About TERC

For more than forty years, TERC has been introducing millions of students throughout the United States to the exciting and rewarding worlds of math and science learning. Led by a group of experienced, forward-thinking math and science professionals, TERC is an independent, research-based organization dedicated to engaging and inspiring all students through stimulating curricula and programs designed to develop the knowledge and skills they need to ask questions, solve problems, and expand their opportunities.

Mission

TERC's mission is to improve mathematics and science education. TERC works at the frontiers of theory and practice to contribute to a deeper understanding of learning and teaching; enhance instruction through teacher professional development; develop applications of new technologies to education; create curricula and other products; and support reform in both school and informal settings.

Vision

TERC imagines a future in which learners from diverse communities engage in creative, rigorous, and reflective inquiry as an integral part of their lives—a future where teachers and students alike are members of vibrant communities where questioning, problem solving, and experimentation are commonplace. This vision is grounded in the belief that science and math literacies are critical to strengthening and preserving a democratic society.

History

In 1965, Arthur Nelson and a small group of co-founders established the Technical Education Research Centers to focus on various aspects of technical and occupational education, primarily at the postsecondary level. In the early 1970s, TERC successfully initiated a series of projects that marked a transition from postsecondary technical education to K-12 science. Today we are simply known as TERC. This change embraces the development of our education initiatives through the years and the learners we serve, including those in K-12 classrooms, museums, after-school programs, community colleges, adult education centers, universities, and other research institutions.

Organizational Structure

Currently, TERC's staff of 104 — including nationally recognized leaders in educational research and curriculum development — are actively engaged in over 54 projects. Sixty-two percent of staff have advanced degrees in science, mathematics, engineering, education, psychology, and technology. Each year, TERC's products and services reach more than 3.5 million students throughout the United States.

TERC's research and development projects are housed within two centers — the **Center for School Reform** and the **Center for Science Teaching and Learning** , the **Education Research Collaborative** division, and the **STEM Education Evaluation Center (SEEC) at TERC**.

The following pages briefly describe the active grant-funded initiatives housed within the centers and division. For more information about these initiatives as well as materials and services offered by TERC visit **www.terc.edu**.

Center for School Reform (CSR)

CSR encompasses multiple bodies of work all aimed at improving math and science education for all students. The work of the center is diverse in that it encompasses research, professional development, direct service, curriculum development, electronic network creation, and evaluation. Projects within the center span elementary, middle, high-school, college and graduate education. While some of the projects are engaged in large-scale, national, systemic change efforts others are local, researching and providing direct service to classrooms in Massachusetts. Bodies of work in the center include: creating, facilitating and researching cutting-edge, online learning communities and collegial networks; researching technology integration in the science classroom; curriculum development, professional development and research projects focused on biology, biocomplexity and ecology; research and professional development aimed at improving the experience of learning-disabled students in the science classroom; informal science education related to energy conservation; and external evaluation of science, technology, engineering, and mathematics projects.

Biocomplexity-Transforming Innovative High School Curriculum

This project is developing a multimedia-enhanced version of the TERC-developed Biocomplexity and the Habitable Planet (DRL-0628171) curriculum, a high school capstone science course. The Biocomplexity developers are designing additional UDL-aligned scaffolding to help more teachers use the material in heterogeneous high school science classrooms. The Biocomplexity and the Habitable Planet curriculum consists of innovative, inquiry-based instructional materials to engage high school students in the recent science of coupled natural and human (CNH) systems.

Funder: National Science Foundation (DRL-1020089)
Partner: Center for Applied Special Technology (CAST)

Creating a Web Presence for the I3 Track

This two-year project is researching, designing, and facilitating a web presence for the National Science Foundation's "Innovation through Instructional Integration" (I3) program— a track instituted in 2008 to challenge United States higher education institutions to strategically integrate NSF awards into programming to address the scientific, educational, and technological challenges currently facing our society. Building on the collective experience of the project team in researching, initiating, and managing electronic communities of practice, the 13 site will be designed around extensive user research and collegial design principles.

The proposed website will make the 13 track more transparent to stakeholders and the public to improve visibility of the 13 projects and effectively disseminate project solicitations, research, and achievements—unifying the internal online community of users through a manageable and organized design hierarchy to optimize opportunities to share resources, highlights, research, and related project work across the various program locales.

Funder: National Science Foundation (DUE-1027418)

Girls' Energy Conservation Corps (GECCo)

This innovative, new media-based after-school project engages girls ages 8-11 in energy conservation activities. It interweaves informal science learning, stewardship, and leadership through activities that include interactive online games, hands-on assignments, and real world energy audits. During the four-year project, more than 5,500 girls will learn about the environmental impact of energy use, practice energy conservation measures, and become agents of change as they recruit peers, family members and neighbors to conserve energy. The project's research study will address the mediation of girls' learning and behavioral change by new media.

Funder: National Science Foundation (DRL-0813434)
Partners: Girl Scouts of Eastern Massachusetts, 360KID.

i-ECS: Inclusive Exploring CS Curriculum Enhancement as Face-to-Face and Online Support for Visually Impaired, High School Students

iECS seeks to broaden participation in computing by increasing access for students with visual impairments. The project will adapt an established curriculum (Exploring Computer Science), making it accessible to visually impaired secondary students. The modified content and supports will be delivered both face to face in a summer academy, and through an online instructional community. Through this process, the project will explore how a distributed group of visually impaired students maintain or increase their level of interest and CS concept understanding outside of a traditional classroom setting. The project will also investigate which features of the accessible curriculum support student participation, engagement, and learning. iECS is a collaboration between researchers at the Rochester Institute of Technology and TERC.

