

**Utah STEM  
Action  
Center  
Annual  
Report  
FY2022**



**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 24 grants in the 2021-22 school year, directly impacting 2972 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.

### **K-16 COMPUTING PARTNERSHIPS**

As part of the K-16 Computing Partnership program, a total of 344 educators in Fall 2021 and 615 educators in Spring 2022, received professional development through face-to-face and zoom trainings, online courses, accredited vendor classes, and conferences. Seven educators from Washington County School District traveled to the STEM Action Center Innovation Hub for a two-day robotics training.

### **K-12 MATH PERSONALIZED LEARNING**

Educators and administrators from 595 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 71 schools and community education programs that participated in the past year through the curriculum kit program and were trained in STEM lesson teaching.

### **STEM BEST PRACTICES CONFERENCE**

The STEM Best Practices Conference provides a variety of professional learning opportunities for educators across the state. The 2022 conference was held in three locations in Utah to reach more educators, and focused on hands-on STEM activities with the theme: I AM STEM. The conference was held on June 6 in Ogden, June 9 in Price, and June 13 in St. George. More than 500 educators attended in the three locations.

The feedback from our post-conference survey showed that attendees appreciated that we came to areas outside of the Wasatch Front. We plan to host the conference in two locations in the future; one in a metro area and the other in a more rural area.

**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:* 10,072 students were impacted by the funded classroom grant projects.

*Competition grants:* more than 1200 students were impacted through participation in STEM related competitions

*K-12 Math Personalized Learning Program:* more than 117,796 students had access to supplemental math software

*Virtual STEM Fest:* Nearly 6,000 students, educators, and parents participated in STEM Fest, which took place virtually on [utahstemfest.com](http://utahstemfest.com). Of those students and educators, 83% were new users to the website.

*Community Impact Grants:* the Center supported and exhibited at 35 STEM community events and programs, thus impacting more than 66,839 students, parents, educators, administrators, community and industry partners.

*STEM in Motion (SIM):* more than 4,581 students were impacted through participation in the SIM programs

*Girls Who Code Club Network:* estimated 370 girls participated in 48 clubs

*K-16 Computing Partnerships:* 22,461 students (participating in 115 new Computer Science class sections), 35,208 students participating in various out-of-classroom experiences, 96 students participating in work based learning activities. (Please note that students may have participated in multiple activities.)

To Learn early math kits: 4120 kits delivered.

Library STEM Backpacks: 400 Fall 2021 Science of Stress backpacks were distributed to libraries statewide. This collaboration with the Utah Division of State Libraries targeted 2nd to 4th graders and provided activities and education regarding the effects of stress on the body and methods to cope with stress.

STEM AC Innovation Hub: 1,529 participants pre-K - 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:

## **A list of providers selected 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

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Community and Innovation Manager (Lynn Reichert), a Program Specialist (Gina Muhlstein), 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 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. Nathan Flores and Yousuf Haidari, high school interns, supported a variety of projects over the FY21 fiscal year.

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.

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 the STEM AC’s strategic plan and statutory expectations.

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

**UTAH STEM FOUNDATION**

Industry support is crucial to the mission of the STEM AC. Industry support ensures 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 has helped to build relationships with industry and the resulting support 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. 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), Par Technology, Texa Instruments, MHTN Architects, Fire Eye,

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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 STEMFest, STEM in Motion, the STEM On Stage Assembly with Paul Brewer, STEM Best Practices, Green Our Planet Hydroponics program, To Learn early math kits, STEMspots, funding for the new STEM Innovation Hub, Robotics, Micro STEM Fest kits, The Chief Science Officer Program, as well as many other STEM initiatives that have impact statewide.

***Cash Donations for fiscal year 2022:***

The Utah STEM Foundation received over \$545,000 in monetary donations, and \$24,000 in in-kind contributions in fiscal year 2022.

***Utah STEM Foundation Highlights***

- Hale Centre Theatre and its Board of Trustees honored the Utah STEM Foundation as one of Utah’s non-profits who is making a real difference in our community. As part of the “HCT Applauds” program, Hale Centre Theatre spotlighted the Utah STEM Foundation in programs and the press release, as well as at the August 10th, 2022 showing of “Silent Sky” —which tells the true story of 19<sup>th</sup>-century astronomer Henrietta Leavitt and her fellow female researchers – or “computers” – in the Harvard University observatory who set the standard still used today for measuring distances in space while discovering thousands of stars.

### ***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 STEMFest, and hosted nearly 120 students as part of the American Indian Services summer PREP program at their facility in July 2021 to discuss future career opportunities. This year, ARUP employees donated over \$18,000 to the STEM AC through their Employee Giving Program.
- Comcast has been a champion by assisting to fund programs, STEM events, as well as create and distribute communication materials to promote awareness for STEM.
- Dominion Energy donated funding for STEM Fest, as well as our new STEM Spots initiative to bring STEM books, kits, and other materials to underserved areas.
- Fidelity Investments has supported our STEMFest events in person and also offers free financial literacy workshops for students in the classroom.
- Hill Air Force Base has continued to support the STEM AC and Utah STEM Foundation to allocate funding to educators, schools, and other organizations, providing STEM opportunities statewide.
- Jeffery R. and Katie C Nelson Family Foundation has provided ongoing support to the Utah STEM AC and pledged continued funding to help create the Utah STEM Artist in Residence Program that will be held in our new Innovation Hub.
- The Larry H. and Gail Miller Family Foundation has championed The Utah STEM In Motion and provided \$50,000 to expand this program into Kits for classroom, expanding resources to more schools statewide. They have also helped provide equipment for the STEM AC Innovation Hub maker space that thousands of patrons have convened at to learn STEM skills.
- Marathon Oil donated \$50,000 to support a new Innovapod program at two SLC Schools, as well as a Salt Lake Community Learning Center. All afterschool Pod programs tie to classroom learning and standards and create an inclusive approach to STEM through integration, meeting students at their skill level and interests.
- Northrop Grumman provided \$10,000 to start our STEM Spots initiative to bring STEM books, kits, and other materials to underserved areas.
- Texas Instruments donated \$35,000 to provide funding for our Innovation Hub programs and equipment, as well as supporting STEM Fest, and helping to organize other Innovation Hubs in Utah.

- US Synthetic has championed bringing partnerships to the STEM community, and has been our largest sponsor of STEM Fest every year since our inaugural event.

### ***Industry Support at STEM Best Practices Conference***

We went back in person this year for our STEM Best Practices conference! In an effort to connect with more educators statewide, this year we actually held 3 conferences—One in Ogden, Price, and St. George. As we want our educators to feel the incredible community support for their tireless efforts, we received over \$24,000 in in-kind prizes that were donated to give out during the conferences. These donations were provided by: Hale Centre Theatre, Traeger Grill, Loveland Living Planet Aquarium, Orbit Irrigation, Curriculum Associates, Denise's Daisies, Red Butte Garden, Clark Planetarium, NHMU, Discovery Gateway, Ballet West, Kneaders, Hogle Zoo, Harbor Freight, Sodalicious, Thanksgiving Point, Utah Jazz, The Nut Garden, PetSmart of Riverton, Nu Skin, Asmodee, Blue Orange Games, Fireside Games, Haba, Math For Love, Playmonster, Genius Games, In N Out Burger, Joshua Roberts Studio LLC.

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### **Utah STEM Industry Coalition (USIC)**

The Utah STEM Foundation oversees the Utah STEM Industry Coalition (USIC), which consists of over 50 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, helping to build STEMSpots and assembly of To Learn math kits and library STEM backpacks. 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 FY22, as well as those hosted by the STEM Action Center (a full list can be found with Appendix XX).

#### ***STEM Night at SLC Stars***

The STEM Action Center partnered with the SLC Stars to host a STEM Night at the basketball game on April 1, 2022. We brought the Micro STEM Fest kit for this event, filled with hands-on STEM activities that the kids loved, including Hot Wheels, marble runs, Tetris puzzles, and more. Many kids stayed near the STEM area to try out all the activities.

### ***Utah STEM Fest***

The STEM Action Center, together with Utah's STEM industries, showcased exciting STEM career paths and hands-on STEM activities in our seventh annual STEM Fest. In FY22, STEM Fest was virtual due to COVID-19 restrictions. Utahstemfest.com provided students, educators, and parents an immersive experience that allowed them to engage with STEAM articles, resources, and hands-on activities. As a result of going virtual, we were able to keep those resources and activities available to attendees throughout the year after the Week of STEM was completed. This allowed us to reach more people over a longer period of time. Website data from November 1, 2021 through the end of FY22 shows that the 2021 Virtual STEM Fest website had more than 9,000 visitors with 50,000 pageviews.

The 2021 STEM magazine was also available as part of STEM Fest, created in partnership with Utah Business. Nearly all 10,000 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.

In 2022, the STEM AC will hold STEM Fest in person at the Mountain America Expo Center in Sandy, welcoming field trips and the public for free Family Night.

### ***STEM Best Practices Conference***

The 2022 Best Practices conference was held in three locations in Utah to reach more educators, and focused on hands-on STEM activities with the theme: I AM STEM. The conference was held on June 6 in Ogden, June 9 in Price, and June 13 in St. George. More than 500 educators attended across the three locations. Sessions were recorded so that educators could go back and watch any that they missed. Our keynote speaker was Maynard Okereke from Hip Hop Science. He spoke to the attendees about his journey in to STEM and how he inspires others to explore the world of STEM.

The feedback from our post-conference survey showed that attendees appreciated that we came to areas outside of the Wasatch Front. We plan to host the conference in two locations in the future; one in a metro area and the other in a rural area.

### **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 that provides experiential, real-world, project based learning opportunities for students. The program also ties classroom-learning experiences to STEM AC classroom grants to help 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 checkout 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

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feedback.

The SIM team added two curriculum kits for the 2021-2022 school year: Utah’s Water Ecosystems: Great Salt Lake and Additive Manufacturing, in response to teacher feedback about curriculum needs. Two additional kits are under development, including a genetics curriculum in partnership with industry leaders, and geology curriculum in partnership with Utah Geological Survey. 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 *impacted due to the coronavirus	2020-2021	2021-2022
Schools Visited	53	64	47	70 (curriculum kits only)	71 (curriculum kits only)
Students Reached	8,437	10,780	6,171	Over 8,000	Over 4,831 (survey methods for students impacted changed)

School Districts Visited	19	20	17	26	26
Total Programs Presented	337	449	288	NA	NA

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. The team worked with teachers in various schools to determine the best model for the new kit program, and it resulted in a highly successful shift. The curriculum is also made available to educators in the form of PDF documents, so that educators can access any resources used, recreate any activities, or explore any concepts as part of their continuing STEM instruction. Registration for the 2022-2023 school year is nearly at capacity, which currently stands at 143 kits per year.

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 increased interest in STEM and an increased interest in having a career in STEM after the SIM experience. Based on teacher

feedback surveys after a STEM in Motion visit, all educators surveyed agreed or strongly agreed that the SIM program introduced their students to new material, and 97.5% said the kits provided a learning experience not usually available in their school. Further, all educators surveyed would recommend or strongly recommend the STEM in Motion experience to other educators. This program provides opportunities and access to STEM education that educators and students may not get in any other capacity.

**Additional teacher testimonials about the STEM in Motion Program:**

*“EVERYONE LOVED THESE. WISH I HAD A SET FOR MY CLASSROOM!!!!”*

*“We loved having the kit, the students were engaged and it helped us reinforce the standards they have been learning. The kit was easy to use and all the information provided was extremely helpful. Thank you for allowing us to use them!”*

*“Thank you for providing such a wonderful opportunity for our students! They thoroughly enjoyed the activities & learned so much!! The kit was very easy to use & was appealing to all age groups (3rd-6th graders)!”*

In addition to classroom visits, the SIM team works on a variety of other outreach programs, including the Robotics Library. The Robotics Library project started with a \$30,000 donation from Marathon Petroleum and the belief that robotics resources should be accessible to every educator in Utah. Five robotics kits were created with the support of the donation and the kits are

housed strategically around the state.

Each kit includes a variety of robotics equipment designed to be developmentally appropriate for grades K-12: 5 Bee-Bot robotics, intended for grades K-1; 10 Ozobot Bit robots, intended for grades 2-3; and 10 LEGO Mindstorms EV3 robots, intended for grades 4-12. These kits are housed at the four rural education service centers: the Southeast Education Service Center in Price, Utah; the Southwest Educational Development Center in Cedar City, Utah; Central Utah Educational Services in Richfield, Utah; and Northeastern Utah Educational Services in Heber City, Utah. One kit is housed at the STEM Action Center offices to be loaned to schools along the Wasatch Front. Educators can check out this equipment free of charge from any of these locations, and are provided free training and professional development to ensure educators feel comfortable with using the technology in their classrooms. Currently the impact of this program is being assessed to determine the feasibility of scaling the program to additional kits. Due to COVID-19 restrictions, only four of the five kits were used during the 2020-2021 school year.

After the initial curriculum development, the SIM team created and distributed 4,500 To Learn kits via schools, community-based programs, and out-of-school-time educational programs. Over 500 volunteer hours from students, industry partners, teachers, and community organizations were donated in order to assemble the kits.

The kits targeted students from 2-8, with half of the kits being focused on 2-4 year olds and the other half being focused on 5-8 year olds. The activities combined math skills with art, movement, engineering, outdoor exploration, and game play.

Surveys were administered to families of students who received a kit by way of a voluntary sign-up. 85% of families surveyed agreed or strongly agreed that the kits included math lessons that encouraged them to continue learning. On a scale from 1-5, with 1 being Strongly Disagree and 5 being Strongly Agree, the average response for “The kit allowed me to support my child’s math learning” and “The kit encouraged us to use everyday experiences for math learning” were both 4.17.

Due to the positive response for the To Learn kits, the program will be further developed based on caregiver feedback, and integrated with other math early learning programs provided by the STEM Action Center.

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

### **THE VALUE OF THIRD PARTY EVALUATION**

Anytime an organization undertakes to evaluate its own programs, there is potential for bias. 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 for third party evaluation with the Utah Education Policy Center (UEPC) at the University of Utah, which supports credible third party evaluation that sustains a high level of fidelity and objectivity. The parameters of the evaluation (such as metrics and data that is to be collected) are defined by the requirements of the STEM AC’s statute, and recommendations by the third-party evaluator, the Utah State Board of Education (USB E), 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 (i.e., fully developed surveys that merely need to be administered).

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

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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. Unfortunately, schools had more uncertainty than usual this year (FY21), and only one of the four providers was able to meet all the requirements of the pilot program. We will have data on the efficacy of that product in December of 2022.

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 AC received a grant from Boeing to initiate 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), the STEM AC will examine trends and patterns in enrollment, graduation, and employment in STEM over multiple years. The goal is to identify factors that increase students' likelihood to persist in STEM fields over time. Another goal of the study is to determine if companies are finding talent easier, or finding employees that are better prepared to succeed in their companies, thus resulting in higher retention. The data will be used to inform monitor and determine strategic responses to programs, as well as marketing and communications efforts. The interactive report can be found at the following link:

<https://uepc.utah.edu/our-work/stem-landscape-interactive-report/>

The STEM Action Center actively seeks out grant opportunities that support research that can help to inform and support innovative program development and assessment. Examples include the current National Science Foundation (NSF) grant, Linking Attitudes and Behaviors for Student Success, which collects data that helps to inform more effective communication strategies to recruit students into Career and Technical Education pathways.

#### **(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 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. Examples of these are a new technology using robotics to teach early math. 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 learning. It is anticipated that this role will grow over time as the Innovation Hub grows in its state role.

