

# Utah STEM Action Center

## Annual Report FY 2019



**STEM Action Center  
Annual Report to the Education Interim Committee  
November 15, 2019**

**The following report is being submitted to the Education Interim Committee by the STEM Action Center. The report contains the following requested information:**

**(1) The Board shall report the progress of the STEM Action Center, including the information described in Subsection (2), to the following groups once each year:**

**(2) The report described in Subsection (1) shall include information that demonstrates the effectiveness of the program, including:**

**(a) the number of educators receiving high-quality professional development;**

**(b) the number of students receiving services from the STEM Action Center;**

**(c) a list of the providers selected pursuant to this part;**

**(d) a report on the STEM Action Center's fulfillment of its duties described in Subsection 63M-1-3204; and**

**(e) student performance of students participating in a STEM Action Center program as collected in Subsection 63M-1-3204(4).**

## **1. The number of educators receiving high-quality professional development:**

The STEM Action Center (STEM AC) oversees two projects that support high quality professional development: (1) the professional learning (PL) program that supports locally identified STEM-related professional learning needs and solutions with activities such as coaching, mentoring, self-reflection, off-contract work, and effective professional learning communities (PLCs) and the (2) elementary STEM endorsement. The STEM AC also provides professional development to support teachers that are participating in other programs such as the K-12 Personalized Digital Math program, the K-16 Computing Partnership program, the annual STEM Best Practices conference and the programs with the Utah STEM Bus (e.g., Leap into Science). The PL program supported 76 grants in the 2018-19 school year, directly impacting 5,592 educators. Program design varies greatly within this grant program and includes solutions to locally identified issues with compensation for off-contract work, scheduled time within a teacher's workday for lesson study in a PLC, substitutes allowing teachers to observe exemplars within their community, and videos to be used for self and peer reflection. Additionally, 435 elementary educators continued their elementary STEM endorsement programs in a second state-wide cohort. A total of 69 educators, as part of the K-16 Computing Partnership program, received professional development for Computer Science Discoveries and Computer Science Principles during

the 2019 summer workshops. There were also 123 elementary teachers who participated in the Computer Science Fundamentals workshops. The funding for professional learning opportunities in computing was provided by an industry partner grant (Hill Air Force Base) and a partnership with code.org. Teachers and administrators from 542 schools received professional learning for the use of the K-12 Math Personalized Learning tools as part of the contracts with the product providers. Leap into Science is a nationwide program that integrates open-ended science activities with children's books, designed for children ages 3-10 and their families. Informal educators are trained to offer programs in community settings like libraries, museums, and out-of-school time programs to engage underserved audiences in accessible and familiar settings. The Leap into Science (LIS) program supported the training of 60 educators in FY19. Each educator has made the commitment to offer at least three workshops in rural or urban underserved parts of their community. The additional impact will be tracked during FY20. A total of 68 educators have received professional development for the Robot Library program, which is funded through a grant with Marathon Oil. The robot library is made up of 5 kits of robotics supplies placed strategically around the state. Each kit includes 10 LEGO MINDSTORM EV3 robots, 10 Ozobot bit robots, and 5 BeeBot robots. The kits are housed at the STEM Action Center office, the Southeast Education Service Center, the Southwest Educational Development Center, Central Utah Educational Services, and Northeastern Utah Educational Services.

The annual STEM Best Practices provided a variety of professional learning opportunities for teachers. The Best Practices conference focuses on experiential learning activities for teachers. The Best Practices conference was hosted on June 10, 2019, and over 700 teachers from around the state participated. The theme for the conference was Equity Elevated.

## 2. The number of students receiving services from the STEM AC

### The numbers of students that accessed resources from the STEM AC are as follows:

- Classroom grants: 19,174
- Competition Grants: more than 2,000
- K-12 Math Personalized Learning Program: 207,314
- STEM Fest: More than 12,000 students participated in the Utah STEM Fest, which took place at Mountain America Expo Center over October 23-24, 2018.
- Organization grants: approximately 80,000
- Sponsorships: The STEM Action Center monetarily supported and exhibited at 58 STEM events, thus impacting more than 299,000 students, parents, educators, administrators, community and industry partners.
- STEM Magic Show Assemblies: more than 40,000 across 65 schools
- Utah STEM Bus (USB): 10,780
- Girls Who Code Club Network: 139
- Code.org impact on students: 10,986
- K-16 Computing Partnerships: 32,957 students (participating in 257 new Computer Science classes)
- K-16 Computing Partnerships: 17,230 students participating in various outreach and engagement activities

## 3. A list of providers selected pursuant to this bill:

See Appendix A.

## 4. A report of the STEM AC fulfillment of its duties described in subsection 63M-1-3204

### (a) STEM Action Center (STEM AC) Staff and Roles - 63M-1-3204; 1(a), (c) (i)

The STEM Action Center (STEM AC) consists of the Executive Advisory Board, an Executive Director (Dr. Tami Goetz), Program Director (Sue Redington), Outreach and Engagement Specialists (Kellie Yates and Clarence Ames), an Administrative Assistant (Melanie Shepherd) and a Marketing and Communication Specialist (Katherine Kireiev). The STEM AC also works collaboratively with several other state agencies (e.g., Utah Department of Workforce Services, the Utah Department of Heritage and Arts, the Office of Energy Development, etc.) to support STEM education and workforce and economic development. These collaborations have resulted in creating shared team members such as with the Utah Department of Workforce Services (DWS; Lynn Purdin). Kellie Yates also serves as a liaison with the Utah State Board of Education (USBE). A part-time Director for the Utah STEM Foundation was added in May 2017 (Allison Spencer), along with a Utah STEM Foundation Board. There are currently four team members on the STEM AC for the Utah STEM Bus (Molly Bock, Becca Robison, Julienne Bailey, and Colleen Fisher), which is funded from a corporate grant with Marathon. The STEM

AC has been working with the University of Utah to hire undergraduate interns to help with several projects. This fits well with the mission and vision of the STEM AC to mentor students. There are two part-time interns with the STEM AC that help with several grant projects (e.g., code.org, Girls Who Code Clubs, LABS2, etc.). In addition to full and part-time staff, the STEM AC works with high school juniors and seniors, as well as undergraduates for the STEM Ambassadors program. The STEM Ambassadors help with numerous outreach and engagement efforts such as events, the annual STEM Fest, and helping to build content on the STEM website. The ambassadors commit to serving a minimum of 20 hours each year and upon completion of their “ambassadorship,” they receive a certificate and award. There were 39 STEM Ambassadors in FY19, an increase of 15 over the number of 24 STEM Ambassadors for FY18. The STEM AC reports to the STEM Action Center Executive Advisory Board, with its membership and duties defined by statute. This model has worked well, with the Board providing tremendous financial and in-kind support, as well as oversight of the STEM AC’s strategy, process, and accountability. The ability of the Board to have a strong role in the direction of the STEM AC, providing guidance to the Executive Director, has led to considerable buy-in from industry and the USBE. The Board has representation from industry, the Utah State Board of Education, the Utah System of Higher Education, the Utah Department of Higher Education, the Utah System of Technical Colleges as well as various state agencies.

## **(b) Private entity engagement - 63M-1-3204; 1(d); 2 (e)**

### *The Utah STEM Foundation*

#### **Why a STEM 501(c)3 ?**

Industry support is crucial to the mission of the STEM Action Center in order to connect companies into the classroom, increase STEM workforce opportunities in Utah, and enhance STEM funding and resource opportunities. Private entity support has been a strong component of the STEM AC, with contributions being provided in a variety of ways including cash donations, grants and sponsorships, program collaborations and in-kind support. The Utah STEM Foundation was added to the STEM AC’s statute, thus allowing for the creation of a public foundation. It became official on May 10, 2017, having received the Letter of Determination from the Internal Revenue Service. The Foundation has an advisory board with industry support from Marathon, (formerly Tesoro), Boeing, Carbonite, Comcast, IM Flash, Intermountain Medical Group, LSI, Lockheed Martin, MHTN Architects, KM Shinn Consulting and US Synthetic. A part-time director (Allison Spencer) oversees the functions and activities of the Foundation Board, as well as the receipt of all donations from corporate partners. The Foundation Board continues to develop and expand on many new and existing community partners and donors, who are in turn increasing their donation each year.

#### **Programs that are supported by the Foundation include:**

STEMFest, The Utah STEM Bus, the STEM Magic Show with Paul Brewer, STEM Best Practices, and STEM entrepreneurial efforts statewide. This year the

Foundation Board specifically chose to support the Girls Who Code Club Network with an Entrepreneurial Challenge. The Entrepreneurial Challenge was launched to encourage greater female participation in STEM. The challenge was hosted in partnership with Carbonite, Comcast, Centeva and Recursion Pharmaceuticals, the Utah STEM Foundation. The Challenge includes four award categories and called for entries that best address contemporary societal issues (social, civic engagement, environment, etc.). Applications were open to all Girls Who Code Clubs statewide. Our first Entrepreneurial Awards event was on April 25th, 2019, where we were able to award \$15,000 in award funding to scholarship accounts for students to further their STEM efforts in schools.

#### **Cash Donations for fiscal year 2019:**

Boeing-\$85,000; Marathon-\$630,000; ARUP-\$1,000, Bamboo HR-\$10,000; Carbonite-\$25,000; Centurylink-\$10,000; Comcast-\$40,000; Dominion-\$45,000; Fidelity-\$5,000; Griffiss Institute/Hill Air Force Base-\$264,050; Henry Schein-\$5,000; Jeff R. and Katie Nelson Family Foundation-\$5,000; L3-\$5,000; Larry H. Miller-\$50,000; Church of Jesus Christ of Latter-Day Saints-\$10,000; Morgan Stanley-\$300; Microsoft-\$175; Integral Consulting-\$120. *Total Cash Donations for fiscal year 2019: \$1,190,645.*

#### **In-Kind Contributions for fiscal year 2019:**

California Pizza Kitchen, Clark Planetarium, Curriculum Associates, Discovery Gateway, DoTerra, FanX, Get Away Today, Hale Centre Theatre, Hogle Zoo, Home Depot, Imagine Learning, InfiniD Learning, Jet Blue, Larry H. Miller Sports & Entertainment, Lucid,

Natural History Museum of Utah, Ogden Nature Center, Orbit Irrigation Products, Inc., Paradise Bakery, Pluralsight, Red Butte Gardens, Ruby Snap, Sphero, ST Math, Swire Coca-Cola, Thanksgiving Point, Traeger Grill, Utah Jazz, Zermatt, UB Tech, Notis, Hands-on Coding. *Total Estimated In-Kind: \$90,000*

#### **STEM Best Practices Conference Donations:**

It has been incredible to see such an immense outpouring of generosity towards educators at the STEM Best Practices Conference over the past two years, and it was equally incredible to see how excited our teachers were to attend a conference where they were treated as VIPs. *The total estimated in-kind value of fiscal 2019 is \$88,000* (the companies that donated are listed in the preceding paragraph).

#### **Utah STEM Foundation Donor Highlights**

- Boeing supports STEM efforts that demonstrate collective impact and has donated \$75,000 in FY19 to work on a STEM Landscape analysis for STEM education in Utah (see below).
- Carbonite donated and assisted in the creation of The Girls Who Code Club Network with an Entrepreneurial Challenge.
- Comcast has been a champion by assisting to fund programs, STEM events, as well as create and distribute communication materials to promote awareness for STEM.
- Hill Air Force Base has worked closely with the Utah STEM AC and Utah STEM Foundation to allocate funding to teachers, schools, and other organizations that are

providing STEM opportunities statewide. These activities include computer science professional learning through code.org.

- IM Flash supports the STEM Bus and has also worked closely with the Utah STEM AC and Utah STEM Foundation to allocate funding to teachers, schools, and other organizations that are providing STEM opportunities.

- Intermountain Healthcare has championed STEM curriculum efforts, bringing career awareness to students and teachers statewide. They are supporting the creation of middle school and junior high outreach and engagement resources to promote healthcare careers.

- The Larry H. & Gail Miller Family Foundation has also played an integral role in bringing STEM to schools statewide with the Utah STEM Bus Program.

- Marathon (formerly Tesoro) played an integral role in the establishment of the Utah STEM Foundation by granting \$1.5 million dollars over a 5-year period for the Utah STEM Bus Program (USB). Marathon has also donated \$30,000 to create Robotic kits to six resource centers in the State of Utah for educators to check out and use for educational purposes.

### Utah STEM Foundation Grant Funding

The Utah STEM Foundation has been critical in leveraging grant opportunities for the STEM AC, in particular, those that are affiliated with an industry partner. The following new grants were secured during the fiscal year 2019: The Utah STEM Collective Impact (conduct a landscape analysis for STEM education in Utah, \$75,000 donated from Boeing); continued

support for our second year of the Girls Who Code Entrepreneurial Challenge. There are several grants pending including Becton Dickinson (a STEM coloring book series that highlights women in STEM and Utah STEM inventions, \$10,000); a collaboration grant with Mark Miller Subaru. Sponsored Events The STEM AC uses a portion of its operational budget, leveraged with industry support, to sponsor various events. Sponsored events help to provide exposure to STEM opportunities for students and communities. The following list includes examples of programs and events that received STEM Action Center sponsorship funding in FY19:

#### STEM SCHOOL ASSEMBLY

The STEM AC receives numerous requests for STEM activities for school assemblies. A number of options were explored as a sustainable approach to student engagement. The STEM AC launched the STEM Magic Show program fiscal year 2016, in partnership with a local magician Paul Brewer and with the support of funding from CenturyLink. Paul Brewer works with the STEM AC team to create an innovative version of a magic show that incorporates STEM themes with a high tech format for delivery. CenturyLink funding allowed for 21 visits to schools, impacting 19 school districts and more than 40,000 students, an increase of 26,000 over the 14,000 of FY18. There are currently 120 schools on the list to be visited by Paul Brewer and his STEM Magic Show.

