Proposal for Mathematics and its Connections to the Arts and Sciences (MACAS) 2025 Symposium

Proposal Title: Inviting Four R's in Mathematics: Exploring (Trans-multi)culturally Responsive Cross-curricular Connections

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Presentation: Remotely, Virtual Presentation

Connections with the 2025 MACAS 2025 theme: My presentation aligns with the MACAS symposium's theme of *Circles of Resonance in Mathematics, Sciences, and Arts*. In this presentation, I will share examples of art-infused, environmentally informed cross-curricular understandings of mathematics that may relate with following conference topics:

- Curricular approaches integrating mathematics and sciences.
- The role of arts, sciences, and humanities in understanding mathematics in everyday situations.
- Historical and intercultural dimensions of studying mathematics.
- Critical issues in STEM and STEAM education.
- Mathematical creativity from interdisciplinary perspective.

Type of Communication: Completed research and practical examples of interdisciplinary teaching and learning.

Proposal Description:

Mathematics taught as a factual, acultural, value-free school subject has been known to cause anxiety and fear among many students in multiple cultural contexts (Abdulrahim & Orosco, 2020; Egbo, 2009; Raisinghani, 2016a, 2021). This trauma triggered by fearful experiences of learning school mathematics has been known to not only negatively affect student

achievement and problem-solving abilities in childhood, but also cause long-lasting impacts affecting one's relationship with/in mathematics even in adulthood (Ramirez et al., 2016, 2018). The resulting influence of such traumatizing learning experiences can solidify one's identity for life as "I am NOT a math person, period!" No wonder, mathematics is considered by many as a "best forgotten (and often painful) requirement of school" (Ezeife, 2003, p. 180). This begs the question: What severs the relational aspects of mathematics and makes it a painful learning experience for many students?

The position of mathematics as a "gatekeeper" that plays a key role in determining one's future career, and thereby, their status and power in our contemporary economy-driven society, often results in focus on mere academic achievement in schools (Gutstein, 2007; Nolan, 2009). This focus inadvertently creates a deficit-based narrative that characterizes many marginalized students as having "achievement gaps" (Gutiérrez, 2011, p. 23) and labels them as problems that need to be fixed (Ladson-Billings, 2001). This emphasis on academic achievement ignores the necessity of inquiring into contextual realities that may influence students' engagement and interest, and ultimately their success in mathematics. How can we create mathematics learning experiences that focus on building positive relationships with/in mathematics and one's identity? How can we invite responsive learning experiences that may allow one to see the mathematics that is embedded all around us in the human and more than human world? How can we invite learning experiences that cultivate a reciprocal relationship with the land, promote well-being, and empower one to engage with/in learning of mathematics that could invite contributions towards addressing social and ecological justice and bring mathematics for all (Raisinghani, 2016b)? Such inquiries could provide insights that may help in better informing educational environments that welcome critical understandings of mathematics as a culturally informed, value-based human endeavor!

In this critical autoethnographic inquiry (Ellis, 2004; Reed-Danahay, 1997), I will share my teaching and research experiences of witnessing the painful learning experiences of mathematics (and science) students in India, Micronesia and Canada, and my attempts to transform these into holistic, relational inquiries that may transpire love with/in mathematics. Informed by these lived encounters and the perspectives of critical and transformational multicultural education (Banks & Banks, 2010; Keating 2007) and culturally responsive teaching

(Gay, 2010), I have conceptualized a (trans-multi)culturally responsive education framework (Raisinghani, 2018, 2019). Rather than focusing on fact-based, abstract teaching of mathematics that may create alienating and unkind experiences for many students, this framework calls for inviting "student's lived experiences and multiple ways of knowing in mathematics classrooms with relational caring and loving kindness" (Raisinghani, 2021).

In this presentation, I will particularly draw upon the four Rs informed by Indigenous ways of knowing: Respect, Relevance, Reciprocity, Responsibility (Archibald, 2008; Kirkness, & Barnhardt, 1991), and juxtapose these with the four Rs proposed by Doll (2004), namely, richness, recursion, relations and rigor, to share some examples of cross-curricular learning of mathematics that values diversity and alternative forms of knowing (Mukhopadhyay & Roth, 2012). In these examples, I have attempted to invite art-infused, environmentally informed cross-curricular understandings of mathematics that weave Elders' wisdom with the interrelationships among science, technology, society and environment to inform contextualized, mathematics learning experiences that are (trans-multi)culturally responsive.

References

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