

**Utah STEM
Action
Center
Annual
Report
FY2023**



Annual Report to the Education Interim Committee November 15, 2022

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 Centers 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).**

The number of educators receiving high quality professional development

The STEM Action Center (STEM AC) supports high quality professional development through the professional learning (PL) program that aligns resources to 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). The STEM AC also provides professional development to support educators that are participating in other programs such as the K-16 Computing Partnership program, the K-12 Math programs, programs with our STEM in Motion team and the annual STEM Best Practices conference.

K-12 PROFESSIONAL LEARNING

The PL program supported 31 grants in the 2022-23 school year, directly impacting 4,224 educators. The program design varies greatly within this grant program and includes solutions to locally identified issues that support their long-term strategic plan with compensation for off contract work, lesson study in a PLC, and videos to be used for self and peer reflection. Additionally, 30 total educators registered to participate in monthly sessions across February, March, and April for our Saturday Educator Learning Series (SELS), and 42 educators were selected to participate in next year's STEM Education Innovators (SEI) program.

K-16 COMPUTING PARTNERSHIPS

As part of the K-16 Computing Partnership program, a total of 636 educators in Fall 2022 and 556 educators in Spring 2023 received professional development, which primarily occurred via face-to-face training at educators' schools or districts. Other professional learning activities occurred via online courses, mentoring from product providers, work-embedded modeling within educators' classes, PL events (e.g., computing kick-offs), as well as conferences or workshops hosted by other organizations.. Professional learning experiences generally focused on building educator knowledge and skills as well as their capacity to use specific technology purchased through the grant and integrate it into their lessons.

K-12 MATH PERSONALIZED LEARNING

Educators and administrators from 657 schools received professional learning for the use of the K-12 Math Personalized Learning tools as part of the contracts with the product providers. This training ensured that educators were able to integrate the use of the software effectively as a supplement to their instruction.

STEM IN MOTION

The STEM in Motion Curriculum kit program allows teachers and educators to check out various STEM-related curriculum kits for their classrooms for a two-week period. Teachers are able to train themselves on the material using our online videos and PDF lesson plans. There were 134 schools and community education programs that participated in the past year through the curriculum kit program and were trained in STEM lesson teaching. 69 of the educational programs were located off the Wasatch front, and 65 were on the Wasatch front.

STEM BEST PRACTICES CONFERENCE

The STEM Best Practices Conference is a conference targeted to formal educators. When it was initially developed, it was offered every summer. After hearing from many rural administrators that their teachers were not able to attend because of how far they had to travel to get to the conference site, in June 2022, the STEM Action Center offered the conference at three locations. After the three conferences were held and the survey data was analyzed from 153 respondents, it was determined that having multiple locations was a priority for attendees, and having recorded sessions made a big difference as well. Based on this feedback, it was determined the STEM Action Center would move to offering the Best Practices conference every other year at two locations, one on the Wasatch Front, and one off the Wasatch Front. Best Practices was not held in 2023, but will be held in June 2024.

The number of students receiving services from the STEM AC and the number of students that accessed resources from the STEM AC are as follows:

Classroom grants: 21,820 students were impacted by the funded classroom grant projects.

Competition grants: more than 1,654 students were impacted through participation in STEM related competitions

K-12 Math Personalized Learning Program: more than 125,958 students had access to supplemental math software

STEM Fest: Nearly 13,000 students, educators, and parents participated in STEM Fest 2022. Students and families engaged in hands-on STEM experiences from more than 60 exhibitors.

Community Impact Sponsorships: The Center supported and exhibited at 34 STEM community events and programs, thus impacting more than 63,921 students, parents, educators, administrators, community and industry partners.

STEM in Motion (SIM): approximately 11,000 students were impacted through participation in the SIM programs

Girls Who Code Club Network: estimated 396 girls participated in 33 clubs

K-16 Computing Partnerships: Approximately 67,600 students participated in activities funded by the grant in Fall 2022 and approximately 40,700 participated in these activities in Spring 2023. The majority of students who participated did so through the innovation and makerspaces and out-of-classroom experiences. (Please note that students may have participated in multiple activities.)

Tinker Totes: There were 266 Tinker Totes assembled by US Synthetic employees. These totes will be distributed to schools who are participating in the Inventioneers of Today and Tomorrow (IT2; aligned to the national Invention Convention program). The Tinker Totes program is designed for 5th to 8th grade students to have access to a more robust tinkering/maker opportunities. These take-home kits allow students to tinker, make, and invent. The Tinker Totes program is a great way for children to have unstructured, open-ended, imaginative projects at home. There also a unique opportunity for industry to get involved.

STEM AC Innovation Hub: 2,344 participants pre-K to adult participated in Innovation Hub programs in FY22. This includes participation in robotics programs, Innovation Hub classes, and Open Tinker Time opportunities.

STEM on Stage: 49,000 elementary students were impacted by the unique STEM assembly show at 75 schools.

A list of provides pursuant to this bill:

See Appendix A

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, a Division Director (Dr. Tami Goetz), Program Director (Sue Redington), Collaboration and Program

Development Manager (Kellie Yates), Research and Implementation Manager (Clarence Ames) and Community and Innovation Manager (Lynn Reichert), a Program Specialist (Gina Muhlestein), a Program Outreach Manager (Julienne Bailey), the Innovation Hub Manager (Becca Robison), an Office Manager (Viena Zeitler) and a Marketing and Communications Manager (Shelby Averett). There are two project manager positions supported by an AmeriCorps grant (AmeriCorps Math Mentor Program or AMMP); Jana Alexander and Emmett Speed.

There is a part-time director for the Utah STEM Foundation (Allison Spencer), along with a Utah STEM Foundation Board. The STEM AC works collaboratively with several other state agencies (e.g., Utah Department of Workforce Services, other divisions within the Utah Department of Cultural & Community Engagement, the Office of Energy Development, Talent Ready Utah, the Utah System of Higher Education, the Utah State Board of Education, the Governor's Office of Economic Opportunity, the Utah Geological Survey etc.) to support STEM education and workforce and economic development. There were four interns at the STEM AC for FY23 including Emma Casey and Tanu Sbarra (from the Academy for Math, Engineering and Science) and Shabari Shankar and Sumyah McMillan (in collaboration with Bank of America).

The STEM AC has had tremendous support from high school and undergraduate students in the STEM Ambassador program over the past several years. The STEM AC team spent time over the past year re-thinking the role of STEM Ambassadors, as well as the way in which volunteers are engaged with the Center. The result is a re-branding of the STEM Ambassador program to the STEM Activist program (to alleviate confusion around the many Ambassador programs currently existing). and reflect the new, and more robust, program that is currently under development. Further, a new volunteer page for the STEM AC website has been developed that will support volunteer sign up, tracking of volunteer efforts and numerous other activities that will enhance the volunteer experience with the STEM AC and its partners (see later in this report)..

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 Director, has led to considerable buy-in from industry and the Utah State Board of Education office. The Board has representation from industry, the Utah State Board of Education, the Utah System of Higher Education, and the Utah Department of Workforce Services. The STEM AC Executive Advisory Board and the Utah STEM Foundation Board meet together at least once a year to facilitate collaboration between the two boards. Further, members of each board attend the other boards meetings on a regular basis to ensure that the activities of each board support STEM education as it aligns to the STEM AC's strategic plan and statutory expectations.

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

UTAH STEM FOUNDATION

Industry partners, and their support, are crucial to the mission of the STEM AC. Industry partners ensure that programs and efforts connect companies into the classroom, increase STEM workforce opportunities in Utah, and enhance STEM funding and resource opportunities. The Utah STEM Foundation, with its vision and mission aligned to the STEM AC, helps to create the bridge from education to the private sector. The Foundation's support from industry has been provided in a variety of ways including cash donations, grants and sponsorships, program collaborations and in-kind support through volunteer efforts.

The Utah STEM Foundation was added to the STEM AC's statute, thus allowing for the creation of a public foundation. The STEM AC worked with State Finance to ensure proper procedure and process for its role, function and operations. 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 Petroleum, (formerly Tesoro), Texas Instruments, MHTN Architects, Rio Tinto, Brassica Protection Products, 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 donations each year.

Programs that are supported by the Foundation include:

The Utah STEM Foundation helps to support STEM Fest, the STEM in Motion program, the STEM On Stage Assembly with Paul Brewer, STEM Best Practices, Green Our Planet Hydroponics programs, STEM Spots, the STEM Innovation Hub, FIRST and VEX Robotics, Micro STEM Fest kits, the Chief Science Officer Program, Tinker Totes, as well as many other STEM initiatives that have impact statewide.

