



The State of Science, Technology, Engineering, Math (STEM) Education in San Diego and Israel

Prepared for the Jewish Community Foundation of San Diego
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Introduction

This research was compiled to inform Jewish Community Foundation donors on the current picture of STEM education in San Diego and Israel. Though not an exhaustive document, it provides a snapshot of current needs, the urgency for continued programs that improve STEM literacy, as well as causes leading to the current state of STEM education in these regions.

STEM Background and Summary

STEM education is an interdisciplinary and applied approach that bridges science, technology, engineering and mathematics with real-world, problem-based learning. STEM education removes barriers between the four disciplines it comprises by integrating them into one cohesive teaching and learning paradigm. Such an interdisciplinary approach is necessary to prepare students, as new innovations and inventions tend to be made at the intersections of these four disciplines.

Beyond inspiring innovation and critical thinking, STEM makes space for creating meaningful connections between school, community, work and global issues. A STEM-literate high school graduate can enroll in a college-level course of study in science, technology, engineering, and math without the need for remediation. Continued evaluations suggest that the fastest-growing and highest-wage jobs in future years will be in STEM fields and that all employees will need to utilize STEM skills for problem solving in a wide range of industries.

Attributes of STEM Educated Students (Jewish Funders Network [JFN] Briefing Book, 2012):

Problem-solvers	able to frame problems as puzzles as well as apply understanding and learning to these novel situations
Innovators	pursue independent and original investigation using the design process
Inventors	recognize the needs of the world; creatively design and implement solutions
Self-reliant	able to set own agendas, develop and gain self-confidence and work within specified time frames
Logical thinkers	use the logic offered by calculus and found in 60% of all professions worldwide; able to make the kinds of connections to affect an understanding of natural phenomena
Technologically literate	understand the nature of the technology, master the skills needed and apply it appropriately
Bridging	participate in the STEM lexicon that supports the bridge between STEM education in school and the workplace
Relators	able to relate their own culture and history to their education

State of STEM in California

California students are falling behind their peers nationally and internationally in both science and math achievement. California's spending per pupil was the same as the national average until the mid-1980s, when it began decreasing due to the changes in school district funding enacted with Proposition 13. (*Proposition 13: Some Unintended Consequences*)

California's Ranking among U.S.:

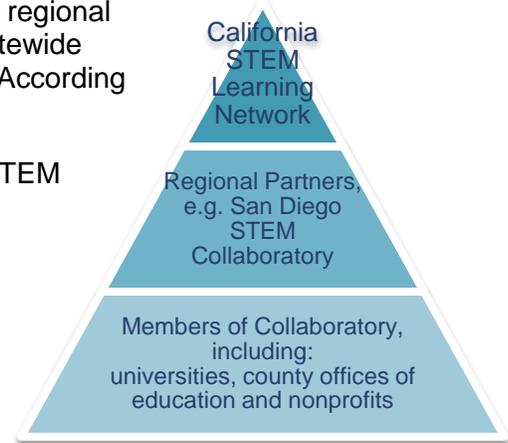
45th Math and Science
 50th Digital Learning
 47th in funding per pupil
 (California STEM Learning Network)

Scores from the 2012 National Assessment of Educational Progress, also known as the Nation's Report Card, ranked California 8th graders 47th in science scores out of 50 states. California students outperformed only Mississippi, Alabama and the District of Columbia. Additionally, only 22% of California students scored proficient or above, and only 11% of Hispanic 8th graders scored proficient or above on these test scores. In a community in which science and technology plays such important economic, cultural and societal roles, these results raise more than mere concerns. (Reuben H. Fleet Science Center STEM Report)

The California STEM Learning Network (CSLNet) works with regional partner organizations throughout California that advance Statewide Initiatives to scale high quality STEM teaching and learning. According to CSLNet:

- Out of a half-million 9th graders, only 4% will earn a STEM bachelor's degree.
- As of the school year 2008-9, only 16% of bachelor's degrees conferred in California were in STEM fields.