The K-16 Computing Partnerships program has provided continued opportunities to review resources that support coding and other areas of integrated computing and computational thinking. There were several

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programs and products included in awarded grants during the 2021-22 school year that include SkillStruck, 4-H Extension, Code Ninjas, Code Changers, and Future in Design.

One goal of the STEM in Motion (SIM) program is to identify and utilize new and innovative approaches in technology. In addition to the exploration of hydroponics programs in libraries and schools, the SIM team has also incorporated additive manufacturing into curriculum offerings. Each of the Utah's Water Ecosystems kits emphasizes learning to use existing simple technology, and developing critical thinking skills so that students know how to select appropriate technology for a task.

#### **(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 recently completed a nine month strategic planning process. Several gaps emerged including a need for early STEM learning resources. The STEM AC is now piloting several new math programs that provide resources to parents to support their "at home" instruction for their children. The To Learn kits, described previously in the STEM in Motion section of this report, are one of the pilot programs launched during FY21.

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 the latest learning tools and practices in the classroom. This provides an opportunity to share ideas and promote the use of the latest in STEM resources.

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The R&D mechanism that is integrated into the K-12 Math Personalized Learning program (discussed previously) is a good example of how the STEM AC works to identify and assess the best resources for math instruction.

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

(1) The STEM AC provides small Innovation 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 sections.

(2) The K-16 Computing Partnerships Initiative provides opportunities to support promising practices in K-12 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 2020-21, the interns deployed wiring and antennas for the first SBRS in-building 5G network in the world. Despite challenges with COVID, MCSD provided eleven student internships in the Fall of 2021 and Spring of 2022.

As San Juan School District (SJSD) covers 7,933 square miles, this Computing Partnerships grantee determined the best use of its makerspace efforts would be the equipping of a mobile option. SJSD purchased a 7’x14’ trailer and consulted with the STEM Action Center to build storage shelves and select durable 3D printers, 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, SJSD intends to provide 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.

(3) 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 updated all of the resources available in the curriculum kits, including expanding activity offerings, connecting teachers to other STEM Action Resources, and providing a wider selection of targeted career exploration options.

In addition to curriculum kit resources, the SIM team is also developing and expanding the

To Learn kit program. The To Learn kits emphasize integrating early math skills with fun activities that students and families are already doing, and are distributed to families.

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

*April through June 2022:* Bastian Family Foundation, BioHive, Daniel Smalley, BYU Professor, Sierra Young, USU Professor, Kensie Dinsmoor, BYU Graduate Student, Myriad Genetics, KnownMed, Million Girls Moonshot;

*January through March 2022:* Club Ability, Autism Solutions (we donated To Learn Kits to this organization), Glendale-Mountain View Community Learning Center, The Utah STEM Foundation and STEM AC have recently created the Utah STEM Industry Coalition to address Statewide STEM Opportunities, consisting of several Industry Partners. Facebook, Adobe, Recursion Pharmaceuticals, KnownMed, and Pluralsight have all joined since January, STEM Ecosystems (Teaching Institute for Excellence in STEM), SciTech Institute, EdTech Evidence Exchange, United Way of Salt Lake, Math Minds, Climate Change Institute for Agriculture and Forestry, Rural and Underserved Utah Training Experience (RUUTE); University of Utah's School of Medicine;

*October through December 2021:* Salt Lake County Parks and Recreation, Utah Valley University, School of Education, Creative Learning Lab, Intermountain Healthcare, Precision Genomics Division (Genetic Counseling), Headstart, Washington County Libraries (Branches: St. George, Washington, Santa Clara, Enterprise, New Harmony, Springdale and Hildale), Minersville Library, Grand County Library – Moab, San Juan County Libraries (Branches: Blanding and Monticello), Broadcom, Society for Science, Public Education Foundation (southern Nevada), Plan B Theatre;

*July through September 2021:* R&O and American Cancer Society, iImpact Utah, Southern Utah University Thunderworks, Dixie State Atwood Innovation Center, AutoLiv, Mark Miller (Subaru), Teaching Institute for Excellence in STEM (STEM ecosystem design), YMCA of Northern Utah, Promise South Salt Lake, Boys and Girls Club of Greater Salt Lake

### **(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, camps, and competitions. Schools may request up to \$100 per participating student, 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 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.

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*“This is real engineering, with real problems, real programming, real project teams. It is close as you can get to an engineering project outside of industry.”*

*- Preston Richey*

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 at all. Many grantees also highlighted the fact that this grant allowed them to focus fully on helping the students because it eased the burden of scrounging for resources that usually occupies much of their time that would otherwise be spent mentoring and coaching.

*“This program has generated so much interest in the rest of the student body. In addition to the competition robotics class, we also have enough student interest to offer 3-4 additional robotics classes (about 200 students) who want to participate in robotics but don't necessarily have time to compete.”*

*- Stephanie MacKay*

*“If it were not for the help from you all, so many underserved students that really cannot afford to tackle scientific research, engineering prototypes and tech opportunities simply would not participate. So thank you so much, these kids learn an incredible amount if not from their work, but from all of the things that go wrong, the things that you don't consider like specifics when making orders, having a good plan and what to do when plan A does not pan out. ”*

The grant program is popular and for the 2021-22 school year grants were awarded to 30 schools. 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

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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 FY22](#).

## 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 FY22, a total of 108 completed grant applications were received. Of those applications, 66 proposals (61%) 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 FY22 totals just over \$77,000.00, with an impact on 10,072 Utah students. In FY22, 24 of 66 (36%) of classroom grants were awarded to educators that identified their students as rural. A summary of the LEAs, grades, and number of students can be found here:

[https://docs.google.com/spreadsheets/d/1\\_VWK61iLxPp4oE\\_EuPd8tXYMIw83ejcr8Fj5C9vUBMo/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1_VWK61iLxPp4oE_EuPd8tXYMIw83ejcr8Fj5C9vUBMo/edit?usp=sharing)

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 several awardees commented this year on allowing students to have access to hands-on resources:

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"This grant was instrumental in providing me with the supplies to try all of these really great projects. The students learned a great deal and as an educator I was able to grow through their inquiry process. I

am able to grow more through this arts integration process, in making connections, educating myself in different mathematical, scientific, and engineering principles that I can tie back into art. I grow significantly by developing these lessons. The process of seeing what works and problem solving when things don't work is valuable as well. The students are able to get a much deeper experience through these arts integration projects. They are hands on experiments that offer rich connections between various disciplines and offer real-world applications. I love that it is inclusive for all my students no matter ability and cultural differences. I stress that STEAM is for everyone, male and female. They use the core principles within their classroom and come to explore richer material with me. The students all get really excited and are very engaged when we learn about the STEAM subjects, and this helps them to learn and retain the information far better than doing a worksheet just in class.”

*“I like that the class and I have worked together and have been successful. There were times at the beginning that students felt like we would not be able to make this technology work, as soon as one student or a group would get it to work the mood in the classroom would change. I like that they have been able to use technology, stick to it, and be successful.”*

*“All of the children in our morning and afternoon preschool class enjoyed and participated in our ramp project. Ramp play naturally emerged as children played in the block area. Teachers were able to observe, make notes, and listen to children explain their thinking as they build ramps. Taking the time to do this allowed teachers to use what children already know about force and motion to support everyone's learning. As we began to introduce the whole class to ramps, children familiar with ramps led the other children's learning. They answered questions and helped them problem solve during ramp building. This was not planned but an unexpected valuable experience. The outcome was increased confidence, oral language, self concept, social skills, and collaboration. I hope to include this component to this unit each year.*

*We analyzed our data and noticed at the final stage of our project girls the were participating equally as much as boys. We observed their play and discovered differences in the play. The girls and boys used ramps as a part of their bigger play scenes. Ramps, force, and motion knowledge was successfully incorporated into the play scenarios. It seems they used their new academic knowledge in service of their playful intentions. We are very pleased with the outcome of this project and all goals were met! This experience helped me learn more about ramps, force, and motion and more about young children's understanding of these concept. I learned what is important, interesting, and meaningful to them. I think my project will be different in the future because of this grant experience. Children are interested in STEM learning, but it needs to be done with an understanding of the children in my current class. There is a social component to learning that I have underestimated. I was surprised at how well the children learned the vocabulary and used it appropriately if the learning experiences were not presented in a forced way. They seemed to enjoy the challenge of explaining their thinking. Painting with the marbles was interesting. At first the children were enjoying the process, but then we ask them how they were making the marbles move. They discovered they were tilting the box and creating angles. That's what made the marbles move in the paint. Giving the children time to think about what was happening and not telling them the answer or pointing it out to them was a powerful experience. As each child realized what was happening, we could see it on their face. This was a turning point in our project! It is hard to explain, but this was when I knew they were doing the cognitive work needed to understand what they were doing and how it was working. After this children began using the terms more in their play and when we asked them to explain what they were doing. I learned about how to facilitate children's learning!! I am so grateful for this experience!”*

*“I just love these STEM grants. It brings the passion back for me and the students. I think it*

*went fantastic. The engagement, understanding, and cohesiveness of investigating the phenomenon were worth the hundreds of hours putting the curriculum together. I looked forward to class everyday and the students loved it. Making this unit hands on, with an engineering design challenge and real-world application was a game changer. This year has been HARD. No other words to describe what the last few years have done for my passion and enthusiasm for teaching. I was really struggling and considering leaving teaching. This project reignited my love of teaching, creating curriculum, and mentoring students. I was so excited to engage with students in the lessons. I loved helping them see real-world connections to scientific principles. Honestly, having this opportunity is the reason I will still be a teacher next year.”*

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### **(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 (ACTE etc) to continue the search for best practices in STEM education. The STEM AC has worked with the Education Commission of the States on several “thought leader” efforts for their reports such as Early STEM Learning and Equity and Access in STEM. Dr. Goetz serves on grant review panels for several federal agencies each year to remain connected to national trends and opportunities. The STEM AC team has adapted several best practices from other states including the new *To Learn* early math kits that were piloted over the 2020-21 school year. The Center is close to launching the Early Learning and Language Opportunities (ELLO) to early math support for parents and communities. MILO (Math Introductions and Learning Opportunities) and Friends will be piloted at Wheeler Farms, in partnership with Salt Lake County Parks and Recreation. There are several new programs that will be launched during the 2022 Week of STEM that are adaptations from successful programs in other states (i.e., Chief Science Officer).

### **(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 will include lessons for teachers, complete with resources in Canvas, a format most teachers use regularly for instruction. 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.

**(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, 2021 to June 30, 2022, stem.utah.gov saw 21,614 users and 64,955 page views, with 83% being new users of the website. The STEM website continues to be a reliable resource for educators, students, parents and industry professionals looking to engage with STEM education in Utah.

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**(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 FY22, four schools that had previously been designated as STEM Schools were re-designated, along with one new school 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:

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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 STEM schools in school year 22 to help their school define what they want STEM to look like there. 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.

### **(l) 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.

In FY21, a planning grant was obtained and the project was completed that 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 will take place in fall of 2022, applications will be due in November of 2022. The cohort will begin in September of 2023.

### **(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 our social media pages, including [robotics competitions](#), summer camps for underrepresented groups including [Kane County's STEM Camp for girls](#), and highlighting our partnership with Utah Valley University on creating the [Micro STEM Fest](#).

In addition to these programs, the STEM AC showcases the work students, educators, community and cultural organizations, other state agencies and industry partners are doing

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.

**(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 most recent strategic plan for the Center, that included community feedback, indicated that there is a need for resources that reach parents and communities, and even can be used in homes. The STEM AC reviewed current projects, assessed several promising practices and selected a few pilot program options that address the need for more resources for parents and homes and remained aligned to strategy and statutory expectations. The include MILO and Friends, discussed later in greater detail, as well as the To Learn early math kit series that is discussed in greater detail in this report.

**(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 2021-22 school year, educators and administrators from 595 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.

Following the successful feedback of a 600 kit pilot, the STEM in Motion (SIM) team designed and created and distributed an addition 45000 To Learn kits to teach early learning math and science skills aligned with K-1st grade standards. This was in partnership with Project Child Success out of Washington State, and the five kits used a To Learn model designed originally by Project Child Success. Kits were distributed in partnership with local preschools, Headstart preschools, Weber and Davis district preschools, Boys & Girls clubs, and local libraries.

Surveys were administered to families of students who received a kit by way of a voluntary sign-up. 85% of families surveyed agreed or strongly agreed that the kits included math lessons

that encouraged them to continue learning. On a scale from 1-5, with 1 being Strongly Disagree and 5 being Strongly Agree, the average response for “The kit allowed me to support my child’s math learning” and “The kit encouraged us to use everyday experiences for math learning” were both 4.17.

The To Learn model incorporates early math concepts into every day fun activities that children enjoy. There were five kit themes available, with each kit offering a 2-4 year old version and a 5-8 year old version, including Paint to Learn, Build to Learn, Move to Learn, Explore to Learn, and Play to Learn. These kits are distributed directly to students without cost, and tie content areas to early math concepts to provide engaging activities for students and important examples for parents.

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

### **Utah Department of Cultural & Community Engagement (CCE)**

The Utah Legislature determined that the STEM AC needed to look for a new “home” agency during the 2019 Legislative Session. The final decision was to move the STEM AC to the Utah Department of Cultural & Community Engagement (CCE). There were several factors that supported the choice: the overall governance structure of CCE was appropriate for the STEM AC, the STEM AC already had several project collaborations with divisions of CCE (e.g., the State Library Division and the Division of Utah History), most of the divisions within CCE supported education-based programs and the fund raising function of the STEM AC was aligned to directions desired by the CCE. The STEM AC has partnered with several of the CCE divisions in greater capacity over the past two years including the State Library Division (STEM Backpacks, Library Maker Spaces, the UIHN) and UServe through two AmeriCorps grants awarded in the past two years. The intent is to increase opportunities for partnering, especially with the Division of History (Week of STEM 2023), Arts and Museums (STEM Artist in Residence) and Multicultural Affairs (increasing outreach to underrepresented communities with programs such as MILO and Friends).

The STEM AC Executive Board has the statutory authority to approve a new physical location for the Center and approved the new Columbus Hub of Opportunity for the STEM AC. The Hub is located at 3848 S. West Temple in South Salt Lake and is a mixed use facility for Columbus Serves, a Utah non-profit that provides resources for individuals with differing abilities. The Hub of Opportunity co-locates retail space with approximately 200 affordable

housing apartments. The STEM AC is located on the ground level and includes not only office space, but the 2,000 square foot Innovation Hub (IH).

The IH opened June of 2021 with the intent to provide a home (and be a demo site) for a community-based model to support FIRST and VEX robotics teams. The IH provides an equipped maker space with a variety of machining, shop and tech tools that support robotics and making efforts. The IH can home up to 15 teams, with a total of eight for FY21. This

model will make it more sustainable to solicit industry support for coaching and mentoring robotics teams by aggregating the need for coaching multiple teams to one site, with scheduled times for coaches and teams. The STEM AC team has worked collaboratively to develop several STEM programs that have been initiated in the IH that highlight the integration of art, coding, textiles, robotics, jewelry making etc with STEM. These will be discussed in more detail later in this report.

The long term goal of the IH was to ensure that it provides not only local support, but also serves a statewide service. It has become clear, over the past year of IH operation, that it has a great deal more potential than merely supporting local robotics teams. The STEM AC has been working with post-secondary, regional education and community partners to create the Utah Innovation Hub Network (UIHN). The UIHN will be discussed in greater detail in later sections of this report.