Cash Donations for FY 23 include:

The Utah STEM Foundation received over \$586,000 in monetary donations in fiscal year 2023 (FY23).

Utah STEM Foundation Highlights

• **Week of STEM:**

In FY23, the first Week of STEM event kicked off at the STEM Action Center with an announcement from Governor Spencer Cox. The Governor introduced six STEM programs serving different populations across Utah: Robotics, Club Ability, Tech-Moms in Color, Chief Science Officer (CSO), Micro STEM Fest Kits, and Hydroponics. Industry and Foundation supporters helped to raise over \$100,000 to go towards these new programs.

Club Ability is dedicated to broadening participation in computer science by offering coding classes to young people, especially females, racial and ethnic minorities, and those with special needs. During and following the Week of STEM, \$65,000 was raised for this program.

Tech-Moms is a nonprofit organization that helps women to transition into technology careers and find more successful employment. About \$75,000 was raised for the Tech-Moms in Color program, which officially began in Fall 2023.

Robotics programs and teams serve students across the state. During Week of STEM, \$7,000 was raised to support teams with a \$7,000 match from the Utah STEM Foundation. This helped to support ten new FIRST LEGO League and FIRST Tech Challenge teams.

The Chief Science Officer program officially launched in Utah as part of the Week of STEM. Chief Science Officers (CSOs) are 6th - 12th graders who are passionate about STEM and making a difference in their community. The CSO program is similar to a Student Body Officer program at a school, but with a focus on student-driven STEM activities for the school and its community. So far 24 students from nine schools are signed up. The Larry H. and Gail Miller Foundation donated \$50,000 to support the CSO program. The STEM AC is working to scale the program during FY24.

Micro STEM Fest Kit is a “pop up” event kit with 10 stations that provides fun and exciting STEM activities that challenge young students to work together to learn STEM. In FY23, 50 kits were checked out and used for school and community events. The kits were designed and 36 were created in partnership with the Utah Innovation Hub Network partners at Utah Valley University. Funding was supported by Lucid, Meta, Fidelity, Texas Instruments, and the Utah STEM Foundation, and multiple companies signed up to help deliver kits to each school that participated.

Green Our Planet's Hydroponics STEM Program provides everything needed to run a successful hydroponics program in elementary schools and libraries. These systems are living laboratories that teach students hands-on STEM skills. Thirty-seven schools and twelve Utah libraries established the Hydroponics program in FY23.

The 2022 STEM magazine was also available as part of Week of STEM, created in partnership with Utah Business. Nearly all 8,000 magazines printed have been distributed across the state to schools, school districts, regional education centers, and to community members at special events. The magazines featured articles and stories from STEM professionals to help inspire students and inform them about potential opportunities that could be available to them in the future.

Utah STEM Foundation Donor Highlights

- ARUP continued to support the Utah STEM Foundation as one of the benefactors of their employee giving program for 3 years. ARUP has also been a very supportive sponsor of STEM Fest. ARUP donated nearly \$20,000 for STEM programs in FY23.
- bioMerieux donated over \$200,000 towards a “Young Makers and Future Innovators” program; this grant is a 3-year effort that will support the expansion of the Micro STEM Fest program and help to pilot the Pop Up Maker Faires and Inventioners of Today and Tomorrow (aligned to the international Invention Convention program).
- The Church of Jesus Christ of Latter Day Saints Foundation has supported STEM Fest through KSL attendance, news and media coverage, as well as our STEM Magazine with at \$5,000 sponsorship.
- Comcast has been a champion by assisting to fund \$30,000 towards STEM programs, STEM events, as well as create and distribute communication materials to promote awareness for STEM.
 - Dominion Energy sponsored \$10,000 for STEM Fest and has supported many STEM programs over the past 9 years.
 - Fidelity Investments has supported our STEM Fest events, as well as financially supporting our hydroponics program with nearly \$10,000 in funding in FY23.
- Hill Air Force Base has continued to support the STEM AC and Utah STEM Foundation to allocate over \$200,000 in funding to educators, schools, and other organizations, providing STEM opportunities statewide.
- The Larry H. and Gail Miller Family Foundation donated \$50,000 to champion a new Chief Science Officer Program.
- Meta donated \$10,000 to support Week of STEM, STEM Day on the Hill, and STEM Fest.
- Nomi Health donated over \$20,000 towards Club Ability.
- Progressive Leasing donated \$25,000 towards Club Ability and STEM Spots.
- Rio Tinto became one of our largest sponsors of STEM Fest in FY23 at \$20,000.
- US Synthetic has championed bringing partnerships to the STEM community, and has been one of our largest sponsors of STEM Fest every year since our inaugural event. This year they sponsored \$15,000 towards STEM Fest.

Utah STEM Industry Coalition (USIC)

The Utah STEM Foundation oversees the Utah STEM Industry Coalition (USIC), which consists of over 90 companies from across the state. The USIC meets every other month and focuses on key STEM-related activities that require industry support, both financially and in kind. The participating companies have been critical in helping with efforts such as STEM Fest, Week of STEM and volunteer support for numerous opportunities that include coaching of competitive robotics teams, and helping to build STEM Spots. They have been helping to support the Governor’s Adopt-A-School program through support of the Micro STEM Fest program.

COMMUNITY IMPACT -- 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 education and career opportunities for students and communities.

The following list includes examples of programs and events that received STEM Action Center

sponsorship funding in FY23, as well as those hosted by the STEM Action Center.

 Community Impact Sponsorships FY2023.xlsx

Week of STEM

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Utah STEM Fest

The STEM Action Center, together with Utah’s STEM industries, showcased exciting STEM career paths and hands-on STEM activities at the eighth annual STEM Fest. There were 10,705 field trip attendees from 103 schools. More than 60 exhibitors provided interactive activities and demonstrations. And an additional 2,850 visitors attended the free Family Night at STEM Fest. Favorite exhibits were the NASA trailer where students could see a rock from the moon, exploring an Army mobile command center, and seeing real human brains on display.

Fourth – 10th graders also got to try out virtual reality, see animals up close from Thanksgiving Point and HawkWatch International, and observe robotics demonstrations. Other highlights included hands-on earth science demonstrations with Utah Valley University, making fake snow with SheTech, pH testing with ARUP, 3D topography with the Utah Council of Land Surveyors, and exploring mining with Rio Tinto. All these opportunities are meant to capture students’ curiosity

and turn that into a love of STEM. For Family Night on September 27, entertainer Paul Brewer impressed the crowd with incorporating STEM into a magic show.

STEM Fest is a great opportunity for students and educators, but also for STEM industry professionals who get the chance to engage with the public and future leaders in STEM. They get to showcase what their company does and bring awareness to job opportunities. Students from all over Utah attended, with some classes traveling from Daggett, Duchesne, Emery, Juab, and Piute counties.

STEM IN MOTION (SIM)

The STEM in Motion (SIM) Program brings exciting STEM activities and resources to schools and communities all across Utah. The outcomes from a SIM experience include increased student engagement and enthusiasm for STEM activities, increased teacher awareness of STEM education, and increased industry investment in STEM.

The SIM team currently uses STEM curriculum materials that provide experiential, real-world, project-based learning opportunities for students. The program also ties classroom-learning experiences to STEM AC classroom grants to help educators get the resources they need to continue the lessons after the SIM experience, as well as serving as a connection point for teachers to learn of other timely STEM resources. The connection to STEM careers is what makes the SIM program unique from many other informal STEM programs in Utah.

The SIM team has been actively engaged in partnering with local companies to enhance the curricula selection every year. Programs are now added regularly based on teacher feedback, industry needs, and core standards requirements.

Currently, the SIM team has redesigned the classroom program into a curriculum kit checkout program due to COVID. Teachers can choose from 13 different curricula to check out for a two-week period, which includes all the materials necessary, and a Google drive with video lesson plans, PDF lesson plans and follow up activities. The new STEM 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 educators receive two professional development hours that can be used for re-licensure points in exchange for their participation and feedback.

