Science Foundation Arizona (SFAz) has been honored to work with the seven schools/districts chosen as Helios STEM Schools. This program was designed to provide a framework for implementing STEM across the grade levels and within the community.

As part of this program, the SFAz team created a series of tools and resources, which when used in conjunction with onsite mentoring from our STEM Technical Advisors, provided a model for systemic STEM immersion. The schools each identified their mission and vision and outlined their projected goals and deliverables in a comprehensive “Strategic Plan”. These plans provided the roadmap for the programs over the next three years. Each year, the Strategic Plan was reviewed and modified. Lastly, a Sustainability Plan was created to take the schools into years four and five after the grant funding has ended.

We hope you enjoy the story of progress as the schools have made the transition to STEM schools—transforming themselves and their communities.
The Alhambra Elementary School District (AESD) is proud to have been one of the seven sites chosen to be a part of the Helios STEM School Pilot (HSSP). Just over three years ago when applying for the grant, we were already a few years into our own STEM initiative. AESD had chosen a science curriculum for grades K-8 and had dedicated personnel in place: district level science coaches, a Director of STEM, and those responsible for materials management. In addition, we had numerous and effective afterschool STEM clubs, including Engineering is Elementary, Design Squad, and MESA.

Still, when we looked at the STEM Immersion Guide, we knew there was room for growth. In order to move from the Exploratory stage to Introductory and eventually, Partial Immersion, we would need more of a focus on integrating STEM into our daily curriculum, and incorporating STEM concepts across as many content areas as possible. The HSSP grant gave us the resources (financial, intellectual, and technical) to do just that.

AESD’s grant was used primarily to build STEM engineering labs using Paxton Patterson Action Labs. These labs were aimed at helping our junior high students gain exposure to new and relevant content, such as Laser Technology, Alternative Energy, and Robotics. The labs also give students a chance to build connections to existing curriculum, and explore the idea of a career in the STEM fields.

As STEM education capacity was built in our teachers and administrators, we moved from the Exploratory model to Introductory. Along the way we started to find additional ways to incorporate STEM into our existing curriculum. AESD created engineering activities aimed at all grade levels, integrated science, technology, and ELA using the College and Career Readiness Standards to produce multiple Technology Enhanced Lessons for every grade level, and engineered multiple new STEM Clubs including Vex Robotics, LEGO League, and Coding.
The results have been staggering. Every year, AESD has over 400 junior high students experience our STEM engineering labs, more than 700 students participate in greater than 40 afterschool STEM Clubs, and every single one of our 13,458 students participate in engineering activities as part of their regular science curriculum. AESD has built strong relationships with business and community partners such as Intel, Vertech, Grand Canyon University (GCU), Arizona State University, University of Arizona, the Burton Barr Public Library, and Quantum Energy and Sustainable Solar Technology (QESST).

In addition, AESD is proud to be the recipient of numerous STEM related grants from the Arizona Diamondbacks, Bosch, Century Link, AzTEA, DonorsChoose, and GCU. Our students have earned awards through their participation in our MESA Clubs, including first place in the 2014 National Championship Award for Design Efficiency and three separate awards at the 2015 Nationals. The Connect 2 STEM Award recognized AESD’s commitment to STEM education and our partnership with Intel, and AESD is proud to say that our district supplies over 30% of the acceptance letters into Phoenix Union’s Bioscience High School.

AESD is grateful for the opportunity that Helios Education Foundation and the Science Foundation of Arizona have provided for our students. Through continued hard work, commitment of resources, and a vision for children’s future, AESD looks forward to sustaining our reputation as a leader in STEM education.

SFAz NOTE:
AESD went from an Exploring STEM Program to Partial Immersion. The true keys were the level integration into the traditional content areas, the commitment to provide quality programming both inside and outside the school day, an integration of business and industry, as well as a change in district culture thereby establishing a true STEM “Ecosystem”.

3
Where We Were: Three years ago, we did not offer any classes that were entirely STEM-focused or college- and career-related. After being awarded the Helios Grant, we decided to use the funding to purchase and implement the Paxton Patterson STEM Learning Systems curriculum at one of our school sites, Altar Valley Middle School. We selected Paxton Patterson because our students, like all students, are extremely interested in technology, and the computer-based portions of the Paxton Patterson Integrated Instructional Units (IIU’s) allow our students to explore that interest. However, the Paxton Patterson units are not solely technology-based; different modalities of learning are addressed, including reading, writing, and hands-on projects. Our Helios Grant Design Team liked the variety of learning experiences offered by Paxton Patterson.

