UTAH STEM ACTION CENTER PROGRAM EVALUATION

Academic Year 2018-19

THE UNIVERSITY OF UTAH
UTAH EDUCATION POLICY CENTER

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Andrea K. Rorrer, Ph.D., Director
Phone: 801-581-4207
andrea.rorrer@utah.edu

Cori Groth, Ph.D., Associate Director
Phone: 801-581-4207
cori.groth@utah.edu

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Vessela Ilieva, Ph.D., Dean
801-863-5183
vessela.ilieva@uvu.edu

Project Staff

Utah Education Policy Center

Andrea Rorrer, Ph.D., Director, College of Education Associate Dean, Department of Education Leadership and Policy, Professor
Stacy Eddings, Ph.D., Assistant Director
Yongmei Ni, Ph.D, Assistant Director, Associate Professor and Chair in Department of Education Leadership and Policy, Professor
Matthew Pecsok, Data Scientist
Robert Owens, Ph.D., Research Associate
Kimberly McCormick, Ph.D., Research Associate
Brody Moore, Research Assistant
Kristen Weissinger, M.S., Research Associate

In association with:

Utah Valley University

Vessela Ilieva, Ph.D., Dean, School of Education, Chair in Department of Education Leadership and Policy, Professor
Suzy Cox, Ph.D., Associate Professor of Secondary Education

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Contents

Addendum to the 2018-19 STEM Action Center Program Evaluation

To be added once 2018-19 SAGE data are available.

Introduction

In 2013, the Utah Legislature passed HB 139, *Science, Technology, Engineering, and Mathematics Action Center*, which established Utah's STEM Action Center (STEM AC). The STEM AC's mission is to serve as "Utah's leader in promoting science, technology, engineering and math through best practices in education to ensure connection with industry and Utah's long-term economic prosperity." The STEM AC was originally supported by the Governor's Office of Economic Development (GOED). In the 2019 legislative session, the STEM AC was moved to the Department of Heritage and Arts.

The Utah Education Policy Center (UEPC) at the University of Utah, in partnership with Utah Valley University's (UVU) School of Education (SOE) received the contract to conduct an evaluation of four of the STEM Action Center's programs:

- K-12 Mathematics Personalized Learning Software Grant,
- Elementary STEM Endorsement Program,
- STEM Professional Learning Program, and
- Computing Partnerships Grant (added to the annual evaluation report this year)

This report presents findings and recommendations on the 2018-19 implementation year of these three programs. This is the third year of a five-year evaluation cycle for the UEPC and UVU team.

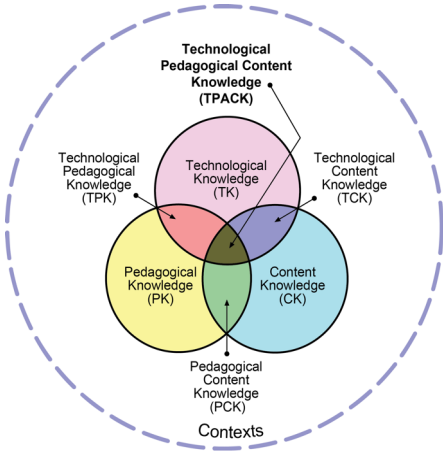
As in the previous years, this evaluation was informed by two frameworks. These frameworks included the Pedagogical Content Knowledge (PCK) and the Technological, Content, and Pedagogical Knowledge (TPACK) frameworks.

Evaluation Background

Continuing the plan started in 2016-17, the 2018-19 evaluation process builds on two foundational frameworks that were applied as appropriate to each project's evaluation. These frameworks include the Pedagogical Content Knowledge (PCK) and the Technological, Content, and Pedagogical Knowledge (TPACK) frameworks. In addition, the evaluation team used the logic models developed along with the STEM AC, to guide the evaluation. A brief overview of the frameworks and the logic model is provided on the next page.

PCK and TPACK

Figure 1. TPACK Framework



SOURCE: HTTP://TPACK.ORG

The Pedagogical Content Knowledge (PCK) framework proposed by Shulman (1986)[1] describes teaching as a continuous interaction between content knowledge, curriculum knowledge, and pedagogical knowledge to produce what Shulman called "knowledge for teaching." The PCK ideas have evolved through the current work of leading STEM researchers. With the expansion of technology integration in schools, Mishra and Koehler (2006) proposed the Technological, Pedagogical, and Content Knowledge (TPACK) framework as one that utilizes the ideas of Shulman. The TPACK framework is enhanced with the integration of technology pedagogy and content. The TPACK Framework (Figure 1) shows the interactions of the three major elements as envisioned by Mishra and Koehler. The TPACK framework establishes a foundation for technology integration in meaningful ways and supports the instructional processes in 21st century classrooms (see http://www.tpack.org for more details). The PCK and TPACK frameworks also provided essential support and guidelines in evaluating the STEM AC projects as they represent most current directions to classroom instruction and to professional development and teacher growth.

Program Logic Models

Program logic models are standard practice for mapping program inputs and resources, implementation activities, and outcomes (e.g., short- and long-term by participant group). Once completed, the logic model is used as a means to focus evaluation efforts (i.e., design, methods, analysis) to assess core program aspects and expectations for outcomes. Logic models facilitate evaluation methodology by providing all program elements that are believed to be important to achieving desired outcomes. Evaluation methodologies based on logic models allow us to assess each model component (or a prioritized subset of components). This allows the evaluation to draw conclusions about the degree to which the outcomes are obtained, as well as why outcomes were or were not obtained.

Evaluation Methodology and Analysis

This five-year evaluation methodology consists of collecting and analyzing data to 1) assess the degree to which process and outcome goals as indicated in the logic models were attained, and 2) provide considerations for program improvement. Computing partnerships grant activities began in the 2017-2018 school year. This current evaluation of computing partnerships focuses on understanding implementation and determining what to measure in subsequent evaluation years. The three primary data sources for

[1] Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4-14.

the evaluations include software vendor data, survey data, grantee reports, and student performance and achievement data.

Software vendor data are available for the K-12 Mathematics Personalized Learning Software Grantees and the STEM Professional Learning Program. Vendors that provide software programs to schools collect data, including the number of licenses used, amount of time spent on the software for each user, and progress made through the material.

Surveys were developed to collect data from participating teachers (math software, professional learning, and endorsement programs), administrators (math software and professional learning programs), and students (math software program only). In all cases, data collection instruments from prior evaluations were reviewed and considered in order to provide continuity in the evaluation. In addition, existing surveys and research literature on TPACK and STEM education were reviewed. New surveys were then developed with particular attention to the program logic models. Furthermore, surveys were aligned across groups of participants to provide comparable data on the project components and their perceived impact.

More detailed information on the methodology and analysis specific to each grant program is provided in the report sections that follow.

K-12 Mathematics Personalized Learning Software Grant

Background

In addition to the creation of the Utah STEM Action Center, HB 139 created the *K-12 Mathematics Personalized Learning Software Grant Pilot Program*. Through this program, the STEM Action Center selected providers of online instructional technology to support mathematics instruction in Utah classrooms. HB 139 required that the technology be individualized, self-adapting, engaging, and provide frequent feedback while addressing core standards for math. The STEM AC uses a competitive bidding process and annual evaluation results to determine which math software products will be offered annually to public K-12 schools in Utah.

This annual report provides results from Year Five of the K-12 Mathematics Personalized Learning Software Grant (2018-19). In the first year of the grant (2014-15), there were 11 software products available to schools and LEAs. In year five (2018-19), there were four supported software products plus a fifth product that was being piloted (see Table 1). Schools and LEAs applied to utilize the programs through a grant application released in January of 2018 and awarded in spring 2018.

Program Overview

The mathematics software programs are intended to improve student math performance. Specifically, the software are designed to increase student math understanding and skill as well as interest and engagement with math, perceived utility of math, and awareness of math in everyday life. Each software program is adaptive and provides problems that are suited to each individual's ability (reportedly minimizing both frustration and boredom). Moreover, the software programs reportedly aid student learning by showing steps to solving the problems, and providing immediate feedback. Some products have competitive features or rewards to engage students. Students can use the software in school or anywhere they have access to a compatible device with internet.

Availability of the math software is not intended to supplant teacher instruction. Teachers are encouraged to actively engage with students during use of the software. For instance, teachers may use the software in small group instruction for acceleration or remediation; teachers can also work one-on-one with students while the rest of the class is engaged with the software. To maximize student outcomes, teachers are expected to make frequent use of student data reports to understand student progress and needs.

Evaluation Methods

The evaluation of the K-12 Mathematics Personalized Learning Software Grant focused on program implementation, educator outcomes, and student outcomes (see the program logic model, Figure 2) to determine the degree to which the program is meeting the goal of increasing student awareness, engagement, and interest in mathematics. Specifically, for program implementation, we assessed both *quantity* (e.g., to what extent were students and teachers using the software, and in what ways?) and *quality* (e.g, what was the perceived quality of each program and training for each program?). We also assessed perceptions of barriers to use as well as factors that facilitated use. For teacher outcomes, we assessed teachers' perceptions of the impact of the programs on

their teaching (e.g., to what extent did they perceive that access to the programs increased their instructional effectiveness, and in what ways?). Finally, for student outcomes, we assessed teacher and administrator perceptions of the impact of program use on student performance and learning as well as student perceptions of the impact of the programs on their engagement with and enjoyment of math, confidence in math, interest in math, and understanding of math utility. Student outcomes will be further assessed by analyzing student end-of-level math performance by program use, as these data become available (see the forthcoming addendum).

Data sources included STEM Action Center records regarding licenses requested and awarded, vendor data (including usage), and year-end surveys of administrators, teachers, and students who used the program during the 2018-19 school year. The STEM Action Center provided survey links to LEA who provided the links to administrators, teachers, and students. In total, 352 administrators and 4,584 teachers began the survey. A total of 93,892 students completed the survey during class time.

This report provides descriptive statistics from the survey responses and the vendor data for each program where there were at least 10 responses. Results are also presented for the grant program as a whole, aggregated across all the software programs (labeled "Combined Programs" on the tables). Note, vendor results are presented alphabetically, except in figures where results are presented in rank order. Qualitative data from the surveys were analyzed by the evaluation team who used open coding followed by development of coding categories. Results are synthesized and presented by major themes.

Figure 2. Math Personalized Learning Software Program Logic Model

What do you want to accomplish?
Applications of digital math programs in order to increase student awareness, engagement, and interest in mathematics

Order of planning ←

RESOURCES	PROCESSES/ACTIVITIES	IMPLEMENTATION	EDUCATOR OUTCOMES	STUDENT OUTCOMES
Vendors Partners (USBE, LEAs, LEA teacher leaders) School technological readiness: availability of technology; internet connection; IT support Home technological resources (student access to technology and internet) Teacher readiness to adopt technological tools	In-class and at home use of digital math programs Vendor support for implementation, training, presentations for teachers Availability/accessibility of technical assistance for teachers. Differentiation of instruction for teachers Criteria for distribution & use (vendor recommendations and LEA actual practice)	**Quantity:** # of licenses requested, distributed, used; changes from previous years % of targeted students with access (home & school) % of students meeting fidelity measures Minutes spent on program Frequency that teachers use data reports **Quality:** Perceived quality by students, LEAs, teachers, IT, administrators (e.g., preference for digital format, product fatigue, vendor support, ease of use; program requirements; admin support) Factors that facilitate or impede use (e.g. teacher and admin experience and attitudes about tech) Integration of program with instructional plans	Teachers perceive increased instructional effectiveness (e.g., more differentiation, less time needed for remediation, more targeted instruction on specific skills, use of data reports) Teachers understand the tool and maximize use of features in an intentional way Teachers have procedures to promote fidelity to the program Teachers perceive increased parent engagement	Teacher perceptions of changes in student learning Changes in student math *Awareness *Engagement *Interest (e.g., increased use of other digital programs; smaller decrease relative to controls) *Perceived utility Improved math SAGE results *Proficiency *Growth percentile *Raw scores *Interaction effects with product type, grade level, usage type, demographic variables, schools or teachers, and teacher use reports

→ Order of implementation

Table 1. STEM AC Funded Personalized Math Learning Products

Year	Vendor	*McGraw-Hill*	*Ascend Education*	*Hot Math*	*The NROC Project*	*Imagine Learning*	*Curriculum Associates*	*Mathspace*	*Pearson*	*Carnegie Learning*	*Compass Learning*	*Explore Learning*	*MIND Research Institute*	*Pearson*
	Product	***ALEKS***	***Ascend Math***	***Catchup Math***	***Ed Ready***	***Imagine Math***	***i-Ready***	***Mathspace***	***Math XL***	***MathiaX***	***Odyssey Math***	***Reflex Math***	***ST Math***	***Success Maker***
2014-15		X		X	X	X	X		X	X	X	X	X	X
2015-16		X		X	X	X	X		X	X		X	X	
2016-17		X	X			X	X			X			X	
2017-18		X	X			X	X						X	
2018-19		X				X	X	Pilot					X	

Table 2. Statewide Distribution by Schools and Districts

	2014-15	**2015-16**	**2016-17**	**2017-18**	**2018-19**
Total licenses requested	n/a	183,109	223,623	195,449	253,595
Total licenses funded by STEM AC	193,213	166,993	134,269	134,616	207,314
Total districts and charters with STEM AC funded licenses	139	93	72	62	85
Total schools with STEM AC funded licenses	653	556	586	440	542
Total number of student licenses used	150,706	131,602	147,238[2]	134,807	209,234

License requests met:
- ✓ 91% in 2015-16
- ✓ 60% in 2016-17
- ✓ 69% in 2017-18
- ✓ 82% in 2018-19

SOURCES: STEM AC DATA

[2] The number of licenses used may be larger than the number of licenses funded by STEM AC because some vendors provided usage data for licenses not funded through STEM AC.

Table 3. 2018-19 License Statewide Distribution by Product

	ALEKS	*Imagine Math*	*i-Ready*	*ST Math*	Total Across Programs
Licenses requested	113,071	42,062	44,345	54,117	253,595
Percent of total licenses requested	45%	17%	17%	21%	100%
Initial licenses awarded	92,781	29,404	38,367	46,761	207,313
Percent of total licenses awarded	45%	14%	19%	23%	100%
Percent of awarded licenses compared to requested licenses	82%	70%	87%	86%	82%
Number of districts awarded licenses	30	11	11	7	46[3]
Number of charter schools awarded licenses	28	18	22	17	39[2]
Number of non-charter schools awarded licenses	235	103	98	149	487[2]
Total number of student licenses used	87,076	31,783	37,892	52,483	209,234

SOURCE: STEM AC DATA AND VENDOR DATA

- ✓ In 2018-19, 45% of requested licenses were for *ALEKS.*
- ✓ 30 school districts received product licenses.
- ✓ 39 charter school received licenses.
- ✓ 487 non-charter schools received product licenses.
- ✓ Product licenses that were unused were redistributed.

[3] Schools could request and be awarded more than one vendor product. Therefore, the *Total Across Programs* for schools and districts is not the sum of the individual vendor totals.

Table 4. Fidelity Recommendations by Product

Vendor	Product	Grade Levels Supported	Fidelity Recommendations
McGraw-Hill	*ALEKS*	Grades 3-12	60 minutes OR 5 topics per week
Imagine Learning	*Imagine Math*	Grades 3-8 Algebra I Geometry	Quarter 1 (Sept-Nov): 5+ Lessons Completed Quarter 2 (Dec-Feb): 10+ Lessons Completed Quarter 3 (Mar-May): 15+ Lessons Completed
Curriculum Associates	*i-Ready*	Grades K-8	30-49 minutes per week plus 70-100% pass rates
Mathspace	*Mathspace*	Grades 3 – Precalculus	30 minutes per week OR 3 subtopics mastered per week
MIND Research Institute	*ST Math*	Grades K-8	K-1: 60 minutes per week 2-8: 75 minutes per week

SOURCE: VENDOR PROVIDED RECOMMENDATIONS

Table 5. 2018–19 Survey Response Rates and Grade Level Distributions for Math Personalized Learning Software

		ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers	**Ns**	913	790	911	25	1,528	4,167
	% Using Each Program	22%	19%	22%	1%	37%	100%
	Teacher Grade Level Distributions within Each Program[4]						
	K - 2nd	12%	23%	41%	19%	51%	34%
	3rd - 6th	30%	73%	54%	41%	47%	49%
	7th - 8th	27%	4%	5%	31%	1%	9%
	9th - 12th	30%	1%	1%	9%	0%	8%
Students	**Ns**	39,196	16,863	13,803	1,760	15,821	87,443
	% Using Each Program	45%	19%	16%	2%	18%	100%
	Student Grade Level Distributions within Each Program						
	3rd - 6th	22%	91%	84%	34%	96%	58%
	7th - 8th	47%	7%	15%	49%	4%	26%
	9th - 12th	31%	2%	1%	17%	0%	15%
Administrator	**Ns**	98	42	95	N<10	103	340
	% Using Each Program	29%	12%	28%	N<10	30%	100%

- ✓ The majority of teacher respondents taught elementary classes (83%).
- ✓ Student respondents for ST Math, Imagine Math, and i-Ready were primarily in grades 3 through 6.
- ✓ Respondents for ALEKS and Mathspace were primarily in grades 7 through 12.

SOURCE: UEPC ADMINISTRATOR, TEACHER, AND STUDENT SURVEYS SPRING 2019

[4] Teachers and administrators could choose all that apply for grade levels and software programs. Students could select only one.

Program Use

Figure 3. Frequency of 2018-19 Student Program Use Reported by Teachers

Teachers of all grade levels were asked how often they use the software in and out of school.

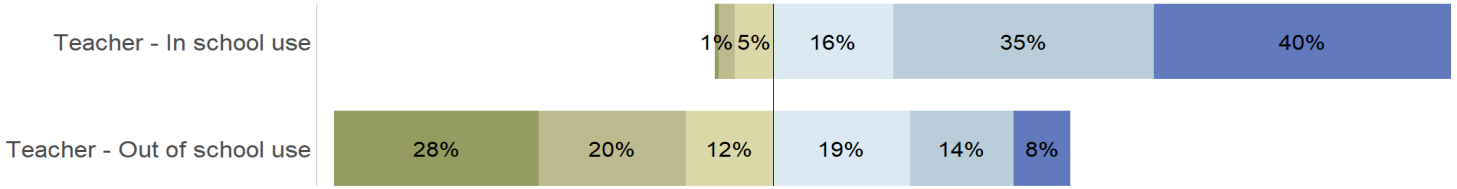
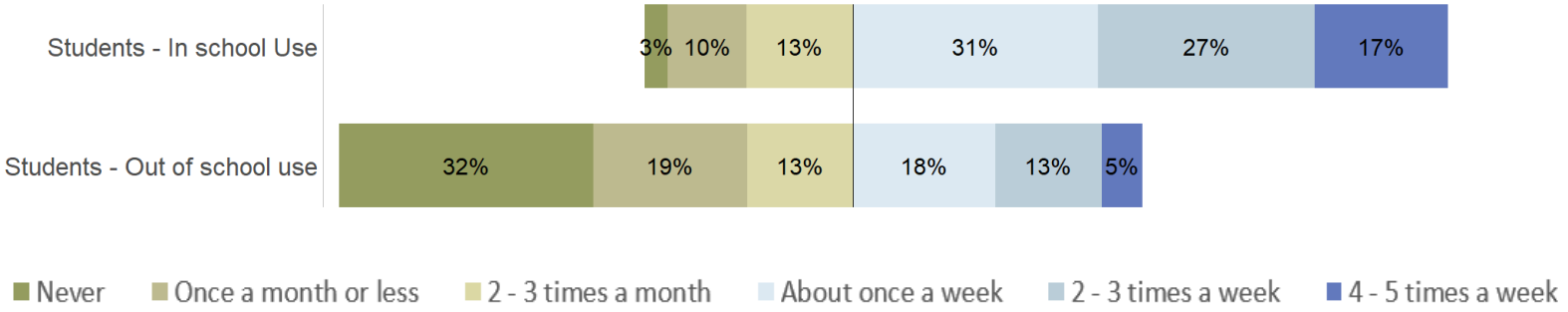


Figure 4. Frequency of 2018-19 Student Program Use Reported by Secondary Students

Secondary students were asked how often they use the software in and out of school.



SOURCES: UEPC TEACHER AND STUDENT SURVEYS SPRING 2019

- ✓ 91% of teachers and 75% of secondary students reported using the program at school at least weekly.
- ✓ The numbers of secondary students who reported using the software at least weekly has increased over the three years of the evaluation (50%, 68%, and 75%, for 2017, 2018, and 2019, respectively.)

Table 6. Frequency of 2018-19 Program Use by Vendor

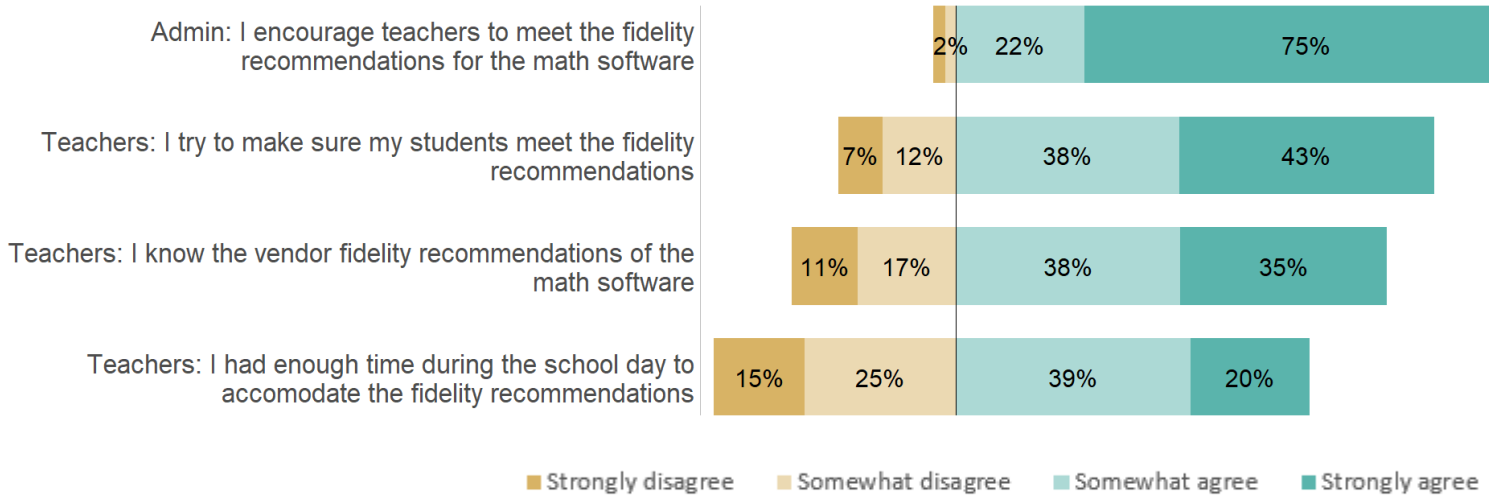
Percentage of teachers and secondary students reporting student use *about once a week* or more.

