

# STEAM INITIATIVES

*In the Department of Mathematics, Science, and Technology  
at Teachers College*

## WHY STEAM NOW?

In the United States, STEM education has traditionally been viewed as a means to an end – the desire to harness creativity in order to build technologies that would further the nation’s superpower status for national security, strengthen the United States’ standing as superior in terms of global competition, and ensure a pipeline of workers and thinkers prepared to address societal problems. Despite children’s earliest experiences with STEM being playful, child-centered, and engaging, much STEM learning in schools not only becomes disengaging and disinteresting to students, but also becomes divorced from artistic practice. Too often, a recipe-like approach to implementing STEM curricula means that the richness and variety of modes for deep learning that can occur rarely do – especially in under-served public schools.

In the Department of Mathematics, Science, and Technology (MST) at Teachers College, we are driven by a belief in the empowering, experiential, and energizing potential of STEAM education, and committed to a vision of STEAM that is engaging and widely accessible. Starting in 2017, we’ve embarked on a series of STEAM initiatives to explore collaborations across our three programs, and to build on our existing work in STEAM education.

Based on our interdisciplinary research and public engagement efforts, we know that teachers at all levels benefit from seeing how experiential learning can motivate understanding and engagement with STEAM concepts. We also know that these benefits are not limited to educators, and that a wide variety of stakeholders – including practitioners, administrators, parents and, last but not least, youth themselves – are energized by a playful approach to STEAM, centered on meaningful inquiry.

### OUR GOALS ARE THUS TO:

- *engage the wider public around STEAM concepts through open inquiry and experimentation*
- *demystify STEAM and STEAM education, lowering barriers to participation*
- *contribute to educators' pedagogical repertoires and instructional practice.*

## WHY MST?

### *A Rich History of Interdisciplinary Work in STEAM Fields*

In MST, we have a rich history of crossing disciplinary boundaries to facilitate learning and engagement in STEAM fields – a commitment that spans our faculty’s research, teaching and professional development activities. On the research front, MST faculty and student research has explored connections across STEAM domains, including work that examines the roles and uses of technology in fostering science and mathematics learning (e.g. *Anderson, Love, & Tsai, 2014*; *Bumbacher, Salehi, Wieman, & Blikstein, 2018*; *Holbert & Wilensky, 2014*; *Kastens & Rivet, 2008*; *Okita & Jamalian, 2011*); the use of hip hop practices in science education (*Adjapong & Emdin, 2015*); book clubs for science teachers (*Mensah, 2009*); the role of the arts, media, and technology in young people’s identity development and creativity (*Literat, 2012*; *Vasudevan, 2010*), and multiple articles and books exploring STEM for underrepresented populations (e.g. *Marrero, Riccio et al.*), civic engagement (e.g. *Wu & Lee, 2015*) and teacher preparation and professional development (e.g. *Lyublinskaya & Tournaki, 2014*; *Karp & Wasserman, 2014*; *Meier, 2005*; *Price-Dennis & Matthews, 2017*; *Walker, 2005*). Further, there are numerous activities and labs in MST that cross disciplinary boundaries and incorporate STEAM concepts, including STEAMnasium, MathCamp, Science Genius, the Games Research Lab, the Media and Social Change Lab, and the Snow Day Learning Lab, among many others.

\*All italicized names are MST department faculty.

Many of our MST courses reflect a strong focus on STEAM education, again embracing this interdisciplinary perspective. Longstanding MST curricular offerings spanning STEAM disciplines have included the *History of Science and Mathematics Education Colloquium* series; *Teaching Mathematics Using Technology*; *Science, Technology, and Society*; *Technology & Culture*; *Informal Science Education*; and *Art in the Digital Age*. Our work as faculty members has also included professional development activities as STEM specialists and researchers on TC grants, including a General Electric Foundation grant with the Office of School and Community Partnerships to enhance instruction in MST disciplines in Harlem schools and an US Department of Education i3 grant with NCREST focusing on professional development in STEM fields to improve students' early college access. Several MST faculty and students have worked on school curriculum and professional development programs for STEM education; and our faculty have received multiple National Science Foundation and private foundation grants for STEM and STEAM education.

## *A Renewed STEAM Focus: Recent Initiatives in the MST Department*

Our department faculty and students recently collaborated on the design and implementation of a series of successful STEAM initiatives that build on our research and practice [Read more at: [stem.tc.columbia.edu](http://stem.tc.columbia.edu)]. Our major goal has been to harness our interdisciplinary knowledge base and content expertise to create increased opportunities for meaningful STEAM engagement within and beyond classrooms. We seek to publicize the importance of STEAM in education, spur collaboration among our faculty within MST and across the College and the University, and highlight our work in the cognate disciplines of STEM education.

Building on this initial work, we collaboratively designed and implemented “STEAMnasium”, a learning space that encompassed a sequence of stations designed for play with multiple science, technology, engineering and mathematics concepts. [See a video from STEAMnasium

2019: [tinyurl.com/STEAMdraftvideo](http://tinyurl.com/STEAMdraftvideo)]. Response to the STEAMnasium from a broad array of children and youth; teachers; community members; TC faculty, staff, students, and alumni; and the broader public has been overwhelmingly positive.

The STEAMnasium, now in its third edition, will be held again on November 5th, 2019, in the Smith Learning Theatre – with a research component (to assess the experiences of STEAMnasium participants, as well as their interests in STEAM) and a professional development component (geared towards NYC K-12 teachers).

As our signature event, our department sees the STEAMnasium as a significant opportunity to both contribute to our research efforts around STEAM, and to explore the impact of a playful and engaging STEAM learning environment on teachers' pedagogical practice as well as the public's understanding of and interest in STEAM and STEAM education. [Read a TC news story about this year's STEAMnasium: [tc.columbia.edu/articles/2019/may/full-steam-ahead](http://tc.columbia.edu/articles/2019/may/full-steam-ahead)]



# FUTURE DIRECTIONS FOR STEAM EDUCATION IN MST AND AT TC



The faculty of MST, with their extensive content expertise and transformative approaches to learning and education, are well situated to both reflect on the history of STEM and STEAM education and forge new directions for STEAM in the present and beyond. In addition to our STEAMnasium work, faculty have explored the possibilities of highlighting existing work in STEAM education as well as producing new avenues for research and practice around STEAM.

Our conversations have included discussions about:

- the history, purposes, philosophies, and practices of STEAM education
- the role of STEAM in solving complex political, social, and environmental problems
- examining faculty common interests in play, civic education, student engagement, and out-of-school learning, and how STEAM could be a driver for those interests
- disparities in STEAM educational opportunities that affect students' learning, persistence, participation, and performance in STEAM fields.

## *About the "A" in STEAM*

One of the digital wishes submitted on Twitter for our STEAM wish tree at STEAMnasium 2018 is that "Art not be an Afterthought" in STEAM. We couldn't agree more, and we subscribe to a view of STEAM that incorporates and celebrates the arts. Our faculty's research agendas already address the role of creativity as a powerful catalyst and conduit for authentic youth learning, and we look forward to exploring these dynamics further in the specific context of STEAM education. Furthermore, across many of our research projects, initiatives, and labs, we recognize the role of the arts and creativity in providing new windows into the study and application of science, technology, engineering, and mathematics concepts, across a variety of formal and informal educational contexts.

*Stay tuned for more information about MST's STEAM initiatives!*