

## Welcome to the Dream:

# EGYPTIAN MODEL STEM HIGH SCHOOLS

## A New Vision for 21<sup>st</sup> Century Advanced Learning

In September 2011, in the midst of the Egyptian Arab Spring, another revolution was taking place in Egypt, a revolution in education. It began small with the establishment of the first Science, Technology, Engineering, and Mathematics (STEM) High School in Egypt - 6 October residential STEM School for Boys. It was a bold step taken by the Drs. Ahmed Gamel el Dun Moussa, Minister of Education, and his First Deputy Minister, Dr. Reda Abouserie. The goal was not only to raise a generation of critical thinkers, problem solvers and future leaders of Egypt, but also to stimulate innovation in the education system and serve as a catalyst for system-wide science and mathematics education reform.

This new goal required technical assistance to design an integrated project based curriculum, train teachers in inquiry pedagogy and laboratory experiments and create an entirely new assessment system. USAID-Egypt sponsored a study tour for an Egyptian delegation led by Dr. Ahmed Gamel el Din and Dr. Reda to visit STEM schools in Philadelphia, USA. They were greeted by Mr. F. Joseph Merlino, President of the *21<sup>st</sup> Century Partnership for STEM Education*, (21STEM); Ms. Jan Morrison, President of the *Teaching Institute for Excellence in STEM* (TIES), and Dr. Frederic Bertley, Vice President of *the Franklin Institute* (TFI). These three organizations, whose staffs had extensive experience in designing US STEM schools, implementing reform curriculum and providing expert teacher professional development, would become the core technical team, led by Dr. Reda, for the development of the Egypt STEM School Model.

In January 2012, the US STEM Technical team began working in Egypt on a short term technical assistance subcontract to provide immediate teacher training to the 6 October Grade 1 teachers and to advise the USAID-Egypt mission about the strengths and needs of the school. In March 2012, a RFA was issued to provide longer term assistance. In August 2012 USAID awarded a \$25M grant to World Learning as prime with the US STEM team providing all of the technical assistance to the MOE in concert with Dr. Reda. A month later, in September 2012, the MOE established another residential school, the Maadi STEM School for Girls.

The US technical team did not import a ready-made US STEM School Model and export it to Egypt. Instead, the US team took the best of everything they knew in the U.S. and then worked together with the Egyptians in a series of design studios to develop a uniquely Egyptian model school. The features of the model include:

- An integrated STEM curriculum based on Egypt ten “Grand Challenges.” All STEM subjects (biology, geology, chemistry, physics, mechanics and mathematics) are taught

every week (but not every day) and woven together using a semester theme, such as Matter Form and Function. The integration is made possible by breaking each course into 1-2 week long Learning Outcomes, then weaving these LOs into content stands that are consistent with learning progressions.

- Exemplary rated U.S. problem-based math and science textbooks developed, field tested and validated with funding from the National Science Foundation.
- Capstone projects that are semester long. There are six Capstone projects over three years which are based on practical problems related to one or more Grand Challenges.
- Digital Fabrication Labs (Fab Labs) that allow student to manufacture objects for their capstone projects.
- Science and mechanics laboratories that are part of the classroom
- Extensive, multi layered, teacher training every year in pedagogy, the integrated curriculum, formative assessments with “PARLO” – Proficiency Based Assessment and Reassessment of Learning Outcome, an advanced assessment management system.
- A mixed measured assessment system for graduation that included: Practical exams; Tests of Concepts; Capstone Exhibitions, and subject specific Learning Outcome Exams.

The Ministry of Education, USAID, and the US STEM Team worked together under the leadership of Dr. Reda. Each had a role to play. The MOE constructed and furnished the schools, and covered the operational expenses, students’ accommodation and teachers’ salaries. The Education Minister issued enabling decrees such for the curriculum and assessment system. Through the systemic and policy reforms associated with the establishment of STEM schools, the MOE institutionalized a transparent STEM admission system, endorsed STEM curricula and recognized the STEM exit exam as a substitute for the national high school exit exam (*Thanaweya Amma*).

With USAID’s support, the U.S. STEM team introduced non-traditional teaching and learning strategies that replaced traditional pedagogies with project-based, cross- disciplinary, inquiry-based approaches to enhance student creativity, critical thinking, problem solving, and engagement. Through USAID’s technical assistance, the MOE developed selection criteria for STEM educators to recruit high caliber teachers for STEM schools. These selection criteria included a solid command of English language as one of the key requirements, plus a demonstrated understanding their field using university-level concept inventories.

By September 2013, the first version of the new integrated STEM curriculum was introduced in the 6 October STEM School for Boys and the Maadi STEM School for Girls. Near the end of the 2013-14 school year students from both schools competed in the Egyptian competition phase of the Intel International Science and Engineering Fair. Winners would qualify to go to Los Angeles in May 2014 to compete internationally. The Maadi girls’ team won in Egypt and placed 3<sup>rd</sup> in their category in Los Angeles. Then, the following year in May 2015, a team of girls placed 1<sup>st</sup> in their category, which was unprecedented in Egypt. Students from these

schools have won national and international awards in scientific invention and discovery. This success resulted in increased demand among students for STEM education.