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
In School	88%	92%	95%	76%	96%	93%
Outside of School	57%	43%	33%	57%	33%	41%
Secondary Students						
In School	75%	50%	80%	74%	65%	74%
Outside of School	37%	32%	26%	42%	11%	36%
Minutes Per Week						
Teacher reported average	75	66	56	59	74	67

SOURCES: UEPC TEACHER AND STUDENT SURVEYS SPRING 2019

- ✓ Teachers reported having students use the software an average of 67 minutes per week.
- ✓ Across all vendors, student use of software in-school more common than out-of-school use.

Figure 5. Administrator and Faculty Intentions to Meet Fidelity Requirements



SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

- ✓ 97% of administrators agreed that they encourage teachers to meet the fidelity recommendations.
- ✓ 81% of teachers agreed they try to have their students meet the fidelity recommendations.
- ✓ Importantly, 40% of teachers do not believe they have enough time during the day to accommodate the fidelity recommendations. This number has stayed consistent over the three years of the evaluation.

Table 7. Administrator and Teacher Intentions to Meet Fidelity Requirements by Vendor

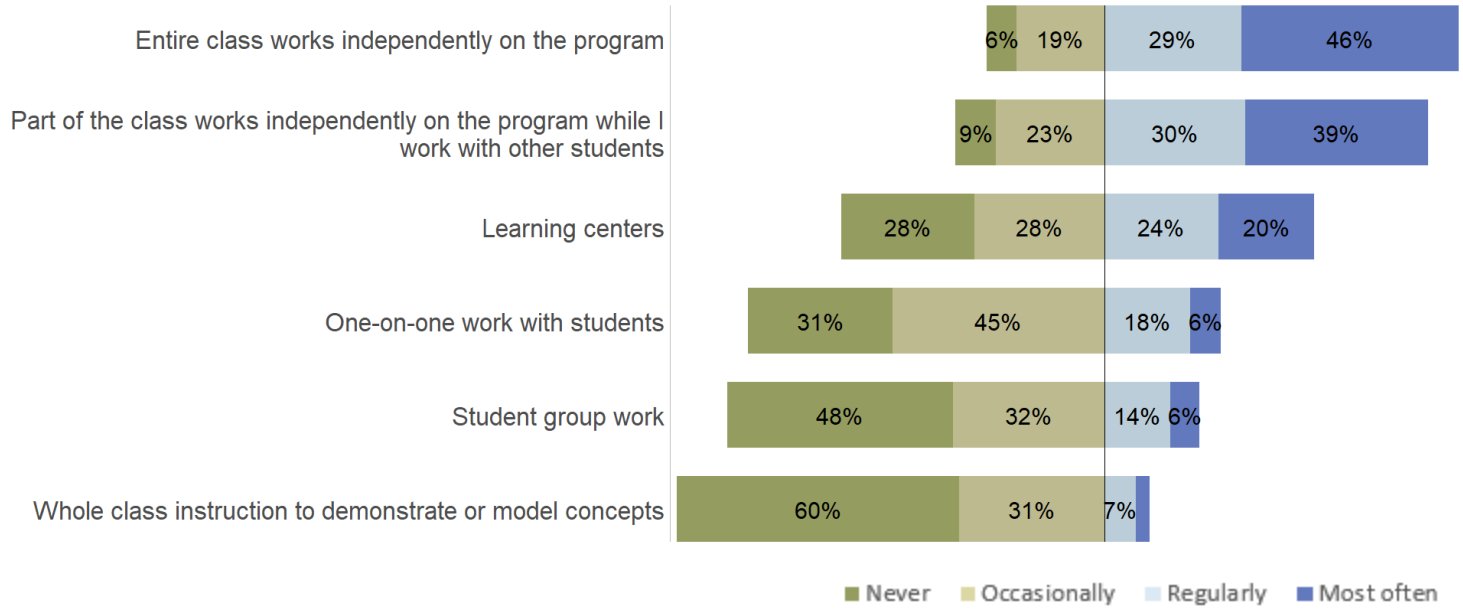
Percentage of administrators and teachers who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Administrators						
I encourage teachers to meet fidelity recommendations for the math software.	97%	95%	97%	N<10	95%	96%
Teachers						
I try to make sure my students meet the fidelity recommendations.	74%	84%	87%	70%	81%	80%
I know the vendor fidelity recommendations of the math software.	64%	76%	79%	74%	74%	72%
I had enough time during the school day to accommodate fidelity recommendations.	55%	63%	67%	43%	57%	59%

- ✓ Administrator reported encouragement for teachers to meet the fidelity recommendations was very high, across all vendors.
- ✓ There was some variation in teacher responses based on which vendor they used. For example, 43% of teachers who used Mathspace indicated they had enough time to accommodate the fidelity recommendations, while 67% of teachers who used i-Ready had enough time to meet recommendations.
- ✓ Across programs, teachers reported not having sufficient time to use the program during the day.

SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

Figure 6. Type of In-Class Use Reported by Teachers



SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ 75% of teachers report they regularly or most often have the entire class work independently on the program.
- ✓ 69% of teachers have the class work independently while they work with other students.
- ✓ In 2019, teachers reported in-class use of programs that was very similar to 2018 reports.
- ✓ *Other ways* teachers reported using the software include: homework, assessment, intervention/remediation, rewards, fast finishers, credit recovery, and lesson plans for substitutes.

Table 8. Type of In-Class Use Reported by Teachers by Program

Percentage of teachers using the method *regularly* or *most often*

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Entire class works independently on the program	81%	73%	70%	74%	75%	75%
Part of the class works independently on the program while I work with other students	61%	71%	70%	65%	72%	69%
Learning centers	28%	44%	47%	22%	53%	44%
One-on-one work with students	34%	22%	16%	35%	25%	25%
Student group work	17%	18%	18%	13%	23%	20%
Whole class instruction to demonstrate or model concepts	12%	6%	10%	22%	8%	10%

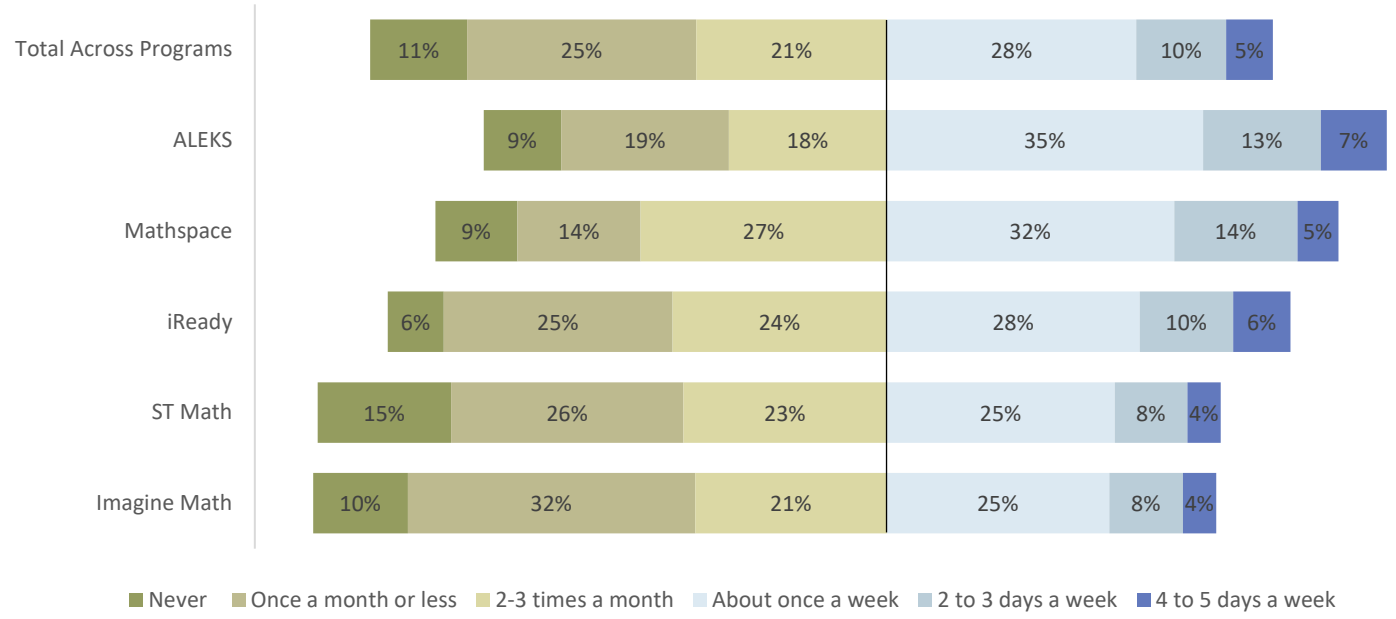
Scale options included Never, Occasionally, Regularly, and most often.

Source: UEPC Teacher Survey Spring 2019

- ✓ Patterns of use are similar across programs.
- ✓ Teachers most commonly have the entire class work independently (70-81%), or work independently while the teacher works with other students (61-72%).

Figure 7. Teacher Reported Frequency of Use of Data Reports by Program

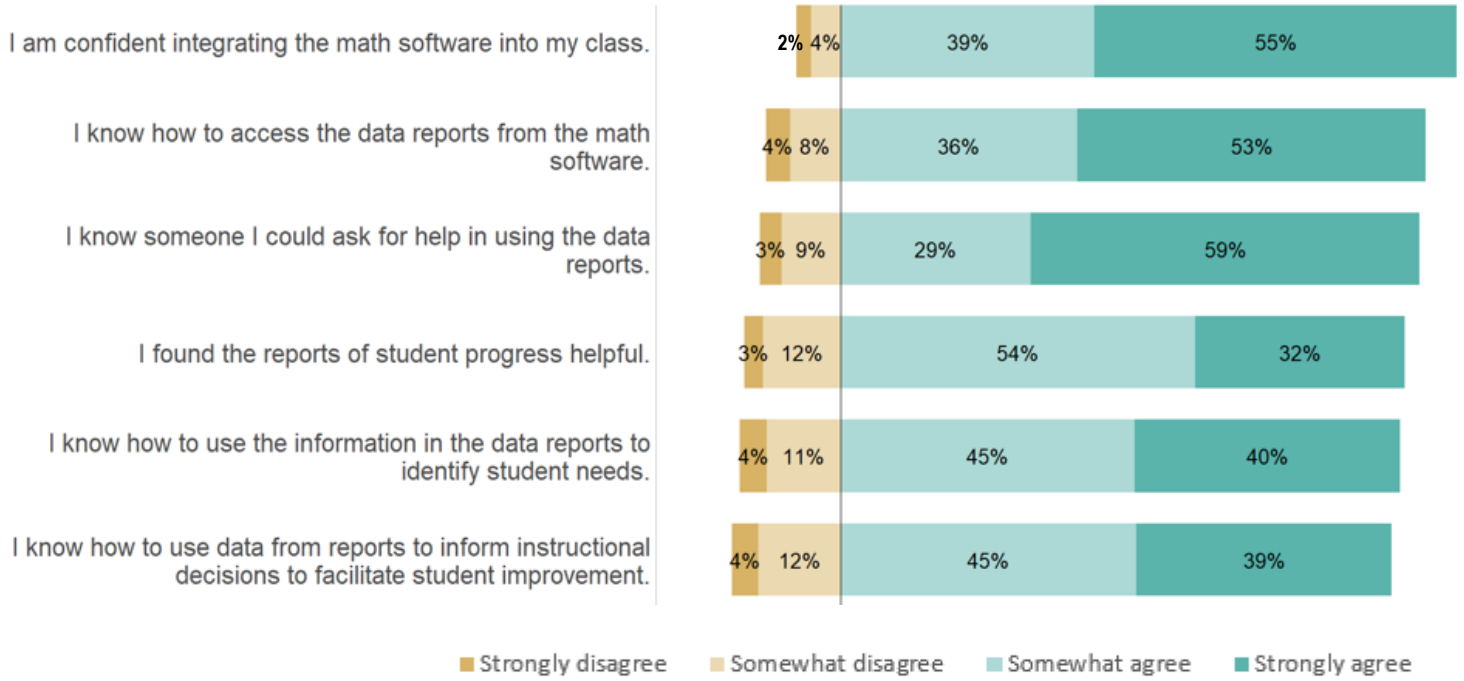
Approximately how often did you use the data reports to assess student learning this year?



SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ For all programs combined, 43% of teachers were using the program data reports at least weekly to assess student learning.
- ✓ The numbers of teachers using program data reports at least weekly has increased slightly over the three years of the evaluation (35%, 40%, and 43%, respectively.)
- ✓ 36% of teachers were using data reports once a month or less.

Figure 8. Teacher Knowledge and Confidence



SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ 94% of teachers are confident integrating the math software into their classes, but 25% do not know how to get immediate support when they need it.
- ✓ Teachers' high level of knowledge and use of the programs are very similar to that reported in the 2018 annual report.

Table 9. Teacher Knowledge and Confidence by Program

Percentage of teachers who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
I am confident integrating the math software into my class.	92%	94%	93%	100%	94%	93%
I know how to access the data reports from the math software.	90%	90%	90%	96%	87%	89%
I know someone I could ask for help in using the data reports.	87%	87%	91%	100%	88%	88%
I found the reports of student progress helpful.	90%	83%	87%	80%	84%	85%
I know how to use the information in the data reports to identify student needs.	85%	84%	88%	100%	83%	85%
I know how to use data from reports to inform instructional decisions to facilitate student improvement.	83%	83%	87%	100%	82%	84%

SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ Teacher knowledge and confidence are similar regardless of which vendor software are used.
- ✓ Teacher knowledge and confidence were similar to that reported on the UEPC Spring 2018 Survey.

Table 10. Reasons Teachers Decided Not to Use the Math Educational Software

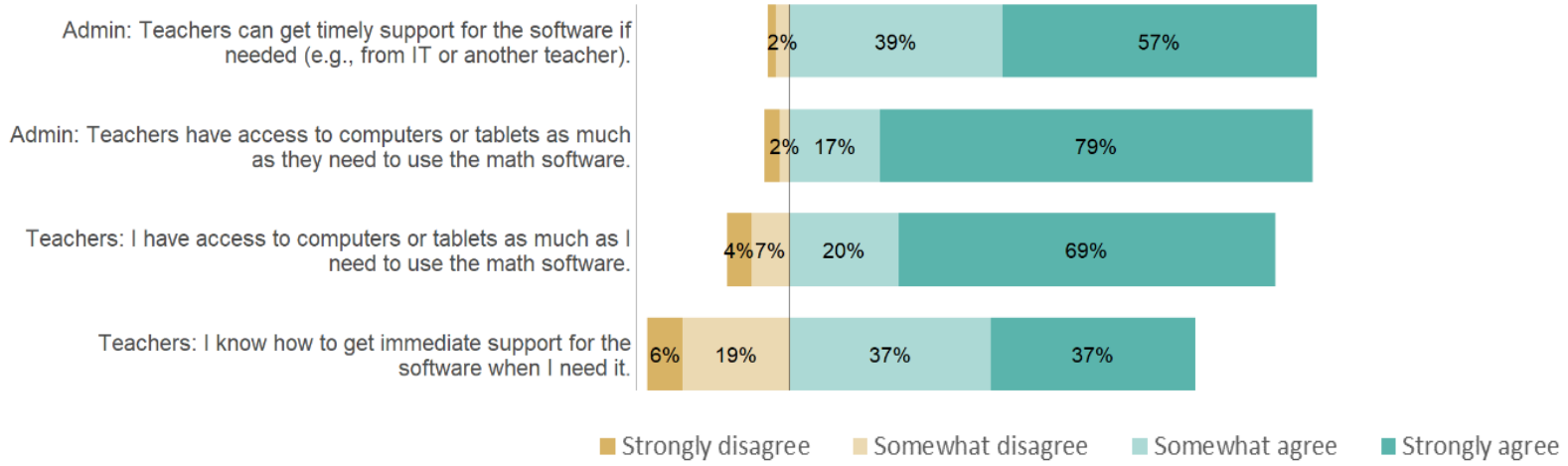
Approximately 3% of responding teachers indicated they do not use the software. These teachers were asked to explain why they do not use the software. The majority indicated they do not teach math. Other themes are provided below.

Theme	Example Quotes
Lack of teacher training	"Mainly because I do not know how and technology is hard for me to understand." "I have had no training and do not feel comfortable using math software in Kindergarten with no training."
Computer access issue	"Because we only have 6 iPads for our class of 28 students, so it is not feasible. Also, I really don't have time to work that into my schedule, but would like to try if I had more equipment." "Because my classroom has clunky desktops that are so dated it takes 5+ minutes for a student to login and generally has pretty crap performance once running any applications. I teach special education, so having 10 minutes of less than fully used time, and having to troubleshoot inevitable tech difficulties, is just not worth it." "We do not have frequent access to computers and math educational software is not our school's priority."
Overwhelmed	"I don't know other programs and I am learning a new curriculum. I have enough on my plate for now." "I decided that I have too many preps (5) to also tackle trying to figure out a new software. Several of my courses are being taught nearly identical to how they were taught last year in order to make this year reasonable for me."
Accessibility issue	"I didn't know it was available to me." "I was not aware we had access to any of these math educational software programs as reg. ed teachers." "Last year I used [software] but could not get enough licenses for all my students."
Not enough time	"The time it took in my classroom, took away from teaching time." "I teach Kindergarten and there is not enough time in a half day session to do it."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Access and Support

Figure 9. Teacher and Administrator Perceptions of Teacher Technology Access and Support

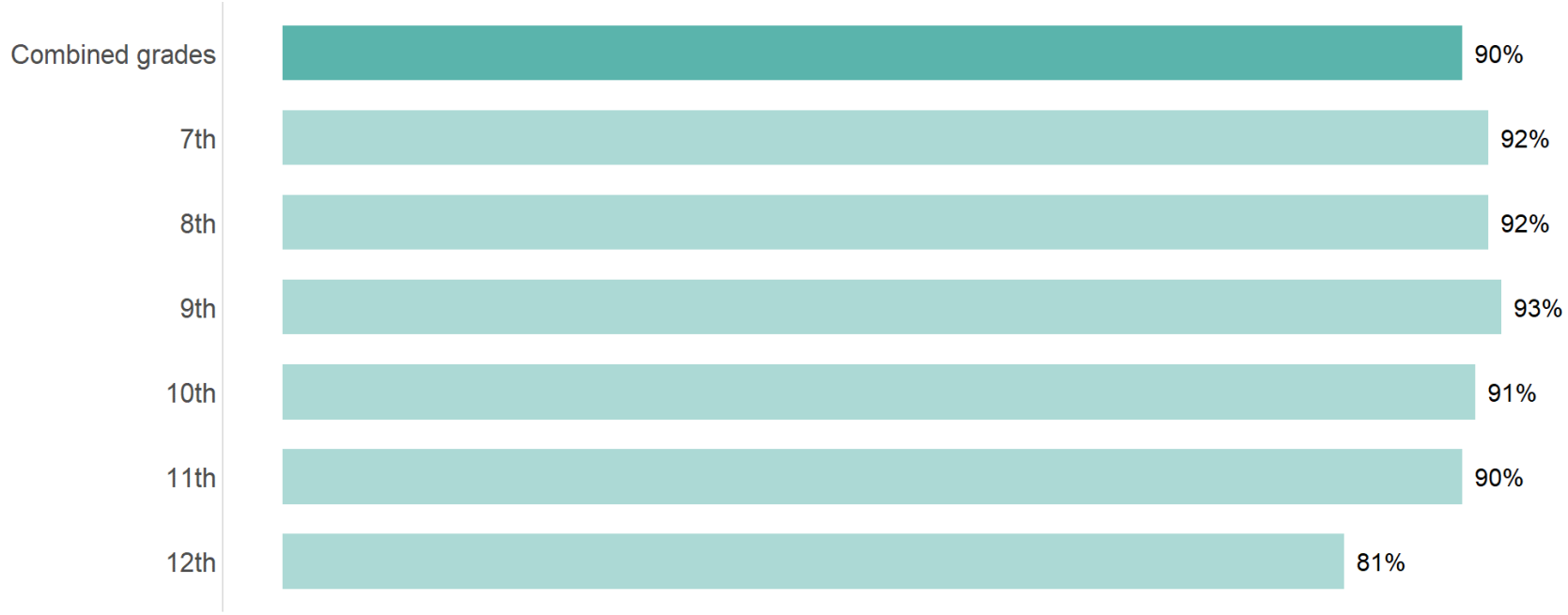


SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

- ✓ 25% of teachers do not know how to get immediate support for the software when they need it. In 2018, 30% of teachers did not know how to get immediate support.
- ✓ 74% of teachers know how to get immediate support when they need it. 96% of administrators thought teachers could get timely support.
- ✓ 89% of teachers reported they had sufficient access to computers or tablets. 96% of administrators thought teachers had sufficient access.

Figure 10. Secondary Student Access to Devices at Home

Percentage of secondary students indicating they have access to a computer or device at home to use the program



SOURCE: UEPC STUDENT SURVEY SPRING 2019

- ✓ Over 90% of students in grades 7-11 indicated that they had access to a computer or device at home.
- ✓ Seniors were among the least likely to report access to a computer or device at home to use the program.
- ✓ Secondary student access to computers and devices at home has been consistent across the three survey years, including the finding that seniors using the software are least likely to have access at home.