#### NORTHERN UTAH STEM EXPO

The STEM AC remains committed to supporting regional STEM outreach and engagement opportunities. The Davis, Weber, Ogden and Morgan school

districts again hosted the Northern Utah STEM College and Career Exposition, on November 5, 2018, at the Davis Conference Center. Two sessions comprised the event: a high school session and a community STEM Family Night. Just under 1,000 high school students, about 60 teachers, 16 industry presenters, and 60 companies participating as exhibitors attended during the high school session. A Family STEM Exposition ran from 5:00–9:00 PM and was open to parents, junior high students and elementary students of Davis, Weber, Morgan and Ogden school districts. There were approximately 5,000 in attendance, for a total of just over 6,000. The STEM Action Center sponsored this event at \$5,000 and helped promote it to the public through the STEM AC newsletter, social media platforms, and the website.

#### **UTAH ENGINEERS COUNCIL**

It is critical for the STEM AC to partner with Utah industry trade organizations, especially around funding scholarships for STEM students. Trade organizations are an essential link to Utah companies and have been very supportive of the STEM AC since its inception in helping to promote and support STEM education in Utah. The Utah Engineers Council (UEC) is an umbrella organization of 15 different local chapters and sections of engineering societies. The purpose of the UEC is to advance the art and science of engineering and to provide a forum for communication between the various engineering societies. The UEC held an awards event on February 22, 2019, during which outstanding engineering educators, professionals, and students were honored. About 325 STEM stakeholders attended the banquet, which the STEM AC

sponsored in the form of a \$1,500 scholarship that was awarded to Kyle May, a chemical engineering student at BYU.

#### **UTAH DAY OF THE GIRL**

We continue to focus on engaging underrepresented groups in STEM, of which females constitute a collective majority. It is vital to our mission of ensuring Utah's long-term economic prosperity by advancing awareness of the need for Utah's increased investment in girls' education and the provision of economic opportunities. The Utah Day of the Girl Luncheon impacted 350 females, emphasizing the importance of young women to the future workforce. The event was celebratory in tone and atmosphere, reinforcing the Girl Scouts of Utah initiatives to draw a greater number of girls toward STEM careers. The event took place at the Salt Lake Marriott Downtown at City Creek on October 12, 2018, and the STEM AC awarded \$2,500 in sponsorship funding.

#### **CRAFT LAKE CITY/STEM BUILDING**

The STEM AC is committed to supporting STEM education and believes that the arts and humanities are critical to supporting the creativity that elevates STEM. Craft Lake City, held at the Gallivan Center from August 9-11, 2018, hosted a STEM Building where the STEM AC interacted with students, parents, and industry members for three days. More than 20,000 community members attended the event, which the STEM AC sponsored at \$1,500.

#### **STEAM FAMILY CAREER NIGHT**

Again, the STEM AC searches out opportunities to support cross-disciplinary events for students to explore the creative side with STEAM, especially for those in rural areas. This



family event offered engaging, all-ages, collaborative activities with industry partners to offer students a glimpse of different careers, and information on how to get involved with these different types of careers. This evening event drew more than 600 individuals from the community and took place at Diamond Valley Elementary in St. George. The STEM AC awarded \$750 in sponsorship funding.

### **LEAGUE OF INNOVATIVE SCHOOLS CONFERENCE**

The League of Innovative Schools is a network of the most forward-thinking school districts in the United States. It has been authorized and supported by the U.S. Congress to explore and support new and innovate school systems that incorporate personalized learning, STEM, and competency education principles. The league hosts bi-annual meetings around the country to highlight and showcase the great things happening in different states and league districts; hence, this once-in-a-lifetime event came to Utah as a result of how we are implementing STEM curriculum and extracurricular STEM activities. The conference was held on October 10-12, 2018, in Park City and Nephi, Utah. Companies, districts, and thought leaders from all over the nation converged to learn and share innovative practices. The STEM AC sponsored this event at \$2,500.

### **MICROMESSAGING TO REACH AND TEACH EVERY STUDENT ACADEMY**

This conference was designed to increase women and underrepresented students in STEM, with the goal of supporting their pursuit and realization of STEM careers. The National Alliance for Partnerships in Equity (NAPE) offers this professional growth opportunity for educators with

immediate application that will improve classroom pedagogy and instruction. This opportunity examines how culture shapes our biases and beliefs about people based on their age, gender, race, language, (dis)ability, or income level, often without our realization. Such biases are then communicated, often unknowingly, through micro-messages. The accumulation of micro-messages over time impacts a person's belief in their ability to be successful in a course, class, college, and career. This interactive workshop took place at Davis School District headquarters on March 28, 2019, and offered 70 educators insights on micro-messages to help achieve equity in the classroom and improve student outcomes. The STEM AC sponsored this opportunity at \$5,000.

### **UTAH PUBLIC ASSOCIATION OF CHARTER SCHOOLS**

The STEM AC continues building relationships with school boards and parent associations. Charter schools are an important stakeholder group and the STEM AC strives to engage with them to understand the needs of their students. Utah's largest gathering of charter school leaders and educators, approximately 700, came together on June 12-13, 2019, at the Davis Conference Center. The STEM AC had a booth and the opportunity to network during meals and work on future collaborations with the Charter Schools to increase STEM awareness. The STEM AC sponsored this event at \$1,500.

### **NEBO INVITATIONAL SCIENCE OLYMPIAD**

This competition underscores a statewide and regional trend among high-school students exploring applied STEM to deliver project-based learning outcomes

in an exciting and challenging forum. Maple Mountain High School hosted close to 300 9th-12th grade students from area schools at a competitive science symposium. The event took place on February 2, 2019, and involved students showcasing their projects spanning life sciences, math, engineering, and computer science for judging, culminating in a medals ceremony. The STEM AC provided \$750 in sponsorship funding.

### UTAH STEM FEST

The STEM AC, together with Utah's STEM industries, showcased exciting STEM career paths in our fourth statewide STEM Fest, which took place on October 23rd and 24th, 2018 at the Mountain America Expo Center. The event opened with a general public night which drew approximately 3,500 Utahns, including professionals, post-secondary students, families, and children of all ages. Just under 100 sponsors from industry, government and higher education offered hands-on learning exhibits at STEM Fest and more than 12,000 students from schools statewide attended the event during the school-group sessions over the 23rd and 24th. This event was managed in partnership with Utah Media Group (UMG), who coordinated and collected all corporate donations to cover the costs associated with renting the exposition space. Additionally, UMG created and placed event advertisements, and produced and supplied all printed materials such as flyers and event signage. The STEM AC provided partial bussing scholarships that facilitated equal opportunities for participation from schools outside the Wasatch Front. Some schools came from towns more than 300 miles away to attend, such as Duchesne and St. George, UT.

### STEM BEST PRACTICES CONFERENCE

The STEM AC held its fifth annual STEM Best Practices Conference: Equity Elevated on June 10, 2019, at the Davis Conference Center. The conference was decidedly different from past years, based on participant feedback and suggestions. There were 777 registered participants, covering the entire state. Strands of sessions were designed for specific grade bands, with presenters required to share hands-on activities for teachers to experience and then take back to their classrooms. Additionally, there were strands for administrators. Attendees were offered five sessions, and the conference offered 52 distinct breakouts overall. Booths featured 30 industry and community partners:

Accelerant BSP  
HawkWatch International  
NuSkin  
Hill Air Force Base  
Red Butte Garden  
Because Learning  
Hogle Zoo  
Sphero  
Bottega  
Ikos  
SpyHop  
Brackitz  
Immersive VR Education  
STEM Partners Foundation  
Chevron: Fuel Your School  
InfiniD Learning  
Talent Ready Utah  
Clark Planetarium  
Lakeshore Learning  
Thanksgiving Point  
DoTerra  
Loveland Living Planet Aquarium  
Utah Afterschool Network  
FanX  
Natural History Museum of Utah

Utah Agriculture in the Classroom  
Neumont University  
Utah Division of State History  
FuzePlay

Intentional efforts were made to shift the culture of the conference to one of educators as professionals seeking additional learning opportunities. Feedback about the conference includes statements such as:

**“This was not just the best education conference I’ve ever attended, it was the best conference I’ve ever attended period.”**

**“I loved the session presenter’s ideas and examples of project-based learning. I am inspired to use this approach in my earth sciences unit (and probably others)!”**

As part of the Best Practices: Equity Elevated Conference, nine Utah schools were recognized with STEM School Designations. A morning discussion panel moderated by State Superintendent Dr. Sydnee Dickson was comprised of STEM stakeholders from education and industry sectors, speaking to the challenge of increasing STEM equity for all underrepresented students. The panelists were Mimi Lufkin, CEO Emerita of NAPE; Rebecca Chavez-Houck, Executive Director of Utahns for Responsive Government; Tami Pyfer,

Education Adviser to Gov. Gary Herbert; and Donna Rae Eldridge, Administrative Coordinator for the University of Utah School of Medicine. These leaders discussed the future of STEM education in Utah and state STEM industry needs, addressing strategies to better engage underrepresented groups in STEM as mission-critical to Utah’s future economic success. Their dialogue comprehensively addressed the urgency of aligning equitable STEM education with industry needs, both emerging and anticipated.

#### UTAH JAZZ AND CENTURYLINK STEM STUDENT RECOGNITION

This partnership represents an opportunity to recognize student achievement in STEM. The Utah Jazz, in partnership with CenturyLink and the STEM AC, presented six awards to outstanding STEM students during the 2018-2019 basketball season. The students were nominated by a teacher and selected by the STEM AC staff to receive a customized Jazz jersey during halftime at a Jazz game. Special to this year was the expansion to include all students statewide, a departure from the previous rule specifying the student must live within a 75-mile-radius of Vivint Smart Home Arena. This change was effected in response to demand to include rural/off of the Wasatch Front candidates. The number of entries more than doubled over the previous season with this rule change.

#### **The following students were recognized:**

November 2018:

Jason Roberts

American Fork High School - 12 th grade

December 2018:

Sydney Nielson

Altamont High School- 8 th grade

January 2019:  
Grace Mead  
Corner Canyon High School - 9 th grade  
February 2019:  
Allison Ames  
Dixie Middle School- 8 th grade  
March 2019:  
Kayden Branch  
Municipal Elementary - 5 th grade  
April 2019:  
Trinity Mauer  
Beehive Academy - 11 th grade

CenturyLink donated \$10,000 to the STEM AC during halftime at the last game of the season. This donation supported the STEM Magic Show Assemblies program, previously discussed.

#### **UTAH STEM BUS (USB)**

The Utah STEM Bus (USB) is a mobile classroom that is bringing exciting STEM activities and resources to schools and communities all across Utah. The outcomes for the USB include increased student engagement and enthusiasm for STEM activities, increased teacher awareness of STEM education, and increased industry investment in STEM. The USB currently uses STEM curriculum that provides experiential, real-world, project-based learning opportunities for students. The program also ties classroom-learning experiences to STEM AC classroom grants to help teachers get the resources they need to continue the lessons after the USB has left. The team has been working closely with Utah State Board of Education (USBE) to make sure all curricula are aligned to Utah core standards and have career pathways tied to local Utah companies. The STEM AC received a grant for \$1.5 million in 2016 from Marathon Petroleum (formerly Tesoro) to fund

the design, purchase, retrofitting, and operation of a mobile classroom. The Utah Transit Authority (UTA) donated two, 40-foot buses and a ten-person van to the STEM AC. The first bus has been completed and had its debut on August 16, 2017, at the Utah Capitol, with Governor Herbert doing the honor of cutting the ribbon. The van, nicknamed the Micro USB, has been retrofitted and wrapped to help deliver programs around the state alongside the USB. The USB has been actively engaged in partnering with local companies to expand the program selection every year. Programs will rotate in and out year to year depending on teacher interest to keep programs exciting for teachers and students. Currently, the program offers either 45 minute or 2-hour programs for grades K-8th. The new curriculum materials are thoroughly tested before each school year. Several schools have offered to help review the curriculum materials to ensure that the materials align with standards, are age and grade-appropriate, and are a good learning experience. The teachers receive two professional development hours that can be used for re-licensure in exchange for their participation and feedback.