Last school year (2014-15), we started off small, piloting four Paxton Patterson units with one group of 23 randomly-selected 8th grade students. The pilot proved to be hugely successful, not only because the students loved the class, but also because we saw significant differences in the achievement data of the 23 students who participated in the pilot as compared with the rest of their 8th grade peers. (See table below.)

<table>
<thead>
<tr>
<th></th>
<th>% Of All 8th Grade Students At Mastery – Fall</th>
<th>% Of Paxton Patterson Students At Mastery – Fall</th>
<th>% Of All 8th Grade Students At Mastery – Spring</th>
<th>% Of Paxton Patterson Students At Mastery – Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading CBM</td>
<td>21</td>
<td>43</td>
<td>58</td>
<td>100</td>
</tr>
<tr>
<td>Math CBM</td>
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<tr>
<td>Reading District Benchmark</td>
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<tr>
<td>Math District Benchmark</td>
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</tr>
<tr>
<td>Science District Benchmark</td>
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<tr>
<td>AIMS Science</td>
<td></td>
<td></td>
<td>33</td>
<td>100</td>
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</tbody>
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The Results Of Our Pilot Program: We attribute the higher assessment scores (specifically, the reading scores) of the Paxton Patterson Lab students to a variety of factors. First, students are required to interact with complex text throughout each unit. Not only do students conduct research and build their background knowledge through reading, but they are asked to think critically about what they read and apply their learning during the project-based portion of their chosen unit.
Also, students complete two AZCCRS-aligned writing assignments over the course of each unit, one narrative and one argumentative. In their writing, students must cite textual evidence to support their ideas and claims. Finally, the integration of reading and writing with STEM assignments and activities allows students to participate in a truly integrated, cross-curricular learning experience, rather than viewing each discipline as a separate, isolated entity.

**Where We Are Now:** We currently offer 14 Paxton Patterson units as a special area class to all of our 6th–8th graders. The units available to students include Alternative Energy, Computer Graphics and Animation, Flight Technology, Forensic Science, Information Technology, Laser Technology, Robotics, and Veterinary Medicine. Additionally, we offer Paxton Patterson’s STEM Train Curriculum, which is designed specifically for 3rd–5th grade, to all of our 5th grade students.

**Where We Hope To Be As We Move Forward:** So far this school year, we have already added two new units: Computer-Aided Drafting and Medical Imaging. We hope to add more units next year, including Digital Manufacturing, which involves the use of a 3D printer! Our long-term goal is to grow and sustain our Paxton Patterson program and continue to build on our successes.

**SFAz Note:** Altar Valley began as an Exploratory District and moved to Introductory. The dedication and commitment of the staff was exemplary noting the high turnover of both administration and staff over the three years of the grant.
At Bagdad Unified School District, we have integrated CTE through a STEM pathways program across the curriculum in support of preparing the workforce of tomorrow. Integrating CTE and engineering practices under the STEM umbrella has led to innovation and collaboration between teachers, students, businesses and the community to engage students in a worthwhile real-world STEM experience, which emphasizes the human elements as well as the physical elements.

The Helios STEM Grant along with the partnership with Science Foundation Arizona helped our school district identify our goals through a vision that led to a strategic plan for implementation. We modified our finances and actively pursued other grants and donations to further our STEM programs and opportunities for sustainability. We also supported our staff interests and experiences with professional development to facilitate collaboration between teachers that created exciting and rewarding hands-on STEM electives and clubs which include: Industrial Tech (Paxton Patterson Lab), Construction Trades, Welding, Automotive, Engineering, Computer Science - Code.org, Aviation (MS & HS), Culinary / Family Consumer Science, Hydroponics, Desert Ecology, Clubs/Camps (Aviation, Cranium Crushers, Engineering), Summer STEM Kids Camp Replaced Title I Summer School and the CTSO’s Leadership program! We were able to increase our student’s STEM opportunities with the following technology thanks to this grant; laptops for high school/middle school students, Google Platform / online resources, Paxton Patterson Lab, Lockheed Martin Flight Simulator Software, 3d printers, drones, bat monitoring equipment, Vernier Labquests, Probes & Software, robotics kits (elementary & high school) and Bridle Creek Outdoor Learning Center equipment (densiometers, clinometers, game cameras, GPS systems, bug nets and cages, soil and water test kits, plant presses, herbarium etc.).

