDOM^e project has established an active and robust research collaborative of STEM scholars and practitioners with a focus on quantitative reasoning (QR). Through the WISDOM^e project, the University of Wyoming and Georgia Southern University are providing practical solutions to enhance and apply STEM learning environments. This monograph, the third WISDOM^e monograph in the series, elevates QR as a catalyst in mathematics education and provides fundamental concepts of its application, presenting mathematics as a true lived experience.

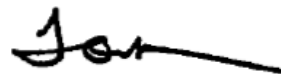


Charles E. Patterson
Vice-President for Research & Economic Development, Georgia Southern University
May 2, 2013

Through this monograph you will see that interest in quantitative reasoning and the research that supports advancement in our understandings about quantitative reasoning are on the rise. No longer solely a part of mathematics curricula for the elite, quantitative reasoning is recognized today as an essential component of the educational experience of all students. The centerpiece of this educational experience is problem solving that involves the quantification of information, the interpretation of quantitative entities, the construction and applications of mathematical models, and much more.

The chapters of this monograph acknowledge the rich history of the construct of quantitative reasoning, but more importantly provide a glimpse of its promise for future research and practice. Chapter authors discuss the role of technology in advancing quantitative reasoning, learners' understanding of size and scale, and the importance of place and time as well as scaffolded instruction on the development of quantitative reasoning. Moreover, the chapters reflect cutting-edge thinking about quantitative reasoning and the significant positioning of quantitative reasoning within the Common Core State Standards-Mathematics and the Next Generation Science Standards. Cutting across all the chapters of this monograph is the idea that quantitative reasoning serves as the glue that unites science, technology, engineering, and mathematics as STEM.

The symposium that gave birth to this monograph was the brainchild of Professors Larry Hatfield and Robert Mayes. Larry, with whom I worked and from whom I learned for 20 years at the University of Georgia, and Robert, a valued colleague that I successfully recruited to Georgia Southern University in 2011, deserve our thanks and congratulations for bringing the symposium and monograph to fruition. This work stands as a testament to their ingenuity and leadership and as a guide for those wishing to learn about and advance understandings of quantitative reasoning.



Thomas R. Koballa, Jr.
Dean and Professor of Science Education, Georgia Southern University
May 8, 2013