The current curriculum includes:

- Physics and Forces (K-3)
- Bee-bots (K-3)
- Hands-on Coding (1-3)
- Power Tiles (1-3)
- Web of Life (2-4)
- Sphero Robotics (2-8)
- Senses and the Brain (3-6)
- App Development: (4-8)
- Mars Mission: (4-8)
- Audio Engineering: (4-8)
- Game Design & Statistics: (4-8)
- Renewable Energy: (4-8)

	2016-2017	2017-2018	2018-2019
Schools Visited	21	53	64
Students Reached	3,281	8,437	10,780
School Districts Visited	14	19	20
Total Programs Presented	129	337	449

During the 2019-2020 school year, registration for the Bus Program closed within 2 hours of opening, and had a waitlist of over 200 schools. The USB team has also appeared at a variety of public and private events reaching 44,165 people throughout the state. Notable events include the Hill Air Force Base Airshow, STEMFest, Ogden Pioneer Day Parade, Junior Achievement Career Fair in the Navajo Nation, Utah Rural Schools Conference and Utah Educators Association Conference. Over 60% of the schools the STEM Bus Team goes to are Title 1 schools, and over 1/3 of all students are qualified for free or discounted lunches. Surveys administered to students before and after participation in a STEM Bus experience reported that their “love for STEM” doubled after the visit. Additionally, students’ interest in getting a STEM job when they grow up doubled after a STEM Bus visit. Based on teacher feedback surveys after a STEM Bus visit, over 90% of teachers said the USB program introduced their students to new material and provided a learning experience not usually available in their school. 99% of teachers surveyed would recommend the STEM Bus experience to other teachers. This program provides opportunities and access to STEM

education that teachers and students cannot get in any other capacity. Here are some additional teacher testimonials about the STEM Bus Program:

**“Keep doing what you are doing. Thank you, my students all went home and talked about it with their parents. They had a blast.”**

**“THANK YOU for funding this fabulous program. I just wish we could have more opportunities, this program is amazing!”**

**“Our students thoroughly enjoyed the programs presented. They were engaged the whole time and so excited about what they were learning. It was a GREAT experience. Thank you.”**

**“On behalf of Delta North Elementary School, I would like to thank you for allowing the STEM Bus to visit. All students who attended left excited and recharged for learning. The topics provided were interesting and current”.**

In addition to classroom visits, the USB team works on a variety of other outreach programs, including the Robot Library. The Robot Library project started with a \$30,000 donation from Marathon and the belief that robotics resources should be accessible to every educator in Utah. Five robotics kits were created with the support of the donation and the kits are housed strategically around the state. Each kit includes a variety of robotics equipment designed to be developmentally appropriate for grades K-12: 5 Bee-Bot robotics, intended for grades K - 1; 10 Ozobot Bit robots, intended for grades 2 -3; and 10 LEGO Mindstorms EV3 robots, intended for grades 4 - 12. These kits are housed at the four rural education service centers: the Southeast Education Service Center in Price, Utah; the Southwest Educational Development Center in Cedar City, Utah; Central Utah Educational Services in Richfield, Utah; and Northeastern Utah Educational Services in Heber City, UT. One kit is housed at the STEM Action Center office to be loaned to schools along the Wasatch Front. Teachers can check out this equipment free of charge from any of these locations, and are provided free training and professional development to ensure educators feel comfortable with using the technology in their classrooms. The impact of the program is being assessed to determine the feasibility of scaling the program to additional kits. The STEM for Life grant from Intermountain Healthcare began with the idea of being a Mobile Museum to highlight healthcare careers for students around the state of Utah. We have now shifted the focus of the STEM for Life project away from a Mobile Museum, and instead to Healthcare Classroom Kits.

These classroom kits will be available for teachers to check out from any of our five resource centers around the state, where the robot libraries are also housed. The kits will be available to 5th-8th grade classrooms. Kits will provide a different healthcare scenario that students will have to solve through their different roles as healthcare professionals. The students will role-play as a different Intermountain Healthcare professional and help guide a patient with an injury or sickness through the intake process, as well as work together to solve a healthcare crisis across Utah. These kits will provide meaningful exposure to lesser-known careers through Intermountain Healthcare, and let students explore firsthand what these professionals do. In order to increase long-term classroom impact, the USB team has developed a series of professional learning opportunities for teachers. In addition to the training provided at the annual Best Practices conference, the USB team has been developing a series of videos targeted to teachers which will allow them to learn to use technologies and other resources, in short, classroom-friendly increments. Videos targeted towards use during classroom instruction will provide continuing support and activities that are matched with the USB curriculum materials.

Educators will be able to integrate USB visits with more in-depth classroom STEM exploration. All of the USB curriculum materials will be made available to teachers in the form of PDF documents, so that teachers can access any resources used, recreate any activities, or explore any concepts as part of their continuing STEM instruction.

### **STEM MENTOR EXCHANGE (STEM MX)**

The STEM AC worked with several industry partners (specifically Comcast, Dell EMC, and Adobe) to build a mobile app called STEM Mentor Exchange (STEM MX). The original STEM MX app idea is modeled after the matching services that exist in the public domain that utilizes a profile-based submission platform. An algorithm then takes the profiles for “need” and matches them to the profiles submitted for “supply” and determines the best matches based upon keywords and phrases. The intent of the mobile app is to give educators, counselors, and parents an effective and easy way to connect to industry mentors and resources in the STEM community. Educators would be able to access industry mentors for help with STEM-related projects (e.g., helping to teach a difficult STEM subject in the classroom, soliciting industry participation in STEM events, fairs, and competitions, etc.). Counselors would have the ability to submit a profile that describes certain careers and STEM areas in which they are deficient in their knowledge and find an industry mentor to educate them. Parents would be able to submit a profile that can help them find resources such as summer camps, scholarships or STEM-related programs or events. This platform could potentially solve the problem of exhausting or overtaxing industry partners. It allows for an industry mentor to toggle between active and inactive for their profile depending upon their current or projected workload. It is anticipated that this control over volunteering will be attractive to industry partners and encourage participation. This match-based platform also facilitates a more targeted approach to finding information. An issue that arises

with keyword or phrase searches on a traditional website is that you only get information based upon what you know about the topic. A profile-based option allows for a user to be completely lacking in content knowledge in an area and still find useful resources and mentors. The mobile app format was exchanged for a web-based format that provides the same outcomes, but is more easily managed. The STEM MX team experienced a few challenges that made the launch difficult. The main observation was that we needed to address proof of concept in a more targeted, or focused approach. The function or purpose for educators needed to be more narrow in scope and focus on one or two activities. The STEM AC has been working with Amy Sibul, the Assistant Director for Community Engaged Learning (CEL) at the University of Utah. Ms. Sibul helps to find community-based volunteer opportunities for undergraduate students. The STEM MX platform will help to connect undergraduate students to teachers in classrooms to provide support to teachers, as well as mentor students.

### **(c) R&D role of STEM AC - 63M-1-3204; 2 (a)- (c); (f)**

#### *The value of third party evaluation*

Anytime an organization undertakes to evaluate its own programs, there is potential for bias. To increase accountability and research integrity, the STEM AC continues to integrate rigorous third-party evaluation for the following programs: K-12 Math Personalized Learning, Professional Learning, K-16 Computing Partnerships, and Elementary STEM Endorsement. The STEM AC has a contract for third party evaluation with

the Utah Education Policy Center (UEPC) at the University of Utah, which supports credible third party evaluation that sustains a high level of fidelity and objectivity. The parameters of the evaluation (such as metrics and data that is to be collected) are defined by the requirements of the STEM AC's statute, and recommendations by the third-party evaluator, the Utah State Board of Education (USB), and LEA partners. Thanks to the robust third party evaluation, the STEM AC has developed a reputation as an evaluation engine. Vendors, education partners, industry leaders, and research centers from this state and other states have contacted STEM Action Center staff to ask questions about how to conduct rigorous research on their programs. Due in part to this reputation, we have received additional opportunities to make positive impacts on K-12 education through industry partnerships.

### *The integration of R&D into STEM AC programs*

#### K-12 Math Personalized Learning

An additional R&D function was added to the K-12 Math Personalized Learning program for the 2017-18 school year. The STEM AC worked with the State Procurement Office to create a process whereby new math personalized learning programs designed for K-12 students can be piloted in Utah schools. Product providers who wish to participate must meet all of the requirements of the original RFP, be approved by a review team, and demonstrate that they are willing and able to provide licenses at no cost to a minimum of 1,000 Utah students for one full school year. Providers are responsible for finding schools that are willing to pilot their products. If they

meet all of the requirements, the impacts of their program will be evaluated by the STEM AC's third party evaluation team. Outcomes from new products will be compared to products currently under contract. If the performance of students using a new product meets or exceeds the average performance of students using other personalized learning products, that product will be added to an approved vendor list. The third-party evaluation team for the STEM AC completed the analysis of outcome data for vendors participating in the first round of the math pilot program in the spring of 2019. Out of seven providers who initially applied to participate, two programs made it through the initial review process. For one of the programs, there was a statistically significant positive relationship between product use and student achievement, and that product was moved onto the approved vendor list. The analysis showed that in the 2017-18 school year, students using the program 30 minutes a week or more were 150% more likely to reach grade level proficiency compared to students without access to software provided by the STEM AC. While one year doesn't give us enough information to draw conclusions, these results appear promising and we are anxious to see what data from their first full year on the approved vendor list. Long-term impact on STEM The STEM AC is working to focus on several areas of assessment to include longitudinal data that shows that increased, and ongoing, access to STEM activities can make a difference in student choices and success in STEM. The STEM AC received a grant from Boeing to initiate a landscape study to capture the current state of STEM in Utah. Working with the Utah



Data Research Center (UDRC), the STEM AC will examine enrollment, graduation, and employment in STEM over multiple years. The goal is to identify factors that increase students' likelihood to persist in STEM fields over time. Another goal of the study is to determine if companies are finding talent easier, or finding employees that are better prepared to succeed in their companies, thus resulting in higher retention. The STEM AC has had initial discussions to work with Qualtrics to build out an ongoing survey project to begin to look at stakeholder perceptions regarding STEM education and careers. There has been national data collected regarding interest in STEM, but the STEM AC is establishing the ability to monitor strategically responses to programs and marketing and communications efforts.

#### **(d) Review and acquire STEM education-related technology - 63M-1-3204 2 (c)**

The K-16 Computing Partnership program has provided continued opportunities to review resources that support coding and other areas of computing. There were several programs and products included in awarded grants during the 2018-19 school year that include BootUp, 4-H Extension Code Playbook, code.org, WozU, Codechangers, and Google coding. Using a third-party evaluation team, the STEM Action Center works to review and acquire new math personalized learning technology every two years. The goal is to ensure that we are always providing our students and teachers with the best resources available.

The STEM AC is launching a partnership with Juab School District, and its new Innovation Center in Nephi, to create

the first-ever LEA-hosted test site for new resources, products, and tools in robotics and technology. The details of this program are being determined, but a pilot product has been identified for the launch during the 2019-20 school year.

#### **(e) Use resources to bring the latest STEM education learning tools into the classroom - 63M-1-3204 2 (f)**

The STEM AC works closely with education partners and the STEM community to identify new STEM education learning tools and resources to support and improve STEM instruction. The annual STEM Best Practices conference has the main goal of bringing together Utah STEM (and non-STEM) teachers to showcase the latest learning tools in the classroom. This provides an opportunity to share ideas and promote the use of the latest in STEM resources. The focus on bringing collaborative grants (e.g. the Carnegie Mellon University, code.org, and STEM Equity Pipeline grants) increases the STEM AC's ability to bring new and innovative tools to Utah classrooms at no cost.

Again, the new mechanism that was recently launched for the K-12 Math Personalized Learning program is a good example of how the STEM AC works to identify and assess the best resources for math instruction.

#### **The following programs help to support the integration of innovative STEM education learning tools in the classroom:**

(1)The STEM AC provides classroom grants to teachers to support the design and implementation of new STEM activities in the classroom. This grant program is

discussed in detail in the following sections.

(2) The K-16 Computing Partnership program provides numerous best practices in K-12 computing education.

(3) The Utah STEM Bus (USB) team members are constantly developing new resources, as well as testing new resources. For example, the Bus Team has started creating professional development webinars for teachers to learn how to use certain STEM technologies, and dive deeper into the curriculum materials presented to them during STEM Bus visits. The robot library will also bring new and innovative tools into Utah classrooms at no cost. Teachers can check out a variety of different robot classrooms sets from their nearest resource library and have step by step tutorials on how to use the robots, and in-depth curriculum to guide their classes in their exploration.

The reputation of the STEM AC, both locally and nationally, has resulted in the STEM AC being invited to join existing partnerships, or apply for grant funding to launch new programs. These programs bring new resources to educators, parents and the community. These programs are discussed in greater detail throughout the report, where appropriate, and include: (1) Carnegie Mellon University CREATE Labs and the Hummingbird robotics program, (2) code.org professional learning workshops (3) STEM Equity Pipeline and STEM Micro-Messaging (4) the National Science Foundation INCLUDES program to broaden participation in STEM (5) Utah Air Quality Challenge (6) Utah STEM Collective Impact Landscape Analysis

(6) Leap into Science (7) STEM for Life (8) UBTech Robotics.

### **(f) Support of STEM-related competitions, fairs, and camps, and STEM education activities - 63M-1-3204; 2 (d)**

The STEM AC funds and oversees three grant programs: (1) Student Competitions grants, (2) Classroom grants, and (3) Organization grants. These three grant programs are funded from the STEM AC's operational budget.

#### **COMPETITIONS GRANT**

Studies show that students who participate in STEM competitions are much more likely to pursue STEM careers (Miller, et al, 2018). The STEM Competitions Grant is intended to support K-12 students' participation in STEM competitions. Applications for the grant program must be completed by a school-level representative on behalf of the students benefiting from the grant in order to be accepted. The school-level representative will oversee the funding and be responsible for reporting outcomes. Competition grants cover costs for supplies, registration, and other expenses related to participation in STEM fairs, camps, and competitions. Schools may request up to \$100 per participating student, and receive funding based on the strength of their application. Scores are generated by a review team made up of other grant applicants and focus on sustainable student impact. Students are required to apply for a grant requesting funds from their school, and student projects are funded pulling from the overall school award. Before the end of the school year, each awarded school must submit detailed receipts and project completion reports showcasing what

students accomplished. During the year, representatives from the STEM AC went out to as many sites as possible to help judge events, talk to teachers and students, and get a feel for what schools are doing around the state. On one site visit, the mother of a participating student approached the STEM AC representative with tears of gratitude and expressed how drastically this opportunity had changed her son. Until he became involved in the STEM competition, he had hated school, he had very few friends, and he was always in trouble. She said that this grant had allowed their school to become involved in this STEM competition and allowed him to participate. It became apparent that he had an aptitude for coding and all things technical, and almost overnight his attitudes began to change. He stopped getting in trouble. He started to make friends. He was elected as the team leader because everyone would come to him with questions, and his grade went up in every subject. The grant program is popular and for the 2018-19 school year grants were awarded to 44 schools. In their project completion reports, teachers and students focused primarily on how much participation in these opportunities positively impacted their confidence in STEM subjects, and on the important interpersonal skills students gained through participation. A summary of the LEAs, grades, number of students and brief project descriptions are included in Appendix B.