**SF Az Note:** Bagdad Unified School District began with limited STEM programming at the beginning of their grant. Their community Design Team began the integration of STEM at the Introductory level and has now transitioned to Partial Immersion. The integration of STEM into the CTE High School Curriculum is an approach that many High school programs across the country can emulate. In addition, Bagdad USD provided extensive opportunities for Students to explore STEM careers and connection to the Community (i.e. Bridle Creek, Freeport Mining and Aviation).
Also, we have integrated the Bridle Creek Outdoor Learning Center, a 27-acre riparian habitat enhancement area in Bagdad, AZ, into our student’s educational experiences. “Bridle Creek is managed both for habitat enhancement and educational outreach, “said Tara Woodcock, Environmental Scientist. Some of the STEM activities and studies completed at Bridle Creek included; plant identification, pollinator species / Monarch Butterflies, animal study utilizing trail cameras & GPS created trail wildlife & plant guides, invasive species and their impact, soil and stream ecology, solitary bee houses, canopy measurements, benches designed and built by CTE, comparing seasons - elementary, Bat Night - Anabat, general clean up/Wellness Walk and the annual Scavenger Hunt with Liberty Wildlife, FMI & AZ Fish and Game. “Freeport-McMoRan places an emphasis on programs that improve STEM education for students. The scavenger hunt at Bridle Creek is one example of how we are partnering with local schools to provide interactive experiences that engage students in STEM, while fostering a respect for the natural world”, said Laura Phelps, Community Development Specialist.

We’ve had a variety of exciting STEM projects over the past three years, which included; robotics, electric/solar powered car, solar charging station, trebuchets, cardboard boats for annual community/school race, plant boxes and many other PBL campus projects! We recently held our Annual Sci-Tech/College and Career Festival, which was a huge success. Bagdad teachers and students proudly demonstrated their STEM curriculum through; drone with onsite live feed, flight simulators, 3-D printer demo, explosive chemistry labs, catapult competition, robotics demo, culinary, hydroponics and a stargazing event that followed.
Hooray for Science, Technology, Engineering, and Math (STEM)! The Science Foundation Arizona Grant, with grant funding by the Helios Foundation, helped support five targeted areas over three years. This is the final newsletter.

**Accomplishments Over Three Years: In the Five Targeted Areas of the Grant**

**Two After School Programs:** The STEM Legos Robotics Club is now yearlong for 6th through 8th Grade Students and competing in FIRST LEGO League (FLL). Robotics and STEM classes are now integrated into the school day for second and fifth grades. All students, K-8, participated in the Hour of Code held in 2015 and continue to code using code.org. In addition, STEM Drama (K-2 and 3-8) does two annual presentations for the entire school as well as friends and families.

**VoiceThread:**
VoiceThread is used in classrooms to document and support developed projects. STEM projects are greatly enhanced by usage of this tool.

**ST Math:** During the second year of the grant, Math scores for the school were double the State average. ST Math makes a critical difference in supporting the school's quality math program.

**DefinedSTEM:** The DefinedSTEM product is used by students and staff to support interdisciplinary STEM units. A local business is supporting Project Based Learning. The school has developed an ongoing partnership with DefinedSTEM. Through their PR firm, the school has been published in District Administration Magazine, Tech and Learning Online, T.H.E. Journal, and The Learning Counsel Online. DefinedSTEM also paid for a team to present at the Association for Supervision and Curriculum Development (ASCD) Conference that took place in Texas, 2015. The title of the presentation was “Shifting to a STEM Culture”.

**SFAz Notes:** Congress Elementary School was our smallest grant award yet continued to exceed in expectations during the entire three years of the grant. Congress continues to embed STEM into their content areas and has changed the culture of their school and community by providing numerous STEM Nights, programs and field trips along with the day-to-day quality education. Congress began as Exploratory and is now Partial Immersion.
W.F. Killip Elementary School  
*Ted Komada, STEM Coordinator*

The No Child Left Behind act of 2001 brought accountability to the United States education system. For schools of poverty however, it also drastically narrowed the curriculum. If it wasn’t tested anymore, it wasn’t taught. Things like communication, collaboration, creativity and critical thinking skills fell off the plate. Whole subjects such as science and social studies began to fade onto dusty bookshelves in back corners of classrooms. An entire generation of students and educators began to focus solely on passing “the tests”. Tests that fall short of measuring the knowledge, skills and abilities students need to be able to survive and thrive in a 21st Century workforce.

