WHAT DOES AN INTEGRATED STEM CURRICULUM APPROACH OFFER THE TEACHING AND LEARNING OF MATHEMATICS?

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After working/discussion groups into integrated STEM education at PME conferences in 2017, 2018, 2019 and 2024, questions remain about the benefits of this approach to mathematics teaching and learning. In their narrative review of the literature from 2017 to 2022, Goos et al. (2023, p. 1201) reported it was rare to find studies showing how integrated STEM education helps students develop understanding of mathematics. When such studies do exist, they often also report challenges in curriculum design and/or delivery. One example was provided by Tytler et al. (2024) who reported successful learning outcomes in their interdisciplinary mathematics and science research in primary grades classrooms. While they described "potential learning payoffs" they also reported "multiple challenges for teachers and students in negotiating the interactions of the two subjects" (p. 39). In a similar vein, Honey et al. (2014) argued the need for a "strategic approach to implementing integrated STEM curriculum that accounts for the potential trade-offs in cognition and learning" (p. 5). It would be useful to identify the 'payoffs' and 'trade-offs' to support integrated STEM curriculum design and implementation, particularly for mathematics teachers and leaders.

Some studies have reported greater affective than cognitive benefits for students as they develop an appreciation for the relevance and usefulness of mathematics (e.g., Anderson et al., 2019). Others have recommended a focus on providing rich opportunities for students to develop 21st century skills such as critical and creative thinking, collaboration and problem solving (e.g., Gravemeiger, 2024). Li and Schoenfield (2019) problematize current approaches to teaching mathematics and argue for a new approach of 'making sense' and 'sense making' in the curriculum that can be applied to all STEM subjects through project-based learning and design-based learning. They argue this needs to be accompanied by a change from "what should the teacher do" to "what mathematical experiences should students have for them to develop into powerful thinkers?" (p. 8).

This discussion group will provide an opportunity for further research to be shared and to foster new international collaborative research that supports mathematics teachers' efforts to design and implement integrated STEM curriculum. During our discussions, several questions need to be considered including what is the balance in the curriculum between disciplinary knowledge and cross-disciplinary knowledge, or between content and practices, or between the STEM subjects themselves. If the role of mathematics in

2025. In C. Cornejo et al. (Eds.). *Proceedings of the 48th Conference of the International Group for the Psychology of Mathematics Education*, Vol. X, pp. XX-YY. PME.

the integrated STEM curriculum is as a goal, as a tool, or as an integrative bridge (such as mathematical modelling) (Goos, 2024), what benefits are evident for the learner of mathematics and how does that approach benefit the learner more than a different approach? How can we better support mathematics teachers and leaders as they design and implement an integrated STEM curriculum in schools?

PLAN FOR DISCUSSION GROUP SESSIONS 1 AND 2

30 mins	**Session 1** – Brief introduction, Judy Anderson and Ban Heng Choy
45 mins	Participants share STEM education perspectives to develop shared understandings of research and to raise questions for research agendas
15 mins	Summary of common (existing and/or emerging) themes, topic areas, questions and making connections with scholars with similar interests
30 mins	**Session 2** – Summary of Session 1. Short presentations on research projects from representatives in the discussion group
45 mins	Discussing possible future research collaborations and publications
15 mins	Developing a final set of outcomes for the discussion group and strategies for continued communication and collaboration

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