### **CLASSROOM GRANT**

Recognizing that innovative curricular resources developed by local teachers need to be replicated and spread as widely as possible throughout the state, classroom grants are used to fund

inventive approaches to STEM education. For FY19, a total of 238 grant applications were received. Of those applications, 176 proposals (74%) received a portion of the funds requested. Applications are scored by previous classroom grant awardees and STEM AC staff using a rubric to determine which proposals will be funded. The amount of funding for classroom grants in FY19 totals just over \$180,000.00, with an impact on 19,174 Utah students. In FY19, 36% of classroom grants were awarded to LEAs off the Wasatch Front. A summary of the LEAs, grades, number of students and brief project descriptions are included in Appendix C.

Lesson plans were collected from awardees in order to facilitate increased access to and involvement with innovative STEM curricula throughout Utah. These resources have been made available to Utah teachers via the STEM Action Center's website. Grant awardees were also asked to present their project in a session as part of the STEM Best Practices conference. At Best Practices 2019, eight of 42 sessions, 19%, were facilitated by FY19 classroom grant awardees. An expectation to complete a final report at the completion of their grant project is also in place. These reports are critical to teachers that choose to utilize the shared materials as it provides follow up information and suggestions to other teachers. Responses on the final report vary greatly, but several awardees commented this year on the requirements of classroom grants requiring them to align engaging activities to state Core Standards:

**“Several things about this project helped me as a teacher. First, it forced me to evaluate my teaching practices critically and determine if my instruction was meeting the needs of students. Looking at my data and evaluating student engagement led me to determine that the way I was teaching this unit previously simply wasn’t meeting the needs of my students. Being able to evaluate and think meta-cognitively like this is so huge for educators, so I appreciate that I was asked to do that to get this grant. I also think that a big help was being asked to look very closely at the standards and justify how specific activities were or were not meeting specific standards. As a teacher, I feel familiar with the standards, but the mandate of alignment really made me dig deeply into them in a way I haven’t before.”**

Additionally, place-based learning was a popular feature among classroom grants in FY19. One example from San Juan School District looked at element half-lives and examined what that meant for those living in the region as part of their chemistry unit. The teacher reported:

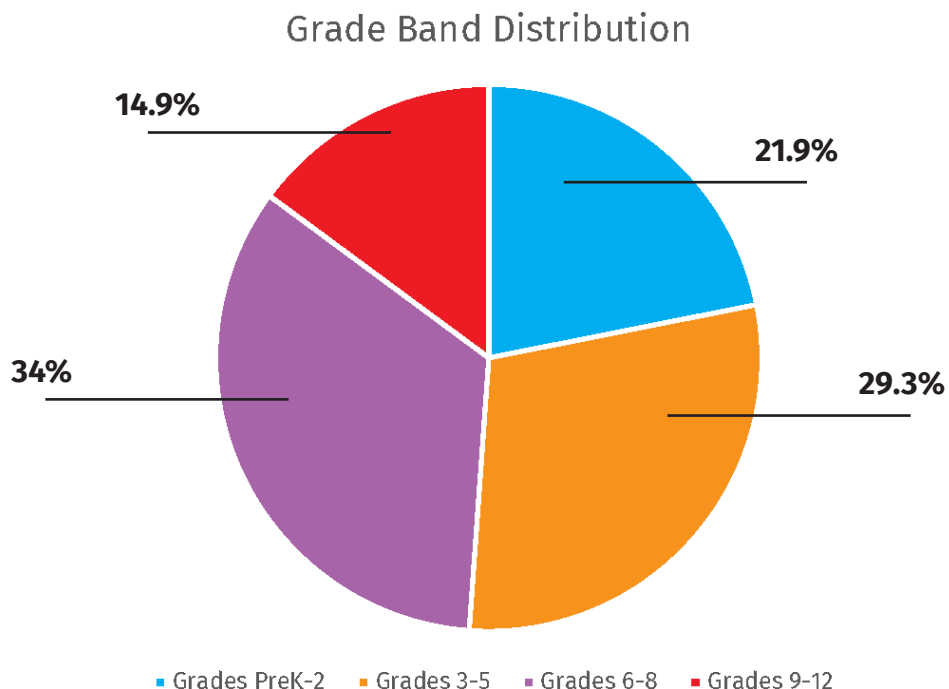
Last, giving students opportunities to engineer solutions to real world problems, a primary tenet of STEM education, was seen in over 51% of both proposals and final reports. This STEM component has previously been a stumbling block for Utah teachers, so this might be viewed as a marker of success regarding teacher understanding of what STEM can look like in a variety of classrooms, evidenced by comments such as:

**“This project gave students the chance to engineer their own solutions and put their research skills to the test. They had to develop prototypes with little guidance from me beyond guiding them to research sites or providing supplies - I didn’t want to turn their project into MY project by giving too much input. Groups that persisted and didn’t give up on perfecting their prototypes felt a real sense of accomplishment. They learned new skills, such as following diagrams, wiring, and model building. They not only had to come up with a problem, they had to research pre-existing solutions, use technology to come up with a solution or method of investigation, and use technology in their prototype.”**

**“We collected qualitative and quantitative data and graphed half-lives over time. The students saw patterns in multiple different elements half-lives and were able to conclude that uranium has an incredibly long half-life making it radioactive over long periods of time. Students were able to confirm suspicions of rock samples containing uranium from homes and different locations. Students learned that areas, where uranium has been mined, are still radioactive (no parties in abandoned mines) We have over 500 in the area! Very good STEM lessons - applied math, analyzed graphs, investigated rock samples, asked questions applicable to real-world, etc.”**

**“I started off the [Biology] unit with dissection. Originally I scheduled a brain as we were talking about blood clots, strokes, and wanted them to see a brain. I was able to find a butcher and I actually got a heart, lungs, eyes, and kidneys to go with the sheep brain. We then discussed biomedical engineering and moved into the structure and function of the brain, after which, the kids created blood clots. They tested various concentrations of Clot-x to determine what dose of medication they would use. They had to analyze the data from their tests, as well as the side effects, and use graphing and math to determine what concentration of medication they would prescribe. Then we created artificial arteries and students had to engineer a device to remove a blood clot. I used sponges and straws to create the blood clot. They needed to remove it and not send it to the brain. Students were surprised by what didn’t work (sucking) and what did work (hooking). I loved the designs and tools they came up with to solve the problem... Students are still talking about how they would solve the problem. I watch them be problem solvers and engineers versus robots just creating reports. I know I gave the same assessment this year as I did last year (just for my own data analysis) and student understanding is 65% greater. Students were asking about colleges that had programs where they could continue to be involved in projects like this one.”**

Grade band distribution noted an increase in grant awards to grades 6-8, which seems to be related to the roll-out of new 6-8 grade science standards.



## ORGANIZATION GRANT

The STEM AC funded 52 Organization Grants that impacted over 80,000 students, with \$185,224.31 allocated from the operational budget. Examples of these organizations include Dixie State University, InfiniD Lab, Boys & Girls Clubs of Greater Salt Lake, Utah Science Teachers Association, Southern Utah University, YMCA of Northern Utah, Neighborhood House Association, University of Utah, Alliance for Innovative Education, American Indian Services, etc. A few of the STEM Organization Grant awardees are listed below in more detail:

- Boys & Girls Club of Greater Salt Lake: The STEM Diversity and Inclusion program gives all Boys & Girls Club members—especially those from groups traditionally underrepresented in STEM—a chance to fall in love with STEM topics. Many of the kids we serve come from households with little or no computer access and do not have very much confidence in their abilities due to lack of exposure to STEM activities outside of school. STEM is increasingly important for success academically and professionally, and these kids need a place to go where they can make STEM a part of their lives in an encouraging, inclusive environment.
- Utah Valley University, PREP Program: To address the low completion of STEM degrees, Utah Valley University (UVU) initiated the UVU PREP program in 2013. UVU PREP identifies low-income, underrepresented, first-generation, and female students entering seventh grade who have an interest and aptitude in math and science, and involves them in a seven-week, three-year summer intensive program integrating STEM teachings. Classes are held on the UVU campus Monday through Thursday from 8:30 am

to 3:00 pm. Fridays are reserved for field trips and special events. The program integrates best practices that have been demonstrated to support success for underrepresented students in STEM pathways. The program has grown from 25 students in summer 2013 and has sparked interested among educators across the state. The program aims to motivate and prepare participants to successfully pursue STEM studies and careers.

- Carbon School District: SESC STEM-Activity Kits provide an opportunity for schools to checkout STEM/Makerspace kits from SESC. Kits will include in-class coaching and professional development, curriculum, and project supplies. SESC will distribute a checkout form and calendar to schools within Carbon and Emery School Districts. Several multi-day events will take place in Grand and San Juan School Districts. This program will allow students and teachers an opportunity to explore robotics, to learn coding tools and materials both physical and virtual, and develop creative projects.

- The Leonardo: The Leonardo on Wheels integrates science core content with 21st-century thinking skills through hands-on exhibits and activities that foster critical thinking, creativity, and innovation. As students explore our interactive exhibits, perform inquiry-based investigations, and work in groups to solve problems, they develop creative and critical thinking skills and come to realize that science is relevant to their lives and even fun. The Leonardo on Wheels uses an open-ended, inquiry-based format where students investigate the subjects that interest them. It requires students to think deeper as they ask their own questions and search for answers. In addition to increasing excitement about science, the inquiry-based approach results in higher

retention than didactic teaching. This is evident through the level of the students' participation, the quality of their questions and answers as they discuss their experiences, and their performance on tests. An experience that engages students and illustrates relevancy between content learned and the students' own lives is one that they will remember long after the memorized facts have faded. Because The Leonardo on Wheels focuses on hands-on activities, it engages students at multiple levels. Even students who typically struggle or are not interested in science actively participate and learn.

- **Civil Air Patrol:** The Civil Air Patrol's cadet program goal is to develop student cadets into future leaders who serve in their communities, state, and nation. Aerospace education is conducted through-out the cadet experience to help develop skills and provide learning opportunities in STEM. A sample of these STEM topics include learning about aerospace engineering, rocketry, robotics, and cybersecurity. Through these learning activities, cadets discover talents and interests that they can then use to guide their studies at the university level and the careers they select; whether in civilian or military life.

**(g) Identification of best practices being used outside the state and learning tools for K-12 classrooms - 63M-1-3204 2 (h and i)**

The STEM AC team continues to reach out to other states to explore best practices and position the State of Utah as a leader in STEM education and talent development. The STEM AC has been one of several states that were invited to work with the Office of Science and Technol-

ogy Policy at the White House to review and update the federal strategic plan for STEM education. The original plan was completed in 2013 and the updated plan was made available in December 2018.

The link to the federal report is:

<https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf>

The STEM AC has been a member of STEMx for the past two years. The STEMx network is a multi-state STEM network developed for states, by states. The STEMx network consists of 21 states and has created an accessible platform that is shared by member states. This platform allows for access to data and tools that can be used to support STEM efforts. The STEM AC team is re-evaluating membership with STEMx. There is new leadership at STEMx, and while membership has been valuable for the past two years, the consensus is that it is wise to sit out a year and see how the new leadership will restructure STEMx services. The STEM AC, along with numerous other partners, won the bid (8 cities applied) to host the 2019 CSforAll National Summit on October 21-23 at the University of Utah. The theme for this year's national summit will be systemic change for computer science education.

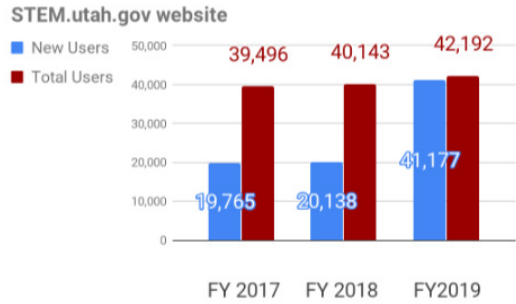
**(h) Provide a Utah best practices database - 63M-1-3204, 2 (j)**

The Curiosity Unleashed ([stem.utah.gov](http://stem.utah.gov)) website provides access to Utah best practices and content that targets students, parents, educators, and industry partners. The website was redesigned to better serve the STEM education community, offering a dynamic and informative user-experience for all stakeholder groups. The new website launched in

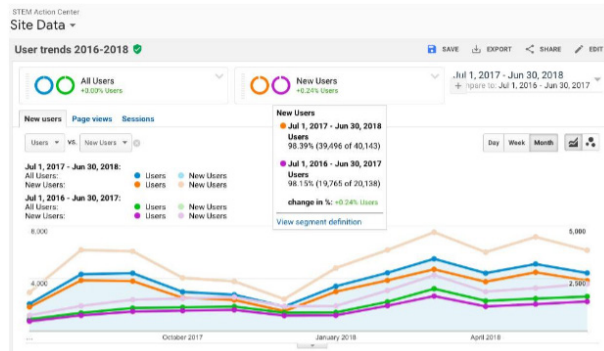
June 2019, complete with a repository of STEM content, showcasing innovative STEM ideas for use in the classroom and at home. This resource will allow teachers to submit resources of their own, rate the resources provided by peers, provide feedback, and connect with other Utah teachers. Information on best practices for STEM in Utah and links to high-quality STEM resources hosted by other websites will also be featured. The new website includes information regarding STEM events and activities across the State; a description of these events, along with dates, locations, and a point of contact. All of this will inform the annual STEM Best Practices Conference, allowing us to provide more targeted, robust opportunities for teachers.