Table 11. Teacher Professional Development and Training on the Programs

Percentage of administrators and teachers who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Admin						
I was satisfied with the professional development provided to teachers.	86%	95%	92%	N<10	90%	90%
Teachers were provided with professional development on effective use of the math software.	82%	95%	93%	N<10	87%	89%
Teachers: I would like to receive more training on…						
customizing programs to better meet student needs.	84%	78%	78%	83%	77%	79%
using various program tools.	75%	69%	70%	75%	70%	71%
using the program to differentiate instruction better.	75%	75%	71%	75%	70%	72%
aligning the program with the concepts I am teaching.	74%	75%	75%	71%	63%	70%
using the student data reports.	72%	71%	68%	88%	72%	71%
integrating program use with regular instruction.	69%	69%	66%	58%	63%	66%
ways to use the math software.	67%	57%	52%	58%	58%	59%

- ✓ Most administrators indicated they were satisfied with the training teachers received on using the software. 11% of administrators indicated their teachers were not provided with training.
- ✓ The majority of teachers wanted more training on all aspects of using the programs. This was similar to 2018.
- ✓ *Other topics* teachers listed were:
  - How to submit suggestions to the product vendor
  - Integrating the program with grading, especially proficiency-based grading
  - How to choose products
  - How to help students who are stuck
  - How to motivate students

SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

Table 12. Ability of Software to Support Student Development

Percentage of teachers who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	Total Across Programs
The personalized math software has helped me teach my students how to…						
be self-directed learners.	94%	92%	91%	100%	93%	93%
think critically.	88%	89%	84%	83%	94%	89%
think creatively.	69%	81%	74%	61%	92%	80%
collaborate.	53%	45%	33%	52%	59%	49%
communicate effectively.	51%	51%	43%	65%	53%	50%

SOURCES: UEPC TEACHER SURVEYS SPRING 2019

- ✓ The majority of teachers agreed the software helped them teach their students to be self-directed learners, think critically, and think creatively.
- ✓ Teachers were split on whether the software helped teach students to collaborate and communicate.
- ✓ Teachers' opinions on the ability of the software to support student development was very similar to 2018.

Table 13. Ability of Software to Promote Effective Mathematics Instruction

Percentage of teachers who *somewhat agree* or *strongly agree* with each statement

Use of the software…	*ALEKS*	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	Total Across Programs
Provided students with increased opportunities to learn from mistakes.	96%	92%	87%	95%	95%	93%
Helped me engage with students more equitably.	82%	74%	73%	86%	79%	78%
Increased my ability to explain concepts in more than one way.	80%	76%	73%	77%	81%	78%
Helped me use data and other evidence to make changes in my instruction.	75%	70%	76%	95%	67%	71%
Helped me analyze student errors and misconceptions and adjust my instruction.	74%	64%	70%	82%	66%	69%

SOURCES: UEPC TEACHER SURVEYS SPRING 2019

- ✓ Agreement was highest (87-96%) that the software provided opportunities for students to learn from their mistakes.
- ✓ The majority of teachers also agreed the software helped them engage with students equitably, explain concepts in more than one way, use data to make changes to instruction, and analyze errors and misconceptions. These numbers were similar to 2018.

Table 14. Ability of Software to Support New Ways to Solve Math Problems

Percentage of teachers and students who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
The math software helped students understand different ways to solve math problems.	89%	92%	89%	91%	95%	92%
Elementary Students						
The program showed me new ways to solve problems.	77%	73%	76%	76%	78%	76%
Secondary Students						
The program helped me understand different ways to solve math problems.	64%	51%	56%	55%	73%	63%
The program showed me ways to solve problems that my teacher didn't show me.	62%	49%	52%	47%	61%	61%

SOURCES: UEPC TEACHER AND STUDENT SURVEYS SPRING 2019

- ✓ Most teachers (92%) indicated the software provided new ways to solve math problems.
- ✓ The majority of elementary students (76%) and secondary students (63%) agreed the software provided new or different ways to solve math problems.

Table 15. Ability of Software to Build Student Confidence in Math

Percentage teachers and students who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
The math software seemed to make students feel they could learn a lot in math.	82%	79%	79%	74%	89%	83%
Elementary Students						
The program made me feel I could be good at math.	67%	68%	68%	66%	73%	69%
The program helped me feel confident about math.	64%	64%	63%	65%	68%	65%
Secondary Students						
The program made me feel I could be good at math.	57%	44%	45%	53%	64%	56%
The program helped me feel more confident about math.	55%	41%	43%	52%	61%	54%
The program helped me feel I could learn a lot in math.	55%	44%	42%	51%	62%	54%

- ✓ Across programs, a majority of teachers (83%) reported the software seemed to make students feel like they could learn a lot in math.
- ✓ Two-thirds of elementary students and about half of secondary students reported the software increased their confidence in math.
- ✓ The percentage of teachers and students who indicated the software built student confidence was very similar across the three evaluation years.

SOURCES: UEPC TEACHER AND STUDENT SURVEYS SPRING 2019

Table 16. Ability of Software to Create Enjoyment of Math, Teachers and Elementary Students

Percentage teachers and elementary students who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
My students enjoy using the software.	71%	80%	77%	78%	93%	83%
The math software helped make math fun this year.	62%	75%	73%	65%	91%	78%
Elementary Students						
I liked using the program at school.	62%	64%	62%	68%	76%	67%
The program helped make math fun.	41%	52%	51%	57%	64%	53%
I spent more time on the program than my teacher required.	35%	36%	39%	38%	43%	39%
I liked using the program at home.	32%	36%	29%	24%	39%	34%
I looked for other math computer programs I could use.	23%	29%	28%	34%	31%	28%

SOURCES: UEPC TEACHER AND STUDENT SURVEYS SPRING 2019

- ✓ More teachers than elementary students agreed that students enjoyed using the software and that the software made math fun.
- ✓ Approximately a third of elementary students liked using the software at home.
- ✓ 28% of elementary students liked the program enough to look for additional math programs they could use.
- ✓ Numbers looked very similar across the three years of the evaluation, although teacher reports that the software made math fun increased this year (70%, 70%, and 78% respectively.)

Table 17. Ability of Software to Create Enjoyment of Math, Secondary Students

Percentage of secondary students who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Secondary Students						
I liked the way my teacher had us use the program.	66%	54%	53%	64%	71%	65%
I liked using the program to work on math at school.	52%	40%	32%	51%	61%	50%
The program helped me want to learn more about math.	42%	34%	34%	42%	59%	41%
I liked using the program to work on math at home.	31%	25%	20%	35%	30%	30%
The program helped make math fun this year.	29%	26%	24%	37%	51%	29%
I spent more time on the program than my teacher required.	26%	25%	30%	24%	32%	26%
The program got me excited about taking more math classes.	23%	19%	19%	26%	39%	23%
I looked for other math computer programs I could use.	17%	20%	23%	19%	43%	18%

- ✓ A majority of secondary students (65%) liked the way their teacher had them use the program.
- ✓ About a quarter of secondary students reported that the programs helped make math fun this year.
- ✓ More than a quarter of secondary students reported that they spent more time on the program than required.
- ✓ 18% of secondary students looked for other math programs to use.

SOURCES: UEPC STUDENT SURVEY SPRING 2019

Table 18. Ability of Software to Increase Student Perceptions of Math Utility and Importance

Percentage of students who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Elementary Students						
The program showed me ways math can be useful.	71%	74%	74%	75%	75%	74%
Secondary Students						
The program showed me ways math can be useful in everyday life.	48%	46%	52%	46%	57%	48%
The program made me realize how important math is.	46%	41%	40%	45%	51%	45%

SOURCES: UEPC STUDENT SURVEY SPRING 2019

- ✓ Nearly three-quarters of elementary students agreed the program showed them ways math can be useful.
- ✓ Nearly half of secondary students agreed the program showed them how math can be useful and made them realize the importance of math.
- ✓ The percentage of teachers and secondary students who agreed the software increased perceptions of math utility and importance was very similar across the three years of the evaluation.

Table 19. Student Comments about What They *Liked* about the Way Their Teacher Used the Program

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Learning format[5]	"I liked that it was easy to find and there were no papers to worry about losing." "It was better than paper cause I could submit it and then know my score" "Our teacher let us use [program] in graphing and that was much easier than on paper." "Was like assessments but no paper and I could get hints if I needed them."
Homework option	"We do homework on [program] and it's quick to finish." "I liked that our homework/class work was on [program]." "Homework was on [program] that was nice. I never had to find papers and the homework you could do on your own because the computer helped you."
Self-directed	"I enjoy that I can move along at my own pace." "we got to do it on our own time and we could get help" "I don't know I just liked it because we could focus on our own work and we didn't have to learn together because we all learn different"
Variety of learning	"She has us use it every Friday and it gives us a break from homework." "I liked how my teacher had us do [program] once a week on Thursdays. Normally I prefer pencil and paper work but [program] has helped my ability with math somewhat grow more." "I liked that we would switch between still doing the homework on paper and using [program]. It is good to use both methods in moderation."
Intrinsic motivation	Cause my teacher makes it fun by giving us prizes when we reach a goal. We got to listen to music while we worked It was fun. And it helped me practice on what I was struggling It was a great opportunity to learn math in a fun supportive way.
Test preparation	"It helped me be prepared for the test because the questions on the homework on [program] were very similar to the ones on the test." "I liked the tests on [program] because if you didn't know what the question was asking you could just ask the computer to help you out." "It also was good because it would show how well you did right after you finished and then you could retake and review only the questions you got wrong to get a better score. I love using [program] for tests and reviews and I loved how well it really helped me and everyone else with math."

SOURCE: UEPC STUDENT SURVEY SPRING 2019

[5] However, see Table 20, some students also reported these reasons as things they disliked about the software.

Table 20. Student Comments about what they *Disliked* about the Way their Teacher used the Program

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Amount of use	"I didn't like how my teacher assigned it every week and almost every day for homework. She would assign homework on paper and on [program]. It just got too overwhelming." "She made us do too much of it does she not know we have other homework."
Different learning style preference	"It was good using it online but it wasn't better than them giving us paper and solving problems on a paper because I feel like we can learn more doing it on paper" "I do not learn math on a computer as easily as I do when I have paper. It made it difficult for me to understand." "It is much more enjoyable when the teacher teaches rather than a website or program."
Confusion with program	"the problems take too long to load and it's too confusing to use and it doesn't clearly explain how to answer the questions or what you're supposed to do with the questions it doesn't teach you anything" "[program] is not explaining anything and is confusing" "Don't make the answers so confusing to put in"
Negative impact on grade	"I hated how we have to pass 30 lessons or more or are grade would drop" "The extra home work was just more stress, and took up way too much of our grades." "They are worth lots of points. I have lots of homework from other classes plus math class. Sometimes I am not able to finish or do my [program]. So I don't get full points."
Need more teacher support	"She would rarely teach and let the dumb program "teach" us." "We only used [program] and almost never did work on paper our teacher also almost never got up and taught she would just have us rely on [program] to learn the material"
Mismatch to classroom	"sometimes the problems on [program] was not the same as we learned so it was hard to get them correct" "I just don't like [program], its teaching us either stuff we already know, don't know, or barely ever what we are learning, I just think it is a waste of time." "She did not assign topics, so once again, my [program] work hardly ever related to my school work."
Boring	"And it was overall really boring to use and do math on and there could have been ways to make the program more fun to use." "we used it in long periods so it kind of became boring" "I liked how [program] helped me with my math skills but I hated how boring it got over time"

SOURCE: UEPC STUDENT SURVEY SPRING 2019

Table 21. Teacher and Administrator Perceptions of the Impacts of the Software

Percentage of teachers and administrators who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
The math software helped my students strengthen important skills.	97%	95%	93%	96%	96%	95%
The software increased my instructional effectiveness.	83%	75%	75%	78%	81%	79%
Administrators						
The math software had a positive impact on students' math performance.	98%	98%	95%	N<10	97%	97%

SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

- ✓ Nearly all teachers felt the software helped students strengthen important skills.
- ✓ 79% of teachers agreed the software increased their instructional effectiveness.
- ✓ Nearly all administrators (97%) agreed the software had a positive impact on students' math performance.
- ✓ These numbers were very similar to the previous two years of evaluation.

Table 22. Teacher Perceived Ancillary Effects of the Software

Percentage of teachers who *somewhat agree* or *strongly agree* with each statement

Teachers	*ALEKS*	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
The math software increased my satisfaction with my job.	77%	70%	66%	74%	74%	73%
The math software provided a way for parents to understand their students' math work.	56%	50%	50%	52%	39%	47%
The math software increased parent engagement.	42%	36%	30%	48%	28%	33%

SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ Although not a specific goal of the software, 73% of teachers reported that the software increased their job satisfaction.
- ✓ Approximately a third of teachers thought use of the software increased parent engagement (33%).
- ✓ Almost half of the teachers thought the software provided a way for parents to understand their children's math work.
- ✓ These numbers were very similar to the previous two years of evaluation.

Table 23. Teacher Reasons that Software Increased Parent Engagement

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Home-school connection	"Parents wanted to see what students were working on and [program] allowed them to see their lessons." "Parents are able to see what lessons their child has passed and where their child needs additional help." "When students do this program at home, parents are able to see what concepts their child is doing in math and help them as needed."
Support from home	"Parents were excited to have a program that students could use at home. I think this helped them know something they could do to support students from home." "I have my students do [program] for 30 minutes of homework a week. Parents usually help their kids with this math, which engages them in what they are learning."
Progress communication	"Parents really liked seeing the growth in their child's abilities. They also understand how the program helps fill gaps in their child's knowledge." "The parents know where to find homework scores and how to look at pie progress. This helps the parents know where their child is so they can help if needed." "Parents can check [program] for missing assignments and test scores. They can see how much time they have been on it compared to how much they have accomplished. It's a big one for holding students accountable for their work."
Built content-knowledge	"Parents were able to use the worked example links to help them understand the concepts so that they could help their students at home." "Parents are able to help their students at home. The pre-lesson explanation section is very effective in helping parents understand the math concepts their students are learning." "Parents can log on with their student to [program] at home and watch videos and go through interactive lessons with them. They can also see how their student is doing."
Pathway for support	"Parents would contact me if they wanted to know more about a lesson they were seeing or if they wanted me to assign their student a lesson on a specific math concept." "Parents can work with students at home to help them correct assignments and quizzes. I know this because parents contacted me to open up expired assignments for their student." "Students were allowed to use the program at home, and I had parents email me with questions about the software. They appreciated that the software was available at home, and could provide ways of learning the curriculum outside of the classroom."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Facilitators of Program Use

Table 24. Reported Facilitators of Software Use, from Teachers

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Professional learning	"I enjoyed having a training from a representative that customized the training to our needs!" "When we were learning about [program], the trainers had us work through part of the program to see what it was like. At first, we experienced that feeling of frustration and of not knowing what to do that our students feel also. But we also got to feel the excitement when we figured it out and were successful. It was helpful to be trained on how to use it and how to instruct our students when they get stuck on a problem." "Our administration was great about setting up training sessions and being united in the use of the software. My math department head and my mentor teacher are also really experienced in [program] and he has been a great resource to me."
Support	"Fantastic support from [program]. They always answered questions quickly and immediately addressed problems." "The few trainings that I have attended have been partly helpful. More helpful, however, has been collaborating with team members, admin, members, [program] staff, and even colleagues from other district schools to figure out how to do things within the program." "I talked with another teacher who had been using more than I had, and she showed me how it worked for her. Having a co-worker that I could talk to, who could show me how to use it in person was very helpful. I was also given access to webinars that were informative."
Software content-knowledge	"Just take the time to learn how the system works and how to be most effective." "I signed up for the math class myself, to see what the students were seeing, as well as to practice my own math skills." "Being able to go in and practice some of the concepts the students were stuck on so I could give them hints on how to better approach the concept they could not figure out how to do." "Spending time using the student view so I knew what the students were seeing as they worked through the program was very beneficial."
Data reports	"Tracking my students' progress and aligning the activities with the classroom curriculum." "Being able to see the growth that my students made was very motivating and helpful." "Taking the time to look through the reports and the lessons. The benchmarks are helpful to show growth. I appreciate being able to assign those for data purposes, for setting student goals and reflecting on my own effectiveness as a teacher."
Access to technology	"I have one to one access in my classroom. Students can access the software many times throughout the day." "Our students have one to one devices. They can log on whenever they want to instead of waiting to go to the computer lab." "We have one to one use of Chromebooks in our school and that has made all the difference in being able to have kids spend the time needed using the software."
Consistency	"Schedule the time for each day and stick with it as much as possible." "Having an allotted time set aside per day helped me be able to meet with a small group of students while engaging the rest of the class and keeping them challenged at their level."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Table 25. Reported Facilitators of Software Use, from Administrators

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quote
Professional learning, training, and support	"We attended the trainings provided by [program], and that helped teachers understand how to maximize use of it. "The consultants for [program] are always available and will answer questions whenever needed." "We had a trainer come to provide professional development on how to effectively use and navigate the software." "The ability to offer professional development through modules online. Teachers appreciated being able to complete the modules when it was best for them and at their own pace."
Access to technology	"We have excellent wifi coverage at our school and a device for every student." "Having 1 to 1 Chromebooks this year has allowed teachers and students to use [program] daily." "The ability to do it in their classrooms as a center rather than only being able to do it in the computer lab made a big difference in fidelity to the program. More money for devices is always appreciated."
Monetary support	"The resource support from the state grant. Without the grant we wouldn't have the funding to supply [program] to all of our students." "Provision of licenses for all students who could benefit. We couldn't have afforded all the licenses that we are now able to utilize." "We received support from the Stem Action Center grant and that was very helpful because our school does not qualify for a lot of extra funding. This was a huge benefit for our students."
Program rollout	"We had a strong push with our math department to use the software consistently and with fidelity. Teachers included passed topics in students' grades." "We had a small group of teachers who tried it with their students and loved it. The word spread and all my teachers 3rd-6th use it and love it. It helped to have someone available with the company to answer questions early on."

SOURCE: UEPC ADMINISTRATOR SURVEY SPRING 2019

Problems and Difficulties with the Software

Table 26. Difficulties Using the Programs

Percentage of teachers, administrators, and students who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
The math software works well on our devices (without crashing or slowing, etc.).	95%	90%	91%	100%	93%	92%
Sometimes the math software was frustrating for students to use.	63%	75%	62%	74%	74%	69%
I would have used the math software more, but I had trouble getting it to work correctly.	8%	16%	9%	4%	10%	11%
Administrators						
The math software works well on our devices (without crashing or slowing, etc.).	96%	100%	99%	N<10	96%	97%
Our school has enough wifi coverage to support widespread use of the software.	94%	98%	97%	N<10	96%	96%
Elementary Students						
I had trouble using the program.	18%	20%	14%	18%	20%	18%
Secondary Students						
Sometimes the program was frustrating to use.	69%	71%	71%	74%	57%	69%
I would have used the program more, but I had trouble getting it to work correctly.	22%	27%	24%	32%	33%	22%

Sources: UEPC Administrator, Teacher, and Student Surveys Spring 2019

- ✓ Most administrators (97%) and teachers (92%) agreed the software worked well on their devices.
- ✓ 69% of secondary students and 69% of teachers agreed the program could be frustrating for students.
- ✓ 22% of secondary students and 11% of teachers agreed they would have used the program more if they had not had trouble with it.
- ✓ Teachers and students indicated slight decreases in problems and difficulties over the three years of the evaluation. For example, the number of teachers who indicated the software worked well on their devices ranged from 86% in 2017, 90% in 2018, and 92% in 2019.

Table 27. Teacher Reported Frustrations with Software

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Login issues	"Only when I needed to transfer students into my classroom. I would go through the process and it was say they were part of my class and then when they logged in again they would be paired back with their old school." "Not having a specific or copy of a log-in number for students to log in. It takes time to retrain students, especially if they keep forgetting how to log in. Students lose interest and get impatient waiting for teacher help. It is extremely hard for SPED students and lower grades."
Technical difficulties	"Sometimes the software will have an unexpected error and log students out. When this happens the progress on their current lesson is not saved. This is frustrating for students who struggle in math." "Occasionally it would glitch and ask a question without providing the answer section or it would ask about a graphic that was not showing. Sometimes a log out and log back in would work, but a couple of times I had to have some students do alternative assignments." "The program often doesn't load, takes a long time to load, or boots them out repeatedly."
Presentation of content	"The wording of some of the problems can be unclear and difficult for students to understand. Sometimes the program would crash as they were working and that added to the frustration." "Sometimes the wording of the problems was very different from the types of problems students have had. They knew answers but not always what they should select from the drop-down questions." "It was frustrating for the students when they solved a problem got the right answer and then was told that it was wrong because they didn't solve all the little steps that you asked for. However, that was good practice for those students to learn to read the problems and instructions more closely."
Software structure	"My students have lost points, or they have gotten every answer correctly on the post quiz and still did not pass. Sometimes if they don't like the problem, they just refresh the page and get a different one." "I wish there was a way to prevent students from trying to create a new profile when they don't want to do their work. They just try to log in as a new student and play the [program] puzzle until I catch them and make them log in for real."
Lack of professional development	"Only had 1 day of training...actually only 1 hour after school" "It was only frustrating because I did not have enough training and was trying to figure out how to create assessments and do reports." "I have received little to no training on this software. Therefore, I don't know how to access things or how to use the reports to better my instruction."
Reporting and data issues	"The students had difficulty finding reports of their progress." "Transferring student data/progress between other schools' accounts was problematic." "I wasn't receiving accurate data on my students' progress because they weren't logging off properly."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Table 28. Secondary Students' Problems with the Software

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Too difficult or confusing	"Sometimes it was hard to understand the explanations to the math equation." "Some of the problems where very confusing because i didn't understand them."
Technical difficulties	"Sometimes my progress was deleted and I had to do that hard topic again." "It is hard to move stuff around on it and the pen tool is very hard to use." "Loading screens is sometimes very long and takes up a lot of time. Some crashes"
Boring content	"It's just boring and doesn't keep my interest in math. I've learned from it, I just wish it was more appealing" "The explanations in [program] were not helpful and irrelevant. This website was not fun and difficult to understand." "I didn't have trouble getting into [program], we just went onto [program] far too often and it became very very boring."
Login issues	"I would have trouble logging on, it would make me put in information multiple times." "It wouldn't let me log in half of the time and it wouldn't show all the topics I've done" "It wouldn't let me sign in because it said that my username was wrong when it wasn't."
Elicits negative emotions	"It makes me feel dumb and stupid so I have trouble sitting down and just doing it." "I got frustrated when I kept getting a problem wrong and I couldn't pass off a topic." "I feel like it doesn't help me. It just drives to bore me by making me frustrated and give up."
Grading/scoring issues	"If you got even a small thing wrong, such as a wrong sign, it would mark it wrong and move you back a space." "When I would get the answer right and it would mark it wrong. (It showed the right answer and it matched mine.)" "If the answer wasn't simplified or rounded correctly it would mark it wrong even though they are the same answers."
Waste of time	"It is just annoying. Sometimes the way you have to put it in is very specific. It is a waste of time." "I feel like it is a waste of time at home but at school it's not taking my fun time away and really is helping." "It was a waste of time and I was just reviewing what i already knew. It made me feel bad when I got a problem wrong." "I feel like [program] was just a waste of time at home especially for how long we had to do it."