Funder: National Science Foundation (CNS-1240856)

IGERT Resource Center

TERC has designed and is facilitating a comprehensive resource center and collegial network for NSF's IGERT program. All IGERT (Integrative Graduate Education and Research Traineeship) programs across the country use this electronic infrastructure to share research, resources, and discoveries with each other and the public at large. The National Science Foundation developed the IGERT program to meet the challenges of educating U.S. scientists, engineers, mathematicians and educators in their chosen disciplines as well as in the technical, professional and personal realms necessary for effective leadership and creative problem-solving in an increasingly complex, technology-driven society. IGERT programs are by nature interdisciplinary and necessitate a collaborative network through which students and faculty can learn from each other, share practices and curricular changes, resources, and emerging research across the thematic links that unite their various disciplines.

Funder: National Science Foundation (DGE-0834992)

Innovate to Mitigate

This project is designing and conducting a crowd-sourced open innovation challenge to young people of ages 13-18 to mitigate levels of greenhouse gases. The goal of the project is to explore the extent to which the challenge will successfully attract, engage and motivate teen participants to conduct sustained and meaningful scientific inquiry across science, technology and engineering disciplines. Areas in which active cutting edge research on greenhouse gas mitigation is currently taking place include, among others, biology (photosynthesis, or biomimicry of photosynthesis to sequester carbon) and chemistry (silicon chemistry for photovoltaics, carbon chemistry for decarbonization of fossil fuels). Collaborating in teams of 2-5, participants engage with the basic science in these areas, and become skilled at applying scientific ideas, principles, and evidence to

solve a design problem, while taking into account possible unanticipated effects. They refine their solutions based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

An interactive project website describes specifications for the challenge and provides rubrics to support rigor. It includes a library of relevant scientific resources, and, for inspiration, links to popular articles describing current cutting-edge scientific breakthroughs in mitigation. Graduate students recruited for their current work on mitigation projects provide online mentoring. Social networking tools are used to support teams and mentors in collaborative scientific problem-solving. If teams need help while working on their challenges, they are able to ask questions of a panel of expert scientists and engineers who are available online. At the end of the challenge, teams present and critique multimedia reports in a virtual conference, and the project provides awards for excellence.

Funder: National Science Foundation (DRL-1316225)

MSPnet III: The Math and Science Partnership Network

This 5 year-grant will support the continuing design, development and maintenance of MSP.net—to include MSPnet's technical development; content and online media creation; outreach, dissemination, and community facilitation efforts; and research and evaluation efforts. In its third iteration, MSPnet will be updated with an enhanced electronic and human infrastructure to meet the needs of an increasingly large and technologically-fluent membership. MSPnet is the TERC-designed-and-developed collegial electronic network and infrastructure for the National Science Foundation's Math-Science Partnership (MSP) program. MSPnet was first launched in January 2004 with 351 pre-registered members representing the initial round of MSP project personnel. It was introduced to provide a mechanism within and across nationwide MSP projects to share resources, research, tools, best practices, and networks in the K-12 and higher education partnering communities. Since then, the network's membership has grown to over 7,200, with an additional 2,500 people subscribed to a weekly guest newsletter. In addition to members (membership is only offered to those affiliated with an active MSP), MSPnet attracts broad public interest. To date, MSPnet has had over 1.5 million unique visitors to the site who have accessed over 7.6 million page views.

Funder: National Science Foundation (DUE-1240555)

The Research and Practice Collaboratory

The Exploratorium, in collaboration with University of Colorado in Boulder; University of Washington in Seattle; Education Development Center in Waltham, Massachusetts; Inverness Research of California, and TERC have formed a Research+Practice Collaboratory to strengthen connections between research and practice in K-12 STEM education across formal and informal settings. The Research+Practice Collaboratory is working with leading educational professional associations and other STEM advocates in leveraging existing knowledge and practices to collect, create, and synthesize translational research resources to expand STEM educators' and educational leaders' access and awareness to current relevant research and STEM educational researchers' access to high quality programs and practices; support multiple opportunities for cross-sector (research and practice, education and social sciences, formal and informal) meetings to foster critical engagement and cultural exchange; and test, document, and innovate new resources and mechanisms at three Adaptation Sites and disseminate both products and results through the R+P Resource Center.

Funder: The Exploratorium through a National Science Foundation grant (DUE-1238253)

Understanding and Improving Curriculum Materials Design Practice for Effective Large Scale Implementation in Science

This is a project to improve understanding of practices critical to the design of curricular materials for implementation in a broad range of educational contexts. Three organizations - TERC, the University of California-Berkeley's Lawrence Hall of Science, and the University of Pittsburgh's Learning Research and Development Center - will collaborate to explore and codify practices that enhance the success of efforts to design K-12 science curriculum materials for large-scale implementation. Investigators from these three organizations will conduct and synthesize results from a series of retrospective and live-design practice, broad and 'deep dive' studies, with the goal of articulating a conceptual model of educational design for large-scale use. Of particular concern are the processes and strategies designers employ to address key challenges to producing curricular materials capable of having meaningful impacts on large numbers of learners (e.g., to achieve deep understanding and rich performance, to connect to and leverage diverse social and cultural experiences, and to facilitate implementation in diverse and resource-limited settings). These issues will be explored from a variety of perspectives, including: interviews with designers and document reviews to identify structural project characteristics that appear to be empirically associated with scaling success; retrospective case studies to identify salient features and lessons learned from more and less successful large-scale design initiatives for science education; and deep dives (involving participant-observation, interviews, focus group discussions, and document analysis) into sustained design practices over an extended period to explore how design teams address key design challenges while developing educational materials for large-scale use.