### **K-16 COMPUTING PARTNERSHIP INITIATIVE**

In 2017, with strong support from industry, the STEM AC secured \$1.255M ongoing to launch the first computing grant initiative in Utah, now known as the K-16 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 K-12. This input has defined a needed shift to a greater focus on integrated computing which can serve a more broad 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 Grants:

- 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
- Teacher retention opportunities, such as summer externships, mentorship, and other models for increasing skills through professional learning
- 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 equity and access.

The current FY21-FY23 grants were identified through a formal, competitive solicitation, with external review of all submissions. Applicants submitted grant requests for three years of funding. From 37 submissions, 17 grants were awarded. Seventy-one percent of these awards were located outside of the Wasatch Front. Of the \$1,058,465.67 awarded in FY22, \$666,370.34, or 63%, were awarded outside of the Wasatch Front. Appendix C provides an outline of the grantees and their funded activities.

Qualitative and quantitative data was collected from grantees in January 2022 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.

During FY22, 22,461 students enrolled in 115 new computing class sections, 35,208 students participated in out-of-classroom experiences, and 96 students participated in work-based learning opportunities. During this same time period, 959 educators participated in professional learning activities. Seven educators travelled from Washington County School District for a two-day robotics training in the STEM Action Center's Innovation Hub. (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 (35%) and Innovation & Maker Spaces activities (37%) 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. 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 statements of confidence in computing instruction, such as "I continually find better ways to teach or integrate computing concepts." In addition, 81% felt that "I can teach or integrate computing concepts into my instruction effectively."

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

#### Maker space and Innovation Spaces

- *"...classroom teachers developed curriculum that allowed for interdisciplinary overlap between makerspace activity and classroom learning. The maker space activities that coordinated with classroom activities included 2nd grade use of 3D printing with their science curriculum, 4th grade use of makey-makey and 3D pens for history, 8th grade use of 3D pens for science PBL projects, 6th-8th graders used the maker space for the production of visual arts in an art PBL."*
- *"...I love seeing students make innovative, creative solutions for problems! Seeing their higher order thinking is incredible!"*

#### 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."*

#### 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."*

### Professional Learning

- *“We have successfully trained STEM educators at each of 21 schools. Those educators provide STEM/Computer Science instruction to all K-6 schools. The goal to increase teacher capacity and confidence has been hugely successful and will continue as we integrate new tools...”*
- *“I have been provided with instruction on how to integrate and teach computing skills to students of all ages.”*

During FY22, the STEM AC provided webinars and connections with technical experts to assist grantees in establishing their maker spaces and meeting specific equipment needs. Grantees shared their progress and best practices, offering other grantees the opportunity to learn and open a dialog on specific program aspects. During FY23, identification of additional webinar topics and technical assistance will continue to build the community of practice for grantees and others interested in their projects.

### **National Science Foundation**

#### *Linking Attitudes and Behaviors for Student Success (LABS<sup>2</sup>)*

The success of key STEM education efforts rely on an effective communication and outreach strategy, with an emphasis on programs that are in Career and Technical Education (CTE). It has been recognized in Utah, as well as in many other states, that CTE programs suffer from myriad negative misperceptions. In order to ensure that any efforts with CTE programs realize their full potential for participation, the stigma that plagues CTE programs needs to be addressed. The STEM AC and partners from higher education, the USBE, several LEAs and the Utah DWS, were awarded funding in 2018 for the Linking Attitudes and Behaviors for Student Success (LABS<sup>2</sup>) proposal from the National Science Foundation’s Advanced Technology Education (ATE) program. The grant was funded on April 1, 2018 for three years and a total of \$766,364. There were significant delays due to COVID-related issues and the grant is now in the first year of a no-cost extension.

The focus of this grant is to work collaboratively to create a new communication and outreach strategy for Career and Technical Education (CTE) programs that is data-driven and utilizes new, and creative communication strategies. There have been two rounds of surveys conducted; the first survey was a general analysis of perceptions and knowledge around CTE programs. The second survey was designed to understand behavior around decision making with students when they consider CTE courses. The data collected from the first survey countered the prevailing assumptions that students do not choose CTE

because they have a negative perception or bias against CTE, or that their parents and teachers influence them due their negative perceptions for CTE. The data from 9th and 12th grade students, parents, teachers (CTE and non-CTE) and counselors did not indicate any significant negative biases or perceptions related to CTE. The data clearly demonstrated that the biggest issue that impacted choices for CTE is a general lack of knowledge. The second survey illuminated key findings. Half of the student respondents were equally divided between rational and intuitive decision-making styles. The remaining 50% were

divided amongst The data has allowed the STEM AC to determine innovative communication strategies that can reach more students and with the right type of message.

A new communication project was designed in response to the data collected from the LABS2 project. The *How'd You Think of That? with Temple Grandin* podcast is a STEM-based series that explores how diverse thinking is so critical to STEM education and to solving STEM problems in our society and world. Dr. Temple Grandin interviews scientists, innovators and educators from across the country who have done something extraordinary in STEM. The first year of the series was completed and the analytics for viewing are shared in Appendix XX.

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### ***Distance Learning***

The STEM AC has always had a strong commitment to access and equity, with a focus on rural students and communities. The challenges that the COVID-related issues has created amplifies the need for greater innovation and capacity for distance learning.

The STEM in Motion team, as previously discussed, has adapted all of the classroom instruction programs to a blended learning model, with kits that can be checked out. The adaptation of the in classroom instruction to kits, combined with remote instruction resulted in increased impact to rural and remote communities.

The Innovation Hub, and the UIHN, will provide numerous ways to offer workshops, courses, professional learning and technical assistance to every community in Utah using blended virtual and in person opportunities.

### ***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 continues to build relations with school boards including the Rural School Boards Association. The STEM AC has committed to attending the Rural School District Association meetings to understand more fully how to support rural districts and their STEM needs. The STEM AC has spent a great deal of time working with the Regional Education Service Agencies (NUES, CUES, SESC and SEDC). The Utah STEM in Motion team works with the rural service centers to provide access to the kits that they have developed.
- The STEM AC continues to work with the USBE as part of a STEM Advocacy Team that has recently released its first collaborative communication document that helps to clarify roles and partnerships between the STEM AC and the USBE.
- The STEM AC partnered with the Utah State Division of Libraries to pilot a STEM Backpack program. The pilot included a Back to School backpack, The Science of Stress, and a Summer backpack, Oceans of Possibilities, aligned to the summer reading theme. In FY22, there were 400 backpacks in total, distributed for check out at local county and city libraries across the state. The pilot helped to finalize a scope that is

sustainable and high impact with only Summer backpacks, once a year to scale the project for year 2 implementation.

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STEM AC conducts site visits to various projects over the year. The following are examples of how the STEM AC team works to engage with partners across the state.

- Classroom grants for the 2021-22 school year varied in scope and subject. Two in-person classroom grant visits were completed, with all other projects submitting video and photo evidence. Greater detail regarding the classroom grants program can be found in preceding sections.
- Five schools completed the STEM School designation process in the 21-22 school year. Each of these schools were designated at the Platinum level, and received visits as part of the designation process.
- The STEM in Motion (SIM) team focuses on in-classroom resources, providing curriculum and materials so that both the students and educators a hands-on experience of STEM. In the last three years, the SIM team has continued providing resources during COVID restrictions, adjusting to classroom and educator needs. The SIM team has impacted nearly 20,000 students in the past three years across 33 districts, helping teachers develop a passion for STEM in their students that starts in elementary school. The SIM team also works with educators to bolster their confidence and knowledge base to consistently teach high-quality STEM lessons in their classrooms, and continues to expand to meet educator needs.

#### *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 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 team (coaching support), STEMFest (sponsorship), To Learn (kit assembly), STEM Backpacks (stuffing), and STEMSpots (construction and financial support).
- The STEM AC is partnering 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. Several STEM AC programs align well with the Adopt-A-School initiative and include Chief Science Officers, Micro STEMFests, Green Our Planet hydroponics, STEMSpots and robotics.

#### *Green Our Planet Hydroponics*

- The Green Our Planet (GOP) Utah hydroponics project is an innovative program that utilizes high-tech hydroponics to teach students and communities about our limited natural resources and how to conserve these resources using STEM. This project uses hydroponics systems for students and communities to explore engineering and technology, integrated with science. The program will inspire students to

become the next generation of scientists, farmers, chefs and entrepreneurs and act as a portal for students to understand both life on Earth and our place in the universe.

- We currently have 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, Hildate, Mindersville, Moab, Blanding, Monticello, and Parowan.

### *STEM Volunteer Program*

- The STEM Action Center recognizes the need for a robust volunteer program, and has started the process of reorganizing the way we advertise volunteer opportunities, recruit new volunteers, and maintain the volunteers we have.
- Our goals for FY23 are as follows:
  - Create a way for potential volunteers and/or donors to find out about opportunities available to them using a website or volunteer portal.
  - Find a way to efficiently track important data points in regards to the volunteer program.
  - Create a community calendar where we can share local STEM events and advertise for STEM volunteer needs with our community partners.
  - Earn a bronze level UServe Utah Volunteer Management Designation.
  - Organize a recruitment strategy to attract students to our re-organized STEM Activist program.

### *Week of STEM*

- The STEM AC was asked to kick off the first ever Week of STEM (WoS) for November 7-10, 2022. The planning for WoS was initiated in spring of 2022 and has had tremendous support from the Utah STEM Industry Coalition, the STEM Education Access Coalition (SEAC) and others in the community. This year's theme will be We Are STEM to continue to promote and encourage diversity, access and inclusion for STEM learning opportunities across the state. There will be a social media campaign that features numerous efforts from industry, education and community partners to support STEM opportunities for all students. There will be four private-public partnerships announced each day of the four day inaugural celebration. These partnerships, and their STEM programs, will illustrate how we can work to ensure that children, youth and communities that typically do not have adequate access to STEM resources can be served when public and private partners come together in shared goals.

### *STEM Spots*

- The STEM AC has partnered with the STEM Coordinator of USU Extension/4-H this year to pilot and develop a new project: 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. Industry partners that have contributed to the book costs and building include: Northrop Grumman, Dominion Energy, Hill Air Force Base, and Jacobson Innovation. At the time of this report, at least eighteen STEM Spots are installed statewide, thirteen additional Spots are in progress, with another twenty-five requested sites. Of those installed, 77% 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.

We started partnering with organizations that primarily served populations underrepresented in STEM professions to provide STEM-focused maker activities in the form of field trips and evening classes. As demand for classes and field trips increased, so did the need for unstructured opportunities for participants to further their understanding of concepts they had learned. In December 2021, we started facilitating Open Tinker Time on Fridays which provides time and space for participants to drop in to work on projects, learn a new skill, or collaborate with other STEM makers. Participation in Open Tinker Time has grown organically with very little advertising and currently has an average of 25 participants each Friday and an average stay time of 3.35 hours.

Simultaneous to the facilitation of classes, field trips, and robotics programs, we also saw an increase in demand for maker education resources from administrators and educators across the state. It became apparent that many schools, libraries and communities were interested in developing spaces similar to the STEM AC's Innovation Hub and needed resources. The STEM AC started identifying high-quality maker programs across the state that could serve as a pool of resources for spaces to ensure that newly created makerspaces and STEM labs were created with intention and were used impactfully. From this identification of partners, the STEM AC's Utah Innovation Hub Network (UIHN) was born. The UIHN intends to both connect makerspaces and STEM labs to resources developed by successful programs and also to each other through the use of collaborative turn-key programs, large regional or statewide events, and through platforms that encourage communication and collaboration like Slack or Discord.

In May 2022 the STEM AC was awarded an AmeriCorps grant which will allow us to strategically place AmeriCorps members across the state to support the efforts of the UIHN. For our first year of AmeriCorps funding, we will be placing AmeriCorps members at the STEM AC's Innovation Hub, Davis School District's Catalyst Center, Utah Valley University's Crative Learning Studio, Southern Utah University's Thunderworks, Utah Tech's Atwood Innovation Center, and the Southeastern Educational Service Center's mobile makerspace program.

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

The STEM AC completed its eighth full year of training and implementation to support the K-12 Math Personalized Learning program (2021-22 school year). The overall goal of this program is to provide supplemental math support to educators and students in an innovative approach that

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includes: (1) ongoing research of best practices in the use of supplemental instructional tools (2) using a statewide approach to design and implement a robust analysis of the use of content specific supplemental technology-based tools and (3) a statewide approach to implement a program that leverages state contracting and critical mass for cost-effective access and (4) integrating a mechanism that allows for continuous assessment of new products at no cost to the state.

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 XX.

A total of 117,796 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 94 LEAs participating (595 schools total). Seven math personalized learning products were used during the 2021-22 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. Admin promised to ensure that students have access to technology for at least 45 minutes per week to use the math software provided. We also required signatures from the IT Director at each LEA to ensure they were aware of any technology provided by the grant and that they would have adequate bandwidth and infrastructure prior to implementation. Each year we require on-site professional learning opportunities 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. We also made sure that usage expectations were clearly communicated to administrators and math coordinators.

To allow school and district administrators to more strategically plan implementation, we open the application for the following school year early in the spring and send award notifications in April before budgets have to be completed.

As this program has matured, we have found there is a difference between "fidelity"- using a

product for a certain amount of time - and effective implementation. When working to ensure products are used effectively with over 100 thousand students, the easiest metric to look at is minutes of use. While we know 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, we have learned human connection is the single most significant factor related to student performance in math. As we have 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 22, the scope of this study was limited, but we learned some valuable lessons and confirmed that teachers are in fact a significant variable in predicting the efficacy of math software. The full report can be found as Appendix XX. In FY 23, we plan to delve deeper into the best practices evaluation, and we look forward to reporting what we learn.

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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 8 years, only 37% of Utah students are reaching grade-level proficiency. That puts Utah in the top 10 best performing states in math, but we still have a lot of 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. Mentors will be getting into classrooms to kick off the program through out the 2021-22 school year. 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. Despite recruitment challenges and other unforeseen obstacles in the first year of implementation, the STEM AC was able to onboard 12 new mentors, positively impacting 304 students. For a full report, see Appendix XX.

As we worked with community partners and stakeholders throughout the state to complete our new strategic plan, 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 FY21, with donations from Boeing and other partners, the STEM AC created Paint to Learn, Build to Learn, and Move to Learn kits targeted at supporting fun, math focused interactions between children ages two to eight and their caregivers. Activities deliberately tie content areas to early math standards established and approved by USBE. Over 5000 kits were distributed directly to students at no cost. Kits are designed to make math fun and engaging so that students develop positive attitudes about math and confidence in their own ability to think mathematically. By providing examples for caregivers about how to talk about math and make math a fun part of everyday activities, we hope to create a meaningful shift in the way Utah families discuss math at home.

Surveys were administered to families of students who received a kit by way of a voluntary sign-up. 85% of families surveyed agreed or strongly agreed that the kits included math lessons that encouraged them to continue learning. On a scale from 1-5, with 1 being Strongly Disagree and 5 being Strongly Agree, the average response for “The kit allowed me to support my child’s math learning” and “The kit encouraged us to use everyday experiences for math learning” were both 4.17.

Due to the positive response for the To Learn kits, the program will be further developed based on caregiver feedback, and integrated with other math early learning programs provided by the STEM Action Center.

In FY22 The STEM AC began working with the CCE 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 first iteration of this program will be deployed in September of 2022 in partnership with Wheeler Farms. Signs will be placed around the farm encouraging caregivers to engage in math conversations with early learners as they explore the farm. See Appendix XX for examples.

### **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.

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 this program. Impacts of the new programs centered on math early learning will also be evaluated.

The third-party evaluator has completed the annual report that includes assessment of the Professional Learning and Computing Partnerships and these reports can be found in Appendices D and E.

