

LIMIN JAO & NENAD RADAKOVIC (Eds). *Transdisciplinarity in Mathematics Education: Blurring Disciplinary Boundaries*. Cham, Switzerland: Springer International. (2018). 278 pp. \$109.00 (hardcover). (ISBN 978-3-319-63623-8)

Transdisciplinarity has emerged in recent years as a way of intentionally merging disciplines and creating new knowledge to solve complex problems (Bernstein, 2015) such as issues related to climate change and the environment (Groß & Stauffacher, 2014), public health (Lawlor, Kreuter, Sebert-Kuhlmann, & McBride, 2015), and education (Matei, 2011). Limin Jao and Nenad Radakovic explore transdisciplinarity within the context of mathematics education in their edited volume, *Transdisciplinarity in Mathematics Education: Blurring Disciplinary Boundaries*. Though a universal working definition of transdisciplinary remains elusive, Jao and Radakovic draw from Klein's (2013) framework of transdisciplinarity to organize their book into five clusters: interdisciplinary approaches in mathematics education; complexity, difference and/in mathematics education; mathematics for the common good; Indigenous and transformational mathematical knowledge; and re-formulating, re-presenting, and re-defining mathematical knowledge and the curricula. In doing so, they take readers on a journey through different levels and expressions of transdisciplinarity in mathematics education, spanning K-16+ grade levels. The first cluster explores interdisciplinary ways of teaching mathematics, including Islamic art and geometry, music for deeper mathematical and musical understandings, and storytelling for concept attainment. The second cluster offers a glimpse into the complexity of a transdisciplinary approach to authentic problem solving within and across the constraints of mandated curricula. The third cluster calls attention to the politics of mathematics, and the necessity of a transdisciplinary approach to address the needs of an unjust world. The fourth cluster examines transformative learning through Indigenous ways of knowing and learning, as well as the prevalence of gender biases. Finally, the last cluster showcases transformative knowledge building through chapters on embodied learning and metaphors in elementary mathematics, the fusion of dance, movement, and mathematics to teach complex topics, and a transdisciplinary collaboration between a secondary mathematics teacher and a graffiti artist.

Reading this volume as a whole forces audiences to view transdisciplinarity from different angles. The book opens with chapters related to art as a means of engaging students in the transdisciplinarity in mathematics. From Karadag's exploration of using Islamic art to teach Euclidian geometry to An, Tillman, and Lesser's analysis of music as a means of deepening conceptual understandings in mathematics, one sees the way cognate subjects can be taught in tandem with mathematics. Jagger then goes beyond subjects to frame transdisciplinarity through the metaphor of a "learning garden" that students tend to, in order to demonstrate how a complete breakdown of disciplinary barriers was crucial in students' being able to solve a problem. In Part 4, Wiseman and Lunney Borden call into question the admittedly Western notion of transdisciplinarity, and rightfully acknowledge the tradition of holistic approaches to problem solving (already) done in and by Indigenous communities / peoples from time immemorial, provoking the reader to rethink the meaning of transdisciplinarity. Thus, one's understanding of transdisciplinarity is interrogated and evolves from chapter to chapter.

Though the subject matter of the volume is diverse in nature, the perspectives shared primarily come from researchers in North America and, in one case, from Turkey. Transdisciplinary approaches would benefit from more transnational perspectives, particularly given the diverse nature of mathematics teaching and learning across the world. Indeed, Blackman and Belcher's chapter on the development of a mathematics cultural resonance approach — one which they specifically use and develop with and for Black communities — suggests the need for more perspectives on the many ways transdisciplinarity can, and should, be approached and implemented in a diverse world. Chapters that move in this direction include that by Radakovic, Weiland, and Bazzul, who suggest the need for integrated ways of approaching the ecological, social, and political complexities we currently face, while Hall's chapter reminds readers of the pervasiveness of gendered perspectives on mathematics aptitude and learning in Western society.

A consistent highlight throughout this text is the pragmatism and explicit strategies that authors provide in every chapter. For example, in Luedtke and Sorvaag's chapter "Using children's literature to enhance math instruction in K-8 classrooms," the authors develop and share a chart for educators who are seeking to incorporate literacy in their mathematics classrooms. Jao, Proietti, and Kobiela provide a model for a transdisciplinary collaboration in mathematics, outlining how a secondary mathematics teacher and a graffiti artist moved from hesitation and distrust to developing new knowledge structures for themselves. Consequently, it becomes evident that the audience for this edited book is not only mathematics education researchers, but teachers, instructional coaches, school leaders and curriculum developers at any level. As a secondary mathematics teacher, I was pleasantly surprised to read about successful transdisciplinary approaches for teaching complex mathematics, as

in Susan Gerofsky's exploration of movement, dance, and mathematics. While it is tempting to assume that a transdisciplinary framework can only be used at the cost of complex mathematics, Gerofsky shows that the potential for deepened understandings and the development of new knowledge is imminently doable through movement and dance, provided an intentional erasure of disciplinary lines is undertaken. This is underscored by Nurnberger-Haag's chapter investigating elementary students' physical movement as a means of concept attainment when learning about base-ten numbers, again suggesting the promise of transdisciplinary approaches for deep learning regardless of age.

In short, this edited compilation demonstrates the efficacy of and potential for various transdisciplinary approaches in mathematics education. While this text convincingly articulates the need for transdisciplinarity in mathematics education, it also acknowledges the challenges of implementing such a dynamic, yet elusive approach. From the omnipresent "math wars" discussed by Vaschyshyn and Chernoff, to Davis's chapter on the curricular constraints that silo disciplines, it is clear that intentionality and persistence is required to effectively use this approach. Nevertheless, Jao and Radakovic create a narrative arc in this volume that leads readers through these very complexities, and ultimately, towards possible successful enactments of transdisciplinarity in mathematics. This volume will no doubt prove to be an invaluable resource for educators, policymakers, and professional development leaders seeking to arm students with the ability to tackle the complex problems of our day.

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