SOURCE: UEPC STUDENT SURVEY SPRING 2019

Table 29. Elementary Students' Problems with the Software

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Math content issues	"I have trouble like integers and ratios word problems and fractions" "Division was hard because I only knew one way to do division and even with the explanation, I couldn't understand it."
Lack of explanations	"It is really hard because they don't teach you they just expect you to know how to solve it. I do not like [program]!" "It gave me really hard problems and I felt like it was 12th grade math and my teacher could not even figure it out!!!!!" "The questions are hard for me to understand and [software] doesn't help me understand it or how to do the questions or problems."
Boring lessons	"It was boring and some of the problems repeated with different numbers so it got kind of boring. Also the timeline was kind of confusing." "my trouble with [program] is I am always playing the same game and I just do not enjoy it some of the questions will malfunction and so I will not learn from my mistakes and my teacher says that she thinks it is fun but I think it is totally boring." "All the lessons were boring, hard, and didn't do a good job at explaining pretty much any subject."
Technical difficulties	"it would not load or work when in was trying to log in and its really slow sometimes" "Sometimes it says wrong user or wrong password even when I put in my right password. Also I can't save my work it always resets me I don't know how to save my work. So every time I log in I need to restart all my work." "Glitches made me go back to other levels." "My computer kept freezing when I was in the middle of a lesson." "Sometimes when I was doing a lesson it would glitch back to the home screen and I would have to restart the lesson."
Frustration and confusion	"It didn't really help me with math it actually made me feel stupid even more than I already do." "Sometimes I would miss at least a few things and it would say that it was wrong and that kind of made me angry and I became very frustrated" "I had fights with my mom. Started to get really angry at it. It was not that helpful my teacher taught me better ways to do that math. And sometimes my mom didn't even have a clue how to do the math that was gave to me! And I didn't even get it sometimes!"

SOURCE: UEPC STUDENT SURVEY SPRING 2019

Table 30. Negative Reactions to the Program

Percentage of teachers and elementary students who *somewhat agree* or *strongly agree* with each statement

	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
The math software takes time away from instruction.	15%	17%	21%	9%	16%	17%
The math software is an added burden.	8%	13%	17%	9%	12%	12%
The math software is not worth it.	5%	6%	9%	4%	5%	6%
The math software was a waste of time.	4%	5%	7%	0%	5%	5%
Elementary Students						
The program was boring.	52%	46%	50%	41%	36%	45%
Secondary Students						
The program was boring.	71%	72%	76%	63%	55%	71%
The program was a waste of time.	42%	50%	54%	40%	35%	42%

- ✓ 71% of secondary students and 45% of elementary students indicated the software was boring.
- ✓ 17% of teachers indicated the software took time away from instruction, and 12% indicated it was an added burden.
- ✓ Despite some negative sentiments about the software, few teachers indicated the software was not worth it (6%) or was a waste of time (5%).
- ✓ Negative reactions to the software were very similar across the three years of evaluation, with a slight decrease in negative reactions over time.

SOURCES: UEPC TEACHER AND STUDENT SURVEYS SPRING 2019

Table 31. Teacher and Administrator Overall Assessment of the Program

Percentage of teachers and administrators who *somewhat agree* or *strongly agree* with each statement

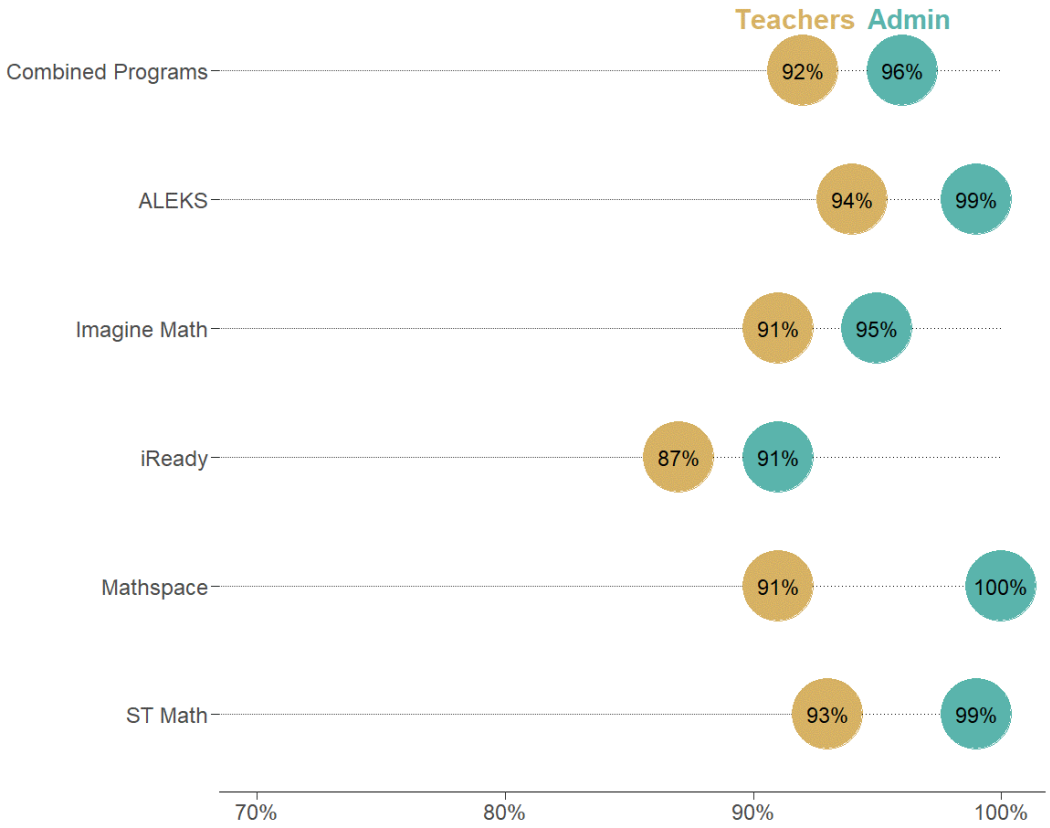
	ALEKS	*Imagine Math*	*i-Ready*	*Mathspace*	*ST Math*	**Total Across Programs**
Teachers						
The content of the software was well aligned with Utah Core Standards.	94%	95%	94%	74%	95%	95%
The software was a good complement to classroom instruction.	93%	89%	88%	91%	93%	91%
The software was well aligned with my textbook or other curricular materials.	82%	77%	74%	64%	82%	79%
Administrators						
Overall, I am satisfied with the math software.	98%	98%	92%	N<10	97%	96%

SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

- ✓ Most teachers felt the software complemented classroom instruction (91%) and was well-aligned with the Utah Core Standards (95%).
- ✓ 21% of teachers indicated the software was not well-aligned with their textbook or other curricular materials.
- ✓ Most administrators (96%) were satisfied with the math software.
- ✓ Overall assessments of the software were very similar across the three years of evaluation, with a slight increase in positive reactions over time.

Figure 11. Teacher and Administrator Endorsement of the Software

Percentage of teachers who *somewhat agree* or *strongly agree* they would recommend the program to another teacher
Percentage of administrators who *somewhat agree* or *strongly agree* they would recommend the program to another school



SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

- ✓ 92% of teachers would recommend the program to another teacher.
- ✓ 96% of administrators would recommend the program to another school.
- ✓ Teacher and administrator endorsement of the software was very similar across the three years of evaluation.

Table 32. Teacher Reasons They Would Recommend the Software to another Teacher

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Differentiation[6]	"The adaptive program is extremely useful. Students are able to learn and work at their own individualized instructional level so students can learn at their own pace." "I would recommend it for teachers because it helps me know where my students need extra help and also helps the upper students and lower students to grow at their own level."
Student learning	"[Program] was a great support to our students' learning this year. I heard many students who traditionally struggle say how much it helped them." "I have been using [program] for four years and have found that the students who actively participate show the most growth in math every year." "I really like the approach [program] takes to capitalize on mistakes and helping kids learn that you can learn from mistakes. That learning is a very valuable skill, not just in math."
Critical thinking and problem solving	"I like how students have to figure out what to do and are not told each step. It increases their willingness to try new things and not to give up." "Great software that allows students to learn math concepts, collaborate with their classmates, think critically, and learn from trial and error. Love it!"
Student engagement[6]	"My students love it. When we have free choice during class time they always choose it for the activity. It makes homework engaging." "Once a week we have a [program] Bowl, and the students love to have a classroom competition. It give me a chance to work with struggling students to understand concepts."
Practice and reinforcement	"I feel like the program gives the students the extra practice they need in a format that closely relates to the end of year CORE testing" "It reinforces everything we are teaching in the way we are teaching it. It is a great, interactive way for students to get more practice!" "It was a great supplement to instruction and it allowed students to have extra practice and gave me time in class to help students one on one."
Customization	"User friendly, many ways to implement, many options for teacher-created assignments and assessments, includes tons of content, many different problems for students to practice" "You are able to set up [program] to be a completely competency and standards based which is where education is heading and it was a little time consuming at first to get it all set up but you only have to do that once and then you have everything ready and online year after year."

[6] Note that other teachers cited these themes as reasons they would not recommend the software to another teacher (See Table 33).

Continued from the previous page.

Theme	Example Quotes
Saves time[6]	"The program is easy to integrate with my instruction. It saves time and is useful for remediation." "It saves on prep time and grading time. You have more time to work with students individually, look at data, identify misconceptions." "Overall it helps cut down on a lot of the data collecting and grading. It allows me to push my higher students while also reaching my lower students without a ton of lesson planning on my part."
Data reports and feedback[6]	"It gives immediate feedback to both students and teachers." "The reporting is effective and it provides growth charts in benchmark tests." "I love being about to use the data to drive my instructional practices."
Gaps in learning	"A good percentage of our students come from the 7 elementary schools lacking in basic skills. [Program] has been instrumental in helping the secondary teachers correct their deficits." "This program is great for my advanced learners to fill any holes in the previous year's work that they may not have fully understood. It helps to deepen their knowledge of math concepts."
Visual learning	"The program is not language dependent which helps our ELL population and teaches students to learn from mistakes." "This program forces to learn through watching and trying. No words are used as concepts are learned, so students must push themselves to think outside of THEIR box." "[Program] is simply the BEST visual-supported method of explaining difficult math concepts. It's amazing how effective [program] is at displaying math in motion, so that students SEE the arithmetic happening, etc."
Student independence	"[Program] has transformed my students in terms of being self paced and self directed learners. It has enabled them to learn and fix mistakes independently." "It provides extra support to the students. I like that they are able to do it independently since everything is explained. It teaches them how to continue to be independent learners."
Aligned to classroom[6]	"It aligns with the math book, you can create individual and whole class assignments, you can choose which types of questions students work on if it's an assignment, etc." "Even though [program] is well aligned with our core program, it teaches math from a more analytical or abstract way. I have many students that struggle with our program workbook, but are successful with [program]." "I love the [program] software and how it directly correlates with the Utah core and what we're learning in class. It allows me multiple avenues of teaching so I can get across to all of my students in the different ways they learn."
Pre-teaches future content	"I have used it for pre-teaching the concept that I will be teaching that week. It is nice for the students to have some background knowledge when I begin teaching the concept." "There were many times that I would teach a new concept that students would say, "Oh yeah, I learned this in [program]." It helped us move much faster and have the ability to teach all of the curriculum and complete all of the required standards."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

[6] Note that other teachers cited these themes as reasons they would not recommend the software to another teacher (See Table 33).

Table 33. Teacher Reasons They Would Not Recommend the Software to another Teacher

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Poor differentiation	"It is not intended for gifted students." "Students don't like it, and it isn't a good source for self-paced learning."
Lack of student engagement	"It is not engaging. It is at times difficult to understand the questions and what it is looking for. Too complex for self-directed learning." "It is a good resource for practice, however it moves too slow and students get bored." "My students get bored and/or the program does not keep them engaged. I am frequently having to give rewards or positive consequences to keep them on task and focused on this program."
Repetitive	"[Program] demands perseverance and accuracy which is good for students to attend to. However, the repetition is too much for some students." "The guided practice and independent practice are too long. It could be shortened a little and still give valid feedback.
Not easy to use	"It doesn't explain concepts well enough for me to understand let alone a child understand it." "It is not an intuitive program for students and the data reports are not helpful as a teacher." "My students get frustrated when using it and so do I because I don't understand it, nor do I know how to access the reports/data."
Time constraints	"It is a great program but it is hard to manage the extra program in addition to our existing math curriculum" "I found the 90 min per week requirement was a major burden. I was always stressed trying to get all the time in and still find time to teach my students. Too much of a requirement" "I think it's just a time filler and busy work. My students aren't engaged with [program]. There's too little time in my day to implement [program] fully. I need to use my math time for the actual direct instruction my students require. A better use of time is more hands-on and practice with my help."
Inadequate data reports	"The data reports were cumbersome and difficult to use in understanding student needs." "[Program] doesn't give good data feedback and it can be frustrating for struggling students when they become "stuck" on the same lesson for a lengthy period of time. I also didn't appreciate the fact that I could not assign concepts that we were working on in class."
Struggling reader difficulties	"The problems are designed in a way that's tough for struggling readers." "Not as helpful for students struggling with reading. It would be helpful if the program had the option to read to students." "I have many students that need the text read to them. This program does not provide that function."
Not well aligned	"Isn't very well aligned with our curriculum" "The software is not geared to high school students, even those that are behind in their math skills."
Lack of support or training	"There has been no training on the software. I do not know how the software works or what the students see when they use this program." "At this point I don't feel that I know the program well enough or know how to access and read the reports. I do not feel we have had adequate training on the software to make a recommendation." "This is great software. We have only been trained once on how to access reports. Any other questions I ask to my school about [program] are given introductory level answers when I need something more advanced in order to implement it successfully."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Table 34. Administrator Reasons They Would Recommend the Software to another School[7]

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Improved learning outcomes	"We are in our fifth year of using [program]. Each year our SAGE scores are increasing as well as our Granite Math Benchmark assessments. [Program] works beautifully when paired with excellent classroom instruction!" "I would recommend this software program to other schools. Our students have been successful in closing some of the skill deficits on specific math standards. The program is differentiated so it meets all of their needs." "In 2018-2019, the first year we had [program], our math scores increased significantly."
Supports EL learners	"Most of our students thoroughly enjoy working on [program], and it is very helpful for our ELLs because it doesn't contain a written component." "[Program] is an excellent and engaging program that is easily accessed by all our students including English language Learners and special education students."
Facilitates differentiated instruction	"This program helps to determine specific skill deficits for students that can then be targeted through interventions. It is also a great enrichment for those who have already met grade level standards." "I have personally used this software in my classes when I was a teacher. It allowed me to accurately pinpoint needs in my classroom to drive classroom instruction, while still addressing learning gaps among individual students."
Increases student engagement with math	"It is highly engaging. The students think they are playing a game." "Anything that can boost student performance and is fun for students is a plus." "It has been an engaging way to get our students that do not enjoy math to get excited about it. It is so exciting to hear our students begging for more time to work on [program]."
Provides practice and supplements instruction	"It is great at reinforcing what the teachers are teaching and a way to practice what the students learn." "This software provides the supplemental support that our staff needs for their students. It also adds the technology piece that students need to prepare for summative assessments and provides opportunities for students to interact independently using a math program that provides support on their learning level."
Aligns with summative assessments	"This software aligns very well to the rigor of end of year testing. It has many great features for assessments, pulling data, and tracking student progress." "We are beginning to see data that supports that achievement with [program] is a good indicator on how the student will perform on state year end testing. It easily identifies low or missing concepts allowing students to achieve concept mastery at higher levels."
Variety of implementation methods	"Teachers are able to use it as an intervention, enrichment and/or homework. Teachers can also assign lessons to individual students based on needs and they are able to compile data easily to use in determining next steps for teaching or intervention. Parents and students love the tutoring component."

SOURCE: *UEPC* ADMINISTRATOR SURVEY SPRING 2019

[7] No administrators provided comments for reasons not to recommend the software to other schools.

Table 35. Recommendations to Other Teachers for Using Software to Benefit Students

The left column represents the themes identified in the comments. The right column provides representative quotes from the responses.

Theme	Example Quotes
Supplement, not supplant, instruction	"Keep yourself free to engage with learners as they need. Don't start them on the program and then go off & correct papers." "Balance teacher-led instruction and student time on the computer. I usually try to teach the main concepts in 20-30 minutes using example problems from [program] that are similar to the homework problems. I then give the students the rest of the time in class to practice by getting a head start on their homework." "I have the whole class do it at the same time once a week and a rotation for groups on the other days during workshop. This gives me a chance to work with kids on hurdles on the whole group day and gives me freedom to work with other kids in small group during workshop days."
Use consistently	"Using it daily is helpful, if we go too many days without using it the students forget what they have done and are slower to progress in the program." "I like using it as a self-starter. Students are expected to come into the room and immediately log in to [program] and start working on their individual pathways. I give them 10 minutes to start out and they can usually get through 1-4 topics. I use this time to take attendance, hand out papers, etc. so I feel like the time is being used for teaching every day and they don't have to just wait for me." "Be sure to give enough time to become familiar with the tools and concepts."
Engage in training	"Get trained before you start using it!" "Have the company come out and do a training. Well worth the time to learn all the features." "Training is the key...becoming familiar with all the components and exploring ways to implement this first year has been helpful."
Data driven instruction	"Pay attention to the reports! The reports help to guide instruction as well as provide interventions to students who are struggling with certain skills." "I have loved the print outs with benchmark information and comparing the reports with their progress in the lessons. The benchmarks and detailed information you gain from them are great ways to inform your instruction, pinpoint misconceptions and trouble areas."
Differentiate to your teaching	"I had to set up my own pathway to align with my [program] and though it was a hassle, I think it was beneficial so that kids were seeing the things we were doing in class and not something random topic." "We align our [program] to the units they instruct. After the initial organization of their course, I don't have to touch it the rest of the year and the students are provided aligned work. That is a tremendous gift."
Use motivational strategies	**"**It is beneficial for the students to set goals on how many lessons they can complete in a certain amount of time." "Have the students help other students when they get stuck on what to do next. They love sharing their strategies." **"**Graphing their progress each session and giving out rewards for those who are progressing through the materials."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Considerations for Improvement for the K-12 Math Personalized Learning Software Grant

Overall, administrators, teachers, and students continue to report favorable opinions of the personalized learning software. Teachers (95%) perceived that the software helped students strengthen important skills and administrators (97%) indicated that the software had a positive impact on student math performance. In addition, three quarters of responding teachers indicated that the software increased their job satisfaction. Teachers' survey responses indicate that the software is working much as intended, and is consistent with the logic model, including increasing student math performance, enjoyment, interest, and perceived utility. Student responses were less positive than teachers in this regard; however, student responses were still positive. Elementary students (65%) and secondary students (54%) perceived that the software helped them feel more confident about math. The majority of elementary students (76%) and secondary students (63%) agreed the software provided new or different ways to solve math problems. Despite the overall positive opinions expressed by teachers, administrators, and students, some respondents indicated concerns and frustrations.

The following considerations are provided for the purpose of improving the math personalized learning software program utilization and benefits.

Findings	Considerations for Improvement
Most teachers reported high levels of use of the software and the data reports. However, some reported lower levels of use. For example, • 8% of teachers indicate they use the software during school 2-3 times a month or less. • 57% use the data reports 2-3 times per month or less. This includes 11% who never use the data reports. • 40% of teachers indicate they don't have enough time to meet fidelity recommendations. The majority of administrators (89%) indicated that their teachers were provided with professional development (PD) for effective use of the software, and 90% of administrators were satisfied with the PD provided. Additionally, most teachers reported that they know how to use the data reports to identify student needs and inform instructional improvement. Despite this, the majority of teachers would like additional, targeted PD on customizing programs (79%), differentiating instruction with the software (72%), using student data reports (71%), using program tools (71%), aligning the program with concepts being taught (70%), integrating program use with regular instruction (66%), on ways to use the math software (59%)	**Differentiate professional development opportunities that align with teachers' needs and utilization.** • Provide a range of scaffolded training options (e.g., introductory, advanced) tailored to teacher needs (e.g., accessibility, integration of software with curriculum). • Diversify professional development offerings to extend reach and use. For example, formats could include information that can be accessed at a teacher's own pace (e.g., webinars, brief emails with usage tips, on-line modules, and online community forums for asking questions and sharing strategies. • Create professional learning communities (PLCs) tailored to the varying needs of teachers. For example, offer a PLC on how to differentiate the software for high abilities learners or a PLC for transferring information learned from the data reports to instructional improvements in the classroom. • Invite teachers who demonstrate high utilization and integration of the software to provide professional learning for other teachers. Professional learning modules can be created to facilitate the dissemination of this learning. • Facilitate opportunities for peer-observations and debriefings for teacher to learn with and from each other. • Create forum for teachers to share the ways that they have increased student engagement in mathematics learning through use of the software.
A quarter of teachers do not know how to get immediate support for the software. This number, along with reports from teachers indicating that issues with the software can be stressful and waste valuable instructional time, suggests that access to immediate support could be a limiting factor for some teachers' willingness to use the software.	**Create alternative pathways for teachers to access technical support that promotes positive engagement with the software and utilizes instructional time.** • Offer quick options for professional learning (e.g., Brown Bags or Pop-Ups) that could be tailored to specific software support questions. • Create quick go-to resources for teachers to have ready to access when they experience technical issues with the software. These go-to resources could also highlight alternatives for how to maximize instruction when problem solving the technology.