W.F. Killip Elementary School in Flagstaff Arizona, was not only an example of this, but we excelled at it. After being the first school in our district to be marked for State mandated school improvement measures, we were also the first to develop and implement the individual assessment and data tracking systems, implement interventions and pull those test scores up. By 2008 we were a labeled a Performing Plus school and we began to ask ourselves as a staff what was next for the kids of Killip. Was there a way we could balance the standardized testing with something more for our students? STEM was the answer.

Through the Helios STEM School Pilot project administered by Science Foundation Arizona, students at Killip Elementary are now receiving individualized attention to their basic reading and math skills while applying those skills through integrated STEM activities.

In year one, we focused on developing an understanding of what STEM is and making the systemic and procedural changes we needed to develop an integrated curriculum. We began to build instructional activities that taught reading standards using science texts. We used hands-on science investigations to reinforce and practice math standards. We are extremely grateful for the additional non-monetary assistance of Science Foundation Arizona. This has included additional professional development, multiple facilitated meetings with other grant participants, and the ongoing encouragement to shift to a higher level of STEM immersion within the school.
Aquaponics in the STEM Lab
In year two of the project, we reflected on our work and realized that although we had integrated science, reading and math content all into one curriculum, the student experience was fragmented. They moved from investigation to investigation, text to text learning science content. Yet nowhere were they applying this content. In year two we focused our efforts on Project and Problem Based Learning. This allowed for opportunities to apply the content they read about in their science text and engaged with in their investigations. Using information to solve a problem or answer a complex question, gave school and learning a purpose again.

Year three of the project has focused on developing STEM units that are based on real-world problems that have a personal or local impact on our student’s lives.

For example:

- Our 3rd grade Weather and Climate unit had students working with local meteorologists to research and identify a weather station that will record weather data at Killip. This allows the students to analyze data for trends and begin to make basic weather predictions. The station was sponsored by a community partner.
- Our 1st graders began to learn about heredity and genetics by solving the problem of not knowing which plant sprouts out in our garden were weeds to be pulled and which were vegetable seedlings we that we had planted.
- Our 4th graders explored alternative energy and designing a solar power system for our aquaponic greenwall.

Next year our 2nd graders will design and dig a pond as they try to answer the question of how to protect the native fish in our local streams and riparian areas. The 4th graders will design a solar power system to power the pond’s pumps.

STEM at Killip is providing students from this demographic, with experiences they wouldn’t otherwise have access to. Our hope is that in time, not only test scores will rise and our students will find good jobs, but that our students, as grown adults can begin to offer their children a life free from the vicious cycle of poverty. Thanks to the Helios Foundation, Science Foundation Arizona, our community partners and STEM we are confidently heading down that path. Thank you to all who have been and will be there with us!

**SFAz Notes:** Killip Elementary School has gone from being an Exploratory school with only limited STEM opportunities for their students, to a Partial Immersion school with STEM opportunities embedded in all grades for all students. They end this grant having developed a series of STEM units that are implemented in all grades, and having teachers excited to teach these units each year.
Salt River Elementary School

Lynette Charlie, STEM Coordinator

Salt River Elementary School is proud to be part of the Helios STEM Pilot (HSSP) schools project. As one of the seven schools chosen for this generous award we have had the opportunity to build a STEM program that reflected the unique environment of the Salt River Pima Maricopa Community school, a program built on the premise that all our students would be provided an equitable opportunity to engage in a STEM environment that fostered proficient inquiry, collaboration and creative problem solving.

The Helios STEM grant provided us with an opportunity to build partnerships with Science Foundation Arizona and other pilot schools. This partnership helped us define our STEM goals, thus creating a strategic plan that assisted in building a solid after-school STEM program and integration of STEM into our daily work in the classroom.

Salt River Elementary used the grant to fund STEM opportunities for our students. It created after-school STEM classes increased our ability to purchase much needed supplies for classroom STEM integration, provided professional development for our teachers, and a much needed mobile tablet lab.

To ensure STEM sustainability a 3 year professional development plan was designed to ensure teachers and administrators develop a deeper understanding of STEM and instructional practices using science and engineering practices allowing us to develop and articulate a vision rich with rigorous STEM programs that is taught to all students. The focus of teacher workshops was to increase their understanding of the NRC Framework for K-12 Science Education as it relates to Scientific and Engineering practices.

