

Editorial of the 2025 Special Issue

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We are delighted to present this Special Issue of the Mathematics Teaching-Research Journal (MTRJ) dedicated to highlighting faculty-led projects across the different colleges within the City University of New York (CUNY). These projects demonstrated the potential to advance STEM pedagogies and to contribute to inclusive STEM teaching and learning. An idea that emerged from the CUNY Innovative Teaching

Academy (CITA) Summer 2023 Institute, this collection showcases the creativity, innovation, and diverse perspectives of educators committed to reimagining pedagogy and fostering equity in STEM education. As guest editors, we are honored to uplift and share the impactful work emerging from CUNY's vibrant academic community.

From Summer Institute to Action: Advancing Equity and Inclusion in STEM Classrooms

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This Editor's Note provides background on the CUNY Innovative Teaching Academy Summer Institute for Equitable and Inclusive STEM Teaching and Learning and introduces the articles featured in this special issue. (pg. 6)



Art Forms: Born Out of Necessity

Urmi Duttgupta

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This collection of artworks expresses the artist's deep passion for mathematics and life's complex balance. As a mathematician who is a woman, she uses artistic expression and intricate patterns to evoke mathematical beauty and feminine strength, celebrating the presence and resilience of women in mathematics. (pg. 15)

Introducing Art into Undergraduate Mathematics Courses at Minority Serving Institutions

Renee Bell, Lehman College of the City University of New York, USA

The recruitment and retention of underrepresented minority students into STEM fields, is a critical goal for educators, particularly in an increasingly tech-oriented world and a diverse society. Research suggests that integrating art into mathematics courses can increase student engagement and broaden participation. Additionally, community-centered intellectual activities, such as such as engagement with art, have been shown to support the success of diverse student populations.

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This article presents two models of integration of art into mathematics curricula. The first model involves a guided tour of an art museum, highlighting mathematical concepts found in artwork from a variety of different cultures. The second model features a student art contest focused on visual representations of mathematical ideas, culminating in an exhibition of the winning pieces. The article discusses the implementation of these models and offers recommendations for future use. (pg. 21)

Integrating Game Play into an Inclusive Computing Project in Calculus Class: Designing and Analyzing Priority Switches for Competing Devices and Apps

Małgorzata Marciniak and Yun Ye

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This study explores the integration of game play into an inclusive, hands-on computing project in Calculus class. The project is focused on designing and analyzing priority switches for applications competing for computational resources on embedded devices such as smart watches and tablets. By engaging students in real-world problem-solving through the form of game play, the project enhances their understanding of mathematical concepts, particularly derivative, while fostering inclusivity in STEM education. The initiative was implemented in a Calculus class with diverse student backgrounds, incorporating structured interventions such as icebreakers, pre- and post-surveys, and interactive lab activities. A key component involved using a hardware emulation setup with an FPGA-based system to simulate communication resource competition. Survey results and informal assessments indicate that the hands-on approach increased student engagement, conceptual understanding, and interest in mathematics and technology. However, some logistical challenges, such as scheduling gaps between theory and lab activities, highlighted areas for improvement. This research underscores the importance of interactive, interdisciplinary learning experiences in promoting student participation and inclusivity in STEM fields. (pg. 39)

Metacognitive Discourse Forums as a Way to Engage Biology and STEM Students in Meaningful Discussions

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The rapidly evolving educational landscape allows, and often demands, the integration of innovative digital approaches into the curriculum. Whether the course is conducted in-person, online, or hyflex, synchronous or asynchronous, the wide range of available digital tools and platforms now offer multi-faceted learning experiences designed to actively engage students. In our biology classes, we used Metacognitive Discourse Forum (MDF), an approach to collective annotation on an assignment, which may help students develop critical thinking, metacognitive skills, and improve academic performance. The article describes the utilization of MDF in our classes and discusses its potential impact for enhancing STEM teaching and learning. (pg. 62)

Professional Development Workshops for Faculty on Addressing Implicit Bias in Computer Science Education

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The "Understanding Implicit Bias" workshops were offered to Science, Technology, Engineering, and Mathematics (STEM) faculty at an urban minority-serving undergraduate institution with a focus on addressing the gender gap in computer science. The workshops aimed to raise awareness of implicit (unconscious) biases and provide practical strategies for addressing them, fostering a more inclusive classroom environment. Analysis of pre- and post-survey responses indicated an increase in participants' awareness of implicit biases in their discipline and a greater openness to taking steps to address them, suggesting the workshops' potential impact on promoting inclusive teaching practices. (pg. 80)

Designing Equity-Focused Pedagogy in Mathematics Teacher Preparation with Digital Data Tools

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This study reflects the implementation of a course module which integrated computing and data analyses. The module focuses on engaging prospective mathematics teachers in the practice of using data sets and analyzing data to answer questions about local Brooklyn schools, and to learn

more about the students and the schools where they do field experience. The module was designed to support prospective mathematics teachers in developing data analytical and critical thinking skills, and to engage them in exploring questions related to student learning opportunity, achievement gap, school segregation, education in(equity), and other social justice issues. During the course module implementation, the teacher candidates explored topics related to school (in)equity and segregation in depth, through texts, data analysis and direct experience. They shared and reflected with others on their findings, and developed a deeper understanding of the topics and questions through a process of collective discussion. The teacher candidates' perceptions of the potential of implementing computing and data analysis in mathematics teaching and learning were mixed. They considered that the use of data analysis can enhance mathematics lessons by connecting them with real-life issues such as poverty rates, student loans, and rising climatic temperature; that is, in helping students make sense of the world around them. They also agreed that it promises to provide relevance to students' personal lives and to introduce social justice issues, encourage a sense of empowerment, and act to increase motivation, which could lead to activism in their communities. However, the overall perception was that this could not be done in the first few years of teaching, as it would require much additional planning. (pg. 98)

Using Digital Tools and Real-Life Interactive Activities to Teach Trigonometric Functions

Lucie Mingla, LaGuardia Community College of the City University of New York, USA

Achieving meaningful educational outcomes requires scalable strategies for mastering mathematical concepts and skills, with student engagement at the core. This paper examines the use of comprehensive, technology-enhanced activities designed to promote active learning and deeper conceptual understanding. Specifically, it focuses on the integration of Desmos, an online graphing calculator, into mathematics instruction. The study explores whether combining Desmos with a hands-on approach to teaching trigonometric functions helps students connect abstract concepts to real-world applications. Findings underscore the effectiveness of digital tools like Desmos in increasing student engagement and improving student performance—particularly in the context of graphing and interpreting trigonometric functions. (pg. 133)