Elementary STEM Endorsement Program

Background

In 2014, the Utah Legislature passed HB 150, Science, Technology, Engineering, and Mathematics Amendments, which required the Utah State Board of Education (USBE) and the STEM AC to work with Utah institutions of higher education (IHEs) to develop an elementary STEM endorsement program for Utah teachers. Utah Administrative Code R277-502-5 further specified that the STEM endorsement would be recognized as a minimum of 16 semester hours of university credit for LEA salary schedules. The program requires partnerships between IHEs and local education agencies (LEAs) across the state. In 2015, the Elementary STEM Endorsement Grant awarded funds to seven partnerships. Additionally, 20% of the seats were made available to districts or charter schools not partnered in an existing cohort.

The STEM endorsement program started its first cohort of teachers in the 2015-16 school year. Course plans and timelines of each partnership varied and endorsements for the first cohort were awarded in fall 2016 or spring 2017. In early 2017, the STEM AC secured funding for a second STEM endorsement cohort, and a new request for applications was released in spring 2017 for endorsement courses that began in summer or fall 2017. The second cohort is completing or nearing the completion of their STEM endorsement in 2019.

Program Overview

The Elementary STEM Endorsement program is comprised of six college courses designed to take place over approximately two years. Courses are designed for elementary teachers and include Data Analysis and Problem-Solving, Energy in STEM, Force in STEM, Matter in STEM, Nature of Science and Engineering, and STEM Practices with a Focus on Technology and Problem-based Learning. The endorsement program is intended to increase teacher content knowledge, ability to integrate STEM into non-STEM lessons, and use of instructional best practices such as hands-on activities and student-directed and inquiry-based learning.

Evaluation Methods

The evaluation of the STEM endorsement program focuses on program implementation, educator outcomes, and student outcomes to determine the degree to which the program is meeting the goal of increasing TPACK and its applications among participating teachers (see the program logic model below). Specifically, for program implementation, we assessed both *quantity* (e.g., how many teachers completed the endorsement at each IHE) and *quality* (e.g., to what extent did the teachers perceive the overall program and specific classes to be useful?). For teacher outcomes, we assessed teachers' perceptions of the impact of the program on their teaching (e.g., to what extent did teachers perceive that the program led to increases in their content and pedagogical knowledge and skill, as well as changes in their instructional practice?). For student outcomes, we assessed teacher perceptions of the impact of their instructional changes on student STEM awareness, engagement, interest, and learning.

The 2017-18 report provided data collected from the second cohort as they were beginning the program. Survey results focused on teachers' expectations at the start of program rather than their experiences in the program. The 2018-19 report provides results from teachers who are just completing (or about to complete) the two-year program. The results reported here focus on teachers' experiences in the program.

Data sources included participation records and a survey administered to all teachers participating in the second cohort to assess participant experiences in the program and overall satisfaction with the STEM endorsement program. The STEM Action Center provided the survey link to higher education partners to distribute to teachers participating in the endorsement. In total, 115 teachers began the survey.

This report provides descriptive statistics from the survey responses for each IHE. Results are also presented for the program as a whole, aggregated across all the programs. Qualitative data from the surveys were analyzed by the evaluation team who used open coding followed by development of coding categories. Results are synthesized and presented by major themes.

Figure 12. Elementary STEM Endorsement Logic Model

What do you want to accomplish? **Implement STEM endorsement programs in order to increase TPACK and its applications**

Order of planning ←

RESOURCES	PROCESSES/ACTIVITIES	IMPLEMENTATION OUTCOMES	EDUCATOR OUTCOMES	STUDENT OUTCOMES
Course frameworks Partners (USBE, IHEs, LEAs, LEA teacher leaders, teachers) Course text books STEM expertise Deep understanding of the state STEM endorsement design, implementation processes, and collaborations Financial incentives Commitment to quality evaluation and stakeholder engagement School support for instructional changes	6 course frameworks; courses completed over 2 years LEAs must identify an IHE partner Mix of in-person and online instruction (blended learning model) Instruction must address both content knowledge and pedagogical skills. District/school leadership support for implementing changes Cohort check-ins by STEM AC	**Quantity** Attrition or STEM endorsement coursework to completion Time to completion **Quality** Teacher satisfaction, perceptions of quality Teacher and instructor perceptions of gaps in content Differences between the programs (how many are using university professors, district instructors or industry partners; length of program; delivery method; emphases within the framework, etc.) What were the barriers and what factors facilitated participation Teacher perceptions of cost and benefit (was it worth their time) For formative purposes, disaggregate by program as well as university based programs vs. alternative formats	Teachers perceive increased instructional effectiveness (e.g., more differentiation, less time needed for remediation, more targeted instruction on specific skills, use of data reports) Teacher reports of: *increased content knowledge *increased technological knowledge and skill *increased pedagogical knowledge and skill *perceived impact of endorsement courses on teaching practices (quality, effectiveness, amount) *confidence *teacher perceptions of abilities to integrate STEM into instruction. Teacher professional satisfaction (incl. turnover) Impact on professional advancement, perceived employment options Changes in lesson plans (pre to post)	Teacher perceptions of changes in student's STEM *Awareness *Engagement *Interest *Learning Improved STEM SAGE results *Proficiency *Growth percentile *Raw scores *Interactions with grade level, usage type, demographic variables, schools/teachers

→ Order of implementation

STEM Endorsement Second Cohort Characteristics

Table 36. Elementary STEM Endorsement – Participants Continuing in the Second Cohort

Partner Institution of Higher Learning (IHE)	Total IHE Participants	Partner Districts (and Number of Participants)
Brigham Young University (BYU)	36	Alpine SD (18), Nebo SD (18) – NOT CONFIRMED
Dixie State University (DSU)	29	Washington SD (20), Charter (9)
Southern Utah University (SUU)	106	Beaver SD (4), Canyons SD (15), Charter (4), Garfield SD (2), Iron SD (23), Jordan SD (45), Kane SD (3), Millard SD (2), San Juan SD (4), Washington SD (4)
University of Utah (UU)	43	Granite SD (24), Murray SD (7), Salt Lake City SD (12)
Utah State University (USU)	49	Box Elder SD (9), Logan SD (1), Cache SD (3), Weber SD (20), Toole SD (14), Charter (2)
Utah Science Teachers Association (UT STA)	68	Alpine SD (6), Beaver SD (1), Cache SD (18), Canyons SD (1), Charter (5), Granite SD (5), Iron SD (2), Jordan SD (6), Murray SD (2), Nebo SD (13), Ogden SD (2), Provo SD (1), Salt Lake City SD (4), Wasatch SD (1), Weber SD (1)
Utah Valley University (UVU)	32	Charter (3), Park City SD (11), Provo SD (12), Tintic SD (6)
Weber State University (WSU)	84	Davis SD (60), Ogden SD (24)
Total	**447**	**25 School Districts plus 23 Charter Schools**

SOURCE: STEM AC DATA

Table 37. Elementary STEM Endorsement 2018-19 Survey Respondents by Partner IHE

	BYU	DSU	SUU	USU	UU	UVU	WSU	Other	Total
Teacher Ns	26	28	2	0	35	22	1	1	**115**

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

Table 38. Elementary STEM Endorsement Survey Respondent Characteristics

Grades currently teaching		**Years of teaching**	
K	9%	No response	6%
1st	12%	0-2	2%
2nd	15%	3 to 5	25%
3rd	12%	6 to 10	25%
4th	19%	11+	42%
5th	20%		
6th	14%		

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ 26% of teachers in the second cohort of the elementary STEM endorsement program responded to the UEPC Spring 2019 Survey.
- ✓ Over 40% of the teachers who responded to the survey had been teaching for eleven years or more.

[4]Respondents may teach more than one grade; therefore, percentages sum to more than 100

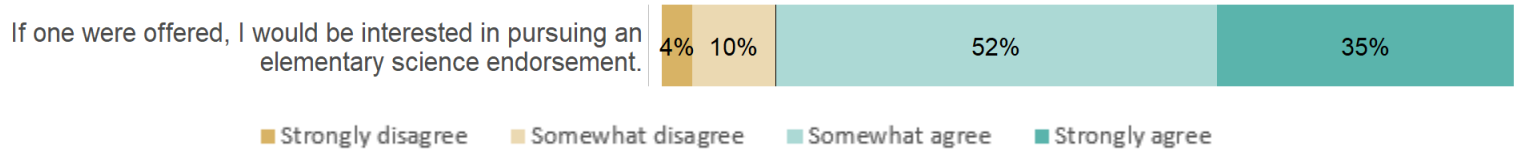
Table 39. Existing STEM-Related Endorsements among 2018-19 Survey Respondents

STEM Related Endorsement	Percentage
None	68%
Mathematics (K-6)	17%
Educational Technology	11%
Biological Science (Secondary)	1%
Chemistry (Secondary)	1%
Earth Science (Secondary)	1%
Environmental Science (Secondary)	1%
Physical Science (Secondary)	0%
Physics (Secondary)	0%
Middle Level Science (Secondary)	1%
Mathematics (Secondary)	1%

- ✓ The majority of teachers did not have a STEM related endorsement prior to starting the program.
- ✓ Over three fourths of teachers reported being interested in pursuing an elementary science endorsement.

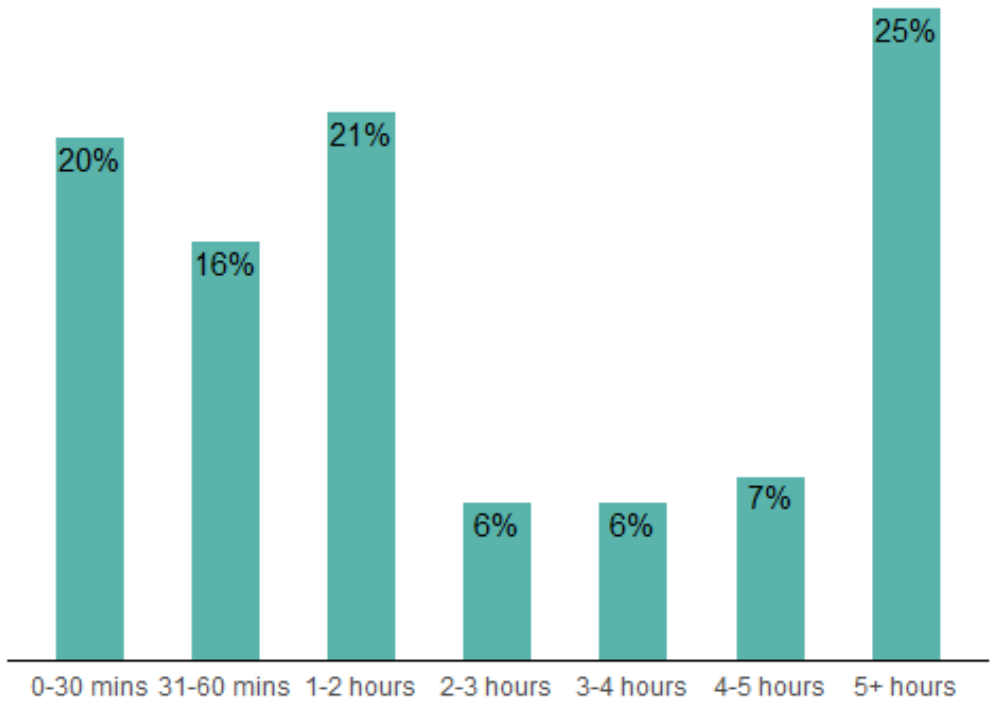
SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

Figure 13. 2018-19 Survey Respondents' Interest in Elementary Science Endorsement



SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

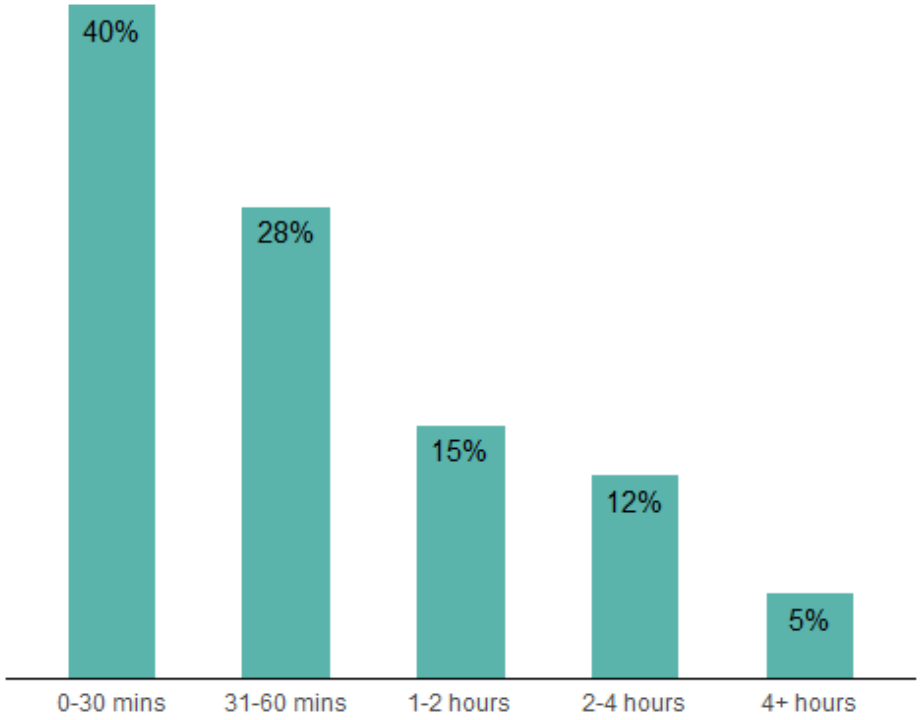
Figure 14. Approximate Minutes Students Engaged in STEM Integrated Instruction



SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ Over a third of teachers reported engaging students in at least 30 to 60 minutes of STEM integration each week.
- ✓ This is an increase from the year prior to starting the STEM endorsement program where almost half reported 30 or fewer minutes per week.
- ✓ A quarter of teachers integrated over five hours of STEM instruction with students each week.
- ✓ This is an another increase from the year prior to starting the STEM endorsement program where only 11% reported integrating over five hours of STEM instruction with students each week.

Figure 15. Approximate Increase of Minutes Students Engaged in STEM Integrated Instruction as a Result of STEM Endorsement

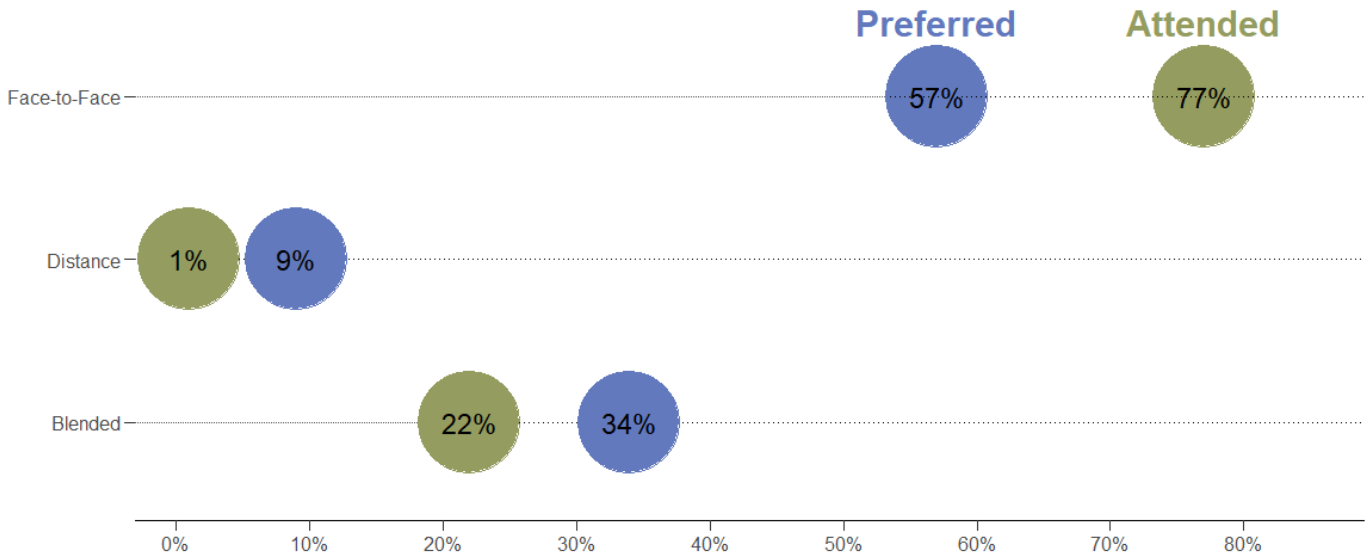


- ✓ Nearly all teachers reported an increase in the amount of STEM instruction that takes place in their classroom as a result of the STEM endorsement.
- ✓ About one third of teachers added an additional 31 to 60 minutes of STEM instruction.
- ✓ Over a third of teachers added more than an hour of STEM instruction.

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

STEM Endorsement Course Format

Figure 16. STEM Endorsement Course Format Actual and Preferred Attendance

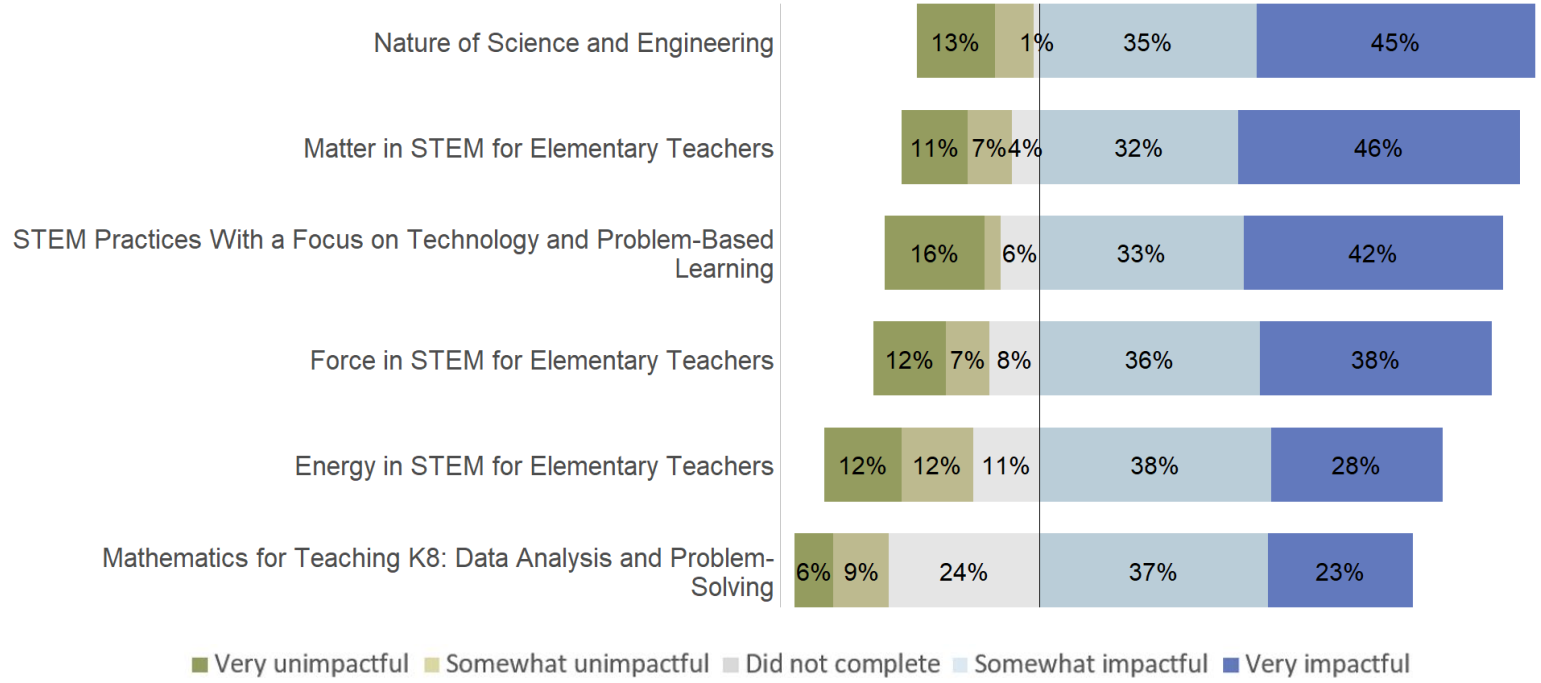


SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ Teachers could select as many as applied.
- ✓ Most teachers attended and preferred face-to-face courses.
- ✓ More teachers preferred a blended course format than attended this type of format.