Our STEM journey has many notable accomplishments. One of those accomplishments was building the STEM knowledge for our parents and local community. Salt River held 4 successful STEM family nights over the course of the grant-period. Prior to the grant, our school science nights often suffered from low attendance rates. Over the years science night attendance by Salt River families ranged from 50-100 attendees for our K-6 school. As we developed our STEM strategic plan we also incorporated ideas to change our science nights. Family focused STEM challenges and booths were integrated into the event, and what we saw was an immediate increase in our Family STEM nights. Attendance count for our first STEM family night was and astounding 332 people!

**SFAz Notes:** Salt River Elementary School has used this grant to strengthen their teacher led-Science team and in the end turned this team into a full STEM Sustainability teach that includes teachers, administrators, and community members. They have also provided their teachers and administrators with extensive professional development in regard to teaching science, implementing STEM activities, and overall STEM implementation. Finally, they have held a series of highly successful STEM events that brought together students, community members, and STEM professionals. Through these activities they have gone from an Exploratory to Introductory STEM school.
Our grant also allowed us to develop our afterschool STEM programs. Partnering with the 21st Century program our students were able to stay late for STEM classes that were held 4 days a week. The partnership that was built between the STEM program and 21st Century program evolved into a STEM summer school program that engaged students from grades K-5 in full STEM integration classrooms.

Our students have earned many opportunities to extend their participation in STEM activities beyond our school. One most notable and recent was a partnership created between our STEM program and the U. S. Embassy. This partnership allowed us to send two of our Salt River students, their parents, and our STEM Liaison to Sri Lanka. They provided STEM workshops to teachers and students and shared the culture of the Onk Akimel O’Odham people while being hosted by the U.S. Embassy.

Salt River Elementary school is truly grateful for the generous support provided by the Helios Education Foundation and Science Foundation Arizona. As we look towards the future, we know the partnerships we have built, the knowledge we have gained and the commitment to our students and STEM education will be the foundation for our STEM sustainability and that future looks bright.
Beginning with a district-wide implementation in the Helios STEM School Pilot (HSSP), Yuma District One has a unique and exciting position. The effort has been district-wide because it joins the resources of the HSSP with a mirror grant from the Department of Defense Education Agency (DoDEA).

Through this coordinated funding, we have begun to change our STEM culture, deepen science instruction, and use technology as an integral tool for fifth through eighth graders in our seventeen schools. Our commitment has been and continues to be to grow in each and every one of our students the science literacy necessary for responsible citizenship and keep them on track for success in post-secondary science education.

Our STEM efforts through these grants have included the following major components:

- An elementary science teacher cadre made up of one teacher per grade level from each school.
- Cadre members participated in eight three-hour professional development sessions annually and were responsible for sharing their learning with all grade-level teachers at their schools.
- Substitutes were provided monthly for cadre members to model or team-teach science lessons developed by the cadre to all classes at their grade level.
- Four days annually of professional development were provided for all middle-school science teachers.
- Emphasis in Years 1 and 2 was on integration of science with math, social studies, and English Language Arts.
- Emphasis in Year 3 was on technology integration, differentiating instruction, and the “5-E” lesson model.
- Developing community resources for bringing science alive for our students.
- A focus on integrating technology into science instruction through purchasing interactive white boards and individual iPads.
- Supporting of effective technology use through the iTEAM KiDS—trained students at each school who can support teachers and other students with a wide variety of technology and applications. iTEAM KiDS present sessions at the annual district-wide Professional Development Day, present training to their own school staffs.
- iTEAM KiDS present presented to a national audience at the January Integrate to Innovate conference in Phoenix.
- National recognition as a District of Distinction by District Administration magazine in March 2016, specifically for the iTEAM KiDS program.
During the life of the HSSP grant, major results have included:

1. In the 2015-2016 school year, adoption of a district-wide one-to-one iPad initiative, funded through a local bond initiative. Two years of iPad experience through the HSSP and DoDEA grants greatly contributed to teacher support for this initiative and willingness to grow their own expertise with personalized learning.
2. District benchmark test scores which suggest that the longer students were exposed to the elementary cadre model, the greater their growth in science.
3. A district-wide culture change in emphasis on science and technology, including involvement of numerous local STEM experiences.

SFAz Notes: Through this grant, YESD has dramatically expanded their teaching of science and integration of technology into all of their schools. They are now immersed in a 1-1 technology initiative, and have provided extensive science professional development to teachers across the district. In connecting this program to funding from other initiatives in the district, they have helped expand their impact of this program exponentially.
Thank you to all of those who have helped make this program a success!