**(i) Keep track of how the best practices database is being used and how many are using it - 63M-1-3204 2 (k) i and ii**

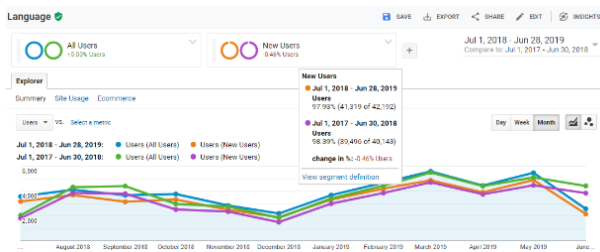
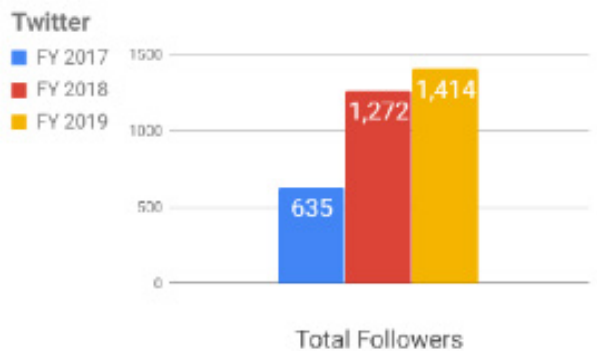
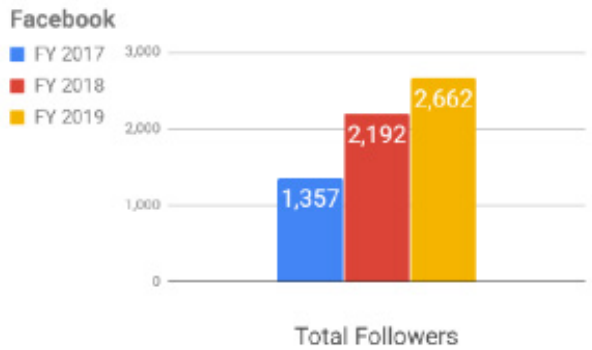
During the 2019 fiscal year the STEM AC website continued its upward trend of site traffic, accruing 41,177 new users compared to 39,496 in FY2018. Furthermore, an almost parallel increase was observed in overall users, with 42,192 total users in FY17 compared to 40,143 in FY18. A total of 53.1% of new traffic was organic (Google search), 34.7% was direct (URL: stem.utah.gov), and the remainder of traffic originated from social media links. The site realized a 49.47% increase in page views: 124,244 vs. 83,130 (FY 2018 vs. FY 2017).



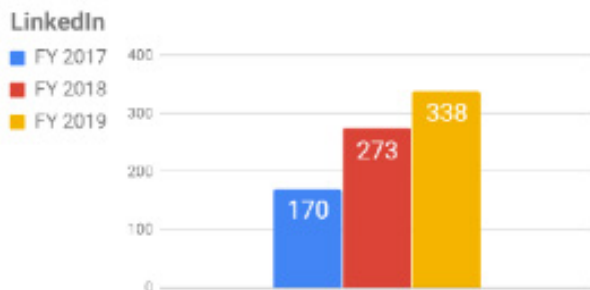
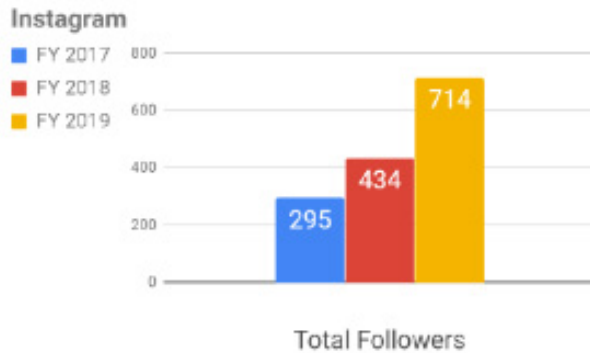
Source: Google Analytics



The STEM Action Center social media accounts also saw growth in FY 2019:







Facebook followers total 2,662 (vs. 2,192 followers/FY18); Twitter followers total 1,414 (vs. 1,272 followers/FY18); Instagram followers total 714 (434 followers/FY18); LinkedIn followers total 338 (vs. 273 followers/FY18). The nearly twofold growth in Instagram followers is notable; further, this underscores the trend of declining engagement and social media use across personal and organization sectors. Digital marketing is constantly evolving, and the best strategy for continued engagement across any channel is active monitoring, engagement with the audience, and above all, value-add content that is of benefit to the user. The objective of maintaining our web assets is to post and promote STEM opportunities to all stakeholders in the spirit of fostering an online network dedicated to STEM education and, ultimately, economic growth in related industries through the cultivation of a future-focused STEM-savvy workforce. Critical to our dissemination of impactful, compelling content, our social media accounts drive traffic to our main

website, [STEM.utah.gov](http://STEM.utah.gov). This was especially successful in FY 2019, during which social media back-links to the STEM AC site was integral to attracting 41,177 new users, comprising 85 percent of total traffic (42,192 users). We also utilize our platforms to create reciprocal relationships with higher-profile organizations by engaging with their content and attracting followers from their audience bases, helping call attention to our own social impacts as well as STEM AC events and related websites such as [stembestpractices.com](http://stembestpractices.com) and [stemfest.com](http://stemfest.com). Social media is an exceptionally valuable tool for promoting stakeholder engagement; patterns demonstrate spikes in traffic around our events, granted that a majority of individuals rely on social media for information. Using the STEM Best Practices conference as anecdotal evidence, we find stakeholder reach increases by an average 4,300 people in both the month prior to the hallmark educator conference, as well as subsequent months (surges of engagement patterns are observed with respect to events we promote in the weeks that immediately follow). The STEM AC distributes a monthly newsletter with a reach of 7,104 Utahns, yielding more than 3,200 unique signups via [STEM.utah.gov](http://STEM.utah.gov) in the past year alone. The newsletter averages a 53.8% open rate.

**(j) Join and participate in a national STEM network - 63M-1-3204 2(l)**

The STEM AC joined STEMx, a national level organization that has evolved to be more service-oriented, with less focus on membership (thus, less overpriced membership dues). This organization is also led by states and their STEM initiatives, which is more appropriate for the STEM

AC. The STEM AC frequently participates in webinars with STEMx and has learned about some successful practices in other states. Leadership at STEMx has changed in the past few months and the STEM AC is waiting, and observing, before joining to see if this change of leadership will negatively impact the quality of services from STEMx. The STEM AC continues to engage with other national organizations such as STEMConnector, but not on a membership basis.

### **(k) STEM School Designation - 63M-1-3204, 2 (n)**

The STEM AC, working with the Utah State Board of Education (USBE), generated a comprehensive plan for a STEM School Designation program, which was included in the FY15 annual report. The USBE and the STEM AC Executive Board approved the criteria in FY15. Over the course of applying for designation, schools complete a self-evaluation on 10 overarching dimensions, which break down into 37 elements. Each element is evaluated by the applicant school and scores are supported with narrative and artifact evidence submitted to the review committee. The review committee is composed of STEM AC and USBE staff, as well as administrators planning to apply the following school year, in addition to each applying school providing a reviewer as well. It is important to note the application to become a designated STEM School is not easy. It takes time and considerable thought and strategy. In spite of the level of work required to complete an application, there has been considerable excitement. The first solicitation for applications was released in early September of 2015, with 19 schools awarded a designation at one of the four

designation levels in FY16. An additional 12 Dual Language Immersion schools were also granted STEM School Designations, starting with their 1st-grade teachers and students to intentionally implement STEM into their school days. In FY17, seven additional schools were awarded new designations, with an additional school applying for a higher level of designation from that awarded the previous year. Nine schools were awarded designations in June 2018, three of which were existing awardees that had applied for an increase in designation level, resulting in 43 STEM School designations across the state of Utah. In FY19, eight new schools and one school seeking an increased designation level applied and were awarded a designation. There are currently 51 STEM schools across the state. Designations are recognized for five years, requiring a school to reapply at the end of that time to maintain the designation. For schools that use reviewer feedback to create and implement improvements within those five years, a modified application process is used to increase the designation level. A summary of the awardees is included in Appendix D.

### **(l) Support best methods of high-quality professional development for K-12 STEM Education - 63M-1-3204 2 (o)**

The STEM AC supports LEA-designed effective professional learning associated with STEM via the Professional Learning program. Changes to the program in FY19 were focused on program evaluation, specifically aligning evaluation efforts to the Utah Effective Teaching Standards (UETS) developed by the Utah State Board of Education (USBE). Specifically, standards 3: Learning Environments, 4: Content

Knowledge, 5: Assessment, 7: Instructional Strategies, and 8: Reflection and Growth, were identified as those that could be directly impacted by this grant program. All funded proposals must also align with the definition of highly effective professional learning, as defined in HB 320 from the 2014 general legislative session. One component that is crucial to these plans success is effective professional learning communities (PLC's), which have teachers work in small teams to identify areas for growth, and then work as a team to collect data and make instructional changes. Recent research shows that, particularly in mathematics instruction, effective PLCs as a component of professional learning have demonstrable positive effects on student performance (Motoko & Guodong, 2016). Other studies demonstrate with longitudinal data that effective PLCs are key to facilitating change in teacher change in areas such as curriculum, instructional strategies and effectiveness, and a change in practice and belief of participating teachers. This type of professional learning also develops structure, a collaborative culture, and the development of effective learning activities (Choi Fung Tam, 2015). All grant participants are required to (1) work toward improved STEM-related instruction and (2) film themselves and watch for personalized learning goals through self-reflection. Participants are also asked to complete a survey at the start and end of the school year by our external evaluator, Utah Education Policy Center (UEPC). One open-ended question asked teachers to "provide any concerns or expectations you have about STEM professional learning". Figure 1 indicates the responses related to expectations. For this question, 440 respondents indicated teachers concerns. Of the 440 answers, 100 responses

were "none" or "NA". These responses are not included in Figure 1. Some responses were classified in more than one category, so the number of responses exceeds 340.

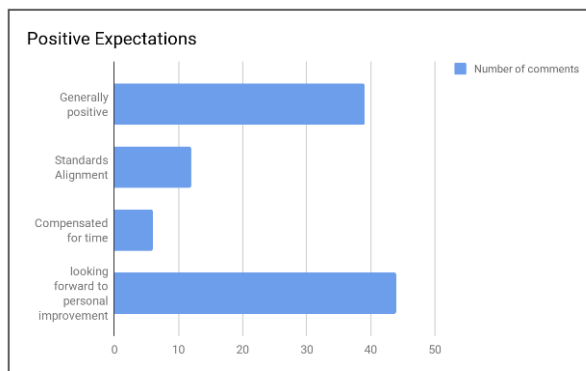


Figure 1: Positive Expectations

Examples of these comments include:

**"I expect that the more I learn about teaching STEM the more my students can connect my content with the world."**

**"I was nervous about starting the training and all the work that will go along with it. However, it's been an amazing learning experience. I have taken some of the ideas and integrated them in my classroom. I have a long way to go, but I'm moving forward and becoming a better teacher because of it."**

**"I love teaching STEM! I feel that the inclusion of student-centered and student-driven learning is wonderful! It is hard when you have limited time as it is, knowing you are creating things that might be a 'one and done' due to changes that are out of your control."**

Another open-ended question indicated a few areas of concern, including a lack of time in a teacher’s day to fully use the resources being provided, and a lack of guidance regarding the LEA’s goals associated with STEM. Specific examples regarding teacher concerns include:

**“It is taking large amounts of time. I want to give NGSS my best effort. With my attention divided I feel concerned with the ‘when’ will each of these events be happening.. I am still giving this my best effort because of the impact it will have on my teaching and the students!”**

**“Even though I know hands-on learning is the best way for children to learn, I’m concerned about the time it will take in my classroom schedule. I already can’t fit in what I have to now. I need to have the students ready for grade-level testing at the end of the year. I don’t know how much of this will transfer over to the test questions, especially in language arts.”**