To improve the outlook, regional partners' programs also encourage continued education and preparation for teachers. CSLNet has committed to launch a statewide STEM Teacher Pathways initiative that increases awareness and opportunities for students from community colleges, informal education and other settings to pursue STEM teaching careers and to use open education resources.



Network of organizations working on STEM initiatives from state- to local-level

2009 National Assessment of Educational Progress (NAEP): Percentage of Students at or Above Proficient

	California	U.S.	Top 3 States
4th grade math	30%	38%	56% (MA, MN, NH)
8th grade math	23%	33%	48% (MA, MN, NJ)
4th grade science	22%	32%	46% (MA, NH, VA)
8th grade science	20%	29%	42% (MA, MT, ND)

State of STEM in San Diego

The demand for STEM professionals in the U.S. and particularly in San Diego outpaces supply. Currently, too few students have the skills that could lead to careers in the field or to participate

in the political and social conversations that will arise if we are to meet a range of new and emerging challenges.

San Diego's challenge is to ensure that its economic drivers have the regional and global resources necessary to compete. CSLNet's San Diego regional partner, the San Diego STEM Schools Collaboratory, responds to community and national calls for quality, innovative STEM education in public schools. Its initiatives strive to increase:

- Communication, collaboration, problem solving and critical thinking skills.
- Student engagement, community support, teacher effectiveness and consistent assessment.
- Numerous efforts in public, charter and private school as well as out-of-school programs providing necessary STEM education modules.
- Resources for students to be on track to fill positions at San Diego's vibrant bio-tech industry and innovative telecommunication companies.

State of STEM in Israel

Israel is among the leading countries in academic research, industrial and military research and development, and high-tech innovation. Yet, STEM education is compromised due to weak infrastructure, high student-to-teacher ratios, and small budgets.

One challenge to Israel's STEM potential is that many of Israel's ultra-orthodox have not participated in STEM education or workforce to date. Fortunately, many companies and programs are emerging to integrate ultra-orthodox men and women into these sectors with great success, particularly given the keen and well-established analytical skills the ultra-orthodox have developed through their Torah studies.

A unique step in Israel's STEM pipeline is compulsory military service for 18-year-olds. This minimum of 2 (women) or 3 (men) years of service provides skills and a work culture that instill innovation and entrepreneurial capabilities, but it also delays entry into the workforce.



Israeli achievement was ranked 26th out of 26 Organisation for Economic Co-operation and Development (OECD) Countries on 4 of 5 tests from 1999-2007.

In 1999, Israeli math and science achievements were 50 points lower than OECD average (ranking Israel 41 of 64).

- Only 5% of 12th graders are eligible for a quality technology-science diploma.
- Only 38% of these eligible students went on to earn the diploma.
- 34% of pupils attend a technology education framework in contrast with an average 49% in the EU19 countries.

Yet, 50% of Israel's exports are from hi-tech industries. The hi-tech industries' contribution to Israel's GNP is 12%, and 7% for the rest of the world. (JFN Briefing Book, 2012)

Further Resources

California STEM Learning Network: www.cslnet.org

Change the Equation Vital Signs Report (California):
http://changetheequation.org/sites/default/files/VitalSigns_California.pdf

Dissecting the Data 2012: Examining STEM Opportunities and Outcomes for Underrepresented Students in California: <http://www.lphi.org/dissecting-data-2012-examining-stem-opportunities-and-outcomes-underrepresented-students-california>

Georgetown's Center on Education and the Workforce: cew.georgetown.edu/stem/

Growing Opportunity: <http://opportunityequation.org/report>

Jewish Funders Network: www.jfunders.org and Briefing Book Funding the Future: Advancing STEM in Israeli Education:
http://www.jfunders.org/sites/default/files/docs/events/briefing_book_final.pdf

Proposition 13: Some Unintended Consequences
http://www.ppic.org/content/pubs/op/OP_998JCOP.pdf

STEM in Israel: The Educational Foundation of 'Start-Up Nation'
<http://www.acolasecretariat.org.au/ACOLA/PDF/SAF02Consultants/Consultant%20Report%20-%20Israel.pdf>

STEM Giving Opportunities

SAN DIEGO

Broadcom MASTERS

www.societyforscience.org/MASTERS

Broadcom MASTERS (Math, Applied Science, Technology, and Engineering for Rising Stars) is the national science, technology, engineering, and math competition for U.S. 6th, 7th, and 8th graders. It is a program of the organization Society for Science & the Public, and inspires and encourages the nation's young scientists, engineers and innovators. Nominees enter the competition by completing an application explaining their science project and demonstrating their use of STEM principles in the development and presentation of their project. Competition finalists showcase their projects for the public and compete as teams in hands-on STEM activities.

