



MITS Summer Institute

Museum Institute for Teaching Science

The mission of the Museum Institute for Teaching Science (MITS) is to raise science literacy by improving the quality of elementary and middle school (K-8) teaching in science, technology, engineering and mathematics (STEM). Science literacy is a critical skill that, if learned at an early age, helps develop critical thinking, reading abilities and computation skills needed to make informed decisions in daily life. America's science literacy, however, has suffered in recent years, posing a serious risk to the nation as the world leader in innovation and its economic future.

In response to this decline, seven Boston-area museum directors formed MITS in the 1980s and found that poor or uninspiring teaching methods often caused students to lose interest in STEM subjects in their formative years. The result has been a dangerous dearth of students who pursue science at universities and as a career. MITS has developed an affordable program that reverses this trend by tapping museum educators to teach schoolteachers hands-on, inquiry-based teaching methods that will inspire students to pursue science rather than discourage them from it. Teacher surveys indicate that they have had very positive reactions from their students when using their new teaching skills.

The program involves a two-week Summer Institute in which museum educators present K-8 instructors with innovative, high quality teaching methods for science, technology, engineering and mathematics. Teachers learn how to teach these subjects using inquiry-based methods on three levels: directed, guided, and open inquiry. Teachers trained in this methodology will be able to encourage their students to think critically, nurture their interest in STEM subjects, and ultimately prepare them for

The Roe Better Government Network researches and distributes public policy solutions for the benefit of the New England states. The Roe Papers are selected from among the most intriguing and original submissions to Pioneer Institute's annual Better Government Competition. Pioneer works with each submission's author to develop their ideas into detailed, actionable policy proposals.

We are appreciative of the Roe Foundation's generous support for this initiative. Their sustained funding has enabled Pioneer to vet these ideas with policy makers and experts as well as legislators and executive officials.

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university-level science study and to be productive members of the workforce.

The MITS Summer Institutes take place in nine regions throughout Massachusetts – the Berkshire region, the Springfield Region, the Boston Region, the Cape Cod Region, the Essex Region, the Lowell Region, the Metro-West Region, the Southeast Region, and the Worcester Region – using educators from 43 museums. MITS primarily serves teachers from the public school system, but also caters to private and parochial school teachers and parents who home-school their children. The Institutes are open to all K-8 educators, including principals. Overall, there is room for 400 teachers to participate.

Each region has a lead educator who facilitates the programs with museum educators from three or four nearby cooperating museums, thus enabling participants in the regional workshop to have the unique opportunity to spend about two days at each museum where they learn from their primary source material. Moreover, each region covers distinct subject areas and teaching approaches that include maritime environments, zoos, and botanical gardens.

During the Institute, teachers develop either two lesson plans for 60 Professional Development Points (PDP's), or a science unit with 8-10 lesson outlines and one complete lesson plan for 90 PDP's which are linked to the Massachusetts Frameworks appropriate for the grade they teach. Teachers who create a unit may also earn 3-4 graduate credits.

MITS provides teachers with detailed information on the course requirements, resource materials, and a subscription to *Science is Elementary (SIE)*, the institute's quarterly publication which includes activities linked to the National Benchmarks and National Science Education Standards, background information, and myriad resources based on the past summer's Institute topic. The museums also provide teachers with a comprehensive set of activities in which they have participated and relevant background information.

To help ensure teachers understand and incorporate the inquiry-based methods of teaching into their curriculum, MITS follows-up its programs with rigorous evaluations. Teachers receive a questionnaire on the first and last days of the program to gauge whether their understanding of STEM content increases. Secondly, teachers must keep a journal that details their understanding of the new inquiry-based, hands-on practices and how they visualize using their new skills in the classroom. The units and lesson plans developed by teachers also help indicate their understanding of their newly acquired methodology and ability to relate the lessons to their curriculum. Finally, in the spring after the Summer Institutes, teachers are required to attend a callback session in each region to discuss how they have used what they have learned, providing valuable feedback on real-world applications of the program. These sessions also allow the teachers to participate in new activities and receive any extra help they may need.

The Museum Advisory Committee, made up of the Lead Museum Educators from the nine regions, begins in September to meet monthly under the chairmanship of the Program director to discuss teacher comments and evaluations of the previous Summer Institute. This allows MITS to make intelligent adjustments in response to experiences from the prior summer and information gleaned from teacher journals. The overall topic for the following Institute is then suggested and submitted to the Board of Directors for its approval. In contrast to the complacency that besets some other professional development programs, the Committee has every year refined some aspect of the information that MITS provides to each teacher.