### **ATTACHMENTS:**

Appendix A: Selected Product Providers

Appendix B: Community Impact - Sponsorships

Appendix C: Computing Partnership Grant Partners

Appendix D: Computing Partnership Evaluation

Appendix E: Professional Learning Evaluation

Appendix XX: MILO and Friends assets [MILO & Friends Wheeler Farm Signs](#)

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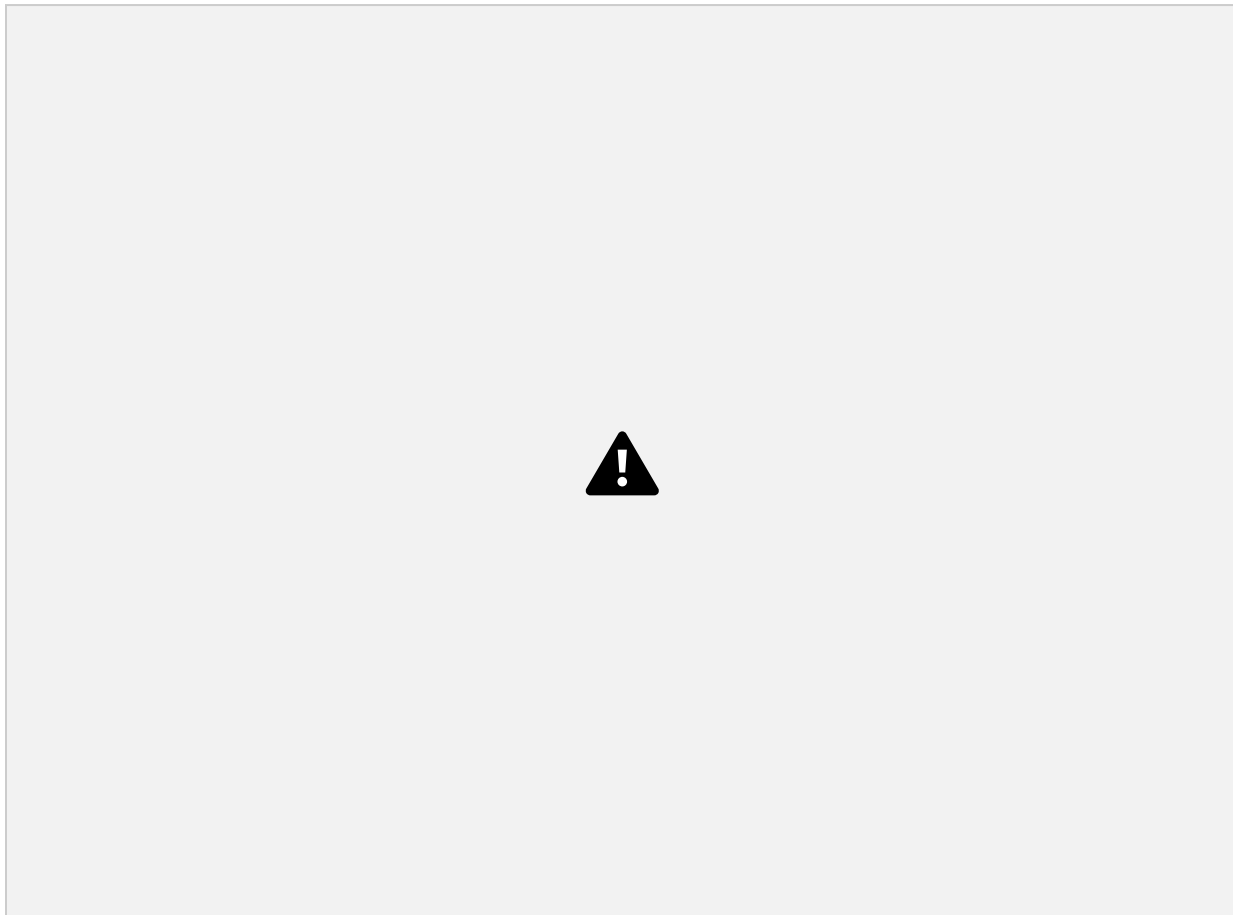
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## Selected Product Providers

### Appendix A

HB Project	Vendor	Alignment
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<p>K-12 Math Personalized Learning</p>	<ul style="list-style-type: none"> <li>- Curriculum Associates (i-Ready)</li> <li>- Dreambox Learning</li> <li>- Imagine Learning (Imagine Math)</li> <li>- McGraw-Hill (ALEKS)</li> <li>- Mathspace</li> <li>- MIND Research Institute (ST Math)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Contains individualized instructional support for skills and understanding of core standards</li> <li>✓ Is self-adapting to respond to the needs and progress of the learner</li> <li>✓ Provides opportunities for frequent, quick and informal assessments</li> <li>✓ Includes an embedded progress monitoring tools and mechanisms for regular feedback to students and teachers</li> </ul>
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**FY 21-23 Computing Partnerships Initiative Grantees**

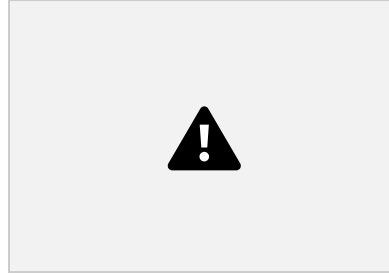
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	W	B	E	A	P	D	E	A	P	B	
	Y	O	X	L	S	O	X	Y	M	O	
	C	C	F	F	C	C	F	F	C	C	
	M	D	F	F	M	D	F	F	M	D	
<b>CUES (7 LEAs)</b>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Duchesne School District (4 Elem)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
<b>Entheos Academy/Pacific Heritage (Charter) (3 campuses – Elem and Jr)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
<b>Granite – Kearns (2 Elem, 1 Jr, 1 HS)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Iron County School District (9 Elem, 3 Mid)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
<b>Jordan School District (39 Elem, 12 Mid, 6 HS)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Juab School District (12 Elem Staff)</b>	<input type="checkbox"/>		<input type="checkbox"/>								
<b>Kane School District (2 Elem, 1 Jr, 1 HS)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

<b>Murray School District (3 Elem, 2 Jr, 1 HS)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
<b>Pinnacle Canyon Academy (Charter)</b>	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>				<input type="checkbox"/>	
<b>San Juan School District (12 schools)</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>	
<b>SEDC (6 LEAs-HS)</b>											
<b>S. Sanpete- Manti Elem (1 Elem)</b>	<input type="checkbox"/>		<input type="checkbox"/>								
<b>Washington School District (4 Elem, 1 Jr)</b>		<input type="checkbox"/>	<input type="checkbox"/>								
<b>Washington SD – Hildale (650 students, K-HS)</b>		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>

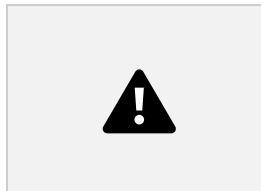
<b>Weber School District (25 Elem, 9 Jr/HS)</b>		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<b>Weilenmann School of Discovery (Charter) (Elem and Jr)</b>	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>				





Prepared by the Utah Education Policy Center  
on behalf of the STEM Action Center

October 2021



## Bridging Research, Policy, and Practice

The Utah Education Policy Center (UEPC) is an independent, non-partisan, not-for-profit research-based center at the University of Utah founded in the Department of Educational Leadership and Policy in 1990 and administered through the College of Education since 2007. The UEPC mission is to bridge research, policy, and practice in public schools and higher education to increase educational equity, excellence, access, and opportunities for all children and adults.

The UEPC informs, influences, and improves the quality of educational policies, practices, and leadership through research, evaluation, and technical assistance. Through our research, evaluation, and technical assistance, we are committed to supporting the understanding of whether educational policies, programs, and practices are being implemented as intended, whether they are effective and impactful, and how they may be improved and scaled-up, and become sustainable.

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The UEPC thanks Lynn Purdin from the STEM Action Center for providing essential insights about the Computing Partnerships Grant and serving as a liaison between the evaluation team and the STEM AC partner schools and districts. We appreciate the time educators and students from participating districts provided to offer feedback on their experiences with the Computing Partnerships Grant Program

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## Introduction

### Computing Partnerships Grant Program Overview

In 2017, Senate Bill 190 (S.B. 190), passed in the Utah State Legislature, created the Computing Partnerships Grant Program. The grant program, as described in the bill text, is to fund “the design and implementation of comprehensive K-16 computing partnerships” (S.B. 190, lines 71-72). Computing partnerships that meet the criterion of comprehensiveness, as S.B. 190 further specifies, are those that intend to enhance outreach and engagement, course content and design, work-based learning opportunities, student retention, professional learning, access, diversity, and equity, and institutional, industry, and community collaborations. The Computing Partnerships Grant Program intends to expand computing opportunities for students and educators in Utah. Public PK-12 districts and schools can apply for grants that allow them to provide and expand computing programs. Grantees are encouraged to increase access to underserved populations and focus on activities that occur outside of the traditional classroom setting.<sup>1</sup> In funding these partnerships, the overarching goal of the grant program is to support students’ acquisition of skills and knowledge necessary for success in computer science, information technology, and computer engineering courses and careers.

The Utah Education Policy Center’s (UEPC) 2020-21 evaluation of the Computing Partnerships Grant Program used a mixed-method design (i.e., interviews, surveys, and secondary data sources) to answer the following research and evaluation questions:

- What are the observable characteristics (e.g., race/ethnicity, gender, degree attainment) of educators who participated in the Computing Partnerships Grant Program?
- How effective are Computing Partnerships Grant activities at increasing educators' computing competence (particularly with aligning curricula with CS standards), confidence, job attitudes/satisfaction, and value of computing?
- What factors support and impede educators' computing competence (particularly with aligning curricula with CS standards), confidence, job attitudes/satisfaction, and value of computing? ■ How did educators provide continuity for programming during the COVID-19 pandemic? ■ How effective are Computing Partnerships Grant activities at increasing students’ computing self efficacy, interest, engagement, skills (as aligned with Utah’s CS standards), computational thinking, awareness of computing career opportunities, and intentions to pursue computing? ■ How well were the program elements of the Computing Partnerships Grant implemented and adapted at each LEA to support students’ computing self-efficacy, interest, engagement, skills (as aligned with Utah’s CS standards),

computational thinking, awareness of computing career opportunities, and intentions to pursue computing?

- To what degree has each LEA met its goals and objectives for the Computing Partnerships Grant?
- How effective are *post-secondary, industry, and community collaborations* at supporting program objective and goal attainment?
- In what ways and to what extent has the STEM AC supported the development and expansion of computing in schools—teacher and school capacity, practice, and scaling up?

A total of 17 projects were funded by the Computing Partnerships Grant Program during the 2020-21 school year. Projects identified objectives and outcomes to guide their work. A summary of these

<sup>1</sup> <https://stem.utah.gov/educators/opportunities/computing-partnership-grant/>

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measures is located in Appendix A. Although there were a range of topics captured in projects' objectives and outcomes, projects primarily noted goals related to educator learning and training (10 of 17) and partnerships and collaborations (6 of 17). Other common areas included afterschool activities, underserved student populations, and the creation of new learning spaces.

## Relevant Literature

As noted in a recent Utah Education Policy Center (UEPC) evaluation of the Computing Partnerships Grant Program,<sup>2</sup> research to date has highlighted the following:

- Computing technologies are critical for the United States' economy. In particular, these technologies are critical to fields such as information technology and other digital careers, healthcare and even the automotive industry (Jeffers et al., 2004; U.S. Congress Joint Economic Committee, 2012). In order for the nation to continue growing in these fields, it is imperative that individuals acquire skills in STEM (science, technology, engineering, mathematics) fields (Blikstein; 2018; President's Council of Advisors on Science and Technology, 2012).
- Job growth is expected in STEM fields throughout the United States and in Utah specifically (U.S. Bureau of Labor Statistics, 2020; Utah Department of Workforce Services, 2018). Despite this demand, the United States is not training enough individuals to work in STEM positions (Sanzenbacher, 2013).
- One strategy for advancing the nation's STEM labor force is increased investment in computer science education in K-12 schools (e.g., (Joshi & Jain, 2018; Leyzberg & Moretti, 2017; Papini et al., 2017). Sanzenbacher (2013) found that K-12 educational settings are expanding computer science opportunities through job shadows, externships, and guest lectures by individuals from the field.
- Despite increased attention to computer science education, there are disparities in access. Students of color are less likely to participate in dedicated computing courses than their White peers, regardless of socioeconomic status (Google Inc. & Gallup Inc., 2015; Qazi et al., 2020). Similarly, girls are less likely than boys to study computer science (Google Inc. & Gallup Inc., 2016), and rural students have less access to computing opportunities (Google Inc. & Gallup Inc., 2015).
- Educators play a critical role in students' STEM outcomes. Most computer science teachers in U.S. K-12 schools do not hold a degree in computer science (Leyzberg & Moretti, 2017), which is a hindrance to student learning (Leyzberg & Moretti, 2017). It follows that educators providing computing instruction to students would likely benefit from increased support and professional learning. This might occur through collaborations with post-secondary institutions (e.g., Sanzenbacher, 2013) or other industry experts (e.g., Papini et al., 2017).
- STEM identity, confidence, and competence are intertwined (Carlone & Johnson, 2007; Herrera et al., 2012; Oyserman, 2015; Perez et al, 2014). To enhance these characteristics, both educators and students can benefit from exploration of their STEM interests and engagement with STEM content. STEM programming, which offers intentional STEM experiences, cultivates STEM efficacy.

<sup>2</sup>Onuma, F. J., Rorrer, A. K., Pecsok, M., Tsagaris, M. (2020). *Broadening Participation in Computing in Utah: An Evaluation of the Impact of the Computing Partnerships Grants Program*. Utah Education Policy Center: Salt Lake City, UT.

## Methods

### Evaluation Questions

This mixed-methods evaluation used interviews, surveys, and secondary data sources to answer research and evaluation questions about the outcomes resulting from the Computing Partnerships Grant Program. We structured our research/evaluation questions and findings around four central topics – educators’ experiences and competencies in computing, students’ experiences and outcomes, LEA implementation and adaptations, and external support for program implementation. Table 1 contains a summary of the research/evaluation questions and data sources used to inform our analysis.

**Table 1. Research and Evaluation Questions and Data Sources**

Research and Evaluation Questions		Data Sources					
		Interviews	Surveys	Focus Groups	Document Analysis	Observations	Secondary Data
<ul style="list-style-type: none"> <li>• Educators’ Experiences and Competencies in Computing</li> <li>• What are the observable characteristics (e.g., race/ethnicity, gender, degree attainment) of educators who participated in the Computing Partnerships Grant Program?</li> <li>• How effective are Computing Partnerships Grant activities at increasing educators' computing competence (particularly with aligning curricula with CS standards), confidence, job attitudes/satisfaction, and value of computing?</li> <li>• What factors support and impede educators' computing competence (particularly with aligning curricula with CS standards), confidence, job</li> </ul>	<b>Educators’ Experiences and Competencies in Computing</b>						
							✓
	✓	✓			✓		
		✓	✓		✓		

attitudes/satisfaction, and value of computing?								
---	--	--	--	--	--	--	--	--

<sup>3</sup>The UEPC Student Computing Survey was newly constructed this year to address implementation and outcomes for students. Because this was the first year of administration, a pilot administration was conducted in a single district.