CONNECT

www.connect.org/stem-programs

CONNECT's STEM program, Entrepreneurs for Young Innovators, inspires middle and high school students to pursue careers in life sciences and technology by introducing them to local entrepreneurs with exciting technology products. Local CEOs visit classrooms to tell their stories, describe their companies, demonstrate the products they are creating and explain how STEM classes can help prepare for college and rewarding careers in technology.

The CONNECT summer internship program inspires high school students to work in the field of computer science and programming. Interns are matched with a host company for a 6 week-long internship and present a summary of their work experience to the CONNECT community.

CONNECT reached 2,500 students by the end of the 2012-13 school year. Since 2010 (inception of the program), CONNECT has visited 30 schools and organizations and has reached 6,200+ students.

Elementary Institute of Science

www.eisca.org

Housed in a 15,000 square foot facility in South San Diego, the Elementary Institute of Science (EIS) is a science enrichment program dedicated to nurturing the intellectual curiosity of San Diego's children by providing hands-on experiences to stimulate an ongoing appreciation and understanding of science, technology and the environment. EIS classes take place in a lab setting with no more than 10 students working with an instructor. Labs focus on the areas of chemistry, computer science, engineering, geology, health, natural science, photography and technology.

Math for America San Diego

www.mathforamerica.org/sandiego

Math for America San Diego (MfA SD) supports highly trained, exemplary math teachers who are dedicated to improving mathematics achievement in secondary schools throughout San Diego County. Founded in 2008 by a consortium of educators concerned about the quality of

local mathematics education, MfA SD seeks to attract, train and retain new and experienced teachers who are committed to helping their students understand and appreciate mathematics.

MfA SD's five-year fellowship is designed to:

- improve the retention rate of math teachers in high-need and urban secondary schools,
- expand teacher content knowledge and improve instructional skills, and
- increase student desire and ability to understand mathematics.

To date, MfA SD has 43 fellowship recipients teaching in 33 schools in 10 districts throughout the region. The program is the recipient of two National Science Foundation Robert Noyce Teaching Scholarship Program awards and is supported by local private funding.

MfA SD is a consortium of three partner universities – California State University San Marcos (CSUSM), San Diego State University (SDSU) and the University of California, San Diego (UCSD) – and five local school districts – Escondido Union High School District, Grossmont Union High School District, Oceanside Unified High School District, San Diego Unified School District and Vista Unified School District.

Ocean Discovery Institute

www.oceandiscoveryinstitute.org

For the past decade, Ocean Discovery Institute (ODI) has been empowering urban and diverse young people to protect our ocean and natural environment, improve the health of our communities, and strengthen our quality of life. ODI is the only nonprofit in the San Diego region expressly dedicated to educating urban and diverse youth through ocean science.

All of the primary concepts in science and conservation can be taught through ocean science. Using the ocean, an extraordinary educational resource intrinsic to San Diego, as an educational tool capitalizes on young people's instinctive attraction to the sea and builds knowledge of our planet's defining feature.

ODI's initiatives combine education, scientific research, and environmental stewardship. Currently these tuition-free initiatives reach 5,000+ low-income students each year, including school-based programs and a series of interconnected after-school and summer programs and support services for middle school, high school and college age youth. To ensure continued effectiveness, a professional external evaluator conducts regular program assessments.

San Diego Science Alliance

www.sdsa.org

San Diego Science Alliance (SDSA) strives to improve K-12 science education in San Diego County, delivering quality experiential programs, building bridges between the region's diverse business, education and scientific research communities, and fostering public/private partnerships to increase science literacy. It reaches 30,000 K-12 students annually in every school district in San Diego County. SDSA delivers innovative and engaging science programs, such as a High Tech Fair and Robotics Education, responsive to the interests and needs of K-12 students, teachers and community partners.