**“Stem expectations are not real clear at our school.”**

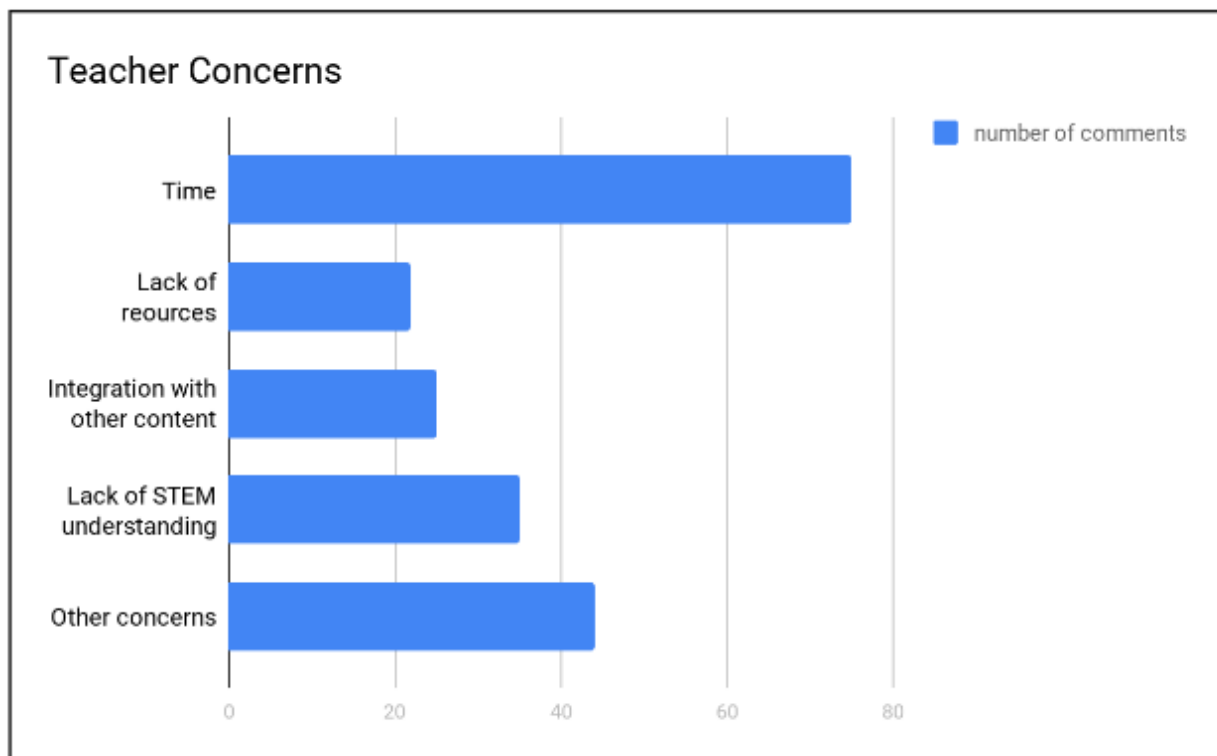


Figure 2: Teacher Concerns

Concerns, illustrated in Figure 2, were shared with site leaders so they could be addressed as instruction began.

The requirement for all teacher participants to use video self-reflection as a part of the program has been challenging some teacher groups. Some sites choose to engage with peer reflection in professional learning communities (PLCs) in addition to self reflection. See Table 1 for teacher pre-survey responses regarding participating in video reflection.

I plan to participate in the following:	I don't plan to do this	I'm not sure	I plan to do this
Video self-reflection	195	383	673
Video peer-reflection	287	515	449

Teacher survey respondents were also given an opportunity to provide feedback regarding the video self- reflection requirement, with 1,116 participants providing responses. Figure 3 demonstrates response categories.

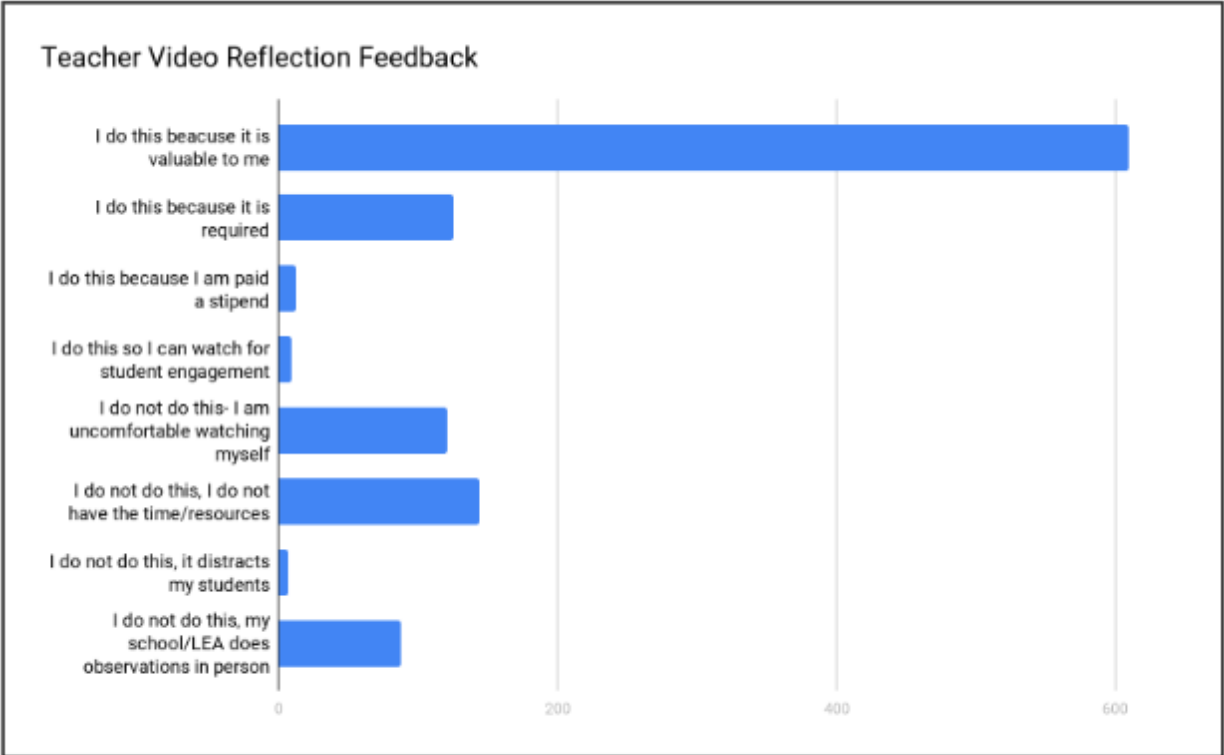


Figure 3: Teacher Video Self-Reflection Feedback

Grant funds are used for a variety of purposes, primarily off-contract time, incentives for completing additional work off-contract, substitutes for work-day efforts, recording devices, conference transportation and registration (within the state of Utah), as well as other locally

designed and supported STEM learning opportunities. Applicants can apply for either a one-year or three-year grant. Of the 76 projects funded in FY19, 30 were three-year grants in their second year. Another 28 grants were three-year grants in their first year. There were 14 one-

year grants. Typically, one-year grants act as a pilot for a project that will turn into a three-year grant in the future. Anecdotally, these three-year grants have increased teacher participation as they demonstrate a long-term focus on improving STEM within a school or LEA. A pilot of three professional learning platforms was implemented in the 18-19 academic year. These platforms relied on video-based professional learning. At this time, none of the platforms were able to provide the data or support necessary to be added to an approved vendor list at STEM AC for the purpose of video-based professional learning. A summary of the current grants being supported can be found in Appendix XX. For more information and additional data, including survey results from the end of the school year after project implementation, see the full report by Utah Education Policy Center in Appendix F. In March of 2019, the funds allocated to STEM AC for the professional learning program were allocated to USBE. STEM AC has worked with USBE to ensure support for the 58 ongoing grants with USBE funds. Additional changes to the program for the 2019-2020 school year include a single survey, administered at the end of the year, which asks teachers to reflect on their growth over the school year. Grant site administrators are also being asked to participate in virtual PLCs to share their experiences with each other throughout the year. One-time professional learning carryover dollars were also used to support a second cohort of elementary teachers that wanted to pursue their Elementary STEM Endorsement. This cohort resulted in an additional 436 teachers completing the six-course endorsement series, which focus on STEM content and instructional

strategies. Evaluation of the endorsement program can be found in Appendix F. In the 2019 legislative session, this program was reassigned to USBE for future management.

### **(m) Recognize a high school student's achievement in STEM Fairs, Camps and Competitions- 63M-1-3204, 2 (p)**

The Spotlight program provides an opportunity to share stories about Utah students, teachers and companies. The STEM AC reaches out to districts, schools, teachers, students, parents, and even companies to showcase innovative efforts in STEM. The Spotlights are sent to educators, businesses, and legislators to highlight the great things going on in their communities. The current portfolio of Spotlights can be found at <https://stem.utah.gov/weeklyspotlights/>. The STEM AC has increased its social media presence as well. The STEM AC currently holds a presence on Instagram with 769 followers, Twitter with 1,446 followers and Facebook where it sports a 5-star review with 2685 followers. In June 2019 the STEM AC launched a #SummerofSTEM campaign on Instagram and Twitter which highlighted spectacular stories of STEM across the state, including highlights of AMES high school students' robotics camp fundraiser, Weber State's all-girls welding summer camp, Alpine school district's Christa McAuliffe Space Center and more. The STEM AC's Twitter platform was also used as a vessel to disseminate exciting STEM news from industry and academia, such as Comcast's accessibility technology and updates from NASA.

**(n) Develop and distribute STEM information to parents of students being served by the STEM AC - 63M-1-3204, 2 (r)**

The STEM AC reaches out to parents at various STEM events, such as the Craft Lake City DIY fair, STEM expo events, and other sponsored events. Parents are encouraged to sign up for the newsletter and to follow the STEM AC on social media, where they can find out about STEM events across the state and student grant opportunities. The third annual STEM Fest attracted more than 4,500 family participants on open family night. A specific section on the website is dedicated to students, where parents and students both can learn the significance of STEM and also keep up to speed on the latest events.

The STEM Bus goes to STEM nights and other events at various elementary schools throughout the year, and opens the bus up to communities to learn more ways to get involved in STEM. Further, the STEM Bus supports the Leap into Science program that provides STEM and reading events at several community venues across the state. Parents, and their children, are a focus of the Leap into Science program and helps to promote reading through engaging topics in science.

**(o) Support targeted high-quality professional development for improved instruction in education, including improved instructional materials that are dynamic and engaging and the use of applied instruction - 63M-1-3204, 2(s) i - iii**

The second cohort of 435 teachers participating in the Elementary STEM

Endorsement started in Fall 2017, and completed all coursework by summer 2019. Prior to starting their endorsement program, nearly half of participants stated in a survey they taught less than 30 minutes of STEM content per week. Survey responses collected by UEPC indicate that that, upon completion of the endorsement, only 20% of teachers are engaging their students in STEM less than 30 minutes a week. A full 25% of participants report using STEM in their classrooms more than five hours a week. Teacher participants report beginning the program for intrinsic reasons, including interest in the course content covered. At the close of the cohort, attrition remains under 10%. In addition to cohorts working regionally with higher education partners, this cohort has seen the addition of distance education courses offered by the Central Utah Education Services (CUES) office, and year-round course offerings from Utah Science Teachers Association (UtSTA). Based on previous and current participant feedback, program leaders in partnership with the Utah State Board of Education (USBE) will be refining the program's course offerings and requirements to have a larger focus on developing content knowledge for educators. In the 2018-19 school year, teachers and administrators from 542 schools received professional learning for the use of the K-12 Math Personalized Learning tools as part of the contracts with the product providers. Working with our third-party evaluation team, we strive to identify best practices and target professional learning opportunities to meet the needs of teachers. The STEM AC team conducted its third annual multi-week "road trip" across the state to provide additional professional learning to teachers for the

use of the math personalized learning tools. The STEM Roadshow consisted of five events around the state of Utah during the last week of July and the first week of August 2019. These events were designed to get the year off on the right foot, providing teachers with opportunities to collaborate, share successes, find solutions to challenges, and receive professional development related to products provided by the STEM Action Center. Across all five locations (St. George, Richfield, Orem, Salt Lake, Layton, and North Logan) 257 participants attended.

**(p) Ensure that an online college readiness assessment tool be accessible by public education students and higher education students - 63M-1-3204, 2 (t) i and ii)**

ALEKS assesses grade-level proficiency in high school students. These assessments provide students with a clear understanding of what they have mastered, and what they still need to learn. These results can easily be compared to college proficiency standards to determine if they are at performance levels in math that meet admission requirements. ALEKS also gives students access to a developmental math curriculum online that allows them to improve in areas that have been identified as deficient for college admission.

The STEM AC works in collaboration with the Utah Education and Telehealth Network (UETN) to support the UtahFutures and American Graduate program. The STEM AC helps to promote and disseminate information from both UETN programs that help students and

parents to access information regarding college readiness.

**(q) The Board may prescribe other duties for the STEM AC in addition to the responsibilities described in this section - 63M-1-3204, 3**

The STEM AC has been involved in additional activities that include the following: Utah STEM Foundation Internal Audit. The STEM AC initiated an internal audit in June 2018 of the UTAH STEM Foundation. The purpose of the internal audit is to be proactive in identifying any weaknesses in the operation of the Foundation. It was felt that the foundation has been in operation a sufficient period of time to allow for an internal audit to identify areas in need of improvement. The objectives of the audit include:

1. Determine whether the STEM Foundation is properly maintaining its tax-exempt status.
2. Determine whether proper internal financial controls are in place.
3. Determine whether any donations have been lost.