	Data Sources						
<b>Research and Evaluation Questions</b>							
How did educators provide continuity for programming during the COVID-19 pandemic?		✓			✓	✓	
<b>Students' Experiences and Outcomes</b>							
How effective are Computing Partnerships Grant activities at increasing students' computing self-efficacy, interest, engagement, skills (as aligned with Utah's CS standards), computational thinking, awareness of computing career opportunities, and intentions to pursue computing?	✓	✓		✓	✓		
<b>LEA Implementation and Adaptations</b>							
How well were the program elements of the Computing Partnerships Grant implemented and adapted at each LEA to support students' computing self-efficacy, interest, engagement, skills (as aligned with Utah's CS standards), computational thinking, awareness of computing career opportunities, and intentions to pursue computing?		✓			✓		
To what degree has each LEA met its goals and objectives for the Computing Partnerships Grant?		✓				✓	
<b>External Support for Program Implementation</b>							

How effective are <i>post-secondary, industry, and community collaborations</i> at supporting program objective and goal attainment?		✓	✓				
In what ways and to what extent has the STEM AC supported the development and expansion of computing in schools— teacher and school capacity, practice, and scaling up?		✓	✓		✓	✓	

## Data Sources & Analysis

### **UEPC Educator Computing Survey**

Districts and schools participating in the Computing Partnerships Grant Program identified 297 educators to participate in a UEPC Educator Computing Survey. In the spring of the 2020-21 school year, these individuals, who were identified based on their knowledge of and experience with the Computing Partnerships Grant Program, were invited via a direct email to complete the survey. The UEPC Educator Computing Survey contained questions designed to assess the competencies that educators developed as a result of their participation in the program, student outcomes, program implementation, and perceptions of the STEM Action Center.

All survey items were on a five-point scale intended to measure either agreement or perceived competency. For items intended to measure agreement, a scale ranging from “strongly disagree” to “strongly agree” was used, where strongly disagree = 1, disagree = 2, neither agree nor disagree = 3, agree = 4, and strongly agree = 5. For items intended to measure perceived competency, a scale ranging from “not at all competent” to “completely competent” was used, where not at all competent = 1, slightly competent = 2, somewhat competent = 3, quite competent = 4, and completely competent = 5. Within each of the topics included in the survey, we calculated average responses on a five-point scale. In the case of items measuring agreement, we also calculated the proportion of responses that were either “agree” or “strongly agree.”

The majority of survey items were asked of all participants. A subset of items, however, was tailored to specific grant activities. Each of the 17 Computing Partnerships projects participated in two to six of seven possible grant activities.<sup>4</sup> As such, educators were only presented with items pertaining to the grant activities that their projects were involved with. For example, if a project engaged in Out-of-Classroom Experiences, Near-Peer Mentorship, and Work-Based Experiences, educators affiliated with that project only responded to survey items related to those activities. Competencies associated with each grant activity were assessed through three to five survey items, and the number of respondents for each bank of items ranged from 45 to 116.

The specific content of the UEPC Educator Computing Survey is presented in more depth in our presentation of findings. Analysis of these items included the generation and interpretation of descriptive summary statistics to identify common trends in responses across topics. In the case of three open response survey items asking respondents to provide additional context about their experiences, we used open coding to categorize responses, then further identified common themes across responses. Quotes are used to provide examples that further elucidate these themes.

We received 174 responses, representing a 59% response rate. Through de-identified *Comprehensive Administration of Credentials for Teachers in Utah Schools* (CACTUS) records, which are described in more detail below, we generated a summary of participants’ observable characteristics in our presentation

of findings in response to our first research question. Of the 174 individuals who participated in the educator survey, CACTUS data records were available for 124. Of the remaining 50 individuals, 33 did not have a CACTUS ID and 17 did not appear in CACTUS records. Because some educators participating in the Computing Partnerships Grant Program are unlicensed educators (e.g., afterschool program

<sup>4</sup>The seven Computing Partnerships Grant Program activities were: Innovation & Makerspaces, Out-of-Classroom Experiences, Integration of Out-of-Classroom Experiences and Classroom Instruction, Near-Peer Mentorship, Work-Based Learning Experiences, Professional Learning for Teachers and Staff, and Post-Secondary, Industry, and Community Collaborations.

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providers, paraprofessionals), they did not appear in CACTUS data records. In other cases, districts/schools may have provided incorrect IDs that did not match with USBE records. Survey responses provided by those without CACTUS IDs were included in our analyses, with the exception of our description of educators' observable characteristics, as this description relied upon CACTUS data.

### ***UEPC Student Computing Survey***

A UEPC Student Computing Survey was piloted in a single district during the 2020-21 school year. This survey intended to measure students' computing self-efficacy/self-confidence, computing interest, computing engagement, computational thinking (including abstraction, algorithmic thinking, decomposition, pattern recognition, and evaluation), and computing identity (including recognition, interest, performance/competence, and goal/outcome expectation). Each of these constructs was measured using anywhere from two to 12 survey items. All survey items were on a five-point scale ranging from "strongly disagree" to "strongly agree." Within each of the topics included in the survey, we calculated the average response where strongly disagree = 1, disagree = 2, neither agree nor disagree = 3, agree = 4, and strongly agree = 5. We also calculated the proportion of responses that were either "agree" or "strongly agree." Further interpretation is provided in our presentation of findings. Only nine responses from middle school and high school students in one district's summer program occurred. In the 2021-22 school year, the UEPC will offer this survey to all students who are part of Computing Partnerships programming. Future analyses of the UEPC Student Computing Survey will include factor analysis to further refine the instrument.

### ***UEPC Grantee Survey***

Grantees from each of the 17 Computing Partnerships programs participated in a fall and spring UEPC Grantee Survey. This questionnaire collected information from grantees about the numbers of participating students and educators, progress on program objectives, and feedback about their work with the STEM Action Center. The UEPC provided these results to the STEM Action Center in an interactive data dashboard to allow STEM Action Center personnel to view program results in an accessible format. Grantees were also provided with access to their own individual responses along with aggregated responses for all programs. While the electronic dashboard is the primary format for these data, this evaluation report provides a synthesis of select data from the UEPC Grantee Survey. Specifically, we summarize progress on grant objectives, barriers related to progress, and feedback about the STEM Action Center. These data are analyzed through the calculation of summary statistics and through open coding of open-response survey items to identify common themes and example quotes.

### ***Interviews***

Interviews were planned with a STEM Action Center representative, STEM Action Center partners, and educators. The purpose of these interviews was to gain a deeper and more nuanced understanding of how the Computing Partnership Grant Program was implemented from the perspective of those in the field. A semi-structured interview protocol was developed to gather information about participants' experiences with implementation as well as suggestions for improving the grant program and for future planning. Respondents to the UEPC Educator Computing Survey were asked if they would be interested in participating in an interview. Of the survey respondents, 22 participants indicated an initial willingness to

participate in a follow-up interview. Two educators responded to the invitation to voluntarily participate in an interview and completed consent forms prior to the interview. In addition, the UEPC was able to interview one representative from the STEM Action Center. Grantees were asked to identify partners they worked with this year. Of those identified, 17 Computing partners were invited to participate in interviews. Five responded to the invitation to voluntarily participate in follow-up interviews. Interviews

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ranged from approximately 45 minutes to one hour. All interviews were conducted virtually via Zoom, and each was recorded and transcribed for analysis.

Analysis of interviews included the use of both open-coding and focused-coding based on the evaluation questions to generate themes (Saldaña, 2016). Due to the small interview participant sample size, we have integrated example interview quotes throughout this evaluation report, rather than presenting a standalone analysis of interview findings.

### ***Secondary Data***

The UEPC used CACTUS data, as permitted through the UEPC DSA with USBE, along with publicly available school data, to generate summary characteristics of Computing Partnerships Grant Program participants and sites. All characteristics were analyzed and presented in an aggregated format to protect the privacy of participants. These data allowed us to identify any differences in experiences with the program by educator characteristic or school setting.

## **Educators' Experiences and Competencies in Computing**

In *Educators Experiences and Competencies in Computing*, we present our findings for one research question and three evaluation questions pertaining to Computing Partnerships educators. Specifically, we discuss the observable characteristics of participating educators, educators' outcomes and the factors that supported or impeded those outcomes, and the extent to which educators provided continuity during the COVID-19 pandemic. To address these topics, we considered a variety of data sources, including CACTUS records, survey data, and interview data. Specific data sources are discussed in more detail in our presentation of findings. Findings are organized by research/evaluation question.

### **Educators' observable characteristics largely mirror those of Utah educators as whole**

Computing Partnerships educators' observable characteristics generally mirror those of Utah as a whole. As shown in Table 2, individuals who participated in the UEPC Educator Computing Survey were primarily female (77%) and White (93%). Statewide, educators were primarily

female (67%) and White (90%). About half of participants held a bachelor's degree, while the remaining either held an advanced degree (38%) or their educational attainment was unavailable in CACTUS records (11%). Educational attainment was similar, with approximately half of educators statewide holding graduating degrees. Most

participants held regular teaching licenses, and experience levels varied. Computing Partnerships educators were, however, less likely to hold regular teaching licenses (76% vs. 90%), which is likely due to the fact that Computing Partnerships educators often serve in positions

**race/ethnicity, gender, degree attainment) of educators who participated in the Computing Partnerships Grant Program?**

**What are the observable characteristics (e.g.,**

outside of a traditional classroom setting (e.g., out-of-classroom programming). Computing Partnerships educators were more likely to have more than five years of classroom experience. As a reminder, these observable characteristics reflect participating educators with CACTUS IDs. Educators without CACTUS IDs are not reflected in this description of observable characteristics. They are, however, reflected throughout the remainder of this report as we address our remaining evaluation questions.

**Table 2. Observable Characteristics of Computing Partnerships Educators and All Utah Educators**

All Utah Educators	Gender Participant Characteristic	CP Educators with CACTUS IDs
--------------------	-----------------------------------	------------------------------

Female 77%	67%	Male 23%	33%	Race/Ethnicity
White 93%	90%	Other racial ethnic group or unknown*	7%	10%
Educational Attainment				
Bachelor's degree 51%	53%	Master's degree or higher 38%	43%	Other 11%
4%	License Type			
Regular classroom level educator 76%	90%	LEA level educator 9%	3%	
Underqualified** or unknown 15%	7%	Teaching Experience		
Five or fewer years 43%	53%	Six to ten years 18%	13%	More than ten years 20%
17%	Unknown 19%	17%		

**\*To protect the identities of participants, groups of participants fewer than 10 individuals were aggregated together. \*\*Underqualified is a term provided by USBE to describe individuals with one of the following licensure types: student, para, ARL, temporary license, C, or no license.**

Educators reported positive outcomes as a result of their participation in the program

**Educators reported high levels of competency in their ability to seek ways to improve their professional practice**

**How effective are Computing Partnerships Grant activities at increasing educators' computing competence (particularly with aligning curricula with CS standards), confidence, job attitudes/satisfaction, and value of computing?**

As part of the UEPC Educator Computing Survey, all respondents were asked to rate their competence in three areas:

- Seeking ways to improve their professional practice
- Computing/technological competence and practices
- Promoting diversity through inclusive practices

Participants responded to four to seven items in each area, as noted in Table 3. For each item, participants rated their competency by selecting one of five options: “not at all competent,” “slightly competent,” “somewhat competent,” “quite competent,” or “completely competent.” We calculated the percentage of responses that were either “quite competent” or “completely competent” in each area and refer to these responses collectively as “Highly Competent.” For example, 88% of responses pertaining to professional learning were rated as either “quite competent” or “completely competent,” whereas in the other two competency areas, computing/technological integration and promoting diversity through inclusive practices, “Highly Competent” rates were lower at 69% and 61%, respectively.

**Table 3. Educators' Self-Reported Competencies**

<u>Competency Area</u>	<u>Number of Items</u>	<u>Sample Item</u>	<u>Learn Percentage Highly Competent</u>
Seeking Ways to Improve of Survey	5	<ul style="list-style-type: none"> <li>• <b>I am willing to share teaching problems with others.</b></li> <li>• <b>As an educator, I know how to</b></li> </ul>	Professional Practice 5

Computing/Technological	<p><b>others.</b></p> <ul style="list-style-type: none"> <li>• <b>I am open to modifying my pedagogical practices as needed to integrate technology.</b></li> </ul>	<p><b>diversity through the behaviors I exhibit.</b></p>
Competence and Practices <sup>7</sup>	<ul style="list-style-type: none"> <li>• <b>I can adapt the use of technologies to different teaching activities.</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>I examine the instructional materials I use for racial and ethnic bias.</b></li> <li>• <b>I have a clear understanding of culturally responsive pedagogy.</b></li> </ul>
Promoting Diversity through Inclusive Practices <sup>4</sup>	<p><b>to improve my teaching.</b></p> <ul style="list-style-type: none"> <li>• <b>I have knowledge on how to cooperate with</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>I can select appropriate computing applications to enhance student learning.</b></li> <li>• <b>I often promote</b></li> </ul>
		88% 69% 61%

\*Highly Competent = Proportion of responses that were either rated as “Quite Competent” and “Completely Competent.”

Open-ended survey responses and interview data provided additional insights about the ways in which educators believed that their participation in Computing Partnerships programming impacted their computing and technological competence and practices. This included reflecting on how their professional practice changed over the course of the year. Reflecting the survey data, educators addressed the ways in which they sought to improve their professional practice—specifically in the areas of computing and technological practices. Educators did not provide interview or open-ended survey responses about promoting diversity through inclusive practices.

Educators described a variety of professional learning experiences that improved their professional practices, particularly with computing and technology. This professional learning included out-of-school professional learning (e.g., classes they took over the summer or outside of the traditional workday), work-based learning (e.g., learning through apprenticeships, internships), and collaboration/mentorship (e.g., learning together and/or from someone perceived to have more skills in that area of learning). Educators also expressed a belief that additional professional learning would continue to increase their skills. A common theme was that professional learning was the precursor to classroom practice; professional learning gave educators the knowledge and experiences that they needed to engage with computing and technology in their instructional practice.

Educators often described their computing and technological competencies as in-progress. Interviewees believed that they improved over the year but still had more to learn. Moreover, educators often described the importance of collaboration with other educators as important to their ability to gain new competencies. Quotations in Table 4 have been organized into the two most-discussed competency area categories, Seeking Ways to Improve Professional Practice and Computing/Technical Competence and Practice. There is notable overlap between the categories. The dotted lines in the table represent the intersections between how educators worked to improve their professional practice and how developing computing and technological practices was at the heart of many of those professional learning experiences.

***Table 4. Educators' Experiences with Seeking Ways to Improve Professional Practice and Computing/Technological Competence and Practice***

Competencies	Example quotations
Seeking Ways to Improve Professional Practice	Professional

**I liked it when we took a summer week to learn to use CODE. I could use a refresher, and would like to extend that training. (Educator survey)**

**I took a class on the Makey Makey . Then throughout the year we were given other opportunities to come into the Maker Space and tryout anything that we hadn't had a chance to try out before. (Educator interview)**

**Professional learning for teachers and staff has helped me to understand how to use certain applications in the computing space so that I could use them in class and help students in their use of these applications. (Educator survey)**

**[During] work-based learning, I learned different learning platforms from my colleagues. (Educator survey)**

**As a teacher supporting these students- the training is so beneficial and needed to be able to confidently teach, guide, and support them. (Educator survey)**

**Professional learning for teachers and staff was most impactful because it provided training to**

**teachers and staff and instilled confidence in using the [new STEH-related] equipment. (Educator survey)**

**I think it takes a lot of time [to gain new competencies] and if you're starting at base zero...the first level of everything, you're working slowly through learning things and getting tips and tricks along the way. Somebody who has tried it, who is not starting at zero, can give you a lift and boost you up. (Educator interview)**

**I was working as a group to be trained on using our STEH resources. From there we were introduced to the computing standards and then asked to write and try lessons that will have students begin to use these concepts. (Educator survey)**

**Professional learning for teachers and staff...allowed me to learn how to use different technology tools and collaborate with other STEH teachers so I could incorporate [new technologies] into our curriculum. (Educator survey)**

## **Skills related to collaborations with community partners were an area of strength for educators**

As part of the UEPC Educator Computing Survey, respondents were asked to assess their skills related to particular grant activities. The Computing Partnerships Grant Program focused on seven key grant activities:

- Innovation and Makerspaces
- Out-of-Classroom Experiences
- Integration of Out-of-Classroom Experiences with Classroom Instruction
- Near-Peer Mentorship
- Work-Based Experiences
- Professional Learning (for Educators)
- Collaborations with Community Partners

Each grant program engaged in three to six of these seven activities (Table 5). Survey participants were asked to rate their competency in activities specific to the project they were involved with. For example, educators from CUES were only prompted to answer items about Innovation and Makerspaces, Professional Learning, and Collaborations.