BE WiSE, a program of the SDSA, invites girls in seventh and eighth grades to Science Overnights at local science institutions to explore their interests in science, hosts events for BE

WiSE alumnae in high school to encourage their selection of more courses in science and math, and exposes these girls to adult women scientists who share their knowledge about, passion for, and experiences with science and engineering careers. Events are scheduled throughout the academic year and during the summer, when more intensive experiences are offered.

SciTech, Reuben H. Fleet Science Center

www.scitechgirls.org

The Fleet Science Center aspires to inspire and educate students and teachers through a hands-on approach to science education that will feed and maintain a steady pipeline of STEM-capable graduates and life-long science learners.

The Fleet Science Center's SciTech program:

- Is an after-school outreach program for girls in fourth through twelfth grades.
- Focuses on underserved girls in San Diego-area schools.
- Uses project-based classes that help girls to make concrete connections to everyday life as they develop creative thinking and problem solving skills.
- Adheres to a project-based format, with every four to six sessions focusing on a different scientific project or challenge. This format has proven successful because it allows for the integration of science with other subject areas.
- Classes are taught by the Fleet's science education staff, with input and collaboration from classroom teachers at each of the eight school sites.
- Integrates girls at the middle and high school levels as mentors for younger girls.
- Expects that girls show increased knowledge of basic science and technology concepts, improved science self-concepts and attitudes, and expanded awareness of STEM-related career opportunities.

University of California, San Diego (UCSD)

create.ucsd.edu/stem-initiative

UCSD's CREATE STEM Success encompasses its STEM outreach programs and is focused on improving and networking UCSD's resources for the K-20 STEM education pipeline in San Diego. This initiative facilitates their integration, improvement, and collective impact.

Among the many STEM outreach services are the following:

- **Jacobs School of Engineering:** The Center for Inclusion, Diversity, Excellence, and Advancement (IDEA Student Center) at the Jacobs School of Engineering is committed to fostering a supportive environment for diverse engineering students as well as increasing K-14 student knowledge and awareness of engineering.
- **Division of Physical Sciences:** The California Teach program provides a deeper, richer understanding of mathematics and science, while enhancing the ability to effectively communicate mathematical and scientific ideas to others.
- **Qualcomm Institute:** The myLab Program combines engineering, art and technology with hands-on experience to inspire passion in engineering. myLab Program partners with university colleagues to provide undergraduate workshops, internships, and K-12 outreach.
- **The UC San Diego Academic Connections** pre-college program connects high-achieving high school students with college subject matter courses led by graduate

students in a wide array of academic disciplines, renowned UCSD faculty researchers and experts in the fields.

- **The Preuss School Science Enrichment Program** offers activities that will inspire interest and engagement in science as a field of study and as a career for Preuss students. It focuses on three projects: 1) Biotechnology Labs, 2) Science Fair Tutorial and 3) Girls in Science.

SAN DIEGO JEWISH DAY SCHOOLS

San Diego Jewish Academy

www.sdja.com

The San Diego Jewish Academy (SDJA) Science Department aims to create lifelong learners of science who are inspired to question and understand the world. Middle and high school students are guided on an adventure through hands-on laboratory activities, group interactions, lectures, and on-campus visitations by specialists in their fields. STEM students grow in confidence as they pursue their own ideas and interact within the scientific community. Students apply creativity, innovation and entrepreneurship to their projects.

In the high school's two- to three-year STEM program, self-driven students work as individuals or teams on STEM research and development projects. Students may develop projects onsite at SDJA or elsewhere in San Diego with the guidance of external mentors.

Students compete at high-level county, state, country and international STEM competitions. Through this award-winning program, three winners placed in the INTEL International Science and Engineering Fair, which is considered the top high school science fair in the world, and one placed first in the 2012 Google Science Fair.