STEM Endorsement Teaching Impact

Figure 17. Degree to Which the Following Courses Have Been Impactful on Teaching



SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

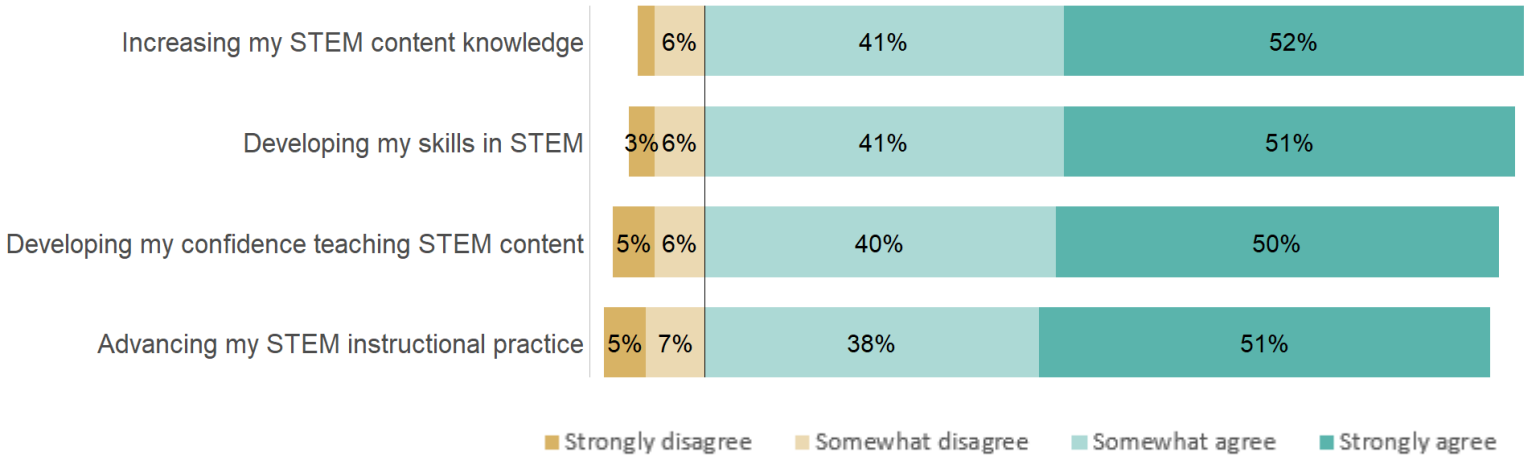
- ✓ Over three fourths of teachers completed all the courses. Mathematics for Teaching K8 had the highest percentage of teachers who reported not completing.
- ✓ At least 60% of teachers found every class to be impactful on their teaching.

95% Of teachers reported that they have started using what they learned from the STEM endorsement program in their classroom.

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

Figure 18. STEM Endorsement Program Impact on Teacher STEM Abilities

The STEM Endorsement Program was effective in…



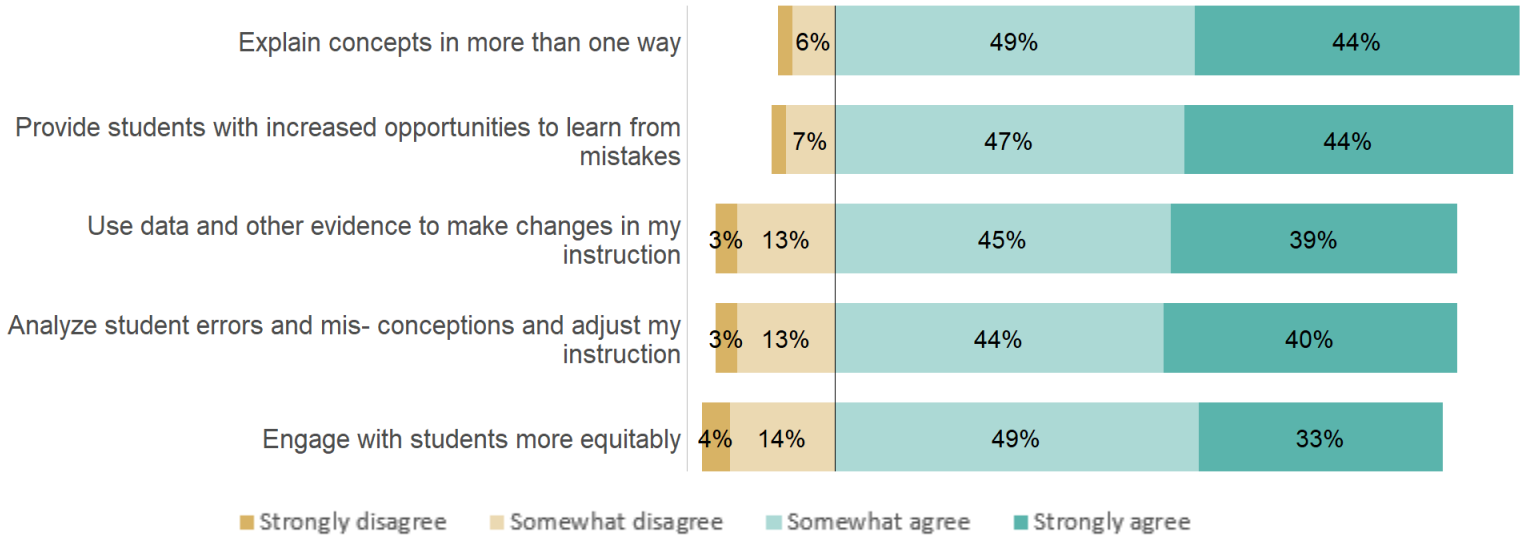
SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ An overwhelming majority of teachers agreed that the STEM endorsement program was impactful on increasing their content knowledge, developing their skills, developing their confidence, and advancing their STEM instructional practice.

- ✓ When comparing the second cohort's 2017-2018 expectations for the STEM endorsement program to their realities in 2018-2019, expectations were slightly higher than what they experienced. In Year 2 over 50% of teachers strongly agreed that the program increased their STEM content knowledge, however 87% strongly agreed in Year 1 that they expected their knowledge to be impacted.

Figure 19. STEM Endorsement Program Impact on Teaching Practices

The STEM Endorsement Program has had a positive impact on my ability to…

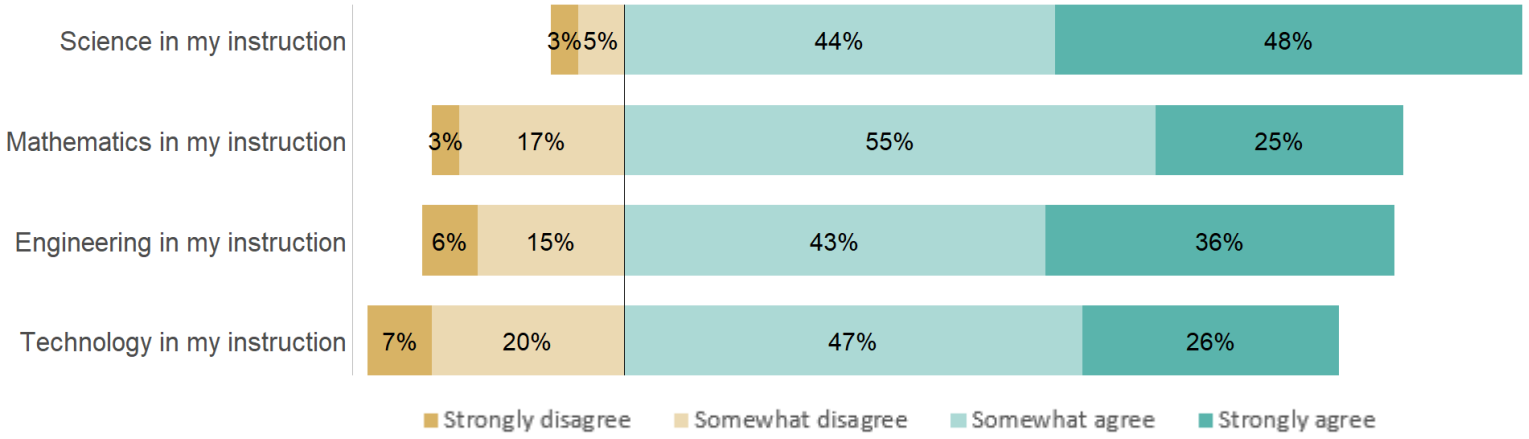


SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ Over 80% of teachers agreed that the STEM endorsement program made a positive impact on their practice of using data and adjusting instruction.
- ✓ Over 80% of teachers agreed that they are able to engage with students more equitably as a result of the STEM endorsement program.

Figure 20. STEM Endorsement Courses Impact on Teacher Integration of STEM

The STEM Endorsement Program was effective in increasing my ability to integrate…

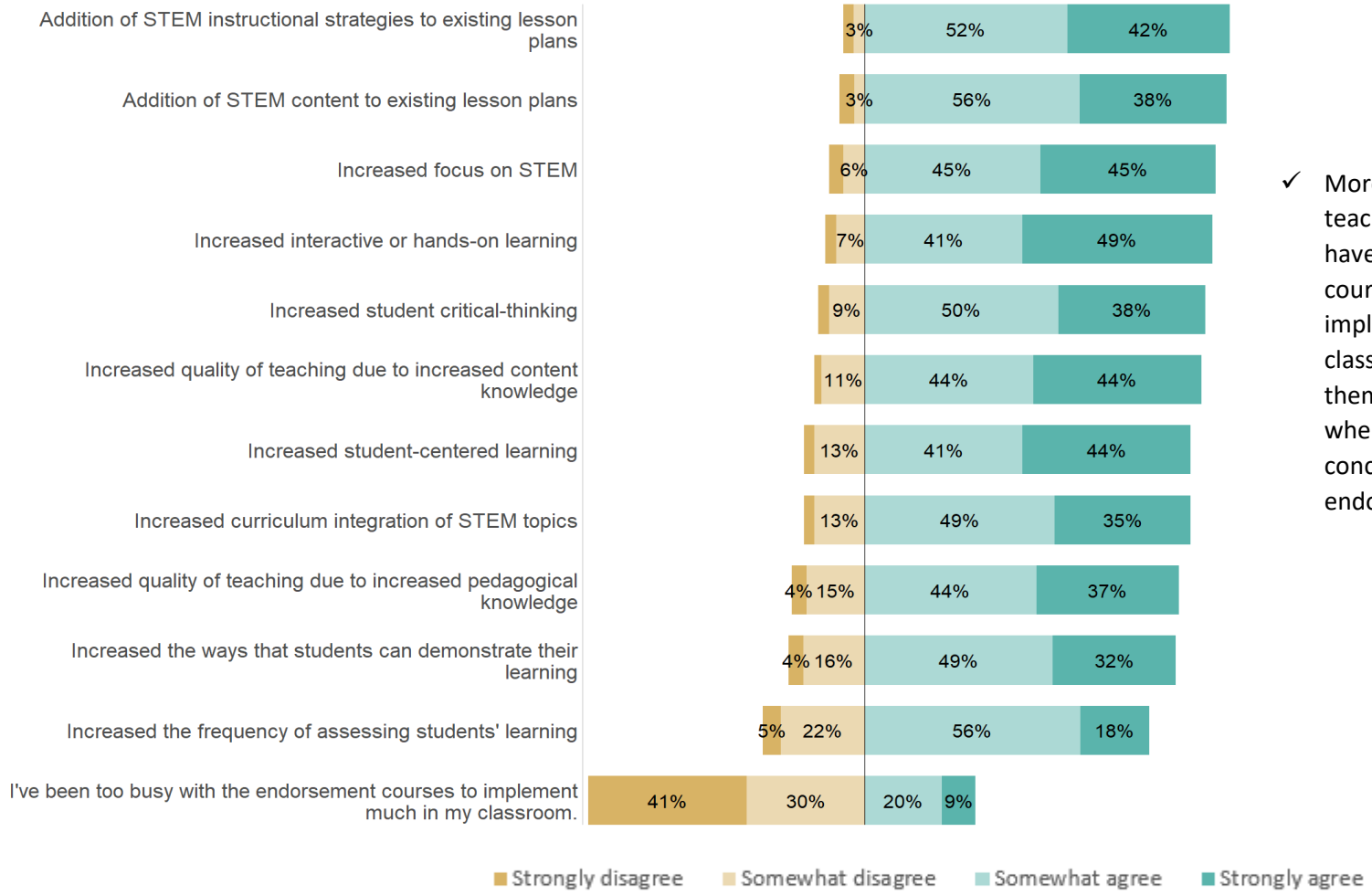


SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ The majority of teachers agreed that the STEM endorsement program positively impacted their ability to integrate STEM topics in their instruction.
- ✓ Teacher agreement was highest for integration of science into instruction (92%), and lowest for technology (73%).

Figure 21. Instructional Changes Based on STEM Endorsement Learning

How much do you agree or disagree that you have implemented the following changes in your classroom based on what you have learned in the STEM Endorsement Program?

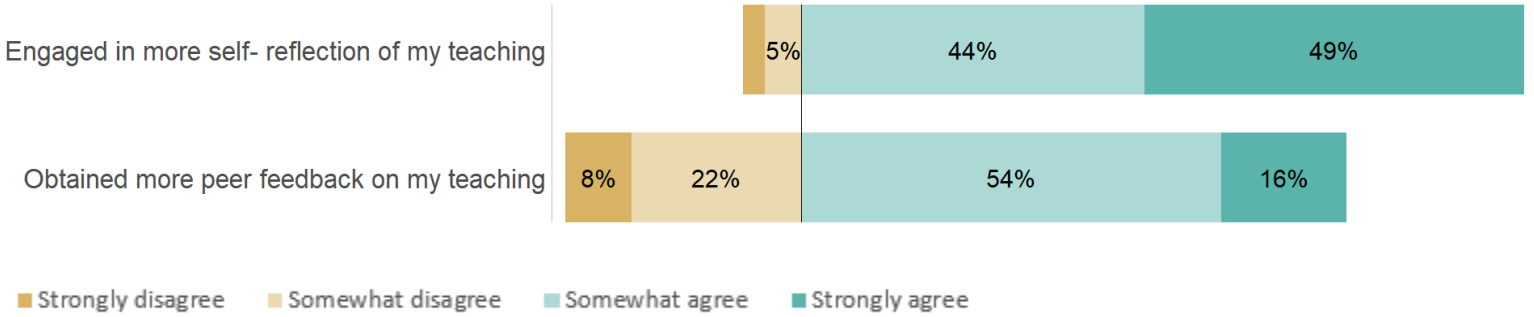


- ✓ More than a quarter of teachers reported that they have been too busy with their coursework to make STEM implementations in their classrooms. Time was also a theme noted in the 2017-2018 when it came to teachers' concerns about the STEM endorsement program.

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

Figure 22. STEM Endorsement Courses Impact on Teacher Self-Reflection and Feedback

As a result of my participation in the STEM Endorsement Program, I have…

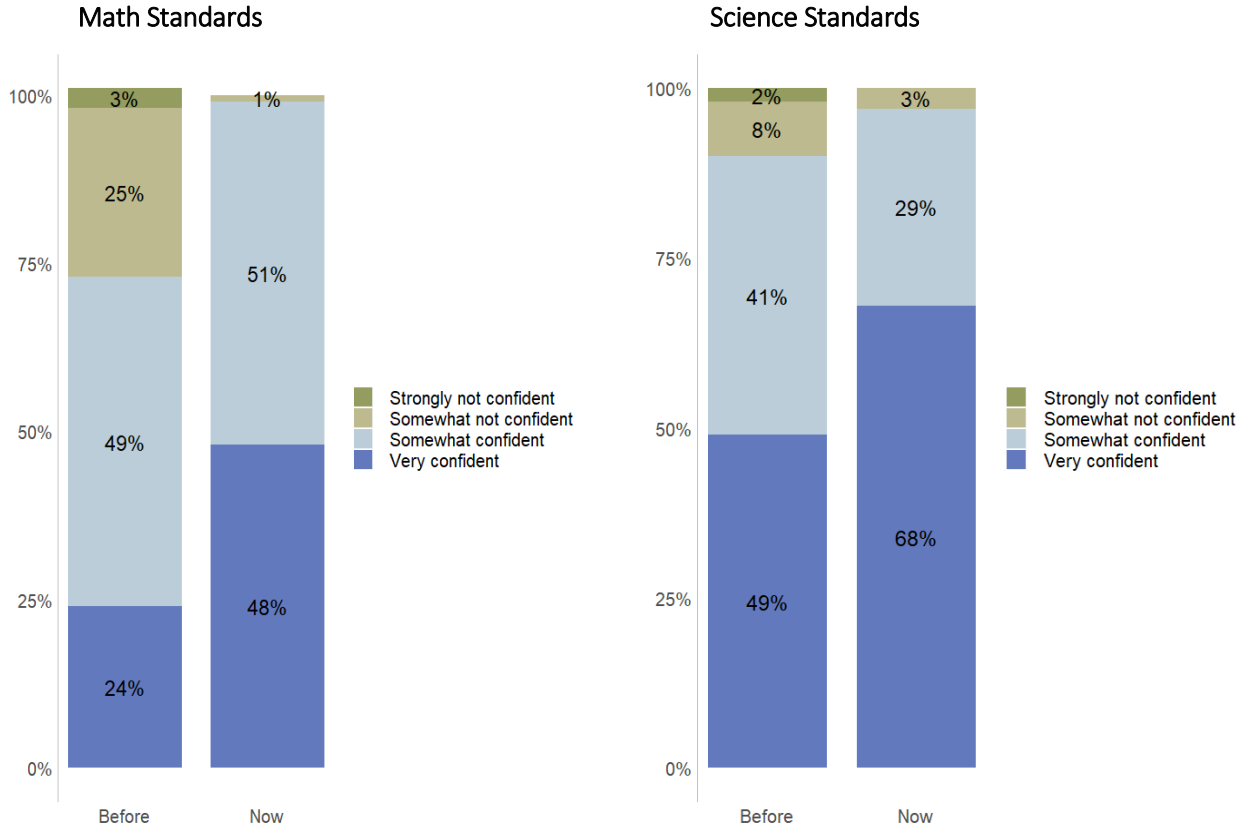


SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ Over 90% of teachers agreed that they now engage in more reflection of their teaching.
- ✓ Thirty percent of teachers reported that they did not agree that they obtain more peer feedback on their teaching because of participation in the STEM endorsement program.

Figure 23. Change in Confidence Levels Related to Teaching Standards

Teachers were asked to indicate how confident they were teaching elementary math and science standards before they started the STEM Endorsement Program (Before) and after completing the program (Now).

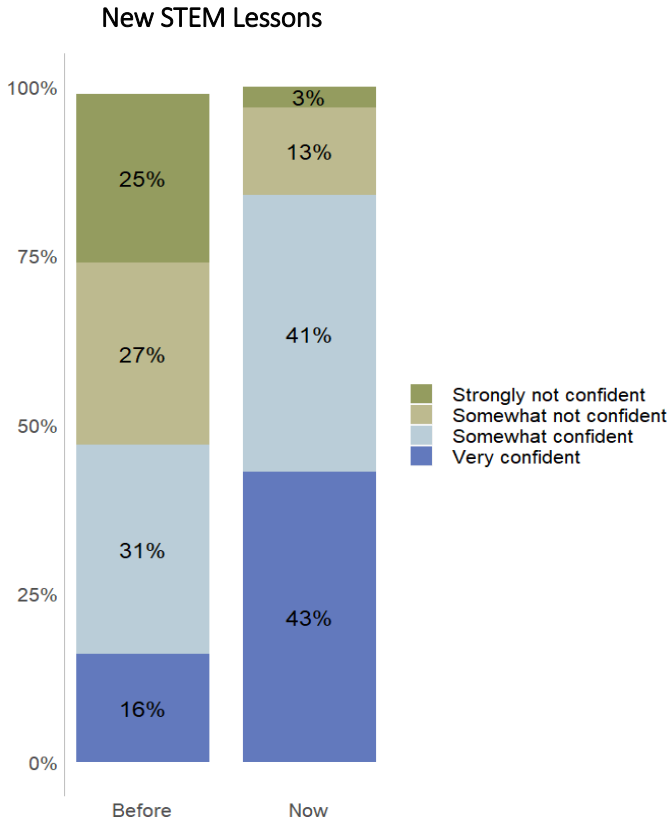


- ✓ Teachers started with more confidence in their ability to teach science standards.
- ✓ However, they reported more change in their confidence to teach math standards.
- ✓ 99% of teachers reported they are confident to teach math standards.
- ✓ 97% of teachers reported they are confident to teach science standards.

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

Figure 24. Change in Confidence Levels Related to Creating New STEM Lessons

Teachers were asked to indicate how confident they were creating new STEM lessons before they started the STEM Endorsement Program (Before) and after completing the program (Now).



93% Of teachers reported that they have confidence to teach STEM lessons that they learned in the STEM endorsement program.

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

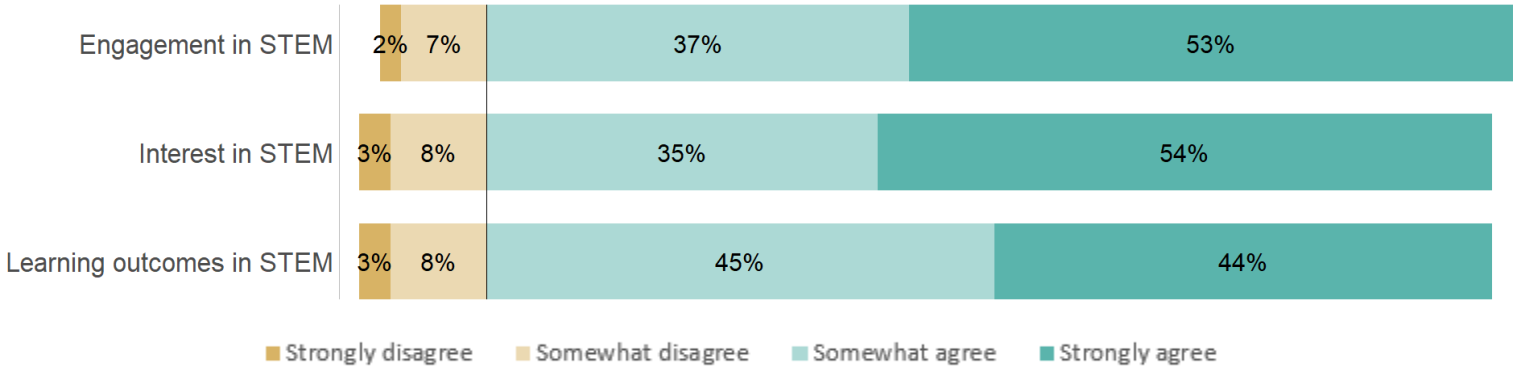
- ✓ Forty-seven percent of teachers reported that they had confidence to create new STEM lessons before they participated in the STEM endorsement program, and now 84% of teachers report having confidence.

