

AMERICAN MODELING TEACHERS ASSOCIATION



Transforming STEM Education

STRATEGIC PLAN 2019-2022



American Modeling Teachers Association

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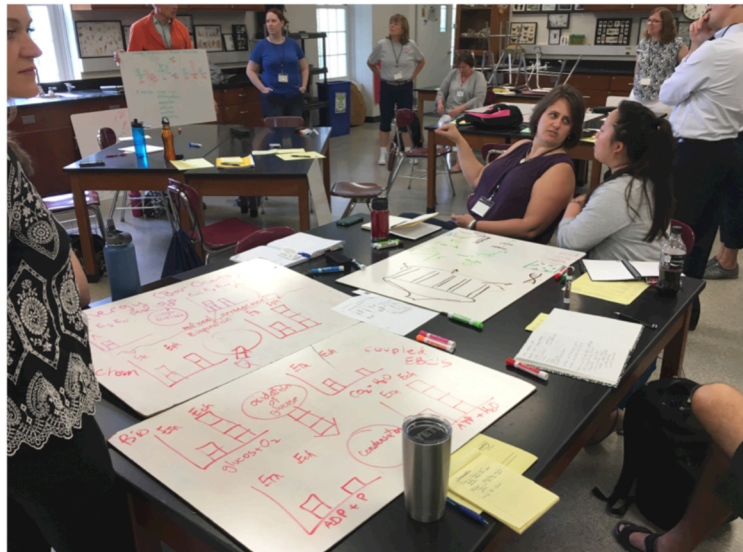
Mission and Values

Mission

The American Modeling Teachers Association (AMTA) enhances student learning through science, technology, engineering, and mathematics (STEM) teacher professional development. We provide teachers with a research-validated pedagogy, classroom-tested instructional resources optimized for Modeling Instruction classrooms, access to a collaborative Modeling community of practice, and research in Modeling Instruction pedagogy.

Values

- AMTA is committed to promoting equity, inclusion, and social justice for all STEM education stakeholders
- AMTA fosters classroom communities where student engagement and sense-making is at the center of learning
- AMTA values teacher-driven advocacy for excellent professional development in science education
- AMTA promotes reflective teaching and learning
- AMTA continuously remodels the pedagogy and updates resources to reflect the evolution of science education and provide teachers with best practices in the 21st century



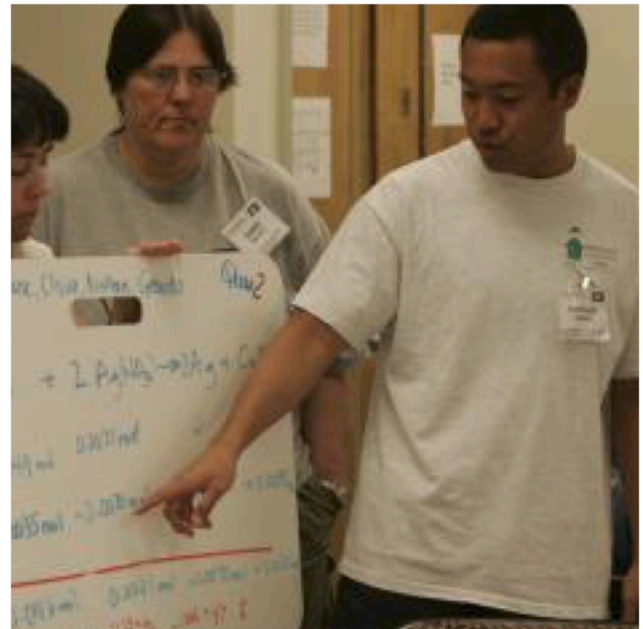
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Crisis in US science education, why it matters to our students, and why Modeling is the solution

As our economy becomes more and more reliant on technology, a home-grown workforce with the STEM skills needed to engineer our future is in short supply. Employment in STEM occupations has increased by 79% since 1990, outpacing overall U.S. job growth.¹ In addition to being more available, STEM jobs tend to come with higher pay: the national average wage for all STEM occupations in 2015 was \$87,570, nearly double the national average wage for non-STEM occupations (\$45,700).²

Meanwhile, students in the United States lag their counterparts in the rest of the developed world in science and mathematics achievement. The U.S. placed 38th out of 71 countries in mathematics achievement and 24th in science according to the 2017 Programme for International Student Assessment (PISA).³