While educators rated their own competencies for five of these seven grant activities—Innovation & Makerspaces, Out-of-Classroom Experiences, Integration of Out-of-Classroom Experiences with Classroom Instruction, Professional Learning, and Collaborations with Community Partners—the remaining two activities, Near-Peer Mentorship and Work-Based Experiences, were assessed from the perspective students. Due to the nature of these activities, educators were asked to reflect their students’ competencies rather than their own. While items related to Near-Peer Mentorship and Work-Based Experiences focus on students’ experiences, we include them here to allow the reader to look across grant activities more easily.

Figure 1 provides a summary of educators’ own competencies across five of seven grant activities, and Figure 2 contains educators’ perceptions of students’ competencies across the remaining two grant activities. The light blue bars illustrate the distribution of responses, ranging from “not at all competent” (1) to “completely competent” (5). The dark blue line indicated the mean response within each grant activity. For example, educators participating in Innovation and Makerspaces most commonly indicated that they were “quite competent,” and the average response in this bank of items was 3.6, falling between “somewhat competent” (3) and “quite competent” (4).

Looking across grant activities, the greatest level of competency was in the area of *Collaborations*, with a mean response of 4.0. This suggests that educators felt confident in their abilities to collaborate with community partners around computing activities. In contrast, Near-Peer Mentorship was associated with the lowest levels of self-reported competency. The average response in this area was 3.3, or just above “somewhat competent.” As noted above, we remind the reader that educators responding to items about Near-Peer Mentorship were asked to rate students’ competencies rather than their own due to the nature of the grant activity. Despite this variation, educators generally reported strong levels of competency across grant activities, with all activities falling somewhere between “somewhat competent” and “quite competent” on average.

**Table 5. Grant Activities by LER and Project**

Innovation and Out-of-classroom Integration of out-of classroom experiences and Near-peer Work-based learning Professional learning for teachers and Post-secondary, industry, and community District Project  
 The Portable Universe of makerspaces experiences classroom instruction mentorship experiences staff collaborations

Science, STEM and Coding X X X ✓  
 CUES  
 Computing, Computing

Computer Science  
 Duchesne District

Entheos Academy/  
 Experience for Underserved Students in Duchesne County Elementary Schools

Computing Expeditions  
 X ✓ X ✓ X ✓

Pacific  
 Heritage Academy Granite District (Kearns)  
 Consortium X ✓ X ✓ X X ✓ X ✓ Coding in Kearns X X ✓ ✓ X X ✓

Iron District Code2Create Partnership  
 Grant X ✓ X ✓ X ✓ ✓ X ✓  
 Jordan  
 District

Juab District  
 Building a Computing  
 Culture X ✓ X ✓ ✓ X Expanding Computational  
 Thinking in Juab SD X X ✓ Expanding a Computer

Kane District Murray  
 Science Pathway for Students in Kane County School District  
 X ✓ X ✓ X X

District Murray PowerPlay X X ✓ X ✓ ✓  
Pinnacle

Academy Pinnacle Designs X X ✓ X ✓ X ✓ ✓  
Canyon

Code to Success,  
Elementary Coding,

San Juan District  
Computer Science  
Professional Development for Teachers, and Mobile Makerspace  
X X X18 | Page

**District Project**

Work-Based Learning  
Internships and  
Certifications in 6 Rural  
**Innovation and  
makerspaces  
Out-of  
classroom experiences  
Integration of out-of classroom  
experiences and classroom instruction  
Near-peer mentorship  
Work-based learning experiences**

X ✓  
**Professional learning for teachers and staff  
Post-secondary, industry, and community  
collaborations**

SEDC  
South  
Sanpete  
District

Washington District  
Utah Districts

Space/STEM Room) X X X  
COVE 21 (Maker

Hurricane Cone Site  
Science X ✓ X X X  
Pipeline for Computer

Establishing a Computer  
Washington District  
(Hildale)  
Weber  
Science Pathway for  
Underserved Students in Hildale, Utah  
CS Outreach and Retention  
X ✓ ✓ X

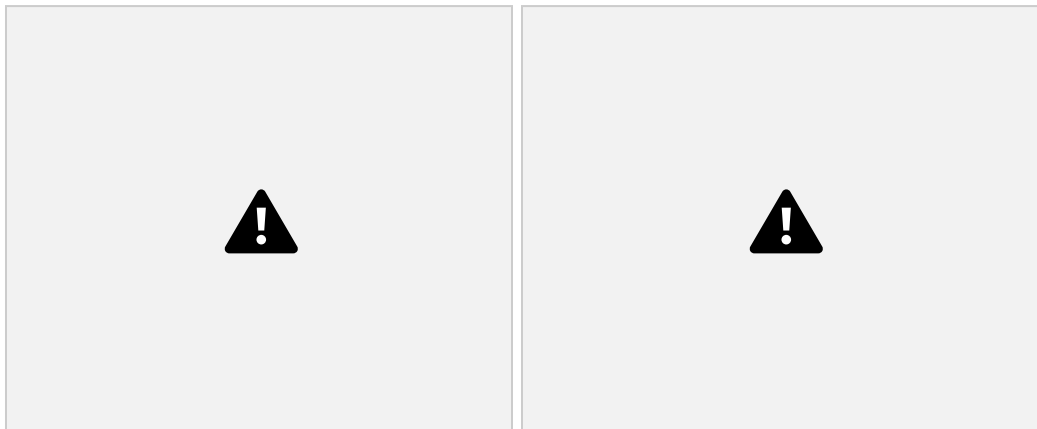
District  
Weilenmann School of  
Learning

Plan X ✓ ✓ X ✓ Makerspaces X ✓ ✓ ✓ ✓ X X Project-Based Learning

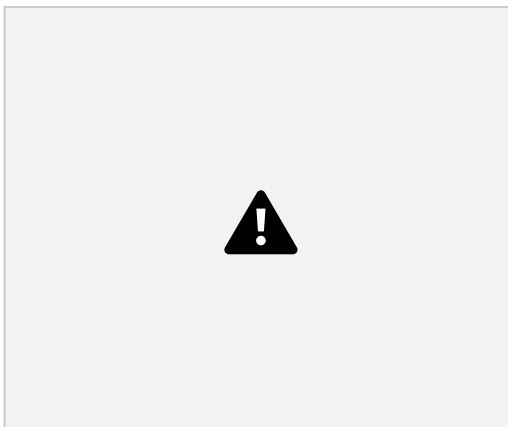
Note: ✓ = noted by grantees, X = noted by STEM Action Center

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### **Figure 1. Educators' Competencies Specific to Grant Activities**



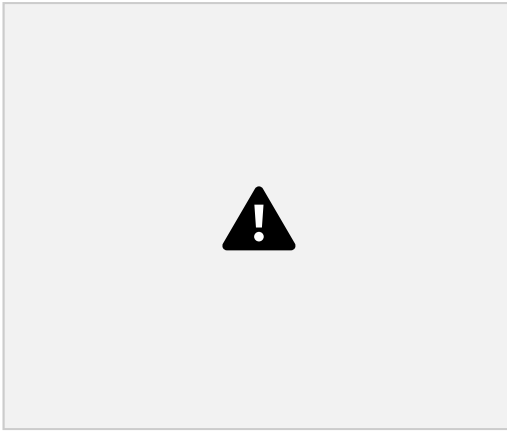
**Sample survey item: Design questions to scaffold students in the making process**



**Sample survey item: Align curriculum and activities between out-of-classroom and in-classroom experiences**

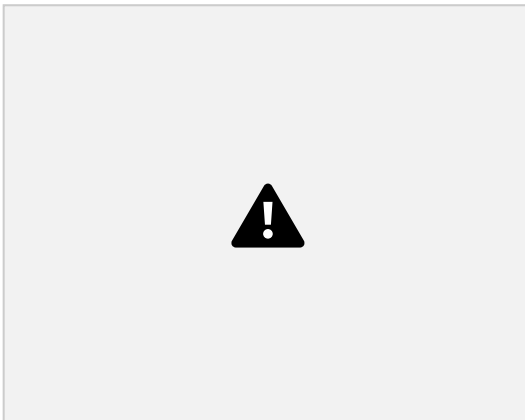
Note: Educators were only invited to respond to items pertaining to grant activities that their programs were involved with, as noted in Table 5. As such, data represented in Figures 1 and 2 represent subsets of the full group of survey participants.

**Sample survey item: Use appropriate techniques and equipment.**

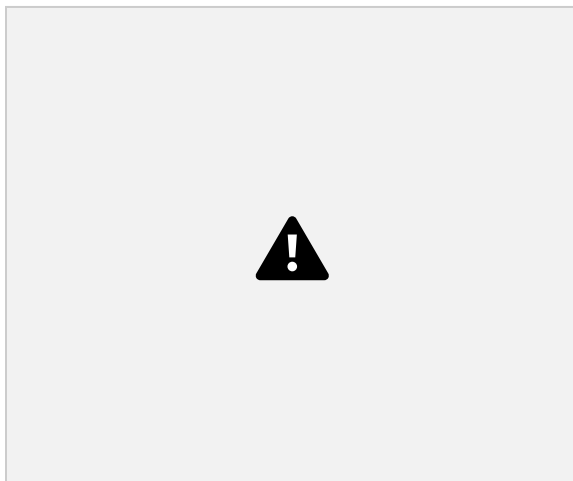


**Sample survey item: Identify who to contact if I have questions about our shared work to support student success in computing**

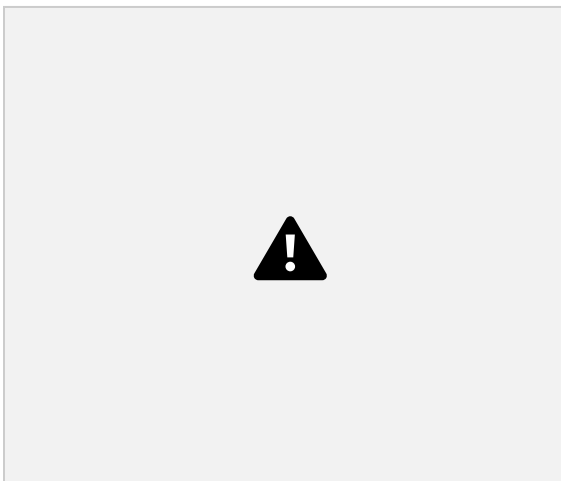
**Sample survey item: Integrate computing and computational thinking into other subjects**



**Figure 2. Students' Competencies Specific to Grant Activities**



**Sample survey item: Demonstrate leadership skills through their work with younger students**



**Sample survey item: Apply computing skills in the workplace**

**Educators reported positive beliefs about the value of computing/technology integration**

As part of the UEPC Educator Computing Survey, respondents were asked to rate their level of agreement with statements measuring beliefs about the value of computing/technological integration, confidence with their computing/technological skills, and professional satisfaction. As shown in Table 6, educators responded to five to nine items in each area. Within each outcome area, we calculated the percentage of responses that were either “agree” or “strongly agree” on a five-point scale ranging from “strongly disagree” to “strongly agree.”

Approximately seven in ten responses (71%) were in agreement with statements about their confidence with their computing/technological skills and professional satisfaction. The perceived value of computing/technology integration was greater. In this domain, 85% of responses were either “agree” or “strongly agree.”

**Table 6. UEPC Educator Computing Survey Outcomes**

Outcome Area	Perceived Value	Number of Survey Items	Sample Items	Percentage in Agreement
Confidence with	of	6	<ul style="list-style-type: none"> <li>• <b>I know how to get students excited about</b></li> </ul>	71%
Confidence with	of	9	<ul style="list-style-type: none"> <li>• <b>Students learn more easily when using technology.</b></li> <li>• <b>Instruction is more effective with technology.</b></li> </ul>	85%
Confidence with	of	6	<ul style="list-style-type: none"> <li>• <b>I know how to get students excited about</b></li> </ul>	71%
Confidence with	of	5	<ul style="list-style-type: none"> <li>• <b>Properly</b></li> </ul>	71%

**computing.** 71%

Professional Satisfaction 5

**• I usually welcome students' questions about computing**

**concepts.**

**• I am willing to be observed by a teacher leader while teaching computing concepts.**

**• My present conditions as an educator are excellent.**

**• I am satisfied with being an**

**educator. • If I could choose my career over, I would change almost nothing.**

71%

Open-ended survey responses and interview data augment educators' higher rates of agreement with survey items measuring the value of computing/technology integration and lower rates of agreement with survey items measuring confidence with computing/technological skills and professional satisfaction. Summarized in Table 7, examples of these responses suggest that educators and/or their colleagues may have rated their confidence with computing/technological skills in part due to comparing their technology skills to students perceived to have more advanced computing skills than they did at times. Educators also described enjoying their peers' support as they collaborated and planned. The following quotations provide more insight into participants' experiences:

**Table 7. Examples of educators' experiences related to valuing of computing/technological integration, confidence with computing and technological skills, and professional satisfaction**

**Outcome Areas Example Comments**

Perceived Value of Computing/Technology Integration

**Integration of technology into the science classroom instruction has helped me provide better instruction for students. (Educator survey)**

**I think one of the most valuable things is having that access to the technology and having different ways of being able to get the kids to do similar tasks. So, "Can we build something on the 3-D printer? Can we build it conceptually? Can we print it? Can we also do**

Computing and Technological Skills Confidence

**the same thing out of a LEGO?" And to be able to use those different disciplines with the kids has really helped. And to be able to use the things that we have from this grant to build excitement. (Educator interview)**

**The biggest challenge was teaching 26 classes and having the equipment work the same each time a new classroom of students would use it. If there are resources available to replace equipment or provide software upgrades or enhancements to have full performance and**

**capabilities so each student will have the full opportunity and experience available to them every time. (Educator survey)**

**Our after school program has given me confidence to integrate computer coding in my classroom, and has helped me to develop relationships with students in other grades. (Educatorsurvey)**

**Our staff trainer has been great; however, I would love to have more hands on training to build my confidence on using the space. (Educator survey)**

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**(Educator survey)**

**We have had a lot of fun learning how to use robots and all of the things that they can do. (Educator survey)**

Professional Satisfaction

**I would like more training on the coding end of it...to be able to be more confident in that basic coding for students who probably can code better and faster than us, that would be really helpful to me to have more of a working knowledge, so I'm not just staying one step ahead of six-year-olds. (Educator interview)**

**The continued professional development and being able to work together with the other schools in our district have been a great asset. I would like to see that continue.**

**We have two first-grade teachers this year, and we each teamed up with a third-grade teacher to help us... So it's been really fun having that near-peer interaction with the kids, especially as the year went on and [student near peers] could spend more time together. So [our first and third grade teaching team] had collaboration with each other in our planning, and then that collaboration with our [student-to-student] near-peers. So that was fun. And then to have the perspective of an**

**older-grade-level teacher going, "Here's what we've done and how**

**we've done it," has really been successful also. (Educator interview)**

**Educators named learning opportunities and collaboration as supports, while challenges pertained to the availability of developmentally appropriate materials, time, and COVID-19**

**What factors support and impede educators' computing competence (particularly with aligning curricula with CS standards), confidence, job attitudes/satisfac**

**tion, and value of computing?**

Drawing on open-ended survey data from the UEPC Educator Computing Survey and educator interviews, as well as the UEPC Grantee Survey, we sought to understand the factors that supported and impeded educators in integrating technology and computing into the curriculum. Overall, we found that training opportunities and collaboration with other educators were primary sources of support. The factors that impeded educators' competence, confidence, and value of computing in the 2020-21 school year centered around the limited availability of

developmentally appropriate activities, lack of time, and challenges related to the COVID-19 pandemic. The following sections provide more detail about each of these factors and examples of supporting data from educators and grantees.