The SIM team developed two additional kits, including a genetics curriculum in partnership with industry leaders, and geology curriculum in partnership with Utah Geological Survey. The two new kits will be available in the 2023/2024 school year, in addition to increasing the number of kits available for the most requested curriculum. The current curriculum includes:

- Physics and Forces (K-3)
- Bee-bots (K-3)
- Hands-on Coding (1-3)
- Power Tiles (1-3)
- Sphero Robotics (2-8)
- Senses and the Brain (3-6)
- Additive Manufacturing (6-8)
- Mars Mission: (4-8)
- Probability & Game Design: (4-8)
- Renewable Energy: (4-8)
- Utah's Water Ecosystems: Colorado River (3-5)
- Utah's Water Ecosystems: Utah Lake (5-8)
- Utah's Water Ecosystems: Great Salt Lake (4-6)

	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Schools Served	53	64	47	70	71	134
Students Reached	8,437	10,780	6,171	> 8,000	>4,831*	~11,000
School Districts Visited	19	20	17	26	26	33

*Implementation of new survey methods impacted reported numbers.

Based on teacher feedback, the STEM in Motion program has shifted to a kit-based model, with a focus on gathering data on what elements teachers used most frequently and found most valuable.

During the 2021-2022 school year, the SIM team continued to support classrooms through a kit style program, with a focus on gathering information on what formats would serve teachers best. 77.4% of teachers found the included presentations and lesson plans valuable, with 74.2% of teachers implementing the pre-recorded video lessons. Other offerings, such as career connection videos, follow-up activities, and other STEM Action Center resources were used by between 20% and 35% of teachers. 78.1% of teachers indicated that a delivered curriculum kit is a format that would be very useful for their classroom, with 61.9% indicated that in-person activity facilitation would be very useful.

Over 50% of the schools the SIM Team goes to are Title 1 schools, and over 1/3 of all students are qualified for free or reduced lunch. Surveys administered to students before and after participation in a SIM experience reported that students had an overall 11% increase in STEM identity, measured by a students' interest, perceived ability, and perceived future prospects.

Based on teacher feedback surveys after a STEM in Motion visit, 90.7% of educators indicated that they felt prepared or very prepared to teach STEM in their classrooms after using a SIM kit, compared to 56.2% before using a SIM kit. 90.7% of teachers agreed or strongly agreed that the STEM in Motion kit introduce their students to new material, and 89.1% agreed that the SIM Kit provided a learning experience not usually available in their school. More than 98% of teachers would recommend the STEM in Motion program to other teachers.

Additional teacher testimonials about the STEM in Motion Program:

“Thank you for a wonderful experience!! We've checked out a few of the STEM in Motion kits & have loved using them every time!! They have really helped to create an excitement for STEM within our school! THANK YOU!!!! Such an amazing resource!”

“Thanks for your time! The students were really engaged with the brine shrimp petri dishes, that was probably their favorite part. The whole kit brought up some great discussion questions including why are lakes like the Great Salt Lake and Lake Mead drying up, Spiral Jetty and nature art, etc. There is a lot we integrated with this kit!”

“I LOVED being able to have access to this kit and hope to use many more in the future. I found out about this too late to get to utilize additional kits. I wish there was more availability. My classroom is very unique which is why you won't see many surveys. I serve students in the custody of the state that are in and out of foster care etc. My students come and go throughout the year. Having good hands on lessons is so great for my classroom. Thank you for helping me serve my students!”

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

THE VALUE OF THIRD-PARTY EVALUATION

The STEM AC continues to integrate rigorous third-party evaluation to increase accountability and research integrity for the following programs: K-12 Math programs, Professional Learning, and K-16 Computing Partnerships. The STEM AC has a contract 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 are 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 (USBE), and Local Education Agency (LEA) partners.

Comprehensive logic models are created for all programs, and the outputs and outcomes defined in the logic models drive the data collection and evaluation process. The STEM AC team reviews the third-party evaluation scope annually to ensure that the data fulfills the metrics identified in the logic models for each program. The STEM AC team also looks for opportunities to shift a portion of the evaluation work to the Center staff that will not compromise the integrity of the evaluation, but allows for efficient use of funds.

Product and 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, the Center has received additional opportunities, such as the STEM Landscape Analysis grant from Boeing, to make positive impacts on K-12 education that support data-driven decisions.

THE INTEGRATION OF R&D INTO STEM AC PROGRAMS

An additional R&D function was added to the K-12 Math Personalized Learning program beginning with the 2017-18 school year. The STEM AC worked with the State Procurement Office to create a process to allow new math personalized learning programs, which met all of the requirements of the original Request for Proposals (RFP), to be piloted at limited capacity (minimum of 1,000 students and maximum of 3,000) for two years, at no cost to the participating LEAs and be willing to be integrated into the evaluation process. Outcomes from the new products are 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. Starting in the 2020-2021 school year, new providers who already have strong usage in Utah can submit data from past years for analysis. This effectively shaves a full year off of the pilot period for any providers who wish to participate, increasing both the effectiveness and the efficiency of this program. In FY20, four new products were cleared to begin the pilot process starting in the 2020-2021 school year. Moving forward, the STEM AC intends to expand the R&D function of this program from strictly focusing on math personalized learning technology, to extending evaluation opportunities to all technology-based math interventions to understand the relationship between product use and student achievement for any math products being used in Utah schools.

The STEM Action Center actively seeks out grant opportunities that support research that can help to inform and support innovative program development and assessment. Past examples include the National Science Foundation (NSF) grant, Linking Attitudes and Behaviors for Student Success, which collected data that helps to inform more effective communication strategies to increase awareness of Career and Technical Education pathways. Another example was a grant from Boeing to complete a landscape study to capture the current state of STEM education and employment in Utah. Working with the Utah Data Research Center (UDRC) and the Utah Education Policy Center (UEPC).

Current research efforts are focused on securing support to begin measuring how children,

youth and adults acquire a STEM identity through participation in STEM programs and using STEM resources. The initial effort will leverage maker learning program within the STEM AC Innovation Hub and partners in the Utah Innovation Hub Network.

The R&D efforts at the STEM AC with select programs provides a valuable resource to Local Education Agencies (LEAs; school districts and charter schools). The STEM AC is able to evaluate larger sample sizes through the aggregation of multiple participating LEAs which results in more credible data. Education partners are inundated with numerous education-related products and services and often do not have the time or ability to conduct thorough research or validation of new resources. The STEM AC works to conduct research on new resources in an intentional and productive manner such that it provides optimal value to education partners.

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

There are several programs at the STEM AC that review new education-based technologies that can help to supplement instruction in classrooms, as well as informal and community-based efforts. The criteria for review focus on whether it addresses a need, the quality of the resource, user friendliness for implementation in a variety of environments, implementation support included with the resource and cost effectiveness that will impact scalability and sustainability.

The STEM AC Innovation Hub, which opened in June of 2021, is already playing a large role in testing new technologies and resources that can support STEM education through maker learning. For example, a program out of University of California-Davis, C-STEM and Barobo, integrates the use of engaging robotics to teach elementary and early secondary math. The Hub tested the effectiveness of the program and it is now being used with great success in several programs across the state including Utah Valley University and the Jordan School District. The Hub is now working in collaboration with the Hub partners in the Utah Innovation Hub Network to identify valuable resources for statewide support of STEM programming as it relates to maker learning.

The Computing Partnerships Grant program has provided continued opportunities to review resources that support coding and other areas of integrated computing and computational thinking. There were several programs and products included in awarded grants during the 2022-23 school year that include SkillStruck, 4-H/USU Extension and other makerspace/maker learning resources.

One goal of the STEM in Motion (SIM) program is to identify and utilize new and innovative approaches in technology. The STEM AC has partnered with Utah Geology Survey to provide curriculum around tools and technology used to identify rocks and minerals. Additionally, the Center has added an additional Discovering Genetics curriculum that uses 3D printed educational manipulatives in order to help students explore complex genetics topics.

(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 gaps and needs in STEM education, both for classrooms and for informal STEM opportunities. The intent is to connect new STEM education learning tools and resources as potential solutions to the identified gaps and needs in order to support and improve STEM instruction. This is described in the previous section as it relates to several of the STEM AC programs. The STEM AC has worked with partners in several states, such as Washington, to adapt an early math program that supports parents in math instruction with their young children. MILO (Math Introductions and Learning Opportunities; see below) and Friends has been piloted during FY23 with great success and is being scaled over FY24.

The annual STEM Best Practices conference has been in place since 2015 and has the main

goal of bringing together Utah STEM (and non-STEM) educators to showcase hands-on learning activities and potential effective practices in the classroom. This provides an opportunity to share ideas and promote the use of the latest in STEM resources.