STEM teachers are on the front lines of addressing this crisis. A 2011 study conducted by Microsoft found that 57% of STEM college students were inspired to study STEM subjects because of a teacher or class, and 21% of STEM college students said they decided to pursue a STEM career in middle school or earlier.⁴ The long-lasting effect one expert teacher can have on a student was eloquently stated by a former student of Rex Rice. Rex is a co-founder of the AMTA who recently retired from high school physics teaching. "On behalf of our *nation*, thank you for your 37 years of exceptional physics teaching. You've guided countless adolescents to stores of power they didn't know they had. I am eternally grateful to consider myself one of them," Lisa Einstein noted in her post on Scientific American.⁵



¹ Graf, N., Fry, R., & Funk, C. (2018, January 09). 7 facts about the STEM workforce. Retrieved March 17, 2019, from <http://www.pewresearch.org/fact-tank/2018/01/09/7-facts-about-the-stem-workforce/>

² Fayer, S., Lacey, A., & Watson, A. (2017, January). *STEM Occupations: Past, Present, And Future*[Spotlight on Statistics from U.S. Bureau of Labor Statistics].

³ DeSilver, D. (2017, February 15). U.S. academic achievement lags that of many other countries. Retrieved from <http://www.pewresearch.org/fact-tank/2017/02/15/u-s-students-internationally-math-science/>

⁴ H. (n.d.). *STEM Perceptions: Student & Parent Study Parents and Students Weigh in on How to Inspire the Next Generation of Doctors, Scientists, Software Developers and Engineers*(Rep.). Commissioned by Microsoft. <https://news.microsoft.com/download/archived/presskits/citizenship/docs/STEMPerceptionsReport.pdf>

⁵Einstein, L. (2017, June 05). A Letter to My High School Physics Teacher. Retrieved from https://blogs.scientificamerican.com/observations/a-letter-to-my-high-school-physics-teacher/?WT.mc_id=SA_TW_PHYS_BLOG&sf85530551=1

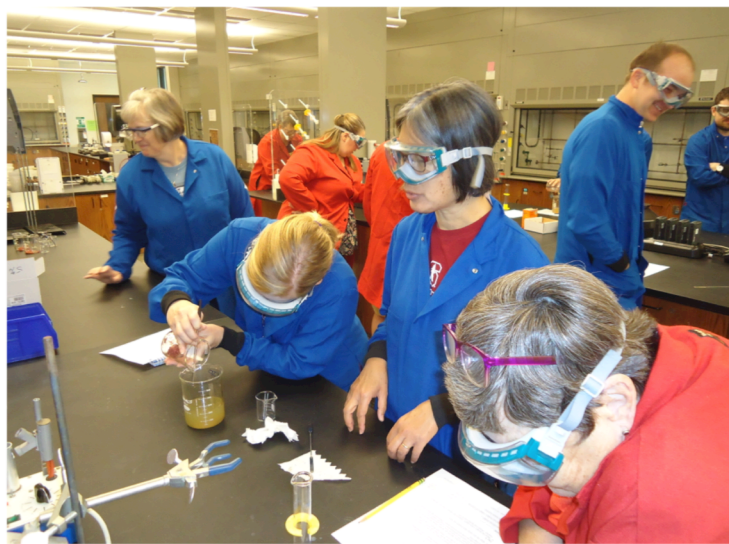
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AMTA retools teachers with a pedagogy that is proven to excite students and improve their understanding of science (e.g. physics, chemistry, biology) concepts over students taught in traditional ways. Teachers who adopt Modeling Instruction typically continue to use it in their classrooms for the remainder of their careers due to its impact on their teaching and students' learning. Thus, Modeling Instruction is a vital tool in the national arsenal in the fight to improve STEM education for all students.

Modeling Instruction

Modeling Instruction is a pedagogy that uses student-driven authentic laboratory investigations to help students construct, refine, and apply the fundamental conceptual models that form the content core of the sciences; represent these models in multiple ways; and share their understanding with their fellow students to promote deeper understanding. In professional development workshops, teachers perform experiments in 'student-mode' using Modeling Instruction instructional resources just as their students would, then discuss how they might work in classrooms through 'teacher-mode' conversations. Modeling is one of the eight Science and Engineering practices identified in the Next Generation Science Standards (NGSS) and one of the eight Mathematical Practices of the Common Core State Standards.