## **Supporting Factors**

### **Support, Training, and Learning Opportunities**

Support, training, and learning opportunities were described collectively as an important factor in educators' ability to integrate technology and computing into the curriculum. Specifically, they discussed the value of understanding the available materials, learning how to use them in the classroom, and receiving ongoing support through training sessions and guidance from leadership. While most comments about available training and learning opportunities were positive, to capture the range of responses, we note that a few participants expressed negative feedback (e.g., "The training was long, boring, and not very effective...[it] was echoed throughout my school as a horrible waste of time...").

- **Before implementing the technology it is vital that I understand what materials are available and have a few ideas of how they can be used. (Educator survey)**
- **Because I was new to STEM having additional support and training made all the difference for me being able to take this into the classroom. (Educator survey)**

- **Having the monthly trainings and ongoing support from [a district leader] was very helpful. (Educator survey)**
- **As a teacher supporting these students- the training is so beneficial and needed to be able to confidently teach, guide, and support them. (Educator survey)**
- **Additional training and support from the grant managers would be very helpful - especially if they can provide specialists or experts from the community to support our work. (Educator survey)**
- **Continue to provide efficient ways to teach Computer Science, training, and support. (Educator survey)**
- **It would be really helpful if there was a list of good trainings to attend or a way to find out what training are being offered. Often times a training are announced a few days in advance without time to make it. (Educator survey)**

#### Collaboration with Other Educators

Collaboration was highly valued by educators and supported the development of individual competence. Although some educators noted that the pandemic was an added challenge for educator-to-educator collaboration, they also described how collaborative support added to their ability to gain knowledge and experience. Participants discussed how some of the factors that initially impeded them at the beginning of the project became less challenging as their own comfort and skill levels increased over the course of the year.

- **Honestly, I would not have been able to learn as much, I would not have been to do as much with my students if I did not have that collaborative support [from my teaching team]. (Educator interview)**
- **I learned different learning platforms from my colleagues. (Educator survey)**

- **Having somebody to work with who asked different questions, having somebody to work with who started from a different spot and who understood more [than me] really did pave the way for me to be more successful and provide different opportunities for my students. (Educator interview)**

**■ For me, near-peer mentorship ended up being the most impactful aspect for my first year of teaching. It was a great balance of being mentored and closely guided while also being given independence in planning and solidifying our project-based learning activities. (Educator survey)**

### **Impeding Factors**

#### Availability of Developmentally Appropriate Activities and Resources

In response to an open-ended question about the challenges they faced during the grant program, some educators shared that program curricula, activities, and resources were not developmentally appropriate or relevant for the students they taught. Several respondents specifically attributed this challenge to their students' age/grade level, while others spoke more generally about issues related to amount and pacing of content in relation to their students' abilities.

- Finding curriculum that was age level appropriate for my 1st grade class[was a challenge]. They loved every single lesson, but a lot of the lessons were so jam packed that it went over their heads. (Educator survey)**
- Most often, the activities were not developmentally appropriate for young children. (Educator survey)**
- Material has been too challenging and complicated for the students I am in charge of. Too much was expected of them in a single day, it would have been better if they had received instructions one time and completed the task the next week. (Educator survey)**
- It was not geared to Pre-K, so many of these items do not apply to my students. We did not even touch computers in the school this year. (Educator survey)**

#### Time

Another challenge that educators frequently named was lack of time as a barrier to their successful implementation of program activities. Respondents discussed the difficulties of balancing grant requirements with their teaching responsibilities, and shared feeling that they needed more time to effectively utilize resources like computers and makerspace tools.

- Finding time to meet grant requirements in addition to my regular teaching responsibilities[was a challenge]. There just isn't enough time in a teacher's day to do all that's expected. (Educator survey)**
- I would say the biggest challenge was how short each grade level's window was to use the maker space. I don't feel like 4 total days for a class**

**was enough time. (Educator survey)**

■ **[We need] more time to have students use computers in an investigative way. (Educator survey)**

■ **Finding the time and energy to follow the requirements of the grant in the midst of all the other challenges of teaching students in a hybrid world of in-person and virtual learning. It's just a time-**

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**consuming and labor-intensive work that decreases time and bandwidth for other aspects of the classroom. (Educator survey)**

#### COVID-19

The COVID-19 pandemic was also cited as a factor that impeded educators' competence and ability to integrate technology through grant activities. Examples provided by educators reflected the effects of the switch to virtual teaching and learning, specifically noting the ways in which quarantining and social distancing impacted their ability to use resources and implement hands-on, collaborative activities.

■ **COVID-19 has been an obstacle to our program. It has made it difficult for many of our students to meet the attendance goals for our grant due to mandatory quarantining. Our COVID guidelines also made it difficult to work together as well as we have been able to do in past years. (Educator survey)**

■ **The biggest challenge has been utilizing all of the resources during a pandemic. For a while we weren't able to have our students come into STEM since it was an outside of school activity. I look forward to a return to normal next year. (Educator survey)**

■ **This has been a strange year for implementing a hands-on learning lab such as a maker space with many unknowns early in the year [about] how equipment can be used and shared in a COVID friendly manner...I have also struggled in [thinking about] how to provide similar experiences to students who were participating in remote learning. (Educator survey)**

■ **The biggest challenge has been all of the COVID protocols. Because so much what we did in this program was hands on and working together we had to adjust a little. Lucky for my school I had great support to make sure it was still successful. (Educator survey)**

Several of the unexpected COVID-related barriers that educators discussed—such as inconsistent student participation and significant changes to program activities—aligned with grantees’ perceptions of program implementation in the 2020-21 school year. As part of the UEPC Grantee Survey, grantees were asked to describe progress (or lack of progress) made and challenges experienced with grant activities. As illustrated in Figure 3, the most common challenge indicated by grantees was postponement of programs (82%), followed by program cancellation (65%) and unanticipated need to restructure (59%). Several individuals provided write-in “other” responses, noting issues such as scheduling, social distancing, and sick students.

**Figure 3. Challenges to Implementing Grant Activities (Spring UEPC Grantee Survey Responses)**

Postponement of programs	82%
Cancelation of programs	65%
Unanticipated need to restructure programs or program materials	59%
Shortage of staff	47%
Decline in student participation	41%
Other	35%

## Participants described problem-solving and adapting to address COVID related challenges, including shifts to virtual formats and navigating issues related to space and social distancing

### ***How did educators provide continuity for programming during the COVID-19 pandemic?***

Informed by interview and open-ended survey data from grantees, these impacts varied across projects. For example, some project activities were postponed, or the work continued behind the scenes. Although the COVID-19 pandemic brought on a range of unexpected challenges, many grantees, educators, and partners described efforts to engage in problem solving so that program implementation could continue, albeit often in a restructured or adapted manner. Common adaptations included limiting the number of student participants at any given time and/or reducing the number of student participants who could utilize the materials at the same time due to social distance requirements (e.g., taking half the class into the Makerspace classroom rather than the entire class.). Some grantees described efforts to maintain community partnerships and engage in strategic planning to support current and future program implementation.

The following quotations provide examples of some of the solutions to pandemic related challenges:

■ **Masks and limited groups were an improvement from closed school status, but this limited our enrollment to 28 students. (Educator survey)**

■ **Southern Utah Girls in Technology (SUGIT) activities included a one-day hands-on STEM workshop for high school**

**girls from Utah. Due to COVID-19, the SUGIT 2020 and 2021 in summer was hosted virtually on Google Classroom. Due to the success of virtual SUGIT, the 2022 SUGIT's activities will**

“Our students had some quarantine periods, but we blazed on.”

(Educator survey)

**include: one day campus conference (if the COVID-19 circumstances permit); a two-week virtual platform with technology workshops, videos, certificates, and networking opportunities; and post event(s) of SUGIT for educators and students. (Partner interview)**

■ **There were a lot of COVID adaptations. For example, we couldn't bring our entire class into the Maker Space [room]. It's just not big enough to support that type of social distancing. That was something that I don't think we knew in the beginning and so we had to adapt how to get our children to the Maker Space safely... we did have to change our plans in the beginning. I think that we just thought we would bring our whole class to the Maker Space. (Educator interview)**

■ **Largely inspired by the environment created by the pandemic, this last year, we've created a lot of virtual and mobile learning platforms so, we now have a simulator that we can bring into**

**classrooms. So, we will come with consoles and a portable capsule, and we can convert any classroom into a space station simulator, and we can do that anywhere in the state. (Partner interview)**

■ **Even though Covid created some challenges, we were able to continue to work with our community partners. We are excited to continue to work with them and work towards adding additional partners in the future. (Spring Grantee Survey)**

■ **The capacity of leadership at the junior high and**

**elementary schools was limited due to the pressures of a unique school year. However, a leadership team was created and staging was completed to map out what activities could take place in the makerspaces and materials and supplies were purchased. The plan is now to identify which elementary schools and junior high will have the capacity to take the lead. For the opportunities for elementary students to have access to computer science standards, everything is set into motion for this to happen beginning in the 2021- 22 school year. Materials and programs have been purchased and personnel has been hired and will be trained during June 2021! We are well on our way! (Spring Grantee Survey)**

## **Students' Experiences and**

**Outcomes** In *Students' Experiences and Outcomes*, we evaluate

the Computing Partnerships Grant Program's impact on student outcomes. To do so, we focus on a single

evaluation question to identify the impact the program had on measures such as student self efficacy/confidence, interest, engagement, computational thinking, and computing identity. To answer this evaluation question, we draw upon interviews and educator survey data. In this section, we also briefly describe our pilot student survey findings. Findings in this section are organized by theme. Overall, we found that the Computing Partnerships Grant Program was associated with numerous positive student outcomes such as computing interest and computing identity.

**How effective are Computing Partnerships Grant activities at increasing students'**

**computing self-efficacy, interest, engagement, skills (as aligned with Utah's CS standards), computational thinking, awareness of computing career opportunities, and intentions to pursue computing?**

**A majority of educators agreed that participation in Computing Partnership activities resulted in positive student outcomes**

Educators of PK-5 students who participated in the UEPC Educator Computing Survey (n=84) were asked to assess their students' outcomes in the areas of self-efficacy/confidence, interest, engagement, computational thinking, and computing identity. Table 8 provides a summary of these measures, including subconstructs for computational thinking and computing identity. The number of survey items used to measure each construct ranged from two to 11 items. Rather than reporting each individual item, we generated a composite measure for each outcome area to understand student outcomes more broadly.

Within each outcome area, we calculated the average response on a five-point scale, where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. Most educators agreed with or were neutral about the statements in each of these domains. For example, the average response to items measuring computing self-efficacy/confidence was 3.8, indicating responses just below "agree" on a five-point scale. Average responses ranged from 3.5 to 3.9, with abstraction and performance and competence on the lower end and computing interest on the higher end.

## Students' Computing

Outcomes	Number of	Average Response (1-5)
<b>Efficacy/Confidence</b>	9	
Computing Self		
<b>Learning about</b>		
Computing Interest	11	
Computing Engagement	12	
Instruction		
Computational Thinking		
Abstraction	3	
Algorithmic Thinking	3	
Decomposition	3	
Pattern Recognition	3	
Evaluation	3	
Computing Identity		
Recognition	4	
Interest	3	
Performance and		
Competence	3	
Goal/Outcome Expectation	2	
Computing		

**My students do not feel nervous computing topics.** 3.8

**My students find materials on computing topics fascinating.** 3.9

**My students listen actively during about computing topics.** 3.6

**My students usually...**

**...think about the relations between different problems.** 3.5

**...try to lay out the steps of a solution.** 3.6

**...think about if it is possible to break apart a problem.** 3.5

**...think about how to apply a solution to other problems.** 3.7

**...try to find the most effective solution for a problem.** 3.7

**My students...**

**...think of themselves as computer-savvy** 3.9

**...are curious about computing topics.** 3.8

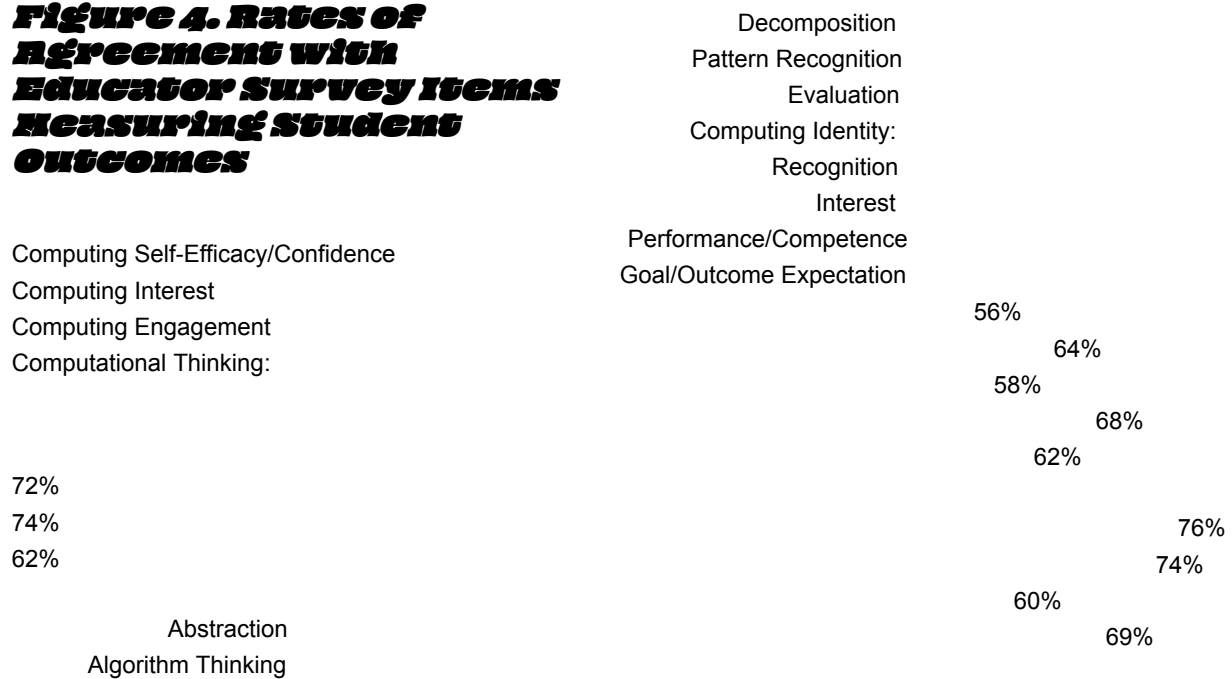
**...help others with software.** 3.5

**...plan to work in a computing job in the future.** 3.7

To provide additional nuance, the values presented in Figure 4 represent educators' perceptions of student outcomes in a slightly different format than Table 8. The values in this figure represent the proportion of responses that were either "agree" or "strongly agree" within each student outcome measure rather than

composite measures on a five-point scale. Rates of agreement ranged from 56% to 76%. The subconstructs within computational thinking (abstraction, algorithmic thinking, decomposition, pattern recognition, and evaluation) had relatively low levels of agreement when compared to other outcomes such as computing interest and computing identity.