The audit report was very positive, and no impairments in the objectives were found at this time. As we are a new 501c3 establishing policies and procedures in conjunction with following the guidelines of the governmental entity, there were a couple of minor procedural suggestions made and agreed upon by all parties. K-16 Computing Partnership Initiative The STEM AC, in partnership with USBE, has identified a serious lack of access in Utah schools to computer science and information technology (CS/IT)



opportunities for students. In 2017, with strong support from industry, STEM AC secured \$1.255M ongoing to launch the first computing grant initiative in Utah (SB190), now known as the K-16 Computing Partnership Initiative. The STEM AC, working with partners from USBE, industry, Utah DWS, LEAs, the Computer Science Teachers Association (CSTA), the Utah State Superintendents Association (USSA), community and cultural organizations and higher education institutions, built out a strategy to support the creation of articulated computing programs, beginning in K-6 and seamlessly transferring through secondary and post-secondary. The results were two key strategic actions: (1) support an industry-led effort to secure legislative funds for funding to LEAs in the form of a competitive grant program and (2) an industry-led collaboration to develop an apprenticeship program in computing. The current grants were identified through two formal, competitive solicitations, with external review of all submissions. Applicants submitted grant requests for 2-3 years of funding. The first solicitation, awarded in 2017, received 24 applications with 10 grant awards. The second solicitation, awarded in early 2018, received 23 grant applications with 19 grants awarded. Fifty-five percent of these awards were located outside of the Wasatch Front. Appendix E provides an outline of the grantees and their funded activities.

Input from STEM AC partners helped to inform funding requests and define the criteria for the grant framework and proposal activities, which address the resource gaps preventing LEAs from offering comprehensive computing

programs in K-12. The activities, as defined in the Request for Grants (RFG), include:

- innovative outreach, engagement and awareness activities with a focus on equity and access for all Utah students
- robust and industry-relevant content for courses
- increasing the number of middle and high schools with CS/IT courses (e.g, ECS, Creative Coding, AP CSP, AP CS, Programming I and II, etc.)
- integration of coding, with a focus on computational thinking, for elementary classrooms
- classroom engagement with industry partners (e.g., support in elementary classroom activities, instruction in secondary courses, etc.)
- professional learning opportunities to increase the number of qualified teachers (e.g, workshops for elementary teachers such as Computer Science Fundamentals, support of endorsement work for secondary teachers such as AP Computer Science Principles or Level 1 or 2 CS endorsement courses, etc.)
- work-based learning opportunities
- effective articulation with post-secondary partners that increases retention of students in undergraduate programs
- increased industry advocacy (e.g., classroom engagement, funding of programs, legislative advocacy, grant partnerships, etc.)
- effective evaluation and assessment of existing and new activities

Qualitative and quantitative data was collected in January 2019 and at the end

of the school year. Third-party evaluator analysis indicates positive outcomes and provides formative guidance regarding how to improve the program and identify future, additional needs. For more information and additional data, see the full report by Utah Education Policy Center in Appendix F. Grantees identified strategies that best addressed the specific computing needs of their school or district. A majority of grant activities focused on teacher professional development and before/after school programming, as seen in the summary of program activities in Figure 5.

Figure 4: Summary of Outreach and Engagement Grant Activities During the 2018-19 academic year, 32,957 students attended 257

Type of Activity	2017-2018		Fall 2018		Spring 2019	
	Hours Offered	# Students Served	Hours Offered	# Students Served	Hours Offered	# Students Served
Afterschool Coding Clubs	245	330	700	1,018	1,018	1,276
First Tech Challenge	55	8	168	59	16	32
Lego League	357	317	415	602	110	507
Other afterschool robotics clubs	144	83	379	628	569	398
Summer coding camps	205	171	N/A	--	N/A	--
Summer robotics camps	24	36	N/A	--	N/A	--
Student conferences/events	74	2,231	12	142	100	885
Aspirations in Computing	12	85	25	100	35	146
Hour of Code activity	9	1,048	14.5	1,745	54	1,487
Family Hour of Code	--	--	1.5	150	3	377
Hack-a-thons	--	--	4	12	6	81
Out-of-school kick-off/family events	7	1,312	13	2,397	31	3,142
In-school assemblies	6	2,838	9	688	19	776
Other	--	--	--	--	59	579
<b>Totals*</b>	<b>1,128</b>	<b>8,459</b>	<b>1,741</b>	<b>7,541</b>	<b>2,020</b>	<b>9,689</b>

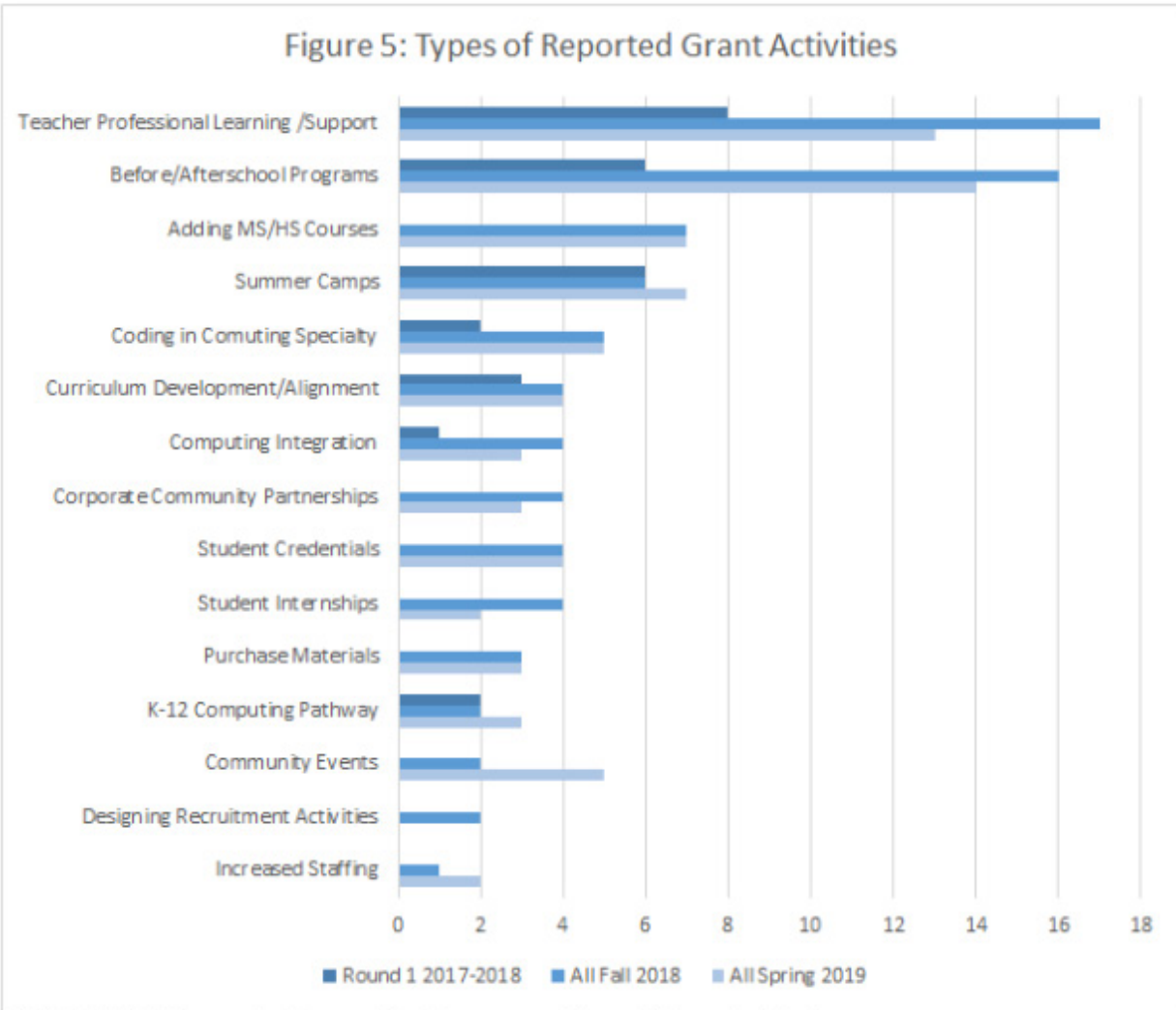
\*Students may have participated in multiple activities.

Participation data for summer 2019 have not yet been submitted by grantees.

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Figure 4: Summary of Outreach and Engagement Grant Activities

During the 2018-19 academic year, 32,957 students attended 257 new computing class sections, and 17,230 students participated in Outreach and Engagement Activities. (Note: Students may have participated in more than one activity.) Figure 4 provides detail regarding the types of outreach and engagement activities provided. Decreased activity from Fall 2018 to Spring 2019 is due in part to programs completing their competition seasons in February/March and to an emphasis on end of year testing.



SOURCE: UEPC Computing Partnership Semester and Annual Reporting Tool

Figure 5: Types of Reported Grant Activities

In addition to output measures, third-party evaluators captured grantee feedback, which included the following sample survey responses.

**Overall levels of participation:**

“We have had our breath taken away by the success of our kickoff events. Thanks to our marketing and mostly to great partners, we recently had our teacher kickoff event where every teacher in the district attended and have had student kickoff events with attendance ranging from 800 - 1500.”

“Our after school CS program was a big success! After only one after school meeting, the word quickly spread on how much fun coding is and we had more kids than we could house in a room after that.”

### **Student gains:**

“It amazed me how much the students grew in knowledge this year. Most of them came in with very little exposure to computer science or robotics. By the end they knew how to program robots, code stories and games, and work as a team to accomplish goals.”

“One of our most important successes was with the near-peer mentoring. With this approach, we use high school students to mentor junior high and elementary students. We work to include mentors that are atypical of the common coding stereotype so that our young students can begin to see themselves as both capable and interested in computing. This approach also increases computing skills for both our mentors and our students.”

“Number of professional certifications exceeded our expectations (especially since all but 1 were earned by 9th-grade students).”

Participation of underrepresented students:

“Each sector of diversity of the Computer Science Classes was higher than that of the school.”

“We now have a small but enthusiastic group of female participants.”

### **New curricula and resources:**

“We felt our Computer Science Canvas professional training provided in August 2018 identified the real need teachers have for these resources aligned with typical secondary instruction. Because of requests from across the state for access to these courses, they are now available on Canvas commons.”

### **Teacher gains:**

“Due to the shift in CS teachers’ mindsets, we have been able to form a committee of both classroom and CS teachers to help finalize DESK Standards and provide a grade-level curriculum in computer science.”

“The instructor’s industry knowledge has been invaluable in working with our students and has helped our school to make industry connections and bridge the gap between education and industry.”

Grantee responses also identified areas of need that include: finding qualified personnel, providing more teacher professional learning, scheduling issues, increased support from higher education partners, more connections with local industry, ongoing need to update equipment, desire for regional workshops provided by the STEM AC and USBE and an online community for sharing ideas and resources that can align and synergize with a possible “local hub” model. Plans for the next RFG, to be released in February 2020, are being developed at present. As informed by the data from the first two grant rounds, the emphasis on access for rural students will

continue, while more focus on robotics and afterschool programming to attract students into coding is being proposed.

### **Additional K-16 Computing Initiative Partnerships**

The K-16 Computing Partnership initiative leverages additional partnerships. Through collaboration with Code.org and key Utah industry partners, the STEM AC provides teacher professional learning endorsement workshops for specific courses in the computing pathway, including Computer Science Discoveries (CSD; 6 th through 10 th grade), and AP Computer Science Principles (AP CSP; 11 th or 12 th grade). An expanded agreement with Code.org is also providing for elementary teacher professional development through Computer Science Fundamentals (CSF) workshops. Hill Air Force Base and in-kind donations from Dell EMC supported participation by 43 middle school teachers (CSD) and 26 high school teachers (AP CSP), participated during the 2018-19 school year. An additional 30 middle school and 19 high school teachers participating in the 2019 5-day summer workshops. A total of 123 elementary teachers (CSF) were supported directly by the STEM AC, in addition to 76 teachers supported by other partners. The STEM AC also collaborates with Girls Who Code Club Network (GWC) to support the creation and facilitation of GWC Clubs across Utah. In November of 2017 there were five GWC Clubs in Utah. The STEM AC's Foundation, working with GWC, Carbonite, and Comcast, have helped to grow the clubs to a total of 62 active clubs affiliated with the STEM Action Center. Carbonite, Comcast, Centeva, and Recursion made cash and in-kind donations to support an inaugural GWC Club Entrepreneurial

Challenge in April of 2019. The four award categories included the Challenge Essay Award (3rd-5th grade clubs), the Facilitator Award (all clubs), the Peer Mentor Award (6th-12th grade clubs), and the Project Challenge Award (6th-12th grade clubs). In all, three facilitators, three peer mentors, one elementary, two middle school and three high school clubs were awarded funding to expand their schools' computer science programs. The STEM AC is one of 17 member states in the national Expanding Computing Education Pathways (ECEP) Alliance. The Utah coalition received a grant from ECEP to complete a statewide CS/IT landscape analysis. The landscape analysis provides data that describes the current status of CS/IT in school districts. It also provides educator and administrator input for needed resources, significant challenges to building and sustaining a comprehensive K-16 computing program. The information collected as part of the landscape analysis will augment the data collected from the third-party assessment of the Computing Partnership grants. Finally, the STEM AC, in partnership with USBE, the Utah Education Network (UEN), Computing Partnership grant awardees, industry partners (listed below) and post-secondary partners are poised to launch the Community of Innovation Network. This network will be a blended community of practice that allows for online sharing of promising and best practices in CS/IT education and career development. It will also support a series of face-to-face regional symposia, which will be supported through a "spoke and hub" model with the STEM AC supporting the collaborative partners. The Community of Innovation Network aligns with and will address a need that

has been identified in the initial feedback from Computing Partnership grant awardees, previously discussed.