Funder: National Science Foundation (DRL-1252416)

The Center for Science Teaching and Learning (CSTL)

The Center for Science Teaching and Learning (CSTL) is a research and development center for K-12 science education in formal and informal learning environments. CSTL conducts research; develops technology-enhanced curriculum and professional development; researches and develops web-based and mobile assistive technologies for individuals with disabilities; researches and designs educational gaming environments; fosters collaborations among students, teachers, and scientists across the world; and promotes policy reform. CSTL hosts the Climate Literacy Network; EdGE (Educational Gaming Environments) Group at TERC; and the series of Signing Math and Science initiatives.

Arcadia: The Next Generation

In this latest project, EdGE—in partnership with Game Gurus—will leverage the research and evaluation findings from the design of Martian Boneyards and Canaries in a Coalmine to design a new gaming model at the intersection of social media, free-choice gaming and STEM learning. In Arcadia: The Next Generation, EdGE will create and study an ecological game that integrates a variety of current transmedia tools including smartphone platforms, avatar-based MMO/RPG environments, and web-based social networking apps to examine if in-game scientific experiences can lead to real-world behavior changes and action. EdGE will work with climate scientists, biologists, and experts in ecological modeling to create dynamic content that "reacts" to player choices so the gaming engine will continually update the conditions of the gaming environment (weather conditions, food prices, travel costs, player activity effects). Players can test hypotheses, model experiments, and make predictions in eco-labs situated throughout Arcadia.

Funder: National Science Foundation (DRL-1134919)
Partners: GameGurus

Children's Understanding of Functions

This research project addresses how children in grades K-2 understand concepts associated with functions—particularly as these concepts relate to different representational tools (e.g. natural language, algebraic notation, tables, and Cartesian coordinate tools). Researchers will study how students are able to coordinate co-varying data and identify and express relationships with such data—particularly examining the connections between their thinking about recursive patterning and co-varying relationships and correspondence relationships.

Funder: National Science Foundation (DRL-1154355)

CLEAN Core NOAA

The research team behind the nearly 500 resource-strong Climate Literacy and Energy Awareness Network (CLEAN) Collection are reviewing, cataloging and disseminating a new 'core collection' of high-quality and easily-accessible resources targeted at educators of students in grades 6-16. To promote awareness and use of this core collection among the target audience, CLEAN team members will be implementing portals to access the core collection via partner websites—including NOAA's web presence at www.climate.gov—in addition to via cleanet.org.

Funder: National Oceanic and Atmospheric Administration (NOAA)

CLEAN Pathway

The Climate Literacy and Energy Awareness Network (CLEAN) Pathway is the latest extension of the work of Climate Literacy Network (CLN)—an organization dedicated to establishing standardized climate education for all. The CLEAN Pathway is a partnership between TERC, the National Oceanic and Atmospheric Administration (NOAA), the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado, the Science Education Resource Center (SERC) at Carleton College, and the National Renewable Energy Laboratory (NREL) and provides a comprehensive collection of climate science and climate literacy resources for students in grades 6-16 and informal citizen learners. The overarching goal of the Pathway project is to introduce standards-aligned "civic science" materials to promote responsible energy use and planetary stewardship for a sustainable future.

The CLEAN Pathway resource collection will contain roughly 500 reviewed resources that align to the Climate Literacy: Essential Principles of Climate Science benchmark standards established by the CLN, National Science Education standards, the AAAS Project 2061 Benchmarks for Science Literacy, and the Guidelines for Excellence in Environmental Education. The CLEAN Pathway will also include teacher professional development and community development opportunities including 2-hour teleconferences, online workshops, 3-day virtual workshops, and social networking communities. These will be available through a comprehensive website which is anticipated to launch in late 2010.

Funder: National Science Foundation (DRL-0938051)
Partners: National Oceanic and Atmospheric Administration, Cooperative Institute for Research in Environmental Sciences at the University of Colorado, Science Education Resource Center at Carleton College, National Renewable Energy Laboratory

Climate Change Education and the Media

This project seeks to overcome the challenges of effectively communicating the facts of climate change by combining new and ongoing initiatives to create an approach to climate change education in which students gain an understanding of cutting edge science and new media tools. In this, TERC is working with UMass-

Lowell to develop new undergraduate- and graduate-level interdisciplinary courses and course modules in climate change at that include the use of NASA data products; create a new urban summer program in which high school students produce videos and animations on climate change science using Cambridge Rindge & Latin School's innovative Media Arts Studio; leverage the new UMass Lowell Climate Change Initiative's (CCI's) Annual Climate Change Teach In to bring high school and university students and faculty together and to engage the broader communities in climate change literacy; enhance NASA's existing web-based resources on climate change with videos produced through this effort; and expand the program to other school systems through teacher development workshops held at UMass Lowell.

Funder: University of Massachusetts-Lowell through a grant from National Aeronautics and Space Administration
Partners: Cambridge Educational Access TV, Sage Fox Consulting Inc., Carleton College and filmmaker Randy Olson

Confronting the Challenges of Climate Literacy

This project is designing, developing, and testing a climate science curriculum and professional development model for high school students and their teachers. Project researchers will study and evaluate primary challenges to student understanding of change on multiple and embedded temporal scales and how to overcome those challenges. The project staff will create capstone materials which will contribute to a collection of modules that will eventually allow teachers to teach various kinds of Earth and space science courses at the high-school capstone level. These courses might include—for example—material on climate science and climate change; environmental science; Earth system science; weather; and geology.

Funder: National Science Foundation (DRL-1019721)
Collaborative Partners: Mississippi State University, University of Texas-Austin Institute of Geophysics
Other Partners: Michigan State University Teachers and schools in Texas and Mississippi, SERC, Carleton College: CIRES, University of Colorado-Boulder

DIG Texas

DIG Texas aims to strengthen Earth science education in Texas by ensuring that the state's Earth and Space Science capstone course is taught at the appropriate level by teachers who are aided by online, well-defined and standards-aligned course 'roadmaps' (blueprints) comprising recommended research-based learning activities and teacher resources. TERC will be training DIG project staff in the use of a CLEAN/SERC-developed online reviewing tool and review criteria for educational resources.