There are several STEM AC programs that “fuel the innovation engine” of the Center.

(1) The K-16 Computing Partnerships Initiative provides opportunities to support promising practices in K-12 integrated computing education. For example, Murray City School District (MCSD) has established a unique “in-house” computing internship program in response to the difficulty of placing students with industry sites. PowerPlay interns receive an \$11 per hour stipend, which allows students of all backgrounds to participate and benefit. The MCSD interns are responsible for preparing, repairing, and updating student Chromebooks. They are in-classroom experts for teachers' technology assistance and teach coding in the after-school coding programs. They also deploy Private LTE radios and assemble LTE routers for students. In 2022-23, the interns deployed wiring and antennas for the first SBRS in-building 5G network in the world. MCSD provided eleven student internships in the Fall of 2022 and Spring of 2023.

As San Juan School District (SJSJ) covers 7,933 square miles, this Computing Partnerships grantee determined the best use of its makerspace and maker learning efforts would be the equipping of a mobile option. SJSJ purchased a 7'x14' trailer and consulted with the STEM Action Center to build storage shelves and 3D printers that are durable and easy to maintain, laser engravers, CNC, robotics classroom sets, etc., able to endure the miles of travel. Schools request the trailer for projects aligned with classroom learning and for special events. Through this mobile effort, SJSJ provides equitable access to materials and equipment to schools that would otherwise not be able to afford the contents and have no space to store the materials and equipment.

(2) The Utah STEM in Motion (SIM) team members are constantly developing and testing new resources. For example, in response to teacher requests, the SIM team continues to update all of the resources available in the curriculum kits, including updating and clarifying lesson plans, adding additional curriculum offerings, and undertaking an assessment of current curriculum offerings in order to increase quality and engagement to be national leaders of high-quality STEM curriculum materials.

(3) The Innovation Hub was awarded an AmeriCorps grant this fiscal year, allowing up to 40 AmeriCorps members to be placed across the state to help expand capacity and create new programs related to maker education. The STEM AC Hub is working with partners to develop a Network strategy that will

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. They also provide an opportunity for the STEM AC to explore new promising and best practices that are happening in other states. The collaborative projects have leveraged partnerships with numerous organizations including Make Salt Lake, Wheeler Farm (MILO & Friends), Utah Geological Survey, BioMade, Smithsonian Science Education Center, Cold Spring Harbor Labs, Dolan DNA Learning Center, Salt Lake City Mayor's Office, Invention Convention, bioMerieux, BD Medical, Carollo, rPlus Energies, Seek Labs, and Varex Imaging, to name a few.

(5) The STEM AC provides small grants, through the Innovation Incubators micro grant program. These funds are awarded to classroom educators to support the design and implementation of new STEM activities. This grant program is discussed in detail in the following section.

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

The STEM AC funds and oversees the Innovation Incubator program. This program includes three micro-grant opportunities: (1) Student Competition (2) Classroom and (3) Organization grants.

COMPETITION GRANTS

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 oversees the funding and is responsible for reporting outcomes. Competition grants cover costs for supplies, registration, and other expenses related to participation in STEM fairs and competitions. Schools may request up to \$100 per participating student, with a maximum of \$5000, and receive funding based on the strength of their application. A review team made up of other grant applicants, focusing on sustainable student impact, helped to generate scores. Before the end of the school year, each awarded school must submit detailed receipts and project completion reports showcasing what students accomplished. Educators report on how things went, what they were able to accomplish, and how projects impacted students.

This year, educators and students were able to master content that could translate directly into STEM careers (such as design, programming, and debugging), and developed 21st century skills (e.g., collaboration, creativity, persistence) in ways traditional classroom learning doesn't always facilitate.

"Students had to work together to follow instructions, share ideas, persevere and problem solve, and collaborate with team members. They developed a really good understanding of the design engineering process."

"The VEX IQ Robotics program includes many authentic STEM learning opportunities. During the five-month season for our team, my students applied Engineering Design steps to improve the structure and function of their robots to meet pre-defined criteria and constraints. Every member on our team showed creative problem solving as they designed, built, tested, and evaluated their robots. They did not settle for a working robot, but instead they persisted in continuous improvement throughout the season, and by doing that became scientists and engineers themselves!"

"Students learned advanced computer programming skills, CAD design, 3D printing, how to follow the engineering design process, and I had multiple students use calculus to map the most effective routes for the robot during competition. We connected with 4 different college engineering depts, 8 different engineering firms, 3 different independent computer engineers. We did 3 live chats with Mark Rober who was the lead engineer for the Mars rover mission, and we consulted on several occasions with a physicist who owns a company that tests equipment that people want to send into space. We didn't just "enhance" their STEM learning, we let them live it, and then we impressed upon them the opportunities and responsibilities that come along with that knowledge. We got them excited about STEM and then we got them excited about sharing it with others."

"The effectiveness is shown in the fact that students indicated at the end of the term interest in pursuing science fields in the event they studied. A few students told me that this was more engaging than the traditional school curriculum. The heredity team indicated that they wanted to study genetics."

Grantees stressed that access to these opportunities helped them reach traditionally marginalized students that would have been unable to participate in programming without these funds. In many cases, grantees indicated that without STEM AC support, they would not be able to run these programs. Grantees also highlighted the fact that this grant allowed them to focus fully on mentoring and coaching the students as it eased the burden of fundraising that often occupies much of their time.

“This grant enabled me to provide experiences for me students that they otherwise would not have been able to be involved in. As an educator the funding for this grant provided valuable learning experiences for me that I will be able to use to change and improve our robotics program.”

“This grant provided the funding to allow students to investigate whatever STEM topic they were most passionate about. They could tap into scientific questions that were most intriguing to them and design and carry out authentic research. Without funding, students would not have had this opportunity for rigorous, meaningful scientific research.”

“As an educator in a school with a large population on free/reduced lunches, I refuse to charge my team to be able to participate. The possibility of this program changing kids' futures is too great for me to turn down a kid because of their family's economic situation. I do ask the team to work as a team to find sponsors, write grants, and participate in fund raising. A key part of that is the STEM AC grant. I was able to provide this opportunity to more kids than I otherwise would have. This grant also made funds available for students to participate in other FIRST programs.”

“More than anything, this grant has given me the ability to say "yes" to students who otherwise wouldn't be able to participate in these types of events. We had several students participate in our teams without the need to pay registration or participation fees. As a result, I was also able to develop and foster relationships with students in new contexts, which helped both in and out of the classroom”

For the 2022-23 school year the STEM Action Center awarded grants to 44 schools, for a total of \$82,122. In their project completion reports, grantees also reported that participation in these opportunities positively impacted students' confidence in STEM subjects, helped develop important interpersonal skills, and even resulted in students choosing to go to college and choose STEM majors. In spite of challenges, all grantees were able to provide engaging activities resulting in increased STEM interest and engagement among their students. Additional report details, including a list of participating schools and number of students impacted can be found at [Competition Grant Report FY23](#).

CLASSROOM GRANTS

Classroom grants directly support educators to pilot inventive approaches to STEM education, recognizing that innovative curricular resources developed by local educators need to be replicated and spread as widely as possible throughout the state. For FY23, a total of 217 completed grant applications were received. Of those applications, 124 proposals (57%) received a portion of the funds requested. Applications are scored by previous classroom grant awardees, using a rubric to determine which proposals would be funded. The amount of funding for classroom grants in FY23 totals just over \$139,953.00, with an impact on 21,820 Utah students. In FY23, 50 of 124 (40%) of classroom grants were awarded to educators that identified their students as off the Wasatch Front. A summary of the LEAs, grades, and number of students can be found here: [FY23 Classroom grant participants](#)

Lesson plans are requested 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 educators 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, which was held at three locations in June of 2022. Participants receiving support are expected to complete a final report that describes outputs and outcomes. These reports are critical to educators that choose to utilize the shared materials as it provides follow up information and suggestions to other educators. Responses for the final report vary greatly, but include:

I saw and heard so much excitement from the students. They learned that exploring, making mistakes and having success is part of the learn cycle. I loved how students were talking about our project and sharing ideas with others students (and parents) outside of class.