Modeling Instruction was originally developed for teaching physics and Physics Modeling Workshops began in 1990. In response to teacher demand, Chemistry Modeling Workshops were developed and offered in 2005. In 2009, a small group of teachers developed and began offering Biology Modeling Workshops. In 2013, with the support of grant funding, AMTA undertook the development of Middle School Modeling Workshops. In 2015, AMTA launched an NSF-funded development project for Computational Modeling Physics First Workshops. Finally, in 2017, we began the development of an Astronomy Modeling Workshop.



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Vision

Who

AMTA is committed to maintaining its focus on student learning and teachers' practices. In addition, we will continue to collaborate with a wide range of partners to strengthen our ability to deliver our mission by:

- Nurturing local organizations to support excellent STEM teaching through the STEMteachersXYZ model.⁶
- Building relationships with local, regional and national affiliates.
- Working with international affiliates dedicated to improving STEM education worldwide.
- Partnering with universities, school districts, administrators, curriculum coordinators, STEM specialists, and individual school science departments.
- Coordinating with researchers, Principal Investigators, science teacher education institutions to identify funders who recognize and appreciate the value of Modeling Instruction.

AMTA will be a recognized and respected organization related to STEM teaching and learning at the local, regional, state, and national levels. AMTA will work with state departments of education, legislators, and policy leaders to improve STEM education.

What

Recognizing that Modeling Instruction is at the heart of the AMTA mission, we and our partners will have a clear understanding of what Modeling Instruction is (and is not). AMTA will continue to identify, train, and support a pool of certified workshop leaders in all subject areas to meet the demand for high-quality Modeling Workshops nationally and internationally. Comprehensive, classroom-tested, standards-aligned, robust science instructional resources for Modeling Instruction will be available as a benefit of AMTA membership. There will be Modeling Instruction science resources, in development or available, at every grade level (K-16) and computational thinking will be explicitly integrated into the Modeling Cycle.

The STEMteachersXYZ affiliates will be partners in hosting professional development and building local professional science teaching communities, and will be recognized as the local face of AMTA for workshops and outreach.

In addition to face-to-face professional development workshops, AMTA will offer distance learning courses and online learning modules to promote Modeling Instruction to provide continuing education for STEM teachers.

AMTA will make progress toward the integration of all STEM subjects in a Modeling Instruction-based, standards-aligned learning progression from K-16 for use by all stakeholders.

⁶There are currently STEMteachersXYZ organizations in Birmingham, Cleveland, Houston, the Massachusetts Bay area, New York City, and Phoenix.

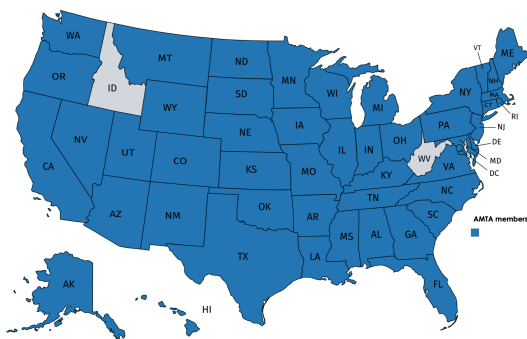
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AMTA will expand current programs to include consulting services for program evaluation, remediation, and outreach. We will lead an active program of research on Modeling Instruction theory and practice. We will present at state, regional, and national conferences and publish research in peer-reviewed journals. AMTA will continue to host an annual conference, which will include a research strand. We will be a clearinghouse for information on accredited Modeling Instruction-based degree programs and college credit for workshops around the country. We will serve pre-service teachers through our university and professional partnerships.

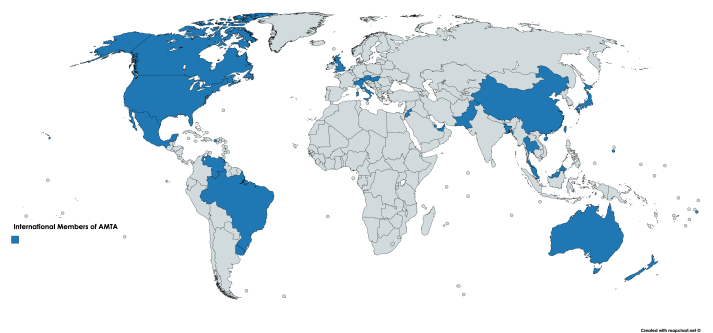
AMTA will influence the formation of educational policy. One critical focus area we will address, both in its own structure and in the larger community, is social justice in science education.