Funder: University of Texas at Austin through a National Science Foundation grant (GEO-1202920)

The Finland-US Network (Project FUN)

The Finnish-US Network (FUN) is blending methods and test beds from both countries to get a broader picture of how engagement and learning are entwined in the growing field of game-based learning. As part of an NSF-funded Science Across Virtual Institutes (SAVI) effort, teams from the Educational Gaming Environments group (EdGE) at TERC, WGBH and Northern Illinois University are partnering with Finnish researchers from University of Tampere and University of Aalto. Together these groups have an extensive set of research-grounded games encompassing science, technology, engineering, and mathematics topics, for audiences from pre-K through postsecondary/undergraduate. Each team in this consortium is examining engagement in game-based learning in a different yet complementary way—methodologies across the research team include a variety of surveys, video analysis techniques, experience sampling methods, and educational data mining. The FUN researchers are conducting cross-team studies to look for similarities and differences arising in

different cultures and different gaming environments. This research begins in spring 2013 with large national surveys of youth 14-18 in both countries to examine the relationships among game experience, gamer identity, science identity, and understanding of the nature of science.

The Handheld Signing Math and Science Dictionaries for Deaf or Hard-of-Hearing Museum Visitors Research Project

TERC and the Museum of Science, Boston (MoS), are studying the integration—into MoS's Take a Closer Look and Science in the Park exhibits—of iPod Touch versions of the Signing Science Pictionary (SSP), Signing Science Dictionary (SSD), and the Signing Math Dictionary (SMD). Developed by TERC and Vcom3D (innovators of the SigningAvatar® technology that powers the dictionaries) with funding from the National Science Foundation (for the SSD and SMD) and the U.S. Department of Education (for the SSP), the dictionaries were originally Web-based and intended for use in classrooms. Project partners are now adding human voice to all the text-based components, developing a Flash-based movie for each dictionary to introduce its features and an accompanying activity to practice its use, and researching how two audiences, each of which includes museum visitors who are deaf or hard of hearing and whose first language is sign, use the dictionaries to access science content during visits to the exhibits. One audience is family visitors ages 5-12+; one audience is classroom visitors in grades K-8+. The partners will also begin to establish the kinds of learning gains that are possible.

The Impact of Early Algebra on Students' Algebra-Readiness

This project is testing the effectiveness of a comprehensive, longitudinal early algebra intervention in elementary grades 3-5 on middle-school algebra-readiness. This project draws from past project researchers' development of an efficacious grade 3-7 early algebra learning progression, assessments, and professional development model.

Leveling Up

In partnership with GameGurus, EdGE researchers are designing and evaluating a transmedia gaming environment with a STEM storyline to study whether the social digital gaming model commonly seen in informal alternate reality games can be adapted to foster and support robust scientific learning and inquiry among high school students. With a team of scientists, high school teachers, and assessment specialists, EdGE will create the Leveling Up gaming environment, which will use multiple media platforms to support a series of free-choice multiplayer alternate reality games (ARGs) about human impact on Earth's ecosystems. Although the game storylines will be fictional and designed to be played out-of-school, Leveling Up games will be embedded with standards-based climate science content and "challenges" (assessments) that will measure individual players' STEM knowledge seamlessly within the collaborative gaming environment.

Mobile Signing Math Pictionary Phase II

For this Phase II SBIR project, the partners will use the SigningAvatar® accessibility software to develop and evaluate an iPad/iPod version of the Signing Math Pictionary for students in grades K-4 that will include mouthings of ASL components and advances in the Avatars' facial expression capabilities.

Funder: Vcom3D through a grant from the U.S. Department of Education

Mobile Communications App Phase II

For this Phase II project, TERC, in partnership with VCom3D, will build on Phase I 'proof of concept' work to develop and evaluate a mobile speech-to-sign translator that will integrate continuous speech recognition software with natural language processing and Vcom3D's Signing Avatar animated American Sign Language (ASL) technology. This speech-to-sign translator will be refined to run on a Mobile Communications App for tablet computers—in addition to the handheld smartphones and MP3 players used for Phase I— providing deaf and hard of hearing learners the independence they need to benefit from opportunity-based, real-time learning in face-to-face interactions and instances in which spoken information enhances the learning experience..

Funder: Vcom3D through a grant from the U.S. Department of Education

The Poincaré Institute for Mathematics Education

In this partnership led by Tufts University's departments of Mathematics, Physics and Astronomy, and Education, TERC is joining nine diverse partner school districts in Massachusetts (Fitchburg, Leominster, Medway, Medford, and Somerville); New Hampshire (Sanborn, and Timberlane); and Maine (Portland) to improve the teaching and learning of mathematics in middle school and build stronger connections between the elementary, middle, and high school math curricula. This project seeks to broaden teachers' understanding of mathematics and of mathematics education, focusing on how middle school children think and learn to identify, streamline, and re-envision how they teach critical math and physics topics to reach all students. The impact of the project will be evaluated by the multidisciplinary research team.