Soille San Diego Hebrew Day School

www.hebrewday.org

Soille San Diego Hebrew Day School is the latest school to join the ranks of prestigious private schools to adopt Singapore's national math curriculum. Students understand the concepts and make connections between the numbers and learn how to do mental calculations. The program uses visual elements such as model-drawings and picture-based problem solving and moves quickly from pictorial illustration to abstract concepts. The children are encouraged to learn through discovery and to use a variety of manipulatives that enhance concept development. They will develop understanding and insight into the patterns of mathematics through use of concrete materials, learning through discovery and an environment of positive reinforcement. They are taught to see the relationships and interconnections of mathematical ideas and concepts.

Standardized tests show that Soille is graduating young men and women who demonstrate achievement in line with students in the finest schools in America.

ISRAEL

Ahed -- The Association of Academics for the Development of Arab Society in The Negev

<http://www.iataskforce.org/members/ahd-high-school-science>

The Ahed is an organization of local Negev Bedouin academics, public servants and university graduates dedicated to advancing the Negev Bedouin community. The school aims to enable its students to participate in the broad high tech era as fully achieving equals and to move toward being fully participating members of Israeli society and the global economic future. It is believed that the creation of this school is the single most important action that can be done to raise the overall level in the Negev Bedouin community.

Ahed aims to cultivate excellence and rigor combined with leadership development, social awareness and civic responsibility, while the objective of this endeavor is to enable acceptance of Bedouin students to the exact and bio-sciences faculties of leading Israeli universities.

Bloomfield Science Museum, Jerusalem

www.mada.org.il/en

The Bloomfield Science Museum in Jerusalem is an informal cultural and educational institution that presents exhibitions consisting of interactive exhibits on subjects of science and technology, and integrates these exhibits into a context through a wide range of educational activities.

The goals of the museum are to increase interest among the general public in science and technology in the world around us, to promote excellence in sciences among youth, and to present science and technology as an integral part of human culture. It hosts a Young Science Contest and a Science Café, a way for children to explore science in a format less rigid than the classroom-and-desks environment.

Center for Initiatives in Jewish Education

www.thecije.org

Center for Initiatives in Jewish Education (CIJE) programs help students master scientific language and concepts, tackling real-world problems in science and engineering through inquiry-based learning and hands-on projects. Initiatives include Science Labs for hands-on learning, math tournaments and virtual competitions, engineering-related study, career preparation and Teacher Training and Professional Development for teachers to ensure maximum impact of STEM education.

Center for Educational Technology

www.cet.org.il

In its 40 years of activity, Center for Educational Technology (CET) has invested significant resources in carrying out its social mission, and has established its expertise and reputation in

the education system in Israel. Main areas of activities are: development of state-of-the-art textbooks and digital content, establishment of rich websites using top-of-the-line technologies, paving new ways in professional development for educational staff and creating online environments and tools for assessment & evaluation. CET adapts products, services and programs to the needs of every population segment: Israeli-born and immigrant students, students from metropolitan and peripheral communities, Hebrew speakers and Arabic speakers alike – taking into account the needs and values unique to each community.

Friends of Ofanim

www.friendsofofanim.org

Ofanim converts buses into mobile classrooms and introduces at-risk youth to the highest quality instructors and after-school enrichment programs in computers, science, math, English, and two new robotics programs co-sponsored by the Technion Israel Institute of Technology in the North and Ben Gurion University in the South. Founded by Israeli social and business entrepreneur Haim Dahan, Ofanim's inspiring vision is to empower the next generation of Israeli leaders, scientists and entrepreneurs.

World ORT

www.ort.org

In 2007, World ORT embarked on a cutting-edge program, Science Journey – Kadima Mada, to redefine science and technology education in Israel, specifically in the periphery. Established in partnership with Israel's Ministry of Education, this multi-faceted program combines state-of-the-art, interactive classrooms and progressive science and technology learning with critical investment in advanced teacher training.

Today, Kadima Mada is active in over 165 schools, has trained and assisted some 3,300 teachers and serves over 100,000 pupils in under resourced areas. World ORT provides support for smart classrooms, science and technology centers throughout Israel and mobile science exhibitions.