- ✓ Most teachers (93%) also reported they were confident teaching STEM lessons learned in the STEM endorsement program.

STEM Endorsement and Student Impact

Figure 25. Reported Benefits for Students of Teachers with STEM Endorsement

The STEM Endorsement Program has had a positive impact on my students'…



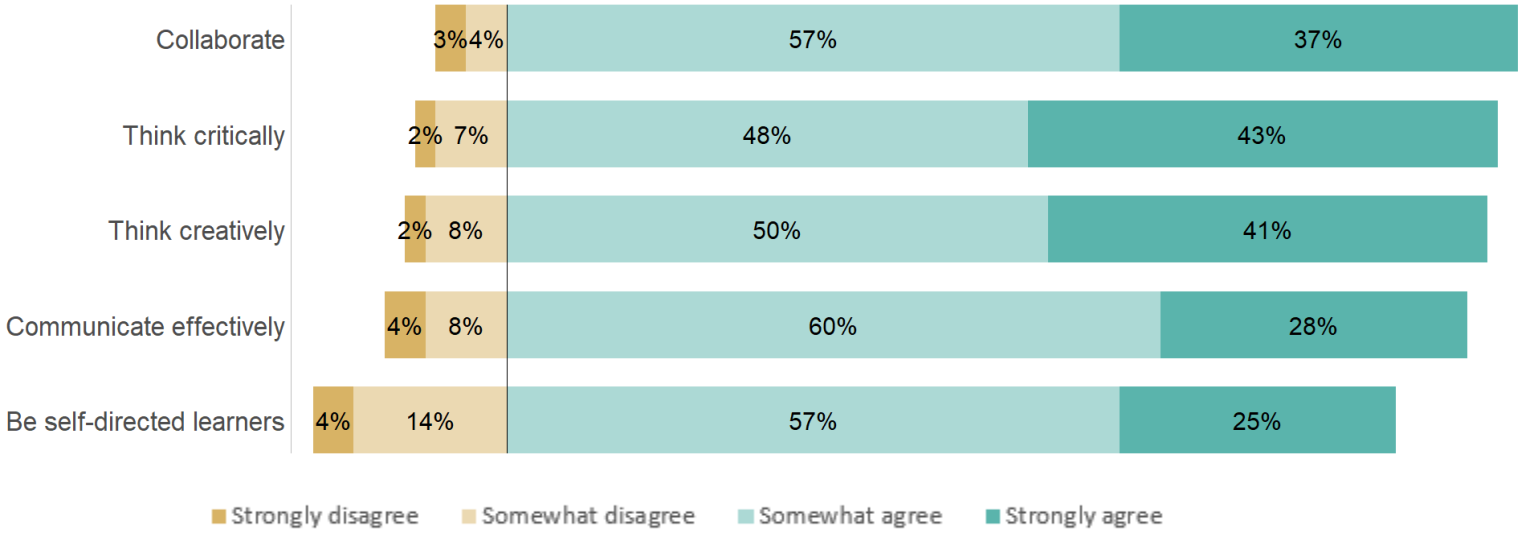
SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ At least 89% of teachers agreed that students were positively impacted in their engagement, interest and learning outcomes in STEM.

- ✓ While these are positive findings, the numbers are lower than what teachers expected impact on students to be before starting the STEM endorsement program. In the 2017-2018 report 88% strongly agreed that engagement in STEM would be impacted, 89% strongly agreed that interest in STEM would be impacted, and 85% strongly agreed that learning outcomes in STEM would be impacted.

Figure 26. Reported Impact of the STEM Endorsement on Students' 21st Century Skills

The STEM Endorsement Program has had a positive impact on my ability to teach my students how to…

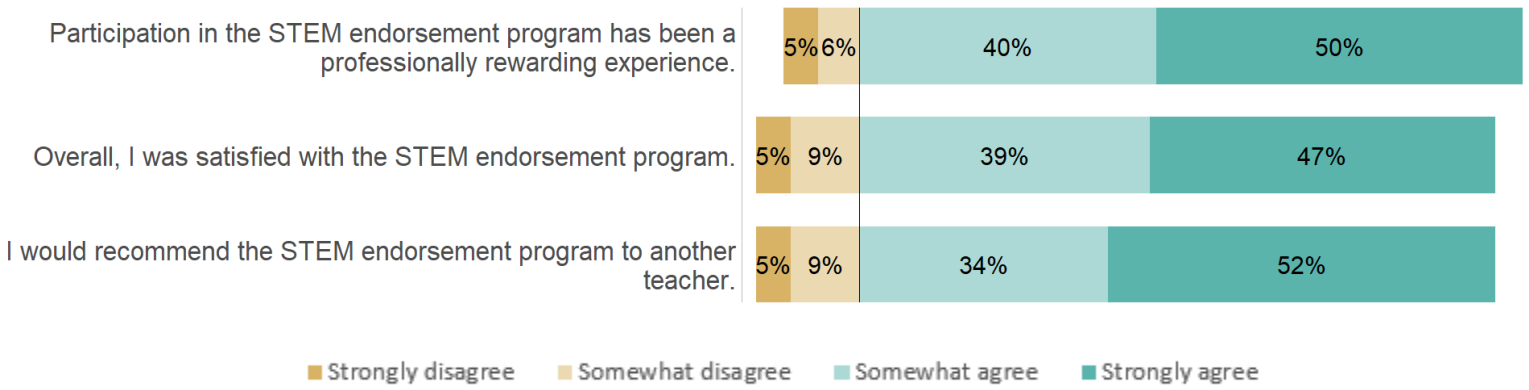


SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ Most teachers agreed that they had been positively impacted to teach students to collaborate, think critically, think creatively, and communicate effectively.
- ✓ Eighteen percent of teachers disagreed that they had been positively impacted to teach students to be self-directed learners.

Teacher Satisfaction with the STEM Endorsement

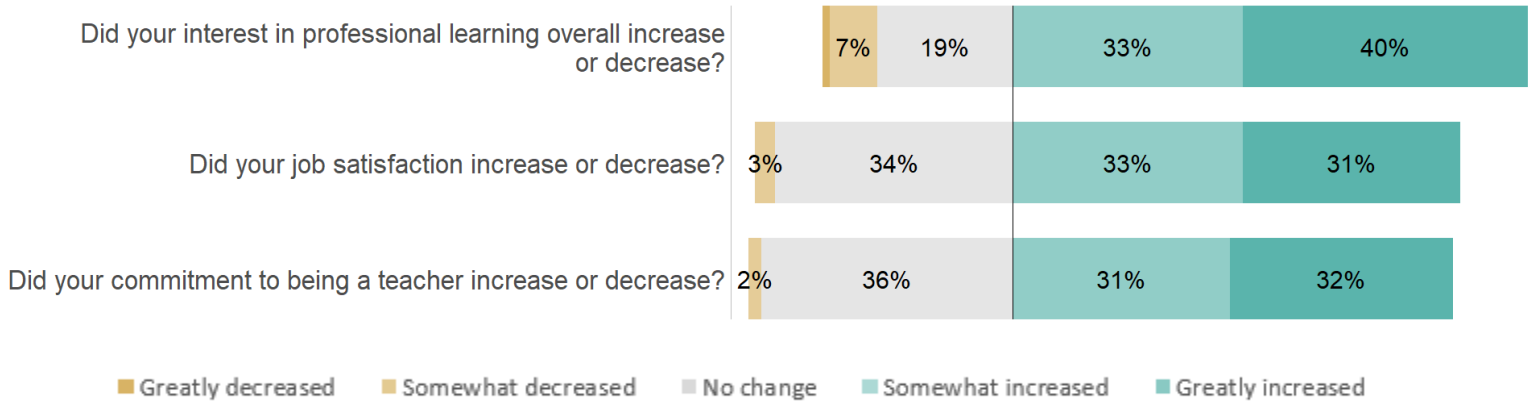
Figure 27. Satisfaction and Recommendations



SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ At least 8 out of 10 teachers agreed that the program has been professionally rewarding, were satisfied with the program, and would recommend it to another teacher.
- ✓ 90% of teachers agreed that they found the STEM endorsement to be professionally rewarding.
- ✓ 86% of teachers agreed that they were satisfied and would recommend the STEM endorsement program to another teacher.

Figure 28. Interest in Professional Learning, Job Satisfaction, and Commitment to Being a Teacher



SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

- ✓ Seventy-three percent of teachers reported an increase in professional learning.
- ✓ Sixty-four percent of teachers reported an increase in job satisfaction.
- ✓ Sixty-three percent of teachers reported an increase in their commitment to being a teacher.

Table 40. Teachers' Feedback for STEM Endorsement Program

The comments below are representative of the feedback provided by teachers of the program.

Theme		Example Quotes
Impact and outcome	**Pro**	"This endorsement gave me a lot more confidence about what STEM truly is and how it needs to be looked at in education. I appreciate that supplies were provided to us, such as notebooks, to use for each class. The professors were very professional and knew a lot about the topics they were teaching." "Often times I left class excited about what I had learned. It has given me a more solid idea of where our science standards are going and how I can teach them. This current class has given me time to dive into our CCC and SEPs. I also think about teaching science and math differently. There has been so many amazing examples of how to teach good science and math lessons. It makes me excited and feel obligated to teach science and math well. I also love my cohort. It has given me a solid go to of professionals."
	Con	"I felt like some of the courses didn't necessarily help me with actually applying strategies in my classroom." "Some teachers expected us to do work that was a little too advanced for us. Again, I just wish we could have had more classroom application. We could have easily rebuilt our entire curriculum in the two years that we have been here, and collaborated with each other would have been so amazing. Instead we have one storyline from our last class and a few ideas here and there that we could have implemented if we took the time."
Engagement and collaboration	**Pro**	"The instructors that had to DO were the best classes. I thoroughly enjoyed the hands-on type activities, and the discussion that came from that." "This is a great experience to learn about Science in an engaging way. The connections we have made with the scientific community have been valuable. It has been wonderful to learn from professional scientists. I also appreciated the instructors who have allowed us to work on assignments in class."
	Con	"Some of the teachers suck at teaching. They planned super boring lessons. They haven't taught us in the way that they are telling us to teach our kids. We need hands on learning not just sitting here listening." "The energy in STEM class did not feel like it had anything to do with teaching STEM concepts in the classroom. It felt very much like a college course I would need to have in order to become a biologist, not to teach k-6 students."
Course content and structure	**Pro**	"It's been wonderfully flexible and we've had freedom to adapt assignments to fit our classroom needs, thus making it meaningful and purposeful. The professors have been wonderful." "I think the courses that make up the program are an excellent, well-rounded offering. Working through the endorsement with a cohort for 2 years has been very beneficial as we have developed professional relationships and support that we wouldn't have if the courses were taught in isolation. Focusing on increasing content knowledge has been so helpful - I am a better STEM teacher because I have stronger content knowledge."
	Con	"The summer was tough and probably too much information to take in during the 3 weeks. At times the work load was too much. As an elementary teacher sometimes my background knowledge was limited and I had to spend a lot of time in research to build my background knowledge. Sometimes this took time from preparation from my own students." "Some classes felt more like lecture, and were less effective. The endorsement needs to be geared for all elementary ages, and need to help lower grade teachers see how it can relate to their core."

Source: UEPC STEM Endorsement Teacher Survey Spring 2019

Table 41. How STEM Endorsement Participation Affected Teachers' Commitment

The comments below are representative of the feedback provided by teachers of the program.

Theme	Example Quotes
Excitement or motivation	"I have enjoyed the learning experiences that I have had in the STEM program. I am more committed to teach the SEEd standards and now I know how to do it. It has made me more excited to teach STEM." "I've always been passionate about professional learning, so that has not changed. Due to my increased knowledge and resources, I have been extra passionate about my job and STEM integration, which has greatly increased my job satisfaction (as well as my admins' satisfaction with my job performance). This also gives me motivation to stick with teaching, but at year 18 I'm mostly already in it for the long haul."
Hands-on learning	"After the STEM endorsement, I have learned how to make learning more concrete and more hands-on. This has especially benefited my ELL students because their learning has become more concrete. It has also benefited their end of year scores as they are able to explore more in science and math, along with engineering to build their knowledge with the science and new SEED standards." "New Ideas on how to implement the standards helped me to integrate theory into hands on action that kids could benefit from. Working with knowledgeable educators helped me to question, understand and implement many new ideas and strategies which are more modern than strategies used in the past. Teachers need hands on experiences too as they learn how to explain phenomena, make claims and explain their reasoning to their students."
New perspective or thinking	"Now completing this endorsement, I have looked at teaching science in a different way. My teaching style has changed from less class time to more lab. Having the students explore content instead of memorizing content is more rewarding for both teacher and student." "Overall, the STEM endorsement has created a different picture of how I look at presenting my lessons. Now, I focus on more integration of Math, Technology, and Engineering within my science lessons. There is also more critical thinking and collaboration going on throughout the students."
Confidence and preparation	"I feel more confident and prepared to address the content, and this makes me more excited and enthusiastic in my teaching." "With the new science standards coming up, I do feel more prepared on how to transition and include the SEP's and CCC's in my teaching. Also I understand what phenomenon is now! I think I can help my fellow teachers know how to handle the standards changes when they arrive." "I greatly enjoyed the opportunity to learn alongside like-minded teachers across many grade levels. This type of professional development really helped me stay motivated to find connections to my own teaching. I feel better prepared to take on the new standards in the sense that I got a sneak peek this year at what is coming as well as a chance to discuss how they will look in an actual classroom with a science coach and other K-2 teachers."

SOURCE: UEPC STEM ENDORSEMENT TEACHER SURVEY SPRING 2019

Table 42. Reasons Teachers Would Recommend STEM Endorsement Program to Others

The comments below are representative of the feedback provided by teachers of the program.

Theme	Example Quotes
Applicability	"It was "user friendly" in that the content was understandable and taught in a way that I could easily implement it in my classroom. I found the coursework to be challenging, yet relevant to my teaching. I utilized many of the lessons and examples within my own classroom, so I got to "test" it out in real-time. That in and of itself made the teaching much more impactful and enjoyable. The classwork was difficult at times, but I feel it only improved my teaching." "I have learned so much from the passionate professors and teachers. Each one has shown me strategies that I can use to implement in my classroom. I have gained a lot of knowledge that has made me a more confident teacher in the STEM areas. I have also developed some strong friendships with my cohorts and have learned from them also. We have shared ideas about our common grade level that I can use in my classroom. I will miss my association with them. I am interested in a science endorsement if there ever is one!"
Knowledge base and understanding	"This course work deepened my understanding of STEM and helped me be better prepared to plan lessons/experiences for my students. I feel it prepared me for the shift in the new core standards too." "I would recommend the STEM endorsement program to other lower elementary teachers because it provides more content knowledge on our science topics. I also gained many new ideas on how to integrate STEM into my current curriculum." "I would recommend this program because I have gained a lot of content knowledge, as well as new effective pedagogical strategies. The STEM practices course has allowed me the chance to write more lesson plans, and has also guided me in planning better for STEM lessons."
Increased confidence	"I feel much more prepared to integrate STEM into my curriculum. I got so many ideas of activities I can do in my class that relate to the Core. I also got ideas about how to teach my students how to collaborate and how to not give up if something doesn't work." "It has been extremely helpful in increasing my confidence in teaching science and technology and engineering. It has been extremely useful in broadening my pedagogical knowledge in these subjects and has been very valuable in increasing my own understanding of these concepts."
Hands-on and student engagement	"I will recommend the program for the hands on activities, teachers explore different ways to teach and use the new generation core to increase the students learning, creativity and exploration with mathematics and science in a fun educational way." "I would recommend the STEM endorsement program to another teacher because I feel like it has helped me think about science in a new way and has helped me make science more engaging to my students. I also think that the more teachers there are that understand STEM based instruction, the more students we will have that can think critically. On top of that I feel like many of the skills I have gained in the endorsement program can be used in other content areas other than science or math, which will result in more engagement overall."

Source: UEPC STEM Endorsement Teacher Survey Spring 2019

Table 43. Reasons Teachers Would Not Recommend STEM Endorsement Program to Others

The comments below are representative of the feedback provided by teachers of the program.

Theme	Example Quotes
Applicability	"I don't feel like a lot that has been taught truly connects with my grade level and/or is not realistic to do in a classroom of children." "I would recommend this endorsement for any upper grade teacher but would not for k-1. I found it very difficult to utilize much of what I have learned." "The endorsement has helped me understand engineering. It has been difficult for me to integrate. I feel lost and need more support. I wish we would have written more lessons and had the teachers look them over and give us specific help." "I feel like so much of the content and lessons are geared toward middle school and high school teachers. It would be nice if it was more geared to elementary specific standards and activities." "As an admin, not in a building, it was very hard to collaborate and work with other teachers and students. The classes were geared to classroom instruction but stayed quite shallow in my point of view. I wished that it was more STEM-oriented and not just a glorify hands-on science lesson. Some instructors did better than others to lead real, authentic experiences. I expected a clear format for PBL and more support to show teachers how to create their lessons, based on their curriculum. It did not happen!"
Workload and expectations	"I dropped out the first semester due to the ridiculous amount of homework and the extra time involved. Quite a few students dropped out of the STEM course at Dixie State University for the same reason." "I think that all the heavy content was a struggle to go through. It was especially hard when we were not connecting it to our classrooms. I also was disappointed that we did not have any information on technology and very little on engineering. In reality this was a science endorsement with one math class. I would have been happier with more classroom application throughout the entire endorsement." "The endorsement program was very intense. As a professional teacher trying to do the STEM endorsement at times was very frustrating and daunting. There was huge work load. It was easier when the teaching and classes became more problem based. We are professionals. We already know about pedagogy. I found my Master degree to be less work than this endorsement. If I had to do it all over again, I don't know if I would because of the work load." "I loved learning about the concepts and the different ways to teach STEM in my classroom. However, I feel the curriculum was very high and some of the content was WAY too in-depth. The two intensive classes in the summer were great, but hard to do that much in that small of a time period. I also feel the outside class work was really a lot when I am already doing a lot this year with learning how to incorporate PBG and having the new science standards coming in two years."

Source: UEPC STEM Endorsement Teacher Survey Spring 2019

Considerations for Improvement for the Elementary STEM Endorsement Program

Teachers continuing in the STEM Endorsement Program were positive about the program, saw an increase in their STEM instruction, developed more skills in STEM content, and reported positively impacting their students in STEM. Data for this evaluation were from teachers in the second year of the program.

The following considerations are provided for the purpose of informing the STEM Endorsement program improvement efforts.

Findings	Considerations for Improvement
Nearly all respondents (95%) reported that they have started using what they learned from the STM endorsement program in their classroom. Almost all teachers reported an increase in the amount of STEM instruction that takes place in their classroom each week as a result of the STEM endorsement. 1 in 4 teachers have added at least 30 to 60 minutes to their teaching. Eighty-four percent of teachers reported that they have the confidence to teach STEM lessons that they learned in the STEM endorsement program.	**Encourage collaboration, professional learning, and sharing knowledge.** • Create a platform (e.g. online network, Twitter chats) for teachers to continue to collaborate on STEM integration and implementation of their professional learning from the endorsement program. • Provide samples of the changes in lesson plans resulting from the endorsement program. • Build a repository of integrated lessons attempted and feedback/reflections from participants to contribute to the lesson bank and professional community. • Facilitate or encourage peer mentoring to support application of the STEM endorsement program learning directly and immediately into the classroom.
At least 8 out of 10 teachers agreed that the STEM endorsement program was a professionally rewarding and satisfying experience. They would recommend the program to another teacher. Levels of professional learning, job satisfaction, and commitment to teaching were positively increased by the majority of teachers in the program.	**Promote teacher enrollment in the STEM endorsement program.** • Cultivate new strategies of course pathways to encourage additional teachers to participant in the STEM endorsement program. • Use stories of previous participants to strategically market the endorsement program to recruit teachers from schools with low scores in math and science to continue to meet the objectives of the program. • Study previous participants to explore how they are applying learning from endorsement program.

Findings	Considerations for Improvement
115 teachers from 16 charter schools and 15 school districts participated in the STEM endorsement teacher survey in spring 2019. This represents about 26% of the teachers in the second cohort.	**Provide opportunities throughout the endorsement program to explore learning transfer to teacher practice.** • Examine strategies used by teachers to increase the application of STEM learning. • Provide a follow-up survey to determine the impact of completing the endorsement program.

STEM Professional Learning Program

Background

In 2014, the Utah Legislature passed HB 150, *Science, Technology, Engineering, and Mathematics Amendments*, which required the STEM Action Center to select a high quality professional learning platform through an RFP process to improve STEM education. HB 150 required the platform to provide educators with automatic tools, resources, and strategies, and allow teachers to work in online professional learning communities (PLCs). The tool was also required to include videos of highly effective STEM education across a range of content and grade levels, and allow teachers to upload their own videos and provide and receive feedback.

The STEM Action Center initially selected Edivate by the School Improvement Network (SINET) as the platform that was best able to meet all of the legislative requirements; however, schools may choose a combination of technology-based, face-to-face, and hybrid or blended learning opportunities. Funds for professional development are made available to Utah's public K-12 schools through a competitive grant application process for LEAs.

Program Overview

The STEM Professional Learning Program has been designed to help schools determine and address their needs regarding STEM professional learning and growth using one-year or three-year plans. As part of the grant, teachers are required to upload videos of themselves teaching in order to reflect on their practices and receive feedback from peers. The program is intended to improve all aspects of STEM instruction, including content knowledge and pedagogy, integration of STEM into non-STEM lessons, and confidence in teaching STEM. Additionally, the program is intended to increase teachers' perceptions of the value of professional learning and reflective practice.