Where

AMTA currently has a strong presence in Alabama, Arizona, California, Florida, Illinois, Indiana, Kansas, Maine, Massachusetts, Michigan, New York, North Carolina, Ohio, and Texas. We will expand the number of locations where Modeling Instruction is used to include regional, statewide, national, and international locations. We will have a presence at professional meetings, professional development workshops, in publications (practitioner and research-based), and on social media. We will operate virtually and face-to-face. AMTA will expand our presence at both the grassroots and institutional level. Our members will use Modeling Instruction resources at the elementary, middle school, high school, and college levels in public, charter, and private schools.



AMTA has members in 48 states across the USA



AMTA has members in 49 countries around the world

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Goals, Strategies, and Tactics for 2019 - 2022

Goal: AMTA will expand the availability of Modeling Instruction Workshops

Modeling Instruction uses data-focused, student-driven, authentic laboratory investigations to help students construct, refine, and apply the fundamental conceptual models that form the content core of the scientific disciplines. The Next Generation Science Standards (NGSS) are becoming the standard by which student success is measured. *Modeling* is one of the eight key science and engineering practices of the NGSS. *Modeling Instruction* (developed in 1990) is a coherent enactment of *all eight* science and engineering practices adopted by NGSS in 2013.

- **Strengthen regional hubs** - AMTA will continue to seek and nurture new partnerships with local organizations and universities to support the provision of face-to-face Modeling Workshops for teachers in these regions. AMTA will increase efforts to identify and recruit Modeling Workshop leaders, provide fiscal management services for Modeling Workshop hosts, promote Modeling Workshops (e.g. AMTA's website, LISTSERVs, social media), and provide host organizations with guidance.
- **Train workshop leaders** - Fundamental to the expansion of Modeling Instruction is the availability of capable Modeling Workshop leaders. AMTA will magnify efforts to organize and conduct leadership development workshops for teachers with demonstrated competency in the Modeling Instruction pedagogy. We will accelerate the preparation of leaders in areas of shortage: biology, middle school, astronomy, and computational modeling. We will expand our corps of distance learning workshop leaders. Our goal is to eliminate leadership shortage as a factor in expanding the use of Modeling Instruction.
- **Expand availability of Modeling Instruction Workshops by location** - Modeling Instruction Workshops are available in 20 or more locations across the United States. AMTA will seek new partnerships with organizations that can host Modeling Workshops. Potential workshop hosts are universities, school districts, funded research programs, national labs, other non-profits, foundations, and national professional organizations. In each locale, AMTA will identify local Modelers who can help connect their peers to the larger Modeling teacher community and to one another.
- **Increase offerings of virtual Modeling Workshops and courses** - Technology offers a powerful means to grow our community of teachers trained in Modeling Instruction. AMTA will continue to build its repertoire of distance learning offerings and online professional development modules. We will optimize our ability to provide for the real-time teacher interactions that are at the heart of all Modeling Workshops. AMTA will develop and offer distance learning courses and online modules to teachers in all disciplines.

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Goal: AMTA will develop opportunities to engage the Modeling teacher community

There remain opportunities to engage teachers and students in elementary and middle school STEM, including mathematics. We will expand the use of computational modeling and engineering in Modeling Instruction classrooms.

- **Strengthen the skills and knowledge of current Modelers** - We will develop opportunities for current Modelers to help deepen their mastery of Modeling principles, strengthen their teaching practices, and nourish their connection to the broader Modeling community.
- **Complete development of Biology Modeling** - AMTA will complete the development and refinement of Modeling Biology Workshops and instructional resources for both the “biology first” and “biology last” sequence, test resources in classroom and workshop settings, and train a cadre of Biology Modeling Workshop leaders.
- **Expand Middle School Modeling** - Middle school science teachers are perhaps the most underserved audience for science professional development, and because every student must take middle school science, middle school represents the best chance to address issues of social justice and inequality of educational opportunity in our schools. AMTA will increase the number of Middle School Modeling Workshop leaders and work to offer these workshops in more locations across the country.
- **Implement Computational Modeling in multiple disciplines** - In early 2016, President Obama announced his *Computer Science for All* initiative to empower a new generation of American students with the computer science skills they will need to thrive in a digital economy. In response, AMTA will work with partner organizations to infuse computational modeling into its workshops and instructional resources to support middle and high school teachers. Going forward, AMTA will expand computational modeling into disciplines beyond physics.
- **Increase availability of Astronomy Modeling Workshops** - Astronomy is typically introduced in elementary or middle school, which is why AMTA is partnering with Global Hands-On Universe (GHO�) to develop an Astronomy Modeling Workshop that is suitable for middle and high school teachers. AMTA will complete development of this workshop with supporting resources and expand the number of locations in which it is offered.
- **Develop elementary school STEM Modeling Workshops** - Elementary school teachers are in an ideal position to inspire interest and enthusiasm for science learning. However, most elementary teachers are underprepared in the sciences - especially in the physical sciences. AMTA will work with mathematics and language arts education researchers to create a Modeling Workshop with instructional resources focusing on the needs of K-5 teachers. These will help elementary teachers develop deeper content knowledge and increased confidence in their ability to do substantive hands-on STEM with their students.