Funder: Tufts University through a grant from the National Science Foundation (DUE-0962863)

Signing High School Science

TERC and Vcom3D are producing a unique set of learning tools that will increase access of high school students who are deaf or hard of hearing to educational content in life and physical science. During this four-year project, the partners will use the SigningAvatar® assistive technology to research and develop two illustrated interactive 3D dictionaries for grades 9-12: a Signing Life Science Dictionary (SLSD) and a Signing Physical Science Dictionary (SPSD). The partners will evaluate the extent to which use of the SLSD and SPSD increases understanding of standards-based content in the life and physical sciences, promotes command of the languages of life and physical science, and furthers the ability to study these content areas independently. The project will build a robust avatar lexicon of signed life and physical science terms that developers, educators, and professionals can use when generating signed life and physical science materials. The SLSD and SPSD will be disseminated on CD-ROM and through Web-based versions. This project builds on research that led to the development of the Signing Science Dictionary (SSD)—a dictionary of ~1,300 science terms and definitions for grades 4-8—and the Signing Earth Science Dictionary for grades 9-12. The SSD was

funded in part by grants from NEC Foundation of America, the National Science Foundation (HRD-0533057), and the U.S. Department of Education (H327A060026). The Signing Earth Science Dictionary was funded in part by a grant for the National Science Foundation (GEO-0913675).

SportsLab 2020

This project is developing and testing a collaborative game-based interactive environment where students, ages 12-18 form a product design team to create a concept model and pitch for a sport product design challenge. Participants, sport researchers, and product experts determine the best pitches with awards for top designs. SportsLab:2020 brings together pedagogical frameworks from game- and project-based learning together with design challenge curriculum that foster learning and understanding of 21st Century skills and STEM concepts. Participants have access to embedded resources to help as they role-play, learn, and tryout skills necessary for success in real world careers. A team collaborative space for planning and tracking prog-ress together with available apps for real world data collection, evaluation, and presentations are used to extend the game beyond the classroom. SportsLab:2020 is modeled after Nike's Innovation Kitchen and Sport Research Lab with an emphasis on creative risk-taking grounded in sound scientific inquiry and engineering design processes. The project engages industry partners including Nike and Vernier Software & Technology for expertise and resources for content as well as awards for the best designs. Ultimately SportsLab:2020 tests the effectiveness of a game-based STEM and ICT-infused sport product design challenge sponsored by industry partners as a way to motivate disengaged youth in ways that lead to potential career paths.

Talk Science

TERC researchers are developing and studying web-based professional development that encourages pro-ductive classroom talk, helping teachers engage with science to linguistically meld subject (discipline) and practice (inquiry) to the benefit of their students. Aligned with the NSF-funded Inquiry Project curriculum (grades 3-5 physical science), Talk Science professional development focuses on academically-productive talk as central to student understanding in inquiry-based, conceptually-driven classroom study. The web-based professional development resources will be available for teachers to use in the context of school-based study groups as they implement the Inquiry curriculum. These web resources include video cases of scientists engaged in inquiry as they conduct student investigations from the curriculum and cognitive psychologists and linguists reflecting on meaning-making discussions in the classroom. The research component of this project will examine the process by which teachers make use of these resources; the effects of the professional development resources on teacher thinking and practice; and their effects on classroom culture and learning.

Education Research Collaborative (ERC)

The Education Research Collaborative (ERC) is devoted to research on math and science learning and the research-based development of curricula, learning tools, and staff development models. Major areas of work include elementary mathematics; research on language, culture and science learning; adult numeracy; math learning out of school; and statistical reasoning and data analysis. ERC houses the Adult Numeracy Center, the Chèche Konnen Center, the Mixing in Math series of initiatives, and the Investigations Implementation and Workshops group.

Beyond the Double Bind: Women of Color in Science, Technology, Engineering, and Mathematics

This project seeks to understand the elements that support the success of women of color in science, technology, engineering, and mathematics (STEM) higher education and early careers. The project has two simultaneous and complementary tracks. The first track collects and analyzes the written and oral life stories of minority women. The second track examines the higher education programs that promote their advancement in STEM.

Funder: National Science Foundation (DRL-0909762)

Bridging Math and Digital Media Creation: Students as Learners, Teachers, and Organizers of STEM Content

TERC is researching how middle school, high school and college students experience learning, teaching, leading, and organizing within a math-based computer programming curriculum developed with the Young People's Project (YPP). YPP is an out-of school math literacy organization that employs a near-peer mentoring model in which college students teach and mentor high school students who are in turn responsible for teaching/mentoring middle school and elementary school students—mostly through playing math games. In this project, YPP and TERC are engaging college and high school student mentors in Greater Boston, MA; Chicago, IL; Jackson, MS; and Eldorado, IL in learning object-oriented programming languages for two purposes 1) to create video games based on the math games students already play in the YPP curriculum; 2) conduct social science research in their communities and program simulations based on that research. At the same time, high school students will plan curricula and teach programming languages and math to younger students. Project researchers will examine a) student understanding of mathematical and computational literacies; b) how the structure of near-peer mentoring (learning/teaching/leading/organizing) contributes to participants' literacies, and c) the development of 'Environments of Demand' among participants (i.e., when members of school communities demand more high quality math and computational educational experiences.)

Funder: The Young People's Project through a grant from the National Science Foundation (DRL-1031633)

Computing Beyond the Double Bind: Women of Color in Computing Education and Careers

The Council for Opportunity in Education, in collaboration with TERC, seeks to advance the understanding of social and cultural factors that increase retention of women of color in computing; and implement and evaluate a mentoring and networking intervention for undergraduate women of color based on the project's research findings. Computing is unique because it ranks as one of the STEM fields that are least populated by women of color, and because while representation of women of color is increasing in nearly every other STEM

field, it is currently decreasing in computing - even as national job prospects in technology fields increase. The project staff will conduct an extensive study of programs that have successfully served women of color in the computing fields and will conduct formal interviews with 15 professional women of color who have thrived in computing to learn about their educational strategies. Based on those findings, the project staff will develop and assess a small-scale intervention that will be modeled on the practices of mentoring and networking which have been established as effective among women of color who are students of STEM disciplines. By partnering with Broadening Participation in Computing Alliances and local and national organizations dedicated to diversifying computing, project staff will identify both women of color undergraduates to participate in the intervention and professionals who can serve as mentors to the undergraduates in the intervention phase of the project.