Since 1986, MITS has had almost 3,000 participants in the Summer Institutes with many of them coming more than once. An evaluation done in 2000 by the Lesley University Program Evaluation and Research Group found that teachers who came multiple times or in groups came away with a better understanding of their subject, as well as how to apply their new skills in class.

While the accrued benefits to teachers and students are priceless in terms of maintaining America's role as a global leader in STEM subjects, MITS has managed to keep the program inexpensive, and it's certainly competitive with more typical professional development programs. MITS is funded by grants from foundations and leading scientific corporations such as Genzyme, Bose and the Cabot Corporation. Subscription to Science Is Elementary also provides important revenue, as do fees from professional development seminars for museum educators. MITS also receives occasional fees for other educational programs, such as a contract with the State of Massachusetts for the Parents Involvement Project. Summer Institute fees - the cost is \$200 per teacher or \$175 if two or more come from the same school – also help.

After completing the Summer Institute, teachers return to their schools with new skills and resources to enhance their curriculum, and are excited and stimulated to share their new teaching and learning experience with their students. They can use the activities directly in their classes and /or use them to model changes in their current curriculum. Teachers can also serve as models for their colleagues using the MITS approach. The teachers benefit from knowledge of new content and methods of teaching and from professional interaction with teachers from other schools. Teachers also become more acquainted with the facilities of the museums and come away with a whole new stable of resources they did not have before, giving them a professional edge over colleagues who have not gone through the program.

In callback sessions and on surveys, the feedback has been overwhelmingly positive. Institute graduates are finding that inquiry-based, hands-on methods for teaching STEM subjects are inspiring greater enthusiasm among their students for these subjects, while they also demonstrate more advanced critical thinking and communicative skills. Several teachers have expressed interest in using inquiry-based methods in other subjects they teach.

Presently, MITS has educators from four or more museums in each of nine regions of Massachusetts providing the two-week Institute on a common topic. This summer there are educators from 43 museums providing the instruction. Educators in each region meet several times in preparation for the Institute to plan a cohesive program.

The program has also grown to include three Professional Development Seminars (PDS) each winter for museum staffs on topics to enhance their teaching and to keep up-to-date on educational reform. Also, STEM booklets are now being created on CD's. These will compile activities from past issues of SIE according to specific disciplines for all the STEM subjects.

The need and urgency of improving STEM education is not limited to Massachusetts, but is an issue throughout the country. Over the last 25 years, the decline of STEM education and its impact on American students and their readiness for university study and career pursuits has reached dramatic scale. If this trend is allowed to continue unchecked, students will be woefully unprepared for the workforce, and will be unable to compete with students in other nations that have invested more in their science education systems.

The nation faces a chronic shortage of qualified teachers who are adequately prepared and supported to teach STEM disciplines effectively. The MITS Summer Institute addresses this concern with an innovative and effective approach that reaches out to all educators. The MITS program focuses on teaching the processes of STEM, allowing teachers to adapt what they have learned to any curriculum and subject rather than to a limited content. This empowers teachers to challenge their students to think about problems and solutions rather than simply providing them with a restricted answer.

MITS recognizes that it too can benefit from collaboration with professionals, and has teamed

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with entities such as Merck and Company, and the University of Massachusetts to bring better STEM teaching methods to teachers and their students. For example, the programs with Merck and the University of Massachusetts are focused on bringing STEM teaching methods to teachers and students in hard-pressed urban schools in Boston.

Despite the daunting challenges of raising science literacy, the success engendered by the MITS program provides hope, and evidence, that with the proper training, teachers can help students enjoy and excel in science, technology, engineering and mathematics. With this optimism, MITS has an eye on future success. For example, MITS is seeking to establish a several-year commitment to a Summer Institute from a school district in one or more of its regional areas. While many teachers return each year to the Institute – another sign of the program’s appeal - having a commitment from a specific school will provide more in-depth information on the impact of the MITS program, and also spawn a ripple effect on other schools.

Given the urgency of the science decline problem, MITS has also made expanding its program to schools beyond Massachusetts top priority. This includes transplanting the idea of museums working together on a permanent basis toward a common goal outside the state.



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85 Devonshire St., 8th Floor, Boston, MA 02109