

# FACILITATING THINKING AND LEARNING IN AND BEYOND THE PHYSICS CLASSROOMS USING RESEARCH-BASED APPROACHES

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I will discuss, using my research in physics education, how research can be used as a guide to develop curricula and pedagogies to reduce student difficulties, and for making physics equitable and inclusive. I will also discuss innovations in teaching and learning methods for physics after the new normal, using my research conducted during emergency remote teaching and lessons learned that can be valuable for innovation in teaching and learning going forward. My research has focused on improving student understanding of introductory and advanced concepts. We are developing research-validated learning tools such as tutorials and peer instruction tools that actively engage students in the learning process. I will discuss how we evaluate the effectiveness of these tools using a variety of methodologies and then describe our research studies that provide guidelines for how to enhance physics by making it inclusive. Finally, I will discuss how a field-tested short intervention was implemented at the beginning of a physics course and how it improved the performance of underrepresented students in introductory physics classes compared to the comparison group.

Proceedings of the IUPAP International Conference on Physics Education, ICPE 2022 5-9 December 2022, page 15, ISBN: 978-1-74210-532-1.