We have been integrating Beebots into our classroom for observation, inquiry and communication skills, as well as for math concepts. The students have been working hard to investigate the mistakes as they code to try to make the bot go where they want it to. We started with one Beebot so we could discuss and collaborate together in our learning as a class. Then the students were all able to work in small groups with that knowledge to work with the Beebots and build on their understanding in a hands on way which enhanced their STEM learning. Now the students get so excited when we pull out the bots and they all want a turn to share in the process and experience of working with the Beebots to share and grow their learning.

I was surprised at the lack of inquisitiveness of some of my students. They just sat and watched their counterparts. It took a lot of encouragement from me to get them to even explore or try to get the bot to work. I saw students who were nervous to even try something new learn how to make the bot turn on and go. Then they (by themselves) learned how to make them go. I loved how this made my students have to think outside the box. They had to try and fail and try again. Great life lessons.

This has helped me not only with tools and equipment but a deeper understanding to the relationship between physical education and science. Teaching students gave me a deeper understanding of the core curriculum, and student objectives. This provided a unique understanding to force of motion and depth of science within an existing relationship with physical education equipment and an ideal student learning setting. The objectives were established, taught and an in depth learning was provided that helped with student learning and engagement.

(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 Director, Dr. Goetz, participates in the annual Midwest STEM Directors Symposium and attends other STEM events (e.g., the annual Washington STEM conference, the Association of Career and Technical Education etc.) to continue the search for best practices in STEM education. Invention Convention is one program that will be implemented in FY24 that has been used successfully in numerous states across the country to engage K-12 students in an "innovation and invention" focused competition. The STEM AC is partnering with Utah State University, as the state affiliate for Invention Convention, to launch Inventioners of Today and Tomorrow (IT2; the Utah re-naming of the event) with support from an industry partner, bioMerieux. The STEM AC is partnering with the Colorado STEM Ecosystem to use their free digital platform to visualize the Utah STEM Ecosystem. The Chief Science Officer (CSO) program was launched this year to engage students in creating action plans that helped to support additional STEM programs and resources in their schools and communities.

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

The STEM Action Center website provides access to best practices and content that targets students, parents, educators, and industry partners. The new website, which was launched in

2021, has been very successful and the analytics from website usage will be discussed in later sections of this report.

The STEM AC initiated a new project that supports online access to high quality STEM resources. The STEM Resource Library includes lessons for teachers, links to online resources, career videos, and more. It also features a map showing where STEM AC programs are being used across the state. Additionally, it has resources for community maker spaces, and activities for home and community spaces. Each of these activities will be supported with video instruction, common mistakes, technical support for common maker tools, and a space for teachers to request connection with industry professionals. Lesson plans shared on the spaces have largely been provided by funded grants, including classroom grants, professional learning grants, and computing partnership grants. The resource library can be found at <https://stem.utah.gov/resource-library/>.

(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

The STEM AC website continues to draw more and new visitors. From July 1, 2022 to June 30, 2023, stem.utah.gov saw 31,715 users and 93,344 page views. Those numbers increased by 47% and 44% respectively over FY22. The STEM website continues to be a reliable resource for educators, students, parents and industry professionals looking to engage with STEM education in Utah.

Facebook reach for FY23 was 329,170, up 64% from the previous year. Instagram reach was 139,834, up 60% from the previous year.

We have a total of 5,461 contacts in emma, our newsletter service.

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

The STEM AC had determined that resources can be accessed readily without paying for membership in the national organizations such as STEMx or STEMConnector. There are greater benefits to attending key conferences or symposia to engage with the larger network of state STEM leaders. Further, several of the national organizations have become more member-focused and less about providing services, which diminishes the role that they can play for an organization such as the STEM AC. However, there have been recent changes with the national organization STEMx and they have restructured membership to be free of charge. The STEM AC is now a regular participant with the STEMx community and it has been a good opportunity to further relationship development with other STEM organizations and communities.

(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, encompassing 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 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 that the application to become a designated STEM School is not easy. It takes time and considerable effort to complete the application portfolio. In FY23, three schools that had previously been designated as STEM Schools were re-designated, along with two new schools receiving designation this year as well.

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 can be found here:

[FY23 Current STEM Schools](#)

Moving forward, program leaders have started a multi-state consortium that meets quarterly to discuss challenges, barriers, and lessons learned with STEM designation programs across the nation. This effort led to school administrators and state program leaders from Nevada visiting several Utah STEM schools in school year 22 to help their school define what they want STEM to look like in Nevada. It was a very successful visit and all participants left feeling inspired and recommitted to STEM. Moving forward, it is the intent of the STEM AC to focus on recruiting and supporting Title I schools, with the assistance and support of industry partners, to receive a STEM Designation over the next several years. Additionally, secondary schools that receive students from STEM Designated elementary schools will be targeted for participation in the program.

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

For five years, STEM AC has supported LEA-designed effective professional learning associated with STEM via the Professional Learning program. Funded projects must align to the Utah Effective Teaching Standards (UETS) developed by the Utah State Board Education (USBE). Additionally, all funded proposals must align with the definition of highly effective professional learning, as defined in HB 320 from the 2014 general legislative session. 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. FY23 PL grantee awards can be seen here: [FY23 STEM PL Awardees](#)

In FY21, a planning grant was obtained through the National Science Foundation Noyce program, in partnership with Utah State University and its College of Education. The project allowed the STEM AC and its partners to assess Professional Learning needs beyond school and district levels. This data was used over the course of FY22 to develop a teacher-level multi-year course entitled STEM Education Innovators (SEI). This experience will require participating teachers to commit to staying in the classroom for five years while developing teacher leadership and mentoring skills. Participants will also identify local problems of practice and work with subject matter experts (SMEs) to design, implement, and evaluate solutions to this problem. Recruiting for this program took place in fall of 2022 and applications were submitted in November of 2022 and cohort participants were identified in FY23. The cohort will begin in FY24.

Another Professional Learning program was started in FY23 titled Saturday Educator Learning Series (SELS). This program allows educators to join STEM AC staff members in a standards-aligned maker lesson. These monthly Saturday sessions allow educators to learn how to use a variety of maker equipment while staying focused on science and math standards in a variety of grades. Each session also includes opportunities to expand their personal STEM networks, learn about citizen science initiatives, and adapt learning opportunities for a variety of learners. These sessions are capped at 20 attendees each to ensure all participants get the instruction and attention they need to have a successful experience. Across the three sessions offered in this fiscal year, 30 educators registered for these sessions. Session attendance and topics can be seen below:

Month	Topic	# Participants
February	3D printing and Animal Habitats	17
March	Laser Cutting and Sun Dials/Shadows	8
April	States of Matter and Sublimation	5

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

The STEM AC highlighted many student achievements on social media pages, including [robotics](#), the [high school volunteers who help us put on STEM events](#) (STEM ACtivists), and the [winners of the NCWIT Award for Aspirations in Computing \(AiC\)](#).

In addition to these programs, the STEM AC showcases the work of students, educators, community and cultural organizations, other state agencies and industry partners around the state using website and social media resources. It is the responsibility of the Center to not only promote the work the STEM AC does, but also the work students, educators, companies and communities are doing to support and promote STEM all over the state.

The STEM AC website, where much of the information is shared about partner achievements and resources, continues to draw more and new visitors. From July 1, 2022 to June 30, 2023, stem.utah.gov saw 31,715 users and 93,344 page views. Those numbers increased by 47% and 44% respectively over FY22. The STEM website continues to be a reliable resource for educators, students, parents and industry professionals looking to engage with STEM education in Utah.

(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 learn about STEM events across the state and student grant opportunities. The annual STEM Fest provides engaging opportunities for families to attend on the 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 MILO and Friends math program is designed to support parents and caregivers in early math support. The STEM AC team engages directly with parents and caregivers to review free math resources with them and determine how to best support their efforts with their children at home. The MILO program is discussed in greater detail in a following section.

(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

In the 2022-23 school year, educators and administrators from 657 schools received professional learning for the use of the K-12 Math Personalized Learning tools as part of the contracts with the product providers. This training ensured that educators were able to integrate the use of the software effectively as a supplement to their instruction.

The STEM AC initiated a new project that supports online access to high quality STEM resources. The STEM Resource Library includes lessons for teachers, links to online resources, career videos, and more. Additionally, it will have resources for community maker spaces, and activities for home and community spaces. Each of these activities will be supported with video instruction, common mistakes, technical support for common maker tools, and a space for teachers to request connection with industry professionals.