**Figure 4. Rates of Agreement with Educator Survey Items Measuring Student Outcomes**



In interviews and open-ended survey data from the UEPC Educator Computing Survey, educators further described how students engaged with the materials and resources provided by the Computing Partnerships Grant Program. Educators noted that most students demonstrated high interest and engagement with Computing Partnership-related materials and resources and often provided examples of how students enjoyed new approaches to learning, such as creating Ozobots or using 3D printers. According to educators, students' interest and engagement in these types of learning activities led to increased skills with the new technology. Interviewees associated computational thinking with the tasks they had created (e.g., cause and effect when writing a program involving a moving object and designing and finding solutions to problems). Although not all educators observed high levels of engagement in their students (e.g., one educator survey response was "Appropriate student use of technology and computing tools was a concern this year. Technology provided as much of a distraction as it was a teaching tool this year"), many educators reported high levels of student engagement and interest. The following sample of quotations are examples of how educators perceived students' experiences:

**■ [The students] can use coding, like with the ozobots. They see [the ozobot] has to go this way and then that way to make the connections. They're actually seeing [cause and effect] through the technology, where they'd maybe have struggled seeing it on a two-dimensional**

**paper before. (Educator interview)**

- **Innovation and makerspaces were impactful because students were able to engage in authentic learning, design thinking, and project-based learning in the maker spaces. (Educator survey)**
  - **We paired [first-grade students] this year with a third-grade buddy to develop their own 3D printing thing. So they had to use that technology with a third-grade buddy... just they loved it. They were so motivated by it and they just caught on so quickly that they were able to design... they just caught on so quickly to utilizing that technology. (Educator interview)**
  - **Students were engaged and motivated to create and integrate [Innovation and Makerspaces] in their daily lives. They were able to explore, design and find solutions to problems. (Educator survey)**
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- **I had a few students participate in the Code Ninjas after school program at my school. They all expressed high engagement and interest in the program, and learned new coding skills that they were excited to use. (Educator survey)**

**Educators most frequently identified Out-of-Classroom Experiences and Innovation & Makerspaces activities as meaningful for students**

Within the UEPC Educator Computing Survey, respondents were asked in an open-ended survey item to identify the one grant activity that was most meaningful for students and to provide an explanation. The educators who responded to this question most often named Out-of-Classroom Experiences (approximately 50% of respondents) and Innovation and Makerspaces (approximately 30% of respondents). It is important to note that these two activities were more common across projects than other activity types (see Table 5), which may have influenced the frequency with which they were identified as meaningful. Given this frequency, our analysis of educators' explanations yielded salient themes for these two activities more so than for other activity types. Below we provide a summary of themes and examples from educators' explanations of the meaningful aspects of Out-of-Classroom Experiences and Innovation & Makerspaces.

**Out-of-Classroom Experiences**

Educators who identified Out-of-Classroom Experiences as most meaningful for their students explained that these activities provided opportunities for student choice (as opposed to required classes), real-world experiences, collaboration with peers in different environments, and confidence-building.

- **The after-school program and clubs impact the students the most because it is often what they are choosing to do instead of required to do.**

**Therefore, they enjoy it more and in turn is more meaningful. (Educator survey)**

- **These kiddos are able to learn and grow in confidence and thinking. Problem solving, collaboration are all natural aspects of working with robotics and these are all skills needed in the real world. (Educator survey)**
- **...the competitions provided students something to work towards and an experience to work with students of other schools in learning to build and code robotics. (Educator survey)**
- **Students are able to interact in multiple environments. (Educator survey)**
- **I think the most impactful thing for our students this year has been the before and after school experiences. Having the chance to come into the school and collaborate and solve problems served as valuable in increased competency with the various programs and also improved confidence among the participants. (Educator survey)**

## **Innovation & Makerspaces**

Educators who identified Innovation & Makerspaces as most meaningful for their students noted that these activities facilitated student engagement, creativity and design, and hands-on learning and tool use.

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- **Innovation and makerspaces has some amazing tools for the children to use. They have many options to work with and it leads to great creativity. There is so much to get out of this room and the resources can be used in a variety of ways to cover many topics. (Educator survey)**
- **The makerspace allows my students the freedom to create, construct, and design. It has boosted their critical thinking skills and creativity. (Educator survey)**
- **Allowing students to have a space of free creative and discovery is where they learn the best. I also find when students have the chance to learn from other students or teach students they are the most engaged. (Educator survey)**
- **Students had the opportunity to explore, and create, having hands-on opportunities to work**

**as a team to develop and see in real life theory to practicability. (Educator survey)**

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## **LEA Implementation and Adaptations**

In *LEA Implementation and Adaptations*, we evaluate the role of LEAs in the implementation and outcomes of the Computing Partnerships Grant Program using interview and survey data, including data from the UEPC Educator Computing Survey and the UEPC Grantee Survey. We address two evaluation questions pertaining to the implementation and adaptation of program elements by LEAs and the degree to which LEAs have met their goals and objectives. Overall, we found that educators had mixed perceptions of program implementation as programming was adapted to fit each unique context. While progress was made on grant objectives, many have not yet been completed.

**Program implementation reflected individual program objectives and varied across project sites**

The implementation of Computing Partnerships projects occurred in a variety of ways based on each unique project and context. The variations across projects – the range of LEAs, different

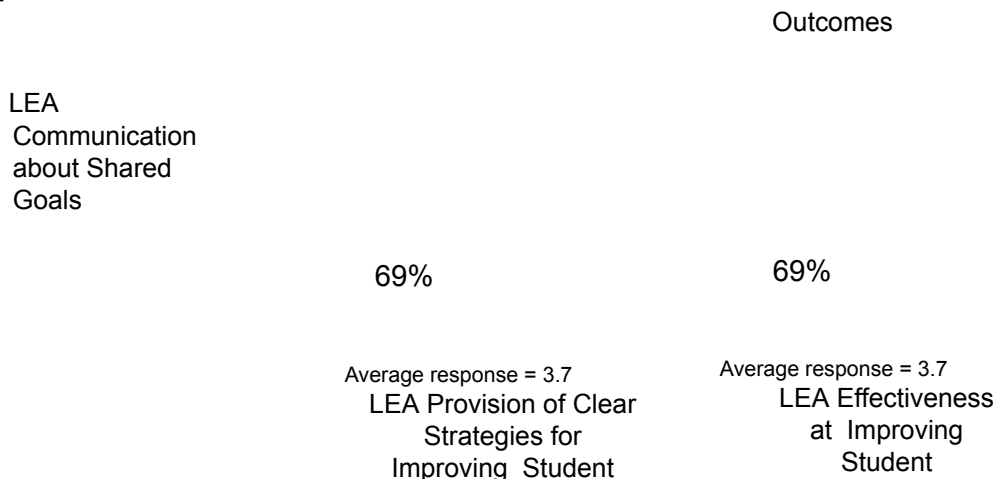
objectives of each project, the unique partnerships, which educators and students were involved, during school versus out of school times – created a wide range of different program implementation approaches.

**How well were the program elements of the Computing Partnerships Grant implemented and adapted at each LEA to support students' computing self**

**efficacy, interest, engagement, skills (as aligned with Utah's CS standards), computational thinking, awareness of computing career opportunities, and intentions to pursue computing?**

To understand implementation across projects, educators were asked to rate their LEAs' program implementation in three areas – communication about shared goals, provision of strategies to improve student outcomes, and effectiveness in improving student outcomes. Within each of these three areas, educators responded to several survey items. By asking multiple items in each of these three areas, we were able to generate composite measures, allowing us to generate a more complete picture of educators' perceptions of program implementation within their LEAs. As shown in Figure 5, educators reported relatively positive perceptions of LEA program implementation. Percentages noted in the figure indicate the proportion of “agree” or “strongly agree” responses to items related to the three topics. Values below each pie chart indicate the average response on a five-point scale, where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. On average, responses fell somewhere between “neither agree nor disagree” (3) and “agree” (4) about LEA Communication and Shared Goals, LEA Provision of Clear Strategies of Improving Student Outcomes, and LEA Effectiveness at Improving Student Outcomes. While agreement that LEAs were effective at improving student outcomes was relatively high (89%), only 69% of respondents agreed with items about LEAs' communication about shared goals and provision of clear strategies for improving student outcomes. Substantial variation in responses was identified across LEAs, with levels of agreement ranging from 0% to 100%.

**Figure 5. Educators' Perceptions of LEA Program Implementation**



89%

Note: Darker shades of green represent the percentage of responses that were either “agree” or “strongly agree.”

Interview data suggest that support from school administration had a positive effect on educators’ perceptions of LEA program implementation. The following interviewee quotations show how involvement from administrators impacted the implementation of two projects:

- ***One principal was just above and beyond. [The principal] would come in and tour the room, have kids show her stuff, ask questions. She was in helping them do all their log-ins at the beginning, so I feel like she really understood what the kids were working towards, and so it was just extra easy to work at that school. (Partner Interview)***
- ***The excitement from the administration contributed to our success.. They encouraged us to break away from where we would normally have been doing things. And this year it's been hard to sit here and go, "Well, we're already breaking away from so many things. We're already doing so much, and now you're giving us another thing to do?" And they were super supportive and encouraging [by saying things like], "This isn't another thing to do. This is how can you use this to be something great, in something that you're already doing." That was a really big part of it. (Educator interview)***

**Although substantial progress was made, many objectives have not yet been completed**

Full results pertaining to LEAs’ progress on grant goals and objectives are available on the electronic data dashboard that has been made available to STEM Action Center personnel and grantees. Here we provide a high-level

***has each LEA met its goals and objectives for the Computing Partnerships Grant?***

***To what degree***

summary of the progress made on grant objectives in the fall and spring of the 2020-21 school year.

As depicted in Figure 6, grantees reported substantial progress on grant objectives between fall and spring of the 2021-21 school year. It is important to note that many of the schools and LEAs engaged in the Computing Partnerships Grant Program were also impacted by shifts in schedules and format due to the COVID-19 pandemic. While only 21% of grant objectives were either “nearly completed” or “completed” earlier in the school year, 43% reached this same status at the end of the school year. Similarly, the percentage of objectives that had either not been started or had achieved no progress decreased from 26% to 17%. This demonstrates substantial progress across LEAs as they work toward their program objectives.

At the same time, however, we note that there is still much work to be done. Despite the marked increase in completed or nearly completed objectives, most have not yet been completed. Our evaluation will continue to monitor progress toward these objectives in the 2021-22 school year, including studying changes that may occur with implementation and related outcomes.

**Figure 6. Reported Progress on Grant Objectives (Fall and Spring Grantee Surveys)**

Fall	Spring				
		5%	40%	18%	25%
		10%	54%	8%	13%

Have not started Started, but no progress Some progress Nearly completed Completed

Interviewees reflected on the extent to which their projects were successful in meeting objectives and goals. To ensure that participants were aware of their projects’ objectives when responding to interview questions, the interviewer provided the project-specific objectives and goals and asked the interviewee about the project’s overall success and challenges related to that objective. In general, interviewees felt their projects had successfully met most project objectives. The quotations in Table 9 illustrate several examples:

**Table 9. Participant Feedback  
about Progress toward Project**

**Objectives** Project Objective Example Quote

Increase equitable access to computing learning and application in the school and within the school community and goal that each student will have scheduled times with their classrooms or small groups to access traditional and technological maker spaces.

**minimum requirement hours in the STEH room. We were able to be creative with that and I worked together with my team so that we could put small groups in the STEH room. So yes, we tried to meet the requirement of the minimum hours in the STEH room and we were very aware of giving [the students] opportunities to use a variety of things in the STEH room.**

Create maker spaces over the course of the award years that will enable students to learn and apply computational knowledge, critical thinking, and authentic application and goal that Professional Development for educators and staff on standards, skills, concepts related to computer science and maker space tools.

**(Educator Interview)**

**The success was a lot higher than I had envisioned, because I initially envisioned that the kids would struggle. And so their success helped drive me to go further. Where the computing standards for first grade is to turn on devices and log in... to see that [these first-grade students were] able to turn on a device, log in, get into a program, and navigate a program all the way to making a 3-D**

Increase the number of opportunities elementary students K-6 have access to the Computer Science Standards by providing before/after school coding clubs and interns teaching alongside mentors.

**I wasn't involved in the [objectives and goals] conversations. So what was handed down to me from our leadership is what we did strive to achieve. So from a teaching perspective we were told we have**

**the success was a lot higher than I had envisioned, because I initially envisioned that the kids would struggle. And so their success helped drive me to go further. Where the computing standards for first grade is to turn on devices and log in... to see that [these first-grade students were] able to turn on a device, log in, get into a program, and navigate a program all the way to making a 3-D**

**print...” {educator goes speechless, shakes her head and raises her hands high in the air} (Educator interview)**

**I think [we] did well [in meeting the grant’s objectives.] By having this much time at each school, we were there for 15 hours, an hour and a half twice a week for five weeks. The kids were able to learn how to use scratch really well, and learn a number of coding fundamentals that if they move into an actual coding language that we have to type and have a syntax, they already know how those things**

**work in a visual way. They’ve had it happen where they’ve built games from a blank screen. So that access worked really well. And the interns worked well. [At] Murray High School we went and talked with their interns and offered them the opportunity to come [intern in the after-school Code Ninjas project] if they wanted. We had four interns that worked with us every week that just really enjoyed it, the teaching side, and they loved the idea of working at Code Ninjas someday. (Partner interview)**

## **External Support for Program Implementation**

In *External Support for Program Implementation*, we examine the role of two types of external support for the grant program, namely the collaborative community partnerships and the STEM Action Center, in supporting the development and expansion of computing in schools. We address two evaluation questions in this findings section, the first pertaining to the effectiveness of partnerships at supporting goal attainment, and the second pertaining to STEM Action Center’s role in building educator and school capacity, practice, and scaling up through the analysis of interview and survey data. Overall, external

**How effective are post secondary, industry, and community collaborations at supporting program objective and goal attainment?**

**In what ways and to what extent has the STEM AC supported the development and expansion of computing in schools—teacher**

**and school capacity, practice, and scaling up?**

**attainment**

Table 10 summarizes partners by organization type. support of the grant program was strong, but some forms of support were more robust than others.

Partnerships with community partners, industry partners, and post-secondary partners played important roles in program objectives and program goal attainment for the projects that elected to engage in external partnerships. Community, industry, and post-secondary education institutions were all represented when looking across all project partners. Of the 17 LEAs who completed the 2021 Spring Grantee Survey (100% response rate), seven projects reported engaging in external partnerships during the 2020-21 school year. Out of those seven projects, six partnered with two or more external organizations.

**Partner collaborations were key to program objective and goal**

**Table 10. Computing Partnerships Grant Program External Partners**

Community Partners	Industry Partners	Post-Secondary Partners
4H	Future InDesign	Southwest Technical
CodeChangers	Guardsight	College University of Utah
Fremont Indian State	Cybersecurity	University of Southern
Park PTO	Metalcraft	Utah Utah State
Utah Afterschool	Northrop Grumman	University
Network Washington	Skill Struck	Utah State University
Libraries	Computer Science	Eastern Utah Valley
Cyberjet	Dixie State University	University Westminster
Facebook	Snow College	College