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Goal: AMTA will develop strategies to optimize Modeling Instruction Workshops delivery

As the Modeling teacher community grows, it is important to maintain a shared standard and set of criteria for delivering a strong Modeling Workshop. AMTA will help workshop leaders stay current with best practices in Modeling Instruction.

- **Update skills of existing leaders** - Modeling Instruction leadership development is the purview of AMTA. We will regularly update leaders with the tools and practices they must master and incorporate into their workshop leadership through modules, webinars, and virtual town hall meetings.
- **Develop a workshop leader handbook** - We will develop a workshop leader handbook and a casebook of best practices, which will be solicited from current workshop leaders.
- **Collect workshop participant data on to inform leader practice** - AMTA coordinates the Modeling teacher community. We develop and curate workshop instructional resources and manage the network of Modeling Workshop leaders. AMTA will collect data on Modeling Workshops nationwide to gather examples of excellence and to monitor quality. Data and analysis strategies will be shared with leaders to improve workshop delivery.

Goal: AMTA will expand services to develop new revenue streams

AMTA depends upon membership and workshop licensing fees to fund our operations. These revenue sources are inadequate to support our current level of activity.

- **Provide program & project evaluation services** - In addition to Modeling Workshops and online learning opportunities, AMTA will develop a network of partners in the academic arena for whom we will provide program evaluation services. Evaluation looks at the impact of specific programs on teacher competence, confidence, and/or student learning.
- **Support collaborative research in STEM education** - While Modeling Instruction is in widespread use across the country, it is continually evolving. There is a perennial need for up-to-date research documenting its effectiveness as a method of instruction. AMTA will form partnerships with universities and Modeling researchers to examine Modeling Instruction as a conceptual framework for teaching and learning in order to understand how it works, to quantify its impact, and to disseminate results to the national community of science educators.
- **Offer consulting services** - AMTA offers our expertise to school districts, universities, policy forums, and other entities involved in the quest to improve science education in the USA. Given Modeling

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Instruction's decades-long record of success, AMTA can help shape professional development programs, grant-funded projects, and educational policy.

- **Export Modeling Instruction to new constituencies** - With approximately 2,500 members, AMTA has an outstanding network of experienced, passionate teachers and teacher-leaders who are devoted to honing their craft and improving science learning among their students. Many Modelers have been honored with prestigious awards, from state teachers of the year to Presidential Awardees for Excellence in Mathematics and Science Teaching. AMTA will mobilize these valuable resources to provide first-hand “stories from the front” and informed commentary to spread Modeling Instruction and expand membership.

Goal: AMTA will strengthen our financial status through third-party funding

AMTA is a vibrant community of dedicated STEM professionals and multiple affiliates. In order to continue operating and growing, AMTA will engage current members, recruit new members, and offer professional development opportunities to spread Modeling Instruction beyond traditional multi-week workshops.

- **Strengthen access to funding resources** - AMTA will make concerted efforts to build relationships that lead to sustained funding. We will seek new partnerships with national organizations to craft projects that further the field of STEM education and work with universities to provide professional development outreach for their federal and state grant programs.
- **Build recognition** - AMTA will promote our professional development opportunities (i.e. workshops, modules, distance-learning) to expand our recognition as an effective provider of high-quality programs in all STEM disciplines. Additionally, AMTA will build recognition through local, regional, and national conference presentations, publishing articles in practitioner and research journals, and maintaining an active digital presence through podcasts, social media, and other outlets.
- **Influence STEM education policy decisions** - Teachers are often excluded from policy discussions at the local, state, and national levels that affect their daily lives. With initiatives like the NGSS and *Computer Science for All*, that policy discussion is increasingly focused on STEM education. AMTA has the experience and expertise to make a contribution to this debate informed by decades of successful classroom experiences in a variety of settings around the country. We will seek opportunities to participate in the policy discourse shaping STEM education funding decisions to enhance the effectiveness of our members.

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