While most caregivers know how to compare large and small, and how to count to ten, they don't know they should be practicing early math skills while they play with early learners. Kindergarten math entry scores predict future math scores, reading scores, and even college and career success. In FY23, the STEM AC officially launched the Math Introductions and Learning Opportunities (MILO & Friends) program to help make math fun for Utah families. As part of this effort, the STEM AC has partnered with organizations like Wheeler Farm, the Living Planet Aquarium, and Tracy Aviary to embed math focused signage, scavenger hunts, and activities in public spaces so that parents see that early math play is important, fun, and achievable. The STEM AC has also partnered with family engagement centers, preschools, libraries, and other community organizations to host family math events. These events typically serve 30-50 families at a time, and caregivers leave with fun, engaging math activities for early learners. The STEM AC has also created a dedicated page for MILO & Friends, allowing caregivers to find ideas, activities, tips, and tricks for how they can make math fun for their early learners.

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

COMPUTING PARTNERSHIPS INITIATIVE

In 2017, with strong support from industry, the STEM AC secured ongoing funding to launch the first computing grant initiative in Utah, now known as the Computing Partnerships Initiative. Since the initiative began, input from STEM AC partners and third-party evaluators have informed funding opportunities and defined the criteria for the grant framework and proposal activities, which address the resource gaps preventing LEAs from offering comprehensive computing programs in Pre-K to 12th grade. This input has defined a needed shift to a greater focus on integrated computing which can serve the increasing need for earlier and effective engagement. It has also emphasized the strategies of maker spaces activities, work-based learning opportunities, and out-of-classroom opportunities.

FY21-FY23 applicants were required to align with two or more key elements, as defined in the Request for Proposals:

- Outreach and student engagement activities through before and after school and summer programs (e.g., robotics and other clubs, innovation/maker spaces, summer camps, etc.)
- Industry involvement, such as mentorship of out-of-classroom programming
- Post-secondary and community collaborations
- Integration efforts between out-of-school programming and classroom learning
- Innovative Pre-K enrichment activities related to computing that emphasize parental involvement and kindergarten preparedness, and
- Activities which promote increased access and broadening participation

In this final of three years awarded, FY23 grants were identified through a formal, competitive solicitation, with external review of all submissions. From 37 submissions, 17 grants were awarded. Seventy-one percent of these awards were located outside of the Wasatch Front. Of the \$1,017,147.59 awarded in FY23, \$645,081, or 63%, were awarded outside of the Wasatch Front. An outline of the grantees and their funded activities can be found here: [FY21-23 Computing Partnership Grantees and Activities](#)

Qualitative and quantitative data was collected from grantees in January 2023 and at the

end of the school year. Grantee responses identified challenges with implementation that include the postponement or cancellation of planned activities and the shortage of staff. Despite these challenges, third-party evaluation analysis provided by the Utah Education Policy Center (UEPC) indicates positive outcomes and provides formative guidance regarding how to improve the program and identify future, additional needs. For more information, see the full report by the UEPC in Appendix B.

During FY23, Innovation and Makerspaces served approximately 33,285 and 32,192 students in the fall and spring, respectively, and 30,2164 students participated in out-of-classroom experiences. Thirty-six students participated in computing internships in both fall and spring semesters and earned 20 industry-recognized certifications. During this same time period, 1192 educators participated in professional learning activities. (Note: students and educators may have participated in more than one activity.)

Grantees identified strategies that best addressed the specific computing needs of their school or district. Educators most frequently identified Out-of-Classroom Experiences (19%) and Innovation & Maker Space activities (51%) as meaningful for students. (Please note that these two activities were the most common across all grantees.) UEPC reported that the Computing Partnerships grants were associated with numerous positive student outcomes, including computing interest and computing identity.

The majority of educators also reported positive outcomes for themselves. The UEPC reported that a common theme expressed by the educators was that professional learning provided the knowledge and experiences needed to engage with computing in their instructional practice. Three quarters agreed with the statement, “I know how to get students excited about computing.” In addition, 85% felt that “I continually find better ways to teach or integrate computing concepts.” Finally, 87% agreed with “I can teach or integrate computing concepts into my instruction effectively.”

The following grantee and educator survey and interview responses, as reported by the UEPC, indicate the strong impact of the Computing Partnerships activities.

Maker space and Innovation Spaces

- *“Our makerspace has been an amazing addition to our school. We have seen all students, including underrepresented populations, thrive in this space. I look forward to see these students journeys in computing and programming.”*
- *“I run [our school’s] Makerspace and have seen firsthand how many students--particularly those who struggle in formal classroom environments--engage fully with our hands-on activities. The fact that Makerspace is focused on student choice above all else allows them to take charge of what and how they want to learn, which leads to higher satisfaction and enjoyment during the learning process.”*
- *“Innovation and Makerspace provides something for everyone to create, explore new technologies and develop their interests. Children get excited about planning, designing, building and want to take the ideas home to continue exploring. It is a wonderful opportunity to give a challenge and see what they do with materials provided. I am simply amazed by their creative work.”*

Out-of-Classroom Experiences

- *“It is most important because it gives the students an opportunity to create through their passions the projects they would like to work on the most.”*
- *“Allowed variety of students to experience different activities and express themselves and learn in different ways.”*
- *“They [students] grow so much from participating in the robotics program - in knowledge, teamwork, communication skills, engineering design, and basic programming.”*
- *“Our out of classroom experiences have really impacted my students. A third of my students have*

participated in our after school club, and they bring their learning and increased confidence back into my classroom and share it with the other students. All of my students see their improvements in learning when we have our robotics program.”

- *“One of my classroom students decided to stay for our after school club. He struggled with skills confidence and to get along with others. I watched him grow out of his shell, and begin to blossom...He gained enough confidence to be working with his classmates and after school teammates positively. I don't think I have ever seen such growth in confidence, reasoning and social skills.”*

Work-Based Learning

- *“My student intern has taken on the responsibility of repairing all district Chromebooks where they have learned valuable life skills of completing tasks and troubleshooting which will benefit them in the work place.”*
- *“Every student that goes through...all of them eventually come back and they're interested and wanting to get on with the school district or they're seeking our help to help them better their position either in education or at a job...They look at this opportunity that we gave them through this program as something that really plays a major role in their next step or two steps or three steps...in their life.”*

Professional Learning

- *“We worked with teachers to help them learn to integrate tools that we were using in out of school time into the afterschool classroom. Usually our integration works the other way, where we see what is happening in classrooms and integrate into afterschool, but with tech mentoring and support is needed in the classrooms.”*
- *“The Computing Partnership grant has allowed [our school district] to increase STEM specialist capacity and competency by providing monthly STEM PLCs and a plethora of Professional Learning like Skill Struck training, Sphero, and Hummingbird (sic.) trainings.”*

During FY23, the STEM AC provided monthly webinars and connections with technical experts to assist grantees in establishing their maker spaces, meeting specific equipment needs, and exploring sustainability options. Grantees shared their progress and best practices, offering other grantees the opportunity to learn and open a dialog on specific program aspects. During FY24, identification of additional webinar topics and technical assistance will continue to build the community of practice for grantees and others interested in their projects.

Outreach, Engagement and Partnerships

There are numerous outreach, engagement and partnership development activities that are included in previous sections, such as the industry engagement portion of the report.

The STEM AC is partnering with the following organizations:

- Talent Ready Utah to support and grow education and training programs for Biotechnology programs and industry in Utah. There are a variety of grant efforts and partnership development opportunities that are underway, including a pending submission for a Bioindustry Manufacturing grant with BioMADE, a manufacturing institute under the US Department of Defense.
- Continuing work with the USBE as part of a STEM Advocacy Team to collaborate on STEM-related projects. In FY23 USBE and STEM AC jointly added reference material and resources to the updated STEM School Designation rubric. The Advocacy Team is collaborating to create a STEM Advisory Committee that will launch in FY24.
- The US Patent and Trade Office (USPTO) that includes planning for a National Summer Teacher Institute (NSTI) in summer of 2025 and a summer institute that will engage educators that engage indigenous students in formal and informal education activities.

- Utah State University to launch Inventioners of Today and Tomorrow (affiliated with the national program Invention Convention) for FY24. This is a program similar in structure to the traditional science fair but focuses on a project that identifies a problem then the student creates an idea or innovation to solve the problem. It utilizes the design process, rather than the scientific method.
- bioMerieux, a life science company, awarded a 3 year grant to support Micro STEMFests, Inventioners of Today and Tomorrow and the design and implementation of the Pop Up Maker Faire program.
- Green Our Planet to pilot high school - community hydroponic farms on the Navajo Nation (Monument Valley and Navajo Mountain).