Funder: National Science Foundation (CNS-1240768)

DNI: Diabetes Numeracy Intervention for American Indians and Alaska Natives

This project is developing and pilot testing an intervention to improve numerical skills required for diabetes self-management among American Indians and Alaska Natives. The study site is the Yakama Indian Health Center in Toppenish, Washington.

Funder: National Institute sof Health

Educating the Imagination

IEducating the Imagination is developing and investigating a prototype "studio science learning environment" for urban, underrepresented adolescents (grades 7-9). Over two year-long cycles of design-based research, students will engage in scientifically and socially meaningful learning in water-related science based on a model that integrates science and art habits of mind—e.g., close looking, thinking, modeling, and constructing with ongoing experimentation and critique. In a studio environment, students will a) engage in interdisciplinary, object-centered inquiries into water-related problems of local and global significance; b) develop multimodal, digitally-mediated responses to the studied objects that aim to provoke new forms of thinking-imagining-acting within the world; and c) exhibit their responses in various ways throughout the wider Boston community with the purpose of involving others in re-imagining water in relation to problems of human development and environmental sustainability.

Funder: National Science Foundation (DRL-1135120)

Partners: Boston Arts Academy, MIT, Tufts University, and the Charles River Water Association

EMPower II

TERC is funded to continue the work launched by Diploma Plus [teachers and students] to design a blended learning program to support performance-based math education for its students. Building off the content and pedagogy of the EMPower adult numeracy curriculum, TERC will develop and deliver targeted mini-lessons to build conceptual understanding of key math topics for students with math skills significantly below grade level (aligned to 8th grade and below CCSS); a video collection of students explaining their thinking on math problems and annotated student work samples; and recommendations for content-aligned online resources for students and teachers.

Funder: The Nellie Mae Foundation

English Learners and Science Tests (ELAST)

In this project, Chèche Konnen Center researchers will explore whether linguistic features of multiple-choice science test items on high-stakes assessments are interfering with the ability of English Learners (ELs) to demonstrate what they know about science. Project researchers will review the research on linguistic features of test items that negatively influence ELs' performance on assessments. Researchers will modify multiple-choice science test items from the 5th grade Massachusetts Comprehensive Assessment System (MCAS) by changing these linguistic features without changing the tested science content. By administering original and modified science test items to a large sample of EL and non-EL students across Massachusetts, researchers will gather evidence to determine whether these linguistic features are in fact interfering with the ability of ELs to demonstrate what they know about science. Researchers will explore the generalizability of these findings by examining science test items and student performance data from the 8th and 10th grade MCAS, other state-wide tests, and the National Assessment of Educational Progress (NAEP).

The outcomes of the project will include: a) empirical evidence that contributes to the field's knowledge of linguistic features of science test items that interfere with the ability of ELs to demonstrate their knowledge on science tests; b) a handbook for state departments of education and multi-state assessment consortia to use to eliminate or modify test items that contain these features; and c) a guide to linguistic features of science test items for teachers of ELs to use with their students. This four-year project is funded by the Institute of Education Sciences at the U.S. Department of Education.

Funder: U.S. Department of Education (R305A110122)

Expansive Meanings and Makings in ArtScience (EMMAS)

EMMAS offers an opportunity to investigate and demonstrate the untapped potential of an artscience approach to learning and teaching in high school for youth from communities historically underrepresented in science. It builds on an earlier project, Educating the Imagination, which developed a summer artscience studio program at Boston Arts Academy focused on wide-ranging explorations of water. EMMAS will work in an emerging scientific domain, the human microbiome, and in classroom contexts. Locally, the project is a partnership between the Chèche Konnen Center (CKC) at TERC, Boston Arts Academy (BAA), the Broad Institute, and local artists with experience working at boundaries of art and science. Nationally, it includes collaborative design research with the University of Washington and Red Eagle Soaring Native Youth Theatre in Seattle, who will pursue artscience inquiries in climate change.

Funder: National Science Foundation (DRL-1348494)

INK-12: Teaching and Learning Using Interactive Ink

This project is investigating how the combination of pen-based computing and wireless communication can support and transform classroom practices that are known to enhance student learning in STEM disciplines. This work builds off of the NSF-funded exploratory study INK-12: Interactive Ink Inscriptions in K-12 (NSF Collaborative DRL-0822278 and DRL-0822055) that examined the role that pen-based wireless computing could have in 4th and 8th grade science and math classrooms. Project researchers will work in three Massachusetts districts to study additional classrooms using pen-based wireless computing, and create a research-based software design for a pen-based wireless technology that can support students' math and science learning. The design will then go through an implementation and evaluation cycle. This project will build a website for dissemination purposes through which research reports and downloadable versions of the software will be available.

Funder: National Science Foundation (DRL-1019841)

iSWOOP: Interpreters and Scientists Working On-Site at Our Parks

National Parks are full of interesting and unusual STEM features which often intrigue visitors whose questions are answered by park personnel. In addition to the natural features, there are often researchers in the parks gathering data and conducting experiments. Park personnel are not apprised of these studies yet are often questioned about them. This collaborative project's goals are to derive a mechanism to educate the park personnel so they can respond to the visitor's inquiries. Collaborators include the National Park Service (NPS), TERC, Winston-Salem State University, and the park personnel at Carlsbad Caverns National Park.

