THE CHALLENGE OF TEACHING MATHEMATICS "AT THE FRONTIER"

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The metaphor of frontier inspires this WG's topic. Over the past 30 years, research considered at the "frontiers" of mathematics education included a focus on minority/underrepresented populations (e.g., Butler-Barnes, Cheeks, Barnes, & Ibrahim, 2021); technology and digital environments, especially in the context of the developing world (e.g., Srinivas, Bose & Kumar, 2019); and the theories, methodologies, and tools that drive and support such research (Sriraman & English, 2010). More recent "frontiers" include teaching at distance, especially in the context of the Covid-19 pandemic (e.g., Brunetto, Bernardi, Andrà & Liljedahl, 2021), and a general focus on meeting the mathematics and socioemotional needs of every student, teacher, and family (Andrà & Bernardi, 2020; Courtney, Austin & Glasener, in press). Moreover, the metaphor is not new to the PME community, as the theme of PME38 in Vancouver was: "Mathematics Education at the Edge", relating to cutting-edge research as well as to issues with groups that are often positioned at the edge or periphery of educational research such as social justice, peace education, equity, and Indigenous education. In this WG, we aim at reflecting on this multi-faced understanding of "frontiers" and to offer new theoretical and operational ways of dealing with frontiers, from a mathematics teacher perspective.

The goals of this working group will be to: 1) build a shared definition of what it means to be "at the frontier" in mathematics education and identify several current and emerging frontiers ripe for examination; 2) discuss the theoretical/methodological frameworks used by contributing researchers and other working group members to examine teachers' challenges at these frontiers; and 3) establish a network of researchers interested in doing research in and developing/adapting existing frameworks for such contexts.

The first 90-minute slot (Slot 1) will be dedicated to examining how research about "frontiers" emerge in literature, as well as to extend it through three episodes taken from WG leaders' previous research (Andrà & Bernardi, 2020; Brunetto et al., 2021; Courtney et al., in press). Slot 1 unfolds as follows: i) [10 mins] Present ways in which previous PME WGs and RRs addressed the metaphor of frontiers; ii) [15 mins] Introduce three examples of possible "frontiers"; iii) [30 mins] Small group discussions to identify other potential examples taken from WG participants' research, with the specific task of accounting for why each example can be considered as being at the frontier; iv) [30 mins] Share out with the entire WG, each small groups' discussions,

examples and characterizations of "frontiers in Mathematics Education"; and v) [5 min] Conclude with a tentative definition of frontiers in Mathematics Education.

Slot 2 is dedicated to theoretical approaches that support examination of the frontiers in mathematics education, in particular for mathematics teachers who live with them. Slot 2 unfolds as follows: i) [10 mins] Summarise the discussions from Slot 1, as well as provide a definition of frontiers constructed by the WG leaders from the work of Slot 1; ii) [10 mins] Recall the three examples presented in Slot 1 with a focus on theoretical approaches used to analyse them; iii) [30 mins] Invite WG participants to share, in small groups, the theoretical approaches used to analysed the examples provided by them in Slot 1; iv) [30 mins] Share with the entire WG, the theoretical approaches used by participants in each small group, and discuss potential integration of theories; v) [10 mins] Propose to establish a network of researchers willing to continue the work of the WG over the next year.

References

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