Utah STEM Industry Engagement – Utah STEM Industry Coalition (USIC)

- The Utah STEM Foundation oversees the Utah STEM Industry Coalition (USIC) which meets monthly and consists of about approximately 80 companies from throughout the state. The USIC focuses on identifying volunteer and sponsorship opportunities to support STEM efforts for the STEM AC and its partners. Several programs have benefitted from the support of the USIC including robotics teams (coaching support), STEM Fest (sponsorships), the Chief Science Officer program, Tinker Totes and STEM Spots (construction and financial support).
- The STEM AC continues to partner with Talent Ready Utah (TRU) to engage industry and support the volunteer and sponsorship needs of numerous programs across the state. Specifically, the STEM AC is working with TRU to align the Center's programs with the Adopt-A-School initiative.
- The STEM AC received a \$200,000 grant from bioMerieux to support MicroSTEMFests and launch the Inventioners of Today and Tomorrow and pilot Pop Up Maker Faires.

Green Our Planet Hydroponics

- The Green Our Planet (GOP) Utah hydroponics project is an innovative program that utilizes high-tech hydroponics that supports STEM learning across numerous disciplines. The program will inspire students to become the next generation of scientists, engineers, farmers, chefs and entrepreneurs.
 - There are currently 12 libraries, off of the Wasatch Front, who are participating in the GOP hydroponics program. These libraries are in the following cities: St. George, Washington, Enterprise, New Harmony, Springdale, Hildale, Minersville, Moab, Blanding, Monticello, and Parowan. The library programs are in their second year of implementation and continue to be successful in their communities.
 - There are currently 37 schools participating in the GOP hydroponics program. Of those schools, 12 of them are off of the Wasatch Front. The feedback from the first year of implementation has been overwhelmingly positive and expansion of the program is underway for FY24. This will include funding for more schools and a pilot of an innovative high school - community hydroponics farm program (see preceding section).

STEM Volunteer Program

- In July 2022, the STEM Action Center launched a brand new volunteer website (www.stemvolunteers.utah.gov). This website has changed the way we manage our volunteer program and has allowed us to efficiently track vital data regarding our program.
- According to our software, in FY 2023 we had:
 - Online Program Views: 1016
 - New Volunteer Registrations: 319
 - Volunteer Hours: 886.9
 - Opportunities Responses: 292
 - Approximate Labor Value of Volunteer time served: \$22,394.23

- In FY 2023, the STEM Action Center earned a bronze level UServe Utah Volunteer Management Designation.

Chief Science Officer (CSO)

The Chief Science Officer (CSO) program is a school-based program that is similar to a Student Body Officer program but with a focus on supporting STEM education. The program supports a group of students, or CSOs, that create a CSO Action Plan that will incorporate 1-3 STEM activities, opportunities or new resources for the school or the community. In FY23, a pilot year for the program in Utah, 24 students from 9 schools completed the Leadership Training Institute, the first required step in CSO training. From there, three schools had STEM nights planned by their CSOs, and other students made plans to add science news segments to their school announcements. Others traveled to a local elementary school to launch rockets and explain how rockets work. Many of these students have intentions to participate in the following year.

Convergence Hall (CH)

The STEM AC has been asked to lead out on a community-based maker space at the new Convergence Hall, which will be a central building in the development, The Point. The Point is being developed at the old state prison site in Draper, UT and will be a multi-use community with housing, businesses, innovation facilities for life science development and spaces for community convening. The STEM AC is working with the design team to create the new maker space, which is tentatively intended for the ground floor in CH. The initial ideation for the maker space is to have integrated learning opportunities about Utah innovations, inventors and patents. The programming will align to learning about Utah innovations.

Week of STEM

- The inaugural Week of STEM was November 8-11, 2022. Several new programs were launched including Chief Science Officer and MicroSTEM Fests. Several partnerships were showcased including Club Ability and Tech Moms in Color. The Utah STEM Foundation committed a matching fund to increase the number of robotics teams for students from traditionally underrepresented populations by 20. During the Week of STEM, there were 3,559 visitors to the STEM AC website, with 82% of them being new website visitors. The highest page views were on the Spanish version of the Week of STEM page; 20 percent of the page views were on the /weekofstemspanol page. There was good engagement on social media channels as well, with top posts reaching 1,668 users.
- The second Week of STEM will open on November 6, 2023. The theme will be Makers, Inventors and Innovators. The new program, Inventioneers of Today and Tomorrow, will be launched as well as a design challenge, Makers for ALL, with Checkerspot, a Utah company that develops technology in biomaterials. The design challenge will incorporate Checkerspot's unique bio-based plastic and focus on designing STEM learning manipulatives that incorporate braille for learners that are blind or have sight impairments.

STEM Spots

- The STEM AC has partnered with the STEM Coordinator of USU Extension/4-H to continue the building and establishing of Utah STEM Spots. These small, stationary enclosures act as outreach posts where community residents are encouraged to engage in a *Take-Enjoy-RETURN-Repeat!* model. Communities decorate the structures and

determine where to install the STEM Spots, providing underserved residents easier access. STEM Spots contain materials (books, To Learn Kits, 4-H kits, etc.) that emphasize Science, Technology, Engineering, Math and the Arts and promote diversity within STEM to all ages, preschool to adult. Industry partners that have contributed to the book costs and building include: Northrop Grumman, Griffis Institute, Dominion Energy, Hill Air Force Base, comcast, Progressive Leasing, and Jacobson Innovation. At the time of this report, at least 48 STEM Spots are installed statewide, with 10 additional Spots in progress. Of those installed, 79% are in communities off of the Wasatch Front.

Utah Innovation Hub Network (UIHN)

- The STEM AC opened the doors of its Innovation Hub to the public in June of 2021 with the original intention of supporting competitive robotics teams as a place to design, build, and connect. Through serving robotics teams over the course of the 2021-22 competitive season, the STEM AC recognized the higher-than-anticipated need for hands-on, personalized and integrated STEM opportunities, like those found in maker education.

FY23 saw an advancement of high-impact maker focused programming in the Innovation Hub and increased demand for already existing opportunities. In August 2022 the Utah Innovation Hub Network (UIHN) AmeriCorps program began, allowing for enrollment of up to 40 AmeriCorps members to be placed in makerspace Hubs across the state. This program has allowed for a dramatic increase capacity of not only the Innovation Hub, but of the entire Utah Innovation Hub Network which includes Utah Valley University, Utah Tech University, Southern Utah University, Davis Catalyst Center, Make Salt Lake, Salt Lake Community College, Utah State University, and Snow College.

The Innovation Hub's Open Tinker Time program saw a dramatic increase in demand resulting in a shift to a reservation system that ensures all participants are able to have an impactful experience during their visit. With the UIHN AmeriCorps program the capacity increased from a total of 25 participants per session to 80 participants per session. On average, 48 participants are served per Tinker Time. Participants reserve time slots of 2 hours.

With the Governor's Week of STEM initiative the STEM Action Center and its Innovation Hub was able to support 10 new robotics teams with teams made up of participants that were underrepresented in STEM. Due to this extra support, robotics teams were able to use the STEM AC Innovation Hub to design, plan, build and connect as a team. The Innovation Hub was booked out every evening for robotics practices from October 2022 - February 2023.

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

The STEM AC completed its ninth full year of training and implementation to support the K-12 Math Personalized Learning program (2022-23 school year). The overall goal of this program is to provide supplemental math support to educators 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.

Utah's eight grade math scores held steady during the pandemic while math scores in every other state plummeted (<https://www.nationsreportcard.gov/highlights/mathematics/2022/#region-state-district-performance-grade-8>). Given the unique learning conditions created as a result of the COVID-19 pandemic, the STEM AC partnered with the Utah Education Policy Center (UEPC) to compare software use before the pandemic to software use after the pandemic started. Results showed that overall, students with software access continued to use software across all demographics, though low-income students used software less overall. Software use was positively related to growth in mathematics. These positive impacts were fairly consistent across demographics. When there were differences, the benefits of using software were stronger for students who were low-income. For full report, see Appendix C.

Survey results from the 2022-23 school year show that

- Utah teachers whose students used math learning software at high levels in 2022-2023 were more likely to report utilizing personalized, competency-based instructional strategies than teachers whose students did not use software or who used software at low levels;
- Utah students who used math learning software at high levels reported greater confidence in math, perceived more improvement in math, and were less likely to believe that math ability was fixed and unchangeable than students who did not use math software; and
- Teachers who routinely set mastery-based goals for their students' use of math software tended to view the software as more valuable than teachers who rarely or never set mastery-based goals.