### *The Utah Computing Apprenticeship Consortium (UCAC)*

Many Utah companies support a variety of internship opportunities for students. However, industry partners have indicated that there are gaps in the process for which they could use resources to improve their early employment opportunities. The STEM AC has been working with the Utah Department of Workforce Services (Utah DWS) and industry partners to create the first computing apprenticeship program. Computing is defined as computer science, information technology, cybersecurity, software development and engineering, data analytics and artificial intelligence. This is an industry-led project and will support opportunities for students to be hired as apprentices, in an “earn while you learn” model. This project originated in November of 2018 with the support of Senator Hatch’s office. The intent was to submit an H1B visa grant to the US Department of Labor (DOL), in partnership with the Utah Technology Council (UTC) and educational institutions. The release of the DOL grant solicitation was delayed, prompting the apprenticeship planning team to look for other opportunities to pilot the apprenticeship program. The UTC, now Silicon Slopes, was awarded a Talent Ready Utah grant for \$245,000, to provide pilot funding to launch the Utah Computing Apprenticeship Consortium (UCAC). The UCAC, now known as Silicon Slopes Apprenti, has facilitated the assessment of applicants and is now matching applicants to industry partners. Classroom training for this first cohort

is planned to begin in August 2019, with on-the-job training following in November. Silicon Slopes Apprenti will act as intermediary between industry apprenticeship sites and the US Bureau of Apprenticeship. The DOL released the awaited solicitation for the H1B apprenticeship grant program in early August 2018. Weber State University took the lead and submitted a proposal, in partnership with Salt Lake Community College, Davis Technical College, Ogden-Weber Technical College, the Utah DWS and the STEM AC. In June of 2019, DOL announced that WSU has been awarded \$2M to begin scaling apprenticeships in IT and IT-related industries. WSU and its partners will align closely with Silicon Slopes Apprenti, to serve 800 apprentices over the next four years.

Utah companies have been engaged in the apprenticeship project for the past two years; these companies include Adobe, 3M, Ivanti, Comcast, Ancestry.com, Vivint, Microsoft, Google, Oracle, IM Flash, Goldman Sachs, eBay, Hill Air Force Base, AT&T, Inside Sales, OC Tanner, Utah Technology Council, Women’s Tech Council, Silicon Slopes, BAE Systems, Intermountain Healthcare, Domo, Health Equity, Instructure and Orbital ATK. National Science Foundation - Linking Attitudes and Behaviors for Student Success (LABS2) The success of key STEM education efforts rely on an effective communication and outreach strategy, with an emphasis on programs that are in Career and Technical Education (CTE). It has been recognized in Utah, as well as in many other states, that CTE programs suffer from myriad negative misperceptions. In order to ensure that any efforts with CTE programs realize

their full potential for participation, the stigma that plagues CTE programs needs to be addressed. The STEM AC and partners from higher education, the USBE, several LEAs and the Utah DWS, were awarded funding for the Linking Attitudes and Behaviors for Student Success (LABS2) proposal from the National Science Foundation's Advanced Technology Education (ATE) program.

The focus of this grant is to work collaboratively to create a new communication and outreach strategy for Career and Technical Education (CTE) programs, which would include Computer Science and Information Technology (CS/IT). The grant was a "Workshop and Conference" grant for an 18-month duration and \$100,000. The grant was evaluated and the reviewer's recommended that the grant be funded, but be extended to a project grant for three years and an expanded scope and budget. The grant was funded on April 1, 2018 for three years and a total of \$766,364. The initial surveys were deployed in May of 2019 and the information from these responses is being analyzed for common themes or trends that will help to create customized messages that address beliefs, misconceptions and biases in each stakeholder group. These new communication strategies, with their messages, will be disseminated through various venues, and in various formats, to the stakeholder audiences. An emphasis will be placed on social media deployment. The LABS2 team will follow up with targeted focus groups and additional surveys to assess the impact of the messages and refine them.

### *Broadening Participation in STEM through Increased Equity, Inclusion, Diversity, and Access*

A key focus of the STEM AC is to promote and support equity and access to all students. There are several projects that the STEM AC participates in to meet this core element of its vision. They include the STEM Equity Pipeline, STEM Micro-Messaging, and the INCLUDES project. A consortium of partners, led by Utah Valley University, initiated the STEM Equity Pipeline in 2014, in partnership with the National Alliance for Partnerships in Equity (NAPE), the STEM AC and Park City School District. The pilot was funded by the National Science Foundation and has been a huge success. The overarching purpose of the STEM Equity Pipeline project is to use root cause analysis to determine the reasons why enrollments for underrepresented populations are unacceptably low in STEM education and career pathways. A pilot was conducted with Park City School District (PCSD) in their middle, junior, and high schools. The first year of root cause analysis was followed by data-driven changes during year two. Year three enrollments for girls in elect STEM courses increased dramatically. Data is being collected for Hispanic and Latino students for year four enrollments. The data from this project is available upon request.

The STEM Equity Pipeline project was completed, but a portion of the project, STEM Micro-Messaging, was found to be extremely useful for district partners. A Motorola Solutions grant was secured in April of 2018, which has helped to create a modified version of the micro-messaging training that is more scalable with respect to time and cost. The pilot

for the modified version was conducted in spring of 2019 with 70 teachers in the Davis School District. The workshop was initiated on March 28, 2019, with a full day of training, followed by two months for the participants to test chosen micro-messaging strategies for their classroom. The two months of classroom testing were followed by the second (and final) day of training in June that allowed the teachers to share their experience and the outcomes, as well as refine and expand their strategy for the 2019-20 school year. The response from teachers was overwhelmingly positive, including the following:

“we made a goal to incorporate a lot of growth mindset lessons, activities, posters, and language in our class. We started off this month by learning about the brain, hippocampus, amygdala, prefrontal cortex, etc. This week we just started having them work for little paper neurons to put on their ‘brains’ when they do hard things, are persistent, etc.”

“(we) are working together as a PLC. Our focus is to help our students understand that everyone can be a scientist. We are going to start the year with a ‘Draw a Scientist’ assignment. Students will be asked to draw a picture of a scientist and identify the attributes of their scientist. Then as a group, students will create a poster with a shared idea about what a scientist looks like and specified attributes. Then students will display their posters around the classroom and we will have a group discussion about the commonalities and differences in the pictures. We want to lead the students to identify missing attributes or if anyone feels like these pictures don’t represent them. We will share an experience from

Edwin Hubble where he ‘reinvented himself’ in order for other scientists to take him seriously by changing his look and behaviors to look more like an expected scientist. Throughout the rest of the semester we will highlight underrepresented scientists each month, focusing on females and scientists of color. We will also work on developing a ‘biography of a scientist’ project for students to complete that will also place a focus on underrepresented scientists. We are also going to modify our ‘cold call’ techniques in the classroom. We will have cards or sticks with student names and we will actually separate them into piles based on gender. This will allow us to alternate calling on girls and boys so that it is equally done in the class. (One teacher) also noted that she focused on providing feedback to both boys and girls and not just to boys. At the end of the semester we will revisit our first assignment of drawing a scientist. Students will go back to their original groups and reflect on how their idea of a scientist has changed (or not). As a group, they will add to or create a new drawing of a scientist and list the particular attributes, with the hope that students’ ideas will be more inclusive by the end of the semester.”

### **OUTREACH AND ENGAGEMENT**

The STEM AC conducts the following outreach and engagement activities as a means to provide project support to teachers and promote STEM AC resources. There are numerous outreach and engagement activities that are included in previous sections, such as the industry engagement portion of the report.

- Visits with district superintendents: The STEM AC continues to work to ensure



that the activities of the STEM AC align with the needs of the LEAs. The ability to discuss gaps and needed resources with Superintendents is critical for the STEM AC. It ensures that the resources that the STEM AC provides are relevant and help the LEAs to create positive change for their students, teachers, and communities.

- The STEM AC continues to build relations with school boards including the Rural School Boards Association. The STEM AC has committed to attending the Rural School District Association meetings to understand more fully how to support rural districts and their STEM needs. The STEM AC has spent a great deal of time working with the Regional Education Service Centers (NUES, CUES, SESC and SEDC). The Utah STEM Bus team works with the service centers to provide access to the kits that they have developed.

- Site visits to STEM AC projects: The STEM AC team conducted site visits for several projects during FY 2016.

- (1) Classroom grants: Classroom grants for the 2018-19 school year varied in scope and subject.

Team members were able to observe 12 projects on-site. Additionally, over 90% of awardees provided pictures and video of projects in action, to be shared along with project reports and lesson plans. Greater detail regarding the classroom grants program can be found in preceding sections. A summary of all classroom grant awards can be found in Appendix C.

### **Acquisition of STEM education-related instructional technology program – Research and development of education-related instructional technology (63M-1-3205)**

The STEM AC completed its fifth full

year of training and implementation to support the K-12 Math Personalized Learning program (2018-19 school year). The overall goal of this program is to provide supplemental math support to teachers and students in an innovative approach that includes: (1) ongoing research of best practices in the use of supplemental instructional tools (2) using a statewide approach to design and implement a robust analysis of the use of content-specific supplemental technology-based tools and (3) a statewide approach to implement a program that leverages state contracting and critical mass for cost-effective access and (4) integrating a mechanism that allows for continuous assessment of new products at no cost to the state. A total of 209,234 students had access to licenses provided by the STEM AC for math personalized learning tools. The program covered 32% of all Utah students in grades K-12, with 39 districts and 46 charter schools participating (542 schools total). Five math personalized learning products were used during the 2018-19 school year. Over the years we have learned that buy-in at all levels is critical to success. In 2018-19, each application required a signature from one district-level admin, and one school level admin, promising to ensure that students would have access to technology for at least 45 minutes per week to use the math software provided. We also required signatures from the IT Director at each LEA to ensure they were aware of any technology provided by the grant and that they would have adequate bandwidth and infrastructure prior to implementation. We also make efforts every year to provide summer learning opportunities for classroom teachers to increase buy-in at the teacher level. We

call this series of learning opportunities the “STEM Roadshow”, and travel the state with product providers, setting up regional meetings about a month prior to the start of school to get as many classroom teacher participants comfortable with the products they will be using over the course of the year. All applications are required to list “on-site” contacts, which are verified by the district point of contact before the beginning of the school year. This ensures that product providers are able to distribute the majority of awarded licenses and facilitate professional development right at the beginning of the school year. Product providers are required to distribute licenses and arrange professional development before they receive payment, which has encouraged them to put forth extra effort to ensure timely completion of these activities. We also made sure that usage expectations were clearly communicated to administrators and math coordinators.

To allow school and district administrators to more strategically plan implementation, we open the application for the following school year early in the spring and send award notifications in April before budgets have to be completed. As this program has matured, we have found there is a difference between “fidelity”- using a product for a certain amount of time, and effective implementation. When working to ensure products are used effectively with over 100 thousand students, the easiest metric to look at is minutes of use. While this metric has been valuable, it does not provide a complete picture of what effective usage looks like. Over the past couple years, we have learned

that we need to increase our focus on implementation strategies and effective use of reporting features as well. Using data from one of these personalized learning programs, one 30-year veteran teacher was able to help 89% of her students reach grade-level proficiency, outperforming the state average by over 45%. As we shared this success story with teachers during our “STEM roadshow,” several other teachers shared similar success stories from their own classrooms. Each of them emphasized the importance of using these supplemental products strategically, rather than just focusing on minutes of use and other product specific “fidelity” requirements. We are working with teachers to identify promising practices that may help improve student outcomes so that those practices can be shared with other teachers throughout the state.

The third-party evaluation team for the STEM AC has been working with the USBE to access end-of-year test scores for 2018-19 to align with the use of digital learning tools. The data for 2017-18 (FY18) was provided to the STEM AC in June 2019. For the 2018-19 school year, the evaluation team will use the lessons learned from previous years to examine longitudinal trends. We anticipate a similar release date for the longitudinal data, showing the cumulative relationship between product use and student achievement over multiple years. The evaluation team will provide a full report and it will be included as an addendum to this report once the RISE data is received and adequate time has passed for completion of the report.

**Third-party evaluation report on performance of students participating in STEM Action Center programs as collected in Subsection 63M-1-3204(4).**

The STEM AC continues to work with the Utah Education Policy Center to expand beyond basic metrics, to facilitate a more robust analysis that provides greater stratification of the data. The STEM AC is working with UEPC evaluators to look at impact in student learning with changes in teaching methodology (for the endorsement and professional learning grants). Strategies are being developed to capture information that will be used to track data longitudinally. Further, the STEM AC has worked with the evaluators to create extensive evaluation strategies which are included in the logic models that are included in the STEM AC strategic plan that can be found on the STEM AC website. The third-party evaluator has completed the annual report that includes assessment of the K-12 Math Personalized Learning, Professional Learning, Elementary STEM Endorsement projects, and K-16 Computing Partnerships. Preliminary information indicates that nearly all teachers and administrators feel that access to these opportunities has had a positive impact on teachers and students. For the math grant, more than half of the students report that using the software helped increase their confidence in math (see Appendix F).

It should be noted that the K-12 Math Personalized Learning report will only include qualitative data from surveys administered by the third-party evaluator and usage data of the licenses that are tracked by the software. The longitudinal student proficiency and growth data will

not be completed until June 2020 due to the time required for careful analysis. The STEM AC will provide the proficiency and growth data as an addendum to the report once it is received.



**ATTACHMENTS:**

Appendix A: Selected Product Providers

Appendix B: Competition Grants Summary

Appendix C: Classroom Grants Summary

Appendix D: STEM School Designation Awardees

Appendix E: Computing Partnership Grant Awards Summary

Appendix F: Utah Education Policy Center Independent Evaluation Report

**REFERENCES:**

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