Funder: National Science Foundation (DRL-1323030)

MA ACLS Numeracy Study Circle Model

TERC's Adult Numeracy Center is developing a 'study circle' professional development program for the Massachusetts state Adult and Community Learning Services (ACLS) staff. Modeled after similar reading 'study circle' programming produced by the National Center for the Study of Adult Learning and Literacy (NCSALL), the study circle is intended to ground administrators (such as learning center directors, professional development generalists, and Department of Education program specialists) in research in quantitative literacy and math education for adults.

Funder: Massachusetts Department of Elementary and Secondary Education

MathCore for Museums

The Science Museum of Minnesota in Saint Paul, Minnesota; Museum of Science in Boston; North Carolina Museum of Life and Science in Durham, North Carolina; Explora in Albuquerque, New Mexico and the Center for Research in Mathematics and Science Education at San Diego State University are collaborating with TERC to create a set of math exhibits for use in science centers and museums. MathCore for Museums is designing, installing and studying a collection of math exhibits to be used in the four partner museums that will introduce algebra—through the topics of ratio and proportion—to children ages 6-12. These exhibits will support children to interact experientially with fractions, similarity, scaling, and percentages to build their mathematical foundation for middle and high school mathematics courses.

The MathCore study relies on an engagement-capacity-continuity continuum to examine children's interactions to determine how their interest in the activities and understanding can be bolstered through multiple visits over several years. While museums traditionally concentrate on developing exhibits that primarily focus on visitor 'engagement', project researchers are developing creative ways for youngsters to solidify necessary math skills over time ('capacity' and 'continuity') and situate them in interactive, out-of-school settings to increase interest in the STEM fields.

Funder: National Science Foundation (DRL-0840320)
Partners: The Science Museum of Minnesota, Museum of Science in Boston, North Carolina Museum of Life and Science, Explora, Center for Research in Mathematics and Science Education at San Diego State University

A Practice-Based Approach to Professional Development in Science in Urban Elementary and Middle Schools

The Chèche Konnen Center at TERC is collaborating with the Boston Teacher Residency of the Boston Public Schools to design, develop, and study a practice-based inquiry approach to professional development that prepares new teachers to move K-5 science teaching toward more rigorous, engaged and equitable learning for their students. The innovation to be investigated will be centered in a school-based seminar designed to introduce new teachers to practice-based inquiry, i.e., investigations into everyday practice, as a form of professional learning.

Funder: U.S. Department of Education (R305A100176)
Partner: Boston Teacher Residency - Boston Public Schools

Pathways to Certification

TERC's Adult Numeracy Center has contracted with the Massachusetts Department of Elementary and Secondary Education (DESE) to delineate features of a system that could certify the proficiency of adult education math teachers. TERC is designing an assessment-based, modular credentialing program to provide clear and manageable pathways for adult mathematics and numeracy practitioners to improve and demonstrate their proficiency as math teachers for adult basic education students aiming to pass the GED, attend college, and access better jobs.

Funder: Massachusetts Department of Elementary and Secondary Education

Project AIM Evaluation

TERC is the evaluator for Project AIM (All Included in Mathematics), a five year NSF-funded project whose goal is to facilitate mathematics communication in the classroom as a viable form to support all students in learning meaningful mathematics content. The project is developing, implementing, and refining a 40-hour professional development program with instructional supports for mathematics coaches and teachers that will use best practices for classroom communication—applying to mathematics teaching and learning what has been learned in the field of literacy about reading, writing and communicating. TERC 's evaluation will test AIM's efficacy in supporting meaningful mathematics communication in the classroom and examine issues related to scaling up the professional development to serve a larger group of teachers.

Funder: NC State University through a grant from the National Science Foundation (DRL-1020177)

Statistics for Action (SFA)

TERC is partnering with environmental action groups in twelve states to advance the quantitative literacy skills needed to understand and solve pressing environmental problems. Statistics for Action (SfA) builds on TERC's research in adult numeracy and helps situate significant math learning in meaningful, accessible contexts: namely, the community centers, public institutions, and homes where concerned citizens gather to examine local environmental and public health data.

SFA researchers will develop video and print materials and a set of training modules for environmental organizers that cover topics including surveying, sampling, quantifying hazards (through numbers, ratios, percentages) interpreting test results and presenting data relevant to issues of air, soil, and water quality.

This project seeks to empower organizers and the citizens they serve to understand and effectively communicate the data behind local environmental and public health issues to neighbors, elected officials, and community decision-makers.

Funder: National Science Foundation (DRL-0812954)
Partners : Toxics Action Center, the Pesticide Watch Education Fund, the Blue Ridge Environmental Defense League, the New England Literacy Resource Center, Operation Green Leaves, and the Little Village Environmental Justice Organization

Technology to Support Mathematical Augmentation

In collaboration with MIT and leading mathematics educators studying early algebraic reasoning,TERC is designing and implementing a computational toolset with which elementary students can construct and share mathematical proofs in the service of learning to be competent algebraic reasoners. These tools will be developed and tested within an existing tablet-based computational infrastructure that supports the sharing of student work as a basis for class discussion.

Funder: National Science Foundation (IIS-1250362)

Using Routines As An Instructional Tool for Developing Students' Conceptions of Proof

This project is developing and investigating a teaching model to help 2nd through 5th grade teachers integrate the concept of proof into their mathematics instruction. Through close collaboration with a group of teachers experienced in incorporating ideas of proof into their instruction, project staff plan to develop a small set of instructional routines that systematically engage students in developing habits of noticing, articulating, representing, and justifying general claims about operations in the context of core grade-level content. After the model is developed and refined through several iterations in classrooms of the experienced teachers, it will be implemented in classrooms with teachers inexperienced in incorporating such material. An important focus of the research is on how such instruction affects the learning of students who have been relatively successful and unsuccessful in achieving competency in numbers and operations.