A total of 125,958 students had access to licenses provided by the STEM AC for math personalized learning tools. The program covered 20% of all Utah students in grades K-12, with 103 LEAs participating (657 schools total). Six math personalized learning products were used during the 2022-23 school year. Buy-in at all levels is critical to success, and for each application a signature from one district-level admin and one school-level admin is required. Administration promised to ensure that students have access to technology for at least 45 minutes per week to use the math software provided. Signatures were also required 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. Each year on-site professional learning opportunities are required from product providers for classroom educators to increase buy-in at the teacher level and ensure classroom teacher participants are 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. The STEM AC also ensured that usage expectations were clearly communicated to administrators and math coordinators.

To allow school and district administrators to more strategically plan implementation, the application is opened 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, it has been found that 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 it is known that greater usage is correlated with greater student achievement, this metric does not provide a complete picture of what effective usage looks like. Over the past couple years, the data has shown that learned human connection is the single most significant factor related to student performance in math. As the STEM AC team has worked to emphasize the importance of using these supplemental products strategically to facilitate better human connection between educators and students, administrators all over the state have expressed their support for this approach and their gratitude toward the STEM AC for understanding the important role of the teacher in high quality math instruction.

To better understand the role of teachers in effective software use, the STEM AC has partnered with the Utah Education Policy Center to evaluate “best practices” around software implementation in classrooms. In FY 23 valuable lessons were learned and confirmed that teachers are in fact a significant variable in predicting the efficacy of math software. Students do better when they perceive high levels of support from teachers, and teachers using software report higher rates of teacher practices that help students feel supported. Students using software also have higher rates of persistence. The full report can be found as Appendix D. In FY 24, the STEM AC plans to look further into the best practices evaluation, and we look forward to reporting what we learn.

Year after year, class sizes grow and it becomes increasingly difficult for students to get the direct attention that will help them reach grade-level proficiency. Few resources are specifically designed to target the needs of struggling students who aren’t identified as students with special needs. As a result, they slip farther and farther behind until, by eighth grade, in spite of consistent positive impacts of software over the past 9 years, only 35% of Utah students are reaching grade-level proficiency. That puts Utah tied for number one for best performing state in math nationally, but there is still work to do. Math is the biggest predictor of students’ future academic and career success, even after controlling for reading skills, attention skills, socio-economic status, and socio-emotional behaviors, and eighth grade is the ‘deadline’ that most accurately predicts success in college and beyond.

The biggest obstacle to fostering greater human connection around mathematics in schools has been an insufficient number of adults in Utah classrooms. In FY20, the STEM AC received an AmeriCorps planning grant for a program designed to bring Math Mentors into classrooms and in FY 21, AmeriCorps awarded the STEM AC a full operational grant to build out the program. This program represents the next step for the K-12 Math Personalized Learning program, working with AmeriCorps members and industry partners to provide evidence-based interventions to Utah students who are struggling in math. AmeriCorps members provide in school mentoring in grades 4-8 using math personalized learning software to help students improve math performance and build important skills for academic and career success. This program helps local communities respond to gaps in education amplified by the COVID-19 pandemic, while actively addressing and removing inequities, including those related to race, gender, educational outcomes, and digital inclusion. Efforts are focused on communities with low performance and limited resources, delivering measurable service and significant impact to areas of greatest need. AmeriCorps members also facilitate recruiting and training of local volunteers to build capacity and sustainability.

The main purposes of this project are to: 1) increase the number of Utah students reaching grade-level proficiency in mathematics, 2) improve students’ confidence and persistence in mathematics, and 3) sustainably increase the number of mentors in classrooms. In the 2022-2023 school year, 76% of AMMP students maintained or increased

their confidence in math, and 86% maintained or increased their effort in math. This is particularly significant given that effort and confidence both tend to drop from the beginning of the school year to the end of the school year. 75% of participating students indicated that their mentor made it “quite a bit” or “a lot” easier for them to understand their classwork in math. Sample sizes for the 2022-23 school year were not large enough to find statistically significant relationships between mentoring and achievement on state-level standardized tests. For a full report, see Appendix E.

A result of nearly nine months of strategic planning efforts for the STEM with community partners and stakeholders throughout the state, another gap in math education became apparent. Stakeholders indicated that there is a dearth of STEM early learning resources for children aged 2-5, particularly in Math.

This is particularly concerning, because research indicates that math scores entering kindergarten are the most significant predictor of future math scores, reading scores, and long term academic and career outcomes. Kindergarten math entry scores are a more reliable predictor than socioeconomic factors, disability status, and socio emotional and behavioral factors, which are frequently highlighted as some of the most significant predictors of long-term success. The beliefs, practices, and language of parents and caregivers almost completely explain gaps in student’s symbolic and conceptual knowledge of the number system and spatial awareness when entering kindergarten. Research shows that gender differences in early math achievement are completely mediated by adjusting the spatial language parents use to talk to their children, and that parents have a significant impact on whether kids feel they are capable of being successful in math.

Despite this, parents and caregivers often lack access to high-quality STEM resources and information about how to help their children gain the skills needed for academic success. Often societal messaging about math can be detrimental to early confidence for girls and children from minority backgrounds. Addressing the awareness of cultural, racial, and class biases is important to how STEM participation is encouraged and nurtured in children. Children have a natural curiosity, and they need adults to foster and guide their STEM abilities.

In FY22 The STEM AC began working with the Community and Cultural Engagement marketing and design team to create a widespread mathematics program systematically designed to empower families to engage with their children in ways that promote the development of numeracy between infancy and age five. The program MILO (Math Introductions and Learning Opportunities) and Friends is adapted from a successful reading program designed and implemented by the STEM education initiative Eastern Washington University. The first iteration of this program was deployed early in FY23 in partnership with Wheeler Farms. Signs were placed around the farm encouraging caregivers to engage in math conversations with early learners as they explore the farm.. Later in FY23, the Living Planet Aquarium joined the partnership to create an early math learning scavenger hunt for families to engage with as they explore the aquarium.

Additional partnerships include LEA-level family and community engagement centers, preschools, libraries, and other community organizations to host family math events. These events typically serve 30-50 families at a time, and caregivers leave with fun, engaging math activities for early learners. More than 90% of respondents who attended these events reported that the event increased their knowledge, interest, and confidence in working with preschool-aged children to build math skills. Participants who spoke Spanish or who spoke English plus one or more other languages had even more positive perceptions of the seminar-style events than English-only speakers. This finding may be attributed to the proactive approach taken by STEM ACs staff to attend to a diverse participant group, including by having surveys and game instructions translated into Spanish.

Attendees also reported large, statistically significant gains from the beginning to the end of the event in their confidence that they have the ability and resources needed to help preschool-age children build early math skills. The greatest gains in confidence were among participants with the lowest levels of education. This finding may result from efforts by STEM AC staff and trained designees to alleviate attendees' concerns about supporting early math learning. Event facilitators achieved this by communicating that engaging in everyday, enjoyable activities with young children – including by counting together, cooking together, and playing games together – helps build early numeracy skills. For a full report, see Appendices F and G. Conversations with additional community partners to adapt MILO and Friends to new public venues are ongoing.

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 (UEPC) to expand beyond basic metrics, to facilitate a more robust analysis that provides greater stratification of the data, as discussed previously.

The UEPC will work with the USBE, mentors, and educators to identify promising practices, assess the relationship between program participation and end-of-year test scores, and understand attitudes and perceptions of teachers, mentors, and students related to the programs directly administered by the STEM AC. Impacts of the ongoing, as well as new programs, will also be evaluated on a project-level basis.

ATTACHMENTS:

Appendix A: Selected Product Providers

Appendix B: Computing Partnerships Evaluation Report

Appendix C: Math Personalized Learning Software: Examining Usage and Associations with Achievement in Utah During the COVID-19 Pandemic

Appendix D: Best Practices for Creating Strong Blended Learning Environments for Mathematics in Utah: Report on Teacher and Student Survey Results

Appendix E: STEM Action Center's AmeriCorps Math Mentors Program: 2022-2023 Evaluation Report

Appendix F: Final MILO 2023 Evaluation Report

Appendix G: Final MILO 2023 Addendum Report

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