In October 2015, the MOE opened seven STEM high schools. They are preparing to establish a total of 27 STEM high schools during the next three to four years. This expansion will lead to increasing enrollment from 270 in September 2014 to more than 3,500 STEM students per year. To date, eleven (11) STEM high schools have been established. More than two hundred and seventy students have graduated from STEM schools in the past two years and have enrolled in joint prestigious universities in Egypt, the U.S. and Italy. With regard to gender equity, 44.5% of the STEM students are girls.

**Below are reprint of USAID and US Embassy web pages the Egypt STEM Schools**



FRONTLINES  
ONLINE EDITION

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## These 3 Egyptian Girls Are Among the Smartest Teens in the World

*Claudia Gilmore Gutierrez*



**Left to right: Mona El Sayet, Hoda Mamdouh and Sara Ezat. Last year, these students from the Maadi STEM School for Girls competed in the Intel International Science and Engineering Fair in Los Angeles and placed third in their category. Claudia Gilmore Gutierrez, USAID <https://www.usaid.gov/news-information/frontlines/science-technology-innovation-and-partnerships/these-3-egyptian-girls>**

High school students are conducting scientific experiments in the classroom to solve some of their country's greatest challenges.

Meet Hoda Mamdouh. She's a 17-year-old girl from the lush Nile Delta region of northern Egypt. Like most teenagers her age, she loves playing sports and listening to music. What makes Mamdouh different is her scientific research that's taking her places she never imagined.

Last May, Mamdouh and two classmates traveled halfway around the world to compete in the Intel International Science and Engineering Fair in the United States. Together these high schoolers found a way to purify drinking water—from either taps or well—using 24 percent less energy than typically used in thermal water distillation. They won second place at Intel's national science fair in Egypt. And at the global competition in Southern California, they placed third in their category among 1,600 of the best and brightest students in the world.



**Two students design new technology with 3D printers in the USAID-funded fabrication laboratory—an MIT-designed “FabLab”—at the Maadi STEM School for Girls, where students are free to experiment and develop critical thinking skills.***Claudia Gilmore Gutierrez*

As high school juniors, Mamdouh and her friends are already preparing to become agents of change in Egypt. They attend the Maadi STEM School for Girls, one of two new secondary schools in Egypt that focus on science, technology, engineering and mathematics. Here they learn how to think outside the box, conduct experiments and work in teams—all important skills for growing into leaders and designing solutions to their country's greatest development challenges. And they're already putting

them to use, conducting classroom research on issues directly related to Egypt’s economic growth like effective water use, traffic congestion and disease prevention.

“Coming here was a turning point in our lives,” Mamdouh says. “We went from memorizing every day at school to doing real research. Everyone’s a teacher, and everyone’s a student.”

This state-of-the-art model for public education was introduced to Egypt by USAID’s Hala ElSerafy, a senior education specialist at USAID’s mission in Egypt, and her team of experts. Instead of using your average high school curriculum—which in Egypt is rote memorization—these students become scientists in the classroom and learn from hands-on experiments and open dialogue.

USAID partnered with the Ministry of Education to build and develop the country’s first two STEM schools three years ago—one for boys and one for girls. “The idea is to raise a generation of critical thinkers and future leaders,” said Maadi school principal Samia Ahmed. “We believe our youth can solve Egypt’s grand challenges through science, technology, engineering and mathematics. And, so far, our experiment is working.”

Currently, 300 students attend the girls’ school and 357 students attend the boys’ school, both located in suburbs outside Cairo. Students from throughout Egypt are selected through their national test scores—the initial groups included only students scoring in the top 2 percent in the country. USAID is partnering with the Government of Egypt to expand this model of public education to all 27 governorates in the country.

Three new schools are nearly complete—two in the Nile Delta region and one in the southern governorate of Assuit—with plans to construct four more by 2017. All nine STEM schools will be able to enroll 3,600 students per year, giving Egypt’s brightest students the opportunity to think outside the box and perform real research before they even graduate high school.

“With the right teachers and education, our students here are capable of anything they set their minds to,” said ElSerafy. “For example, one STEM student, a 16-year-old boy, recently told me he wants to find a cure for Hepatitis C. He started his research at school and was invited to study with university faculty in Germany.”

To accomplish the aims of the project, , USAID **awarded** a grant to consortium of [World Learning](#) ([link is external](#)), **and three partners STEM** institutions—**The Franklin Institute, the Teaching Institute for Excellence in STEM, and the 21<sup>st</sup> Century Partnership for STEM Education**— to help transform these STEM schools into incubators for future leaders and innovators who have the potential to advance research that fuels innovation and generates employment opportunities. [Note language in red is our corrected text from the press release]

**“With the right teachers and education, our students here are capable of anything they set their minds to.”**

“USAID has a history of embracing and advancing science, technology and innovation to create new solutions for age-old challenges,” said Mary Ott, USAID deputy assistant administrator for the Middle East. “The projects the Egyptian STEM students are working on—ranging from water desalination to ultraviolet germicidal irradiation techniques—show the kind of innovation and brilliance that the world needs.”