Funder: National Science Foundation (DRL-1019482)

Zoo and Aquarium Research Collaborative (ZAARC)

Based on prior research conducted as part of the Math in Zoos and Aquariums (MiZA) project, this three and one-half year research study is exploring a collaborative model for action research in which zoo and aquarium educators study how and what visitors learn while they are doing mathematics-based activities. Project researchers will study how zoo and aquarium educators learn to carry out action research—particularly in relation to educators comprehending: how mathematics learning responds to practical (and often pressing) issues in the lives of people in organizations and communities; how mathematics learning opens new 'communicative spaces' for dialogue and collaborative relationships; how mathematics learning draws on existent ways of knowing; and how mathematics learning changes and develops as visitors deepen their understanding of issues that need to be addressed.

Funder: National Science Foundation (DRL-1114335)

The STEM Education Evaluation Center (SEEC) at TERC

SEEC at TERC offers external evaluation services for the STEM education sector. SEEC evaluators have experience conducting needs assessments; front-end evaluations; process evaluations; formative evaluations; and external summative evaluations for clients and organizations ranging from school districts to universities to research thinktanks. SEEC evaluators have content expertise in algebraic thinking; biology and biotechnology education; data and statistics; educational equity; elementary math; environmental and earth science; and online games and software.

Evaluating DMI

Evaluating the Developing Mathematical Ideas (DMI) Teacher Professional Development Program is a 3.5 year efficacy study of a well-known, commercially available math teacher professional development (PD) curriculum. The study uses experimental and quasi-experimental methods to ask: How does elementary teacher participation in DMI affect teacher knowledge, teaching practice, and student learning?

The project works with about 195 public school teachers and their students in several urban and suburban school districts in Massachusetts. Volunteer teachers are randomly assigned either to PD with DMI in the first year of the efficacy study, or as a control/ comparison group who will wait till the second year of the study to receive DMI PD. Both groups of teachers will be followed through two academic years, gathering evidence about teacher knowledge, teaching practice, and student achievement. There are multiple measures of each construct, including video-analysis of teacher practice, and a new video-based measure of teacher knowledge. Analyses use OLS regression, hierarchical modeling, and structural equation modeling, as appropriate, to compare the two groups and to track changes over time.

Funder: National Science Foundation (DRL-1019769)

Excellence in Secondary Science Teaching Evaluation

TERC is evaluating the Rice Excellence Secondary Science Teaching (RESST) program, which provides secondary school teachers with professional development in physics and chemistry, augmented with current research topics in nanotechnology, biotechnology, and environmental engineering.

Funder: William Marsh Rice University

Geniverse Evaluation

The Geniverse project is determining the feasibility of engaging students in experimentally-oriented bioinformatics and DNA science cyberlearning modules. The Concord Consortium, the Maine Mathematics and Science Alliance, the Jackson Laboratory and BSCS are developing and studying 17 computer-based instructional modules that can be used in high school biology courses. Students are working in virtual laboratories to conduct genetics research on populations of mythical dragons by manipulating models and simulations based on well-known genetic disorders. TERC is conducting the project evaluation.

Funder: National Science Foundation (DRL-0918642)
Partners: Concord Consortium, Maine Mathematics and Science Alliance, Jackson Laboratory, BSCS

HAS Evaluation

TERC is evaluating the newest curricular units and computer-based investigations being developed for The Concord Consortium's High-Adventure Science's Earth Systems and Sustainability (ESS) extension. High-Adventure Science (HAS) is a middle and high school investigation-based Earth and Space science program.

Funder: The Concord Consortium through a grant from the National Science Foundation (DRL-1220756)

Helios STEM School Pilot

The Helios STEM School Pilot is a joint initiative of the Science Foundation of Arizona and the Helios Education Foundation to help the Arizona STEM Network improve student achievement in STEM fields. TERC evaluators are tracking implementation efforts at pilot sites by collecting qualitative and quantitative data, which will be examined in the context of teh pilot sites' proposed goals, timelines, intervention plans, and implementation strategies.

Funder: Science Foundation of Arizona

IMPS Evaluation

The project builds off previous EDC work on mathematical, algebraic and geometric habits of mind as well as the CME Project Mathematics and Transition to Algebra curriculum materials. Its goal is to develop and disseminate models and images of the mathematical practices highlighted in the Common Core State Standards, particularly using the curriculum device of dialogues among a recurring trio of students with distinctive mathematical personalities. EDC will develop materials and associated problems for use in classrooms, as well as in teacher professional development sessions. TERC will provide external evaluation of the impact of the project.

Funder: EDC through a grant from the National Science Foundation (DRL-1119163)

ISI Evaluation

TERC is evaluating Purdue University's Indiana Science Initiative (ISI) program efficacy, a collaborative effort with the Department of Education and the Lilly Foundation, which provided hands-on training for 1,050 elementary and middle school science teachers in the summer of 2010. These teachers have implemented outcome-based science curricula in 250 schools across Indiana, reaching nearly 50,000 students.

Funder: Purdue University through a Lilly Foundation grant

LOCUS Evaluation

ERC's Evaluation Group will serve as evaluators for the LOCUS project. Building from the GAISE (Guidelines for Assessment and Instruction in Statistics Education) framework and the Common Core Standards, LOCUS project researchers at the University of Florida, with the support of those at the University of Minnesota, the Educational Testing Service, and Kenyon College, are developing two tests (instruments) to assess conceptual understanding of statistics among students in grades 6-12. The assessments will include a variety of response formats, and will be piloted, revised, and field tested in six states. TERC will conduct a process evaluation, will provide formative feedback on the development of training materials for the project website, and will evaluate the impact of web-based dissemination efforts.

Funder: The University of Florida through a grant from the National Science Foundation (DRL-1118168)