Now others around the world are looking to Egypt’s model of STEM education and talking about ways to introduce it in their own countries. At a recent conference for Arab ministers of education, representatives from both Bahrain and the United Arab Emirates discussed plans to send their students to Egypt’s STEM schools for summer camp this year.

“This will be a great chance for youth from around the region to come and learn how STEM works,” said ElSerafy. “Egypt has really shown the world how this type of education can play a powerful role in development—and delegations around the Arab world are taking careful note.”

The Government of Egypt has also taken note of these remarkable students and their teachers. Just last September, Egyptian President Abdel ElSisi awarded STEM teachers and students with the Order of Distinction by presidential decree, the highest medal bestowed upon Egyptians who make significant contributions to society. Mamdouh and her two classmates who competed at the international science fair in the United States were among the students honored by President ElSisi. He later declared expanding STEM education one of his top educational priorities for Egypt.

Now Mamdouh’s planning her next steps after graduation. “I want to find a cure for Alzheimer’s disease,” she says. “My wish is to study at MIT [Massachusetts Institute of Technology] and research stem cells because I believe they hold the cure.”

**Related Video <https://www.usaid.gov/news-information/videos/maadi-stem-school-girls>  
[Maadi STEM School for Girls](#)**

"You look at sand and you see dust. We look at sand and we see electricity. You look at water and you see a drink. We look at water and we see a fuel cell. You look at garbage and you see dirt. We look at garbage and we see biogas. You look at STEM and you see a school. We look at STEM and we see a dream."



## U.S. Embassy & Consulate in Egypt

### Three New Cutting-Edge Secondary Schools Open in Alexandria, Dakahleya and Assiut

<https://eg.usembassy.gov/three-new-cutting-edge-secondary-schools-open-alexandria-dakahleya-assiut/>

June 1, 2015



Ashraf Abo Arafe

The U.S. Embassy and the Ministry of Education announced yesterday the launch of three new Science, Technology, Engineering, and Mathematics (STEM) secondary schools in Alexandria, Dakahleya, and Assiut. The American people, through the U.S. Agency for International Development (USAID), partnered with the Government of Egypt to build and develop the country's first two STEM high schools in 2011.

“The remarkable thing about STEM education is students learn how to think outside the box, conduct experiments, and work in teams,” said USAID/Egypt Mission Director Sherry F. Carlin. “These are all important skills that will help Egypt’s youth grow into future leaders and design solutions to the country’s greatest development challenges.”

The STEM model of education in Egypt provides a strong academic foundation in science and mathematics for more than 500 of Egypt’s brightest students from a range of socio-economic backgrounds. USAID has developed the STEM curriculum, provided equipment for school laboratories, and conducted training and coaching for teachers and administrators for the STEM Schools in Maadi and 6th of October. Students from these two schools have participated in and won awards at global competitions such as the Intel International Science and Engineering Fair in the United States and the International Science Competition in Taiwan.



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[HTTPS://WWW.USAID.GOV/EGYPT/PRESS-RELEASES/FEB-23-2017-US-INTEL-HONOR-EGYPTIAN-SCIENCE-FAIR-AWARDEES](https://www.usaid.gov/egypt/press-releases/feb-23-2017-us-intel-honor-egyptian-science-fair-awardees)

# U.S., INTEL HONOR EGYPTIAN SCIENCE FAIR AWARDEES



Winners of the Cairo Intel Science Fair will advance to the international competition in Los Angeles later this year. Here, they pose with Minister of Education Dr. Tarek Shawki and USAID/Egypt Mission Director Sherry F. Carlin. *USAID/Jon Erb*

**Cairo** – Several students were recognized for excellence today during the award ceremony for the Intel International Science and Engineering Fair in Cairo. The award ceremony caps off a three-day event sponsored by Intel and the U.S. Agency for International Development (USAID) in conjunction with Bibliotheca Alexandrina, the Ministry of Education, and the Ministry of Youth and Sports.

“Science and technology play a critical role in spurring innovation and increasing economic growth,” said USAID Mission Director Sherry F. Carlin. “The U.S. government is proud to support this competition and hopes that the students here today will design solutions to Egypt’s greatest development challenges.”

Chargé d’Affaires Thomas Goldberger also visited the Intel International Science and Engineering Fair (ISEF) today and congratulated participants for their innovative projects. The U.S. government is sponsoring regional fairs in Cairo, Luxor, and Alexandria in February and March 2017. The winners of each fair will join more than 1,700 high school students from around the world to showcase their independent research and compete for prizes at the international fair in Los Angeles, California in May 2017.

USAID’s support to science, technology, engineering, and mathematics (STEM) education is part of the \$30 billion that the American people have invested in Egypt through USAID since 1978. In addition to providing support for this science fair, USAID helped establish eleven STEM high schools throughout Egypt and formed 140 scientific research clubs in Egyptian middle schools. USAID offers undergraduate scholarships for students to study in STEM fields in Egypt and the United States and supports the U.S.-Egypt Science and Technology Joint Research Program, which pairs scientists from both nations to jointly address world challenges.