Evaluation Methods

The evaluation of the STEM Professional Learning Program focused on program implementation and educator outcomes to determine the degree to which the program is meeting the goal of increasing TPACK and its applications among participating teachers (see the program logic model below). Specifically, for program implementation, we assessed both *quantity* (e.g., how much time did teachers engage in professional learning) and *quality* (e.g., to what extent did teachers perceive that they received useful content?). For teacher outcomes, we assessed teacher perceptions of the changes they had made (and intend to make) based on the professional learning. We also assessed teacher perceptions of the impact of the professional learning on their teaching, STEM skills, instructional practice, interest in professional learning, STEM content knowledge, and confidence teaching STEM. Administrators were asked similar questions about the effect of the professional learning on teachers. For student outcomes, we assessed teacher and administrator perceptions of the impact of the professional learning on students' learning outcomes and interest in STEM.

Data sources included program records and surveys administered to teachers and administrators at participating schools. The STEM Action Center provided the survey link to LEAs who distributed them to teachers and administrators. In total, 1,475 teachers and 113 administrators started the survey. This report provides descriptive statistics from the survey responses. Qualitative data from the surveys were analyzed by the evaluation team who used open coding followed by development of coding categories. Results are synthesized and presented by major themes.

Figure 29. STEM Professional Learning Logic Model

What do you want to accomplish? **Implement STEM Professional Development in order to increase TPACK and its applications**

Order of planning ←

RESOURCES	PROCESSES/ACTIVITIES	IMPLEMENTATION OUTCOMES	EDUCATOR OUTCOMES	STUDENT OUTCOMES
Edivate and other PD providers Partners (USBE, LEAs, LEA teacher leaders, teachers) School support for instructional changes Time provided for PL by the LEA or school Tech resources and support needed for the type of usage of the PD tool (e.g., uploading videos) District leadership participation/buy-in Templates & other support provided by STEM AC	PD must address both content knowledge and pedagogical skills. Vendor support for teachers and leaders for implementation, training, presentations In years 1 - 3, use was exploratory. In year 4+, more structure has been provided. Structured plans are also required for non-Edivate sites. District leadership participation/buy-in Availability/accessibility of technical assistance for teachers. Quarterly check-ins and review of help tickets and usage to identify schools that may need help.	**Quantity:** # of licenses requested, distributed, used; changes over time Participation levels (# of licenses requested, # allocated, # used, comparison to prior years, who is using – teachers or coaches, etc.), % PD used for STEM vs. other areas Depth of teacher engagement in the PD (how many of each type, length of PD) How many teachers are reaching fidelity within Edivate (20 minutes/month minimum) **Quality:** Perceived quality of the delivery system and the content by LEAs, teachers, IT, administrators (e.g., vendor support, ease of use; program requirements; admin support) Teacher perceptions of usefulness of self-videos and self-reflections; was there appropriate hardware and tech support to support this component What were the barriers and what factors facilitated ease of use Integration of the program into teacher learning plans Teacher perceptions of cost and benefit (is the PD perceived as burdensome?)	Teachers perceive increased instructional effectiveness (e.g., more differentiation, less time on remediation, more targeted instruction on specific skills, use of data reports) Teacher reports of: *increased content knowledge *increased technological knowledge and skill *increased pedagogical knowledge and skill *perceived impact of PL on teaching practices *confidence *teacher perceptions of abilities to integrate STEM into instruction *professional satisfaction (incl. turnover) Teachers report increased interest and comfort with self-reflection and videos, including use beyond the requirements (incorporate self-reflection into their teaching practice).	Teacher perceptions of changes in student's STEM *Awareness *Engagement *Interest *Learning Improved STEM SAGE results by teacher PD type and use *Proficiency *Growth percentile *Raw scores *Interactions with grade level, usage type, demographic variables, schools/teachers

Order of implementation →

Table 44. Numbers of Participants in STEM Professional Learning (PL) 2018-19

School District	Reported Professional Learning Participants
Alpine District	1,261
Cache County District	89
Canyons District	204
Davis District	1,188
Emery District	40
Granite District	38
Iron District	6
Jordan District	160
Morgan District	151
Nebo District	103
Ogden City District	32
Piute District	35
Provo District	427
Salt Lake District	135
San Juan District	31
South Sanpete District	71
South Summit District	141
Tooele District	96
Washington District	244
Wayne District	40
Weber District	420
22 Charter Schools	820
Total	**5,732**

Source: STEM AC data and annual reports

- ✓ 5,732 teachers participated in STEM professional learning during the 2018-2019 school year.
- ✓ Participants came from 21 school districts and 22 charter schools.

Table 45. 2018-19 Teacher and Administrator Survey Response Numbers for the Professional Learning Project

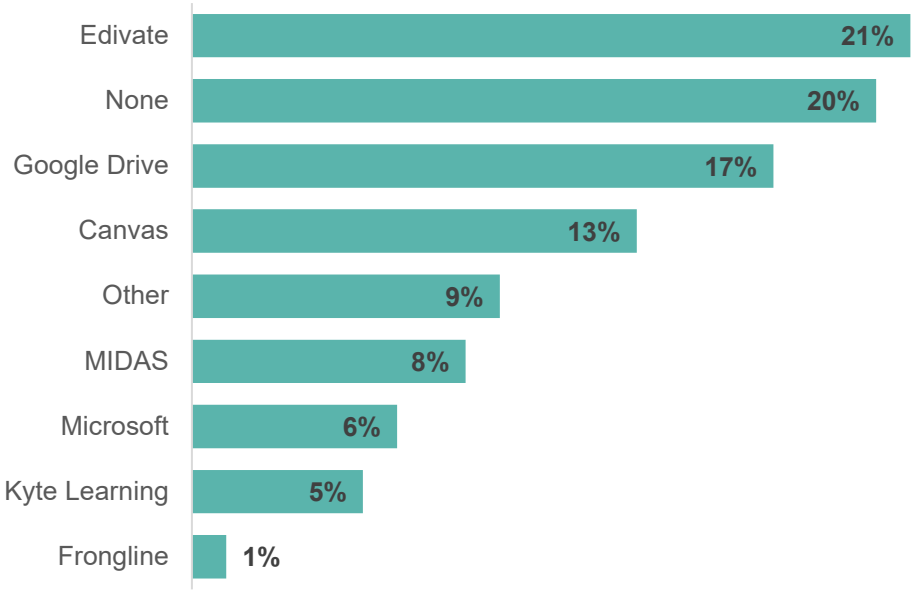
	N	%
Teachers Total	**1,475**	**100%**
Administrators Total	**113**	**100%**
Teachers by Grade Level Distributions		
K - 2nd	443	30%
3rd - 6th	763	52%
7th - 8th	341	23%
9th - 12th	673	46%
Teachers by STEM Areas		
Science	933	63%
Technology	774	52%
Engineering	412	28%
Mathematics	960	65%
Does not teach STEM	236	16%

- ✓ Most teachers (84%) who responded to the professional learning survey taught at least one STEM area.
- ✓ Teachers could choose more than one grade level and STEM area; therefore, the percentages add to more than 100%.
- ✓ Only 28% of teachers indicated they taught engineering.

SOURCE: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

Figure 30. Teacher Reported Primary Platform for Video-Based STEM Professional Learning

This question was asked of teachers who taught a STEM area and participated in STEM professional learning during the school year (n = 915)



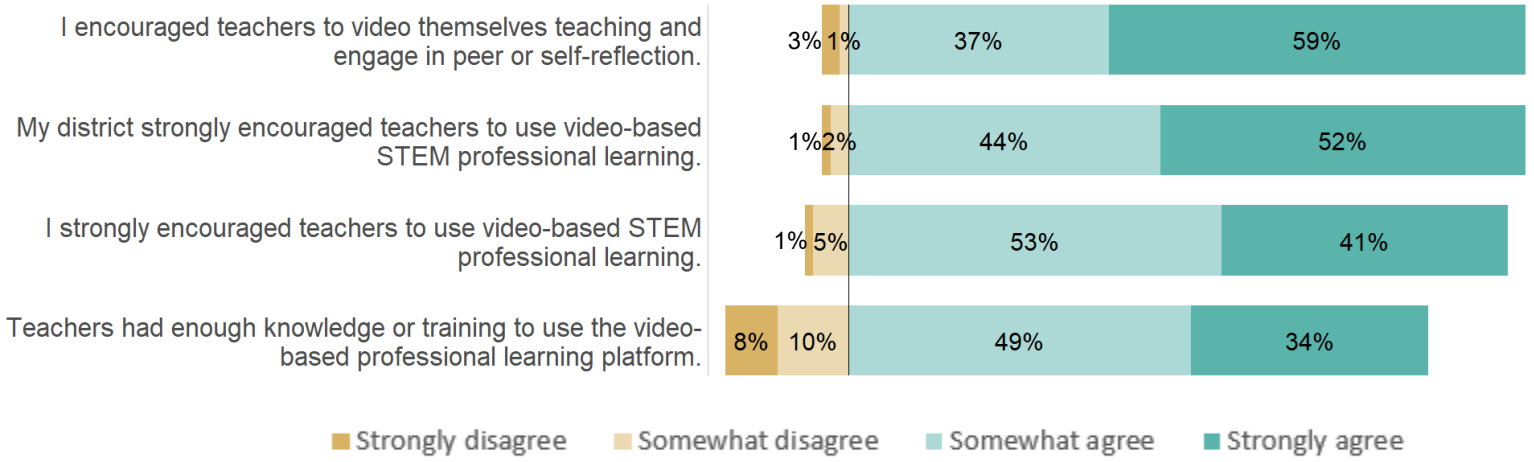
SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ Teachers reported a wide range of primary platforms for video-based STEM professional learning.
- ✓ 20% of teachers indicated they did not have a primary platform for video-based professional learning.

Preparation and Support

Figure 31. Administrator Perceptions of Support for Teachers to Use Video-Based STEM Professional Learning

Administrators who indicated their school used a platform for video-based learning (n = 81) were asked about support for video-based professional learning for teachers in their school.

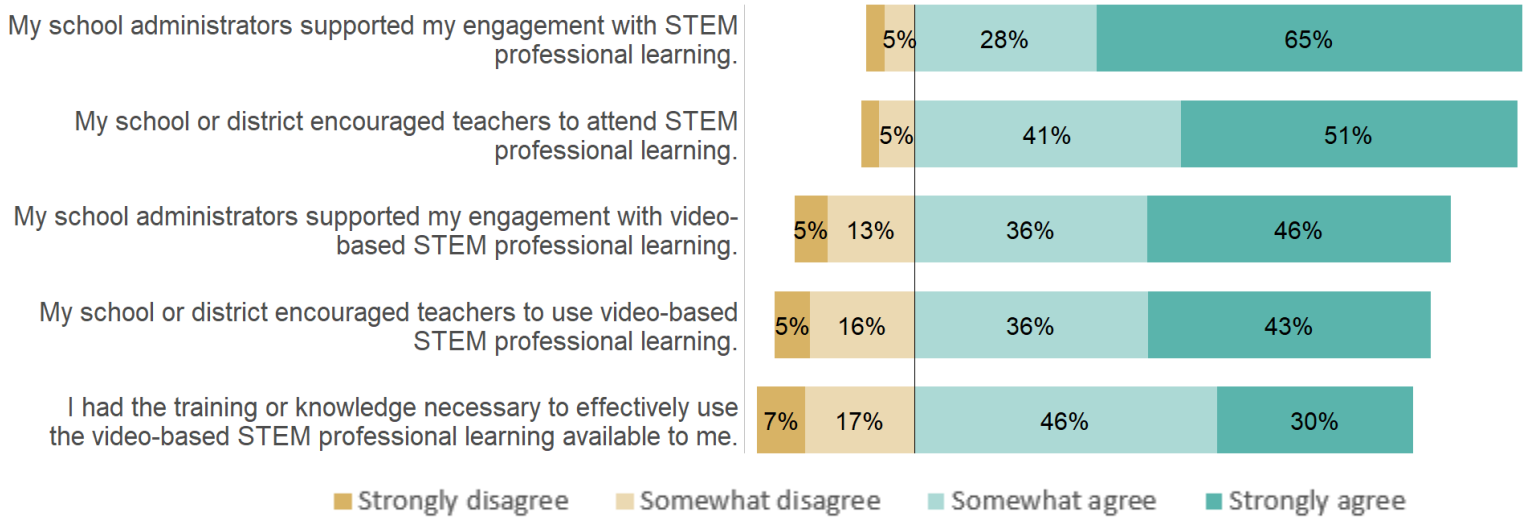


SOURCE: UEPC ADMINISTRATOR SURVEY SPRING 2019

- ✓ 96% of administrators encouraged teachers to video themselves for peer- or self-reflection.
- ✓ 18% of administrators reported that teachers needed more training.

Figure 32. Teacher Perceptions of Support for Use of Video-Based STEM Professional Learning

This group of questions was asked only of teachers who indicated they used video-based STEM professional learning (n = 887).



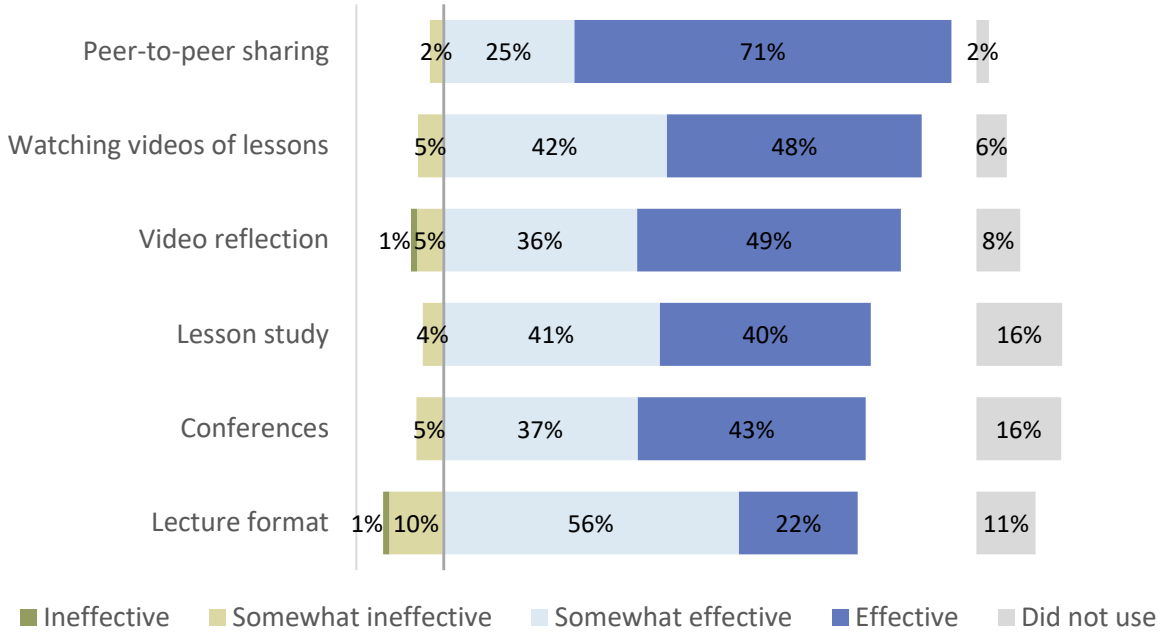
SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ Around 80% of teachers agreed the district and administrators supported participation in STEM professional learning.
- ✓ More than three quarters of teachers agreed they had the training or knowledge necessary to use the video-based professional learning, but 24% could use additional assistance.
- ✓ Teachers reported more support for STEM professional learning than for video-based STEM professional learning.

Use and Effectiveness of Professional Learning Formats

Figure 33. Administrator Perceptions of Teacher Use and Effectiveness of STEM Professional Learning Formats

These questions were asked of administrators who indicated teachers at their school had participated in STEM professional learning (n = 104).

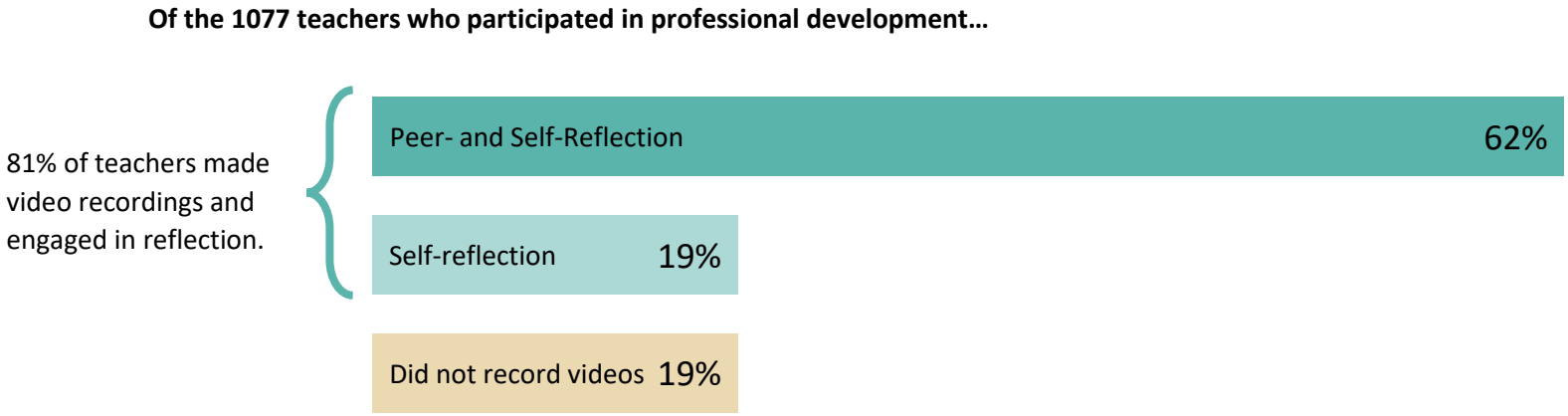


SOURCE: UEPC ADMINISTRATOR SURVEY SPRING 2019

✓ Peer-to-peer sharing, watching videos of lessons, and video reflection were most commonly used, and seen as effective by most administrators.

Figure 34. Teacher Participation with STEM Professional Learning and Video Reflections in 2018-19

94% Of teachers participated in some kind of professional learning during the school year (1101/1077). Below is a breakdown of teachers' recording of video and engaging in reflection as part of their STEM professional learning.



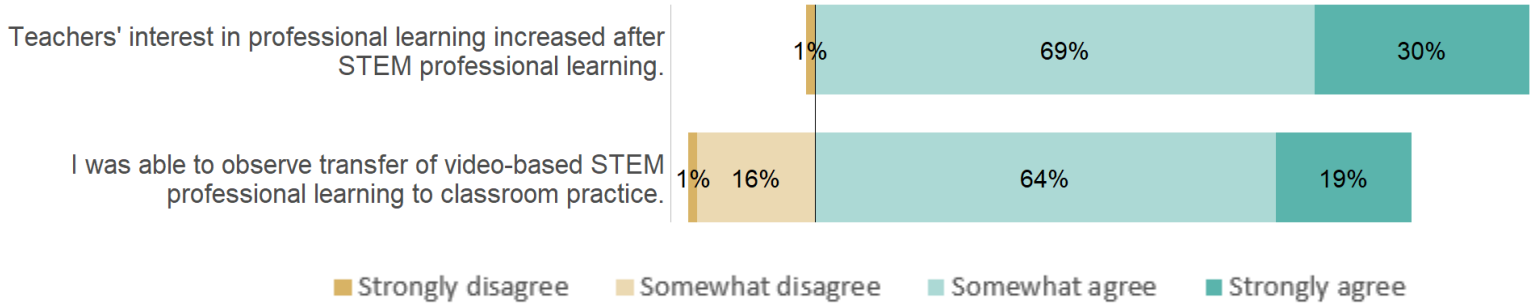
SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ Nearly all teachers participated in some professional learning, and most made reflection videos.
- ✓ The majority of teachers who made recordings engaged in both peer- and self-reflection.

Perceived Outcomes

Figure 35. Administrator Perceptions of Overall Effects of Video-Based STEM Professional Learning on Teachers

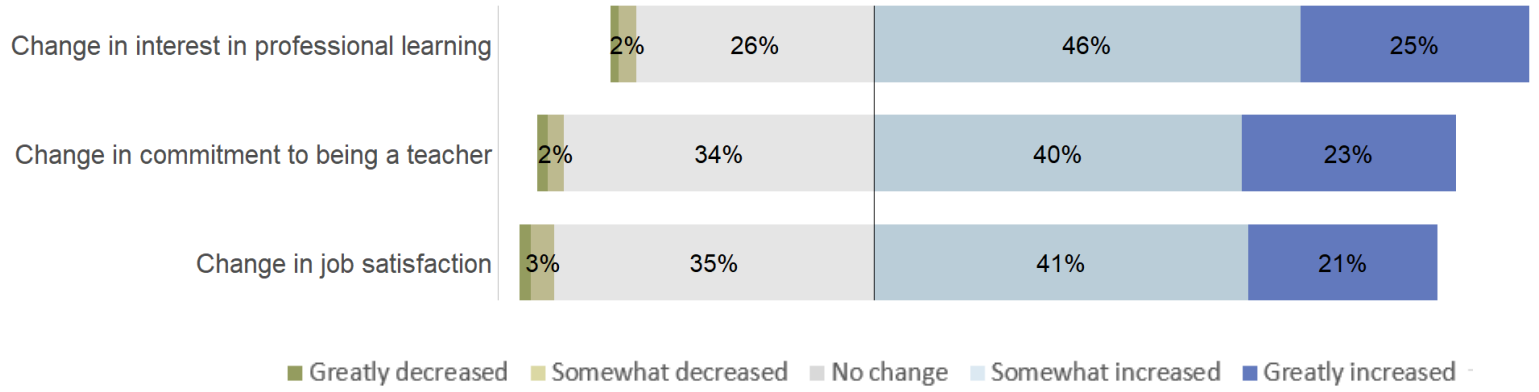
These questions were asked of administrators who indicated teachers at their school participated in video-based professional learning (n = 85).



SOURCE: UEPC ADMINISTRATOR SURVEY SPRING 2019

- ✓ Nearly all administrators (99%) believed teachers' interest in professional learning overall increased due to the STEM professional learning. Last year only 87% of administrators indicated teachers' interest in professional learning increased.
- ✓ 83% of administrators were able to observe changes to classroom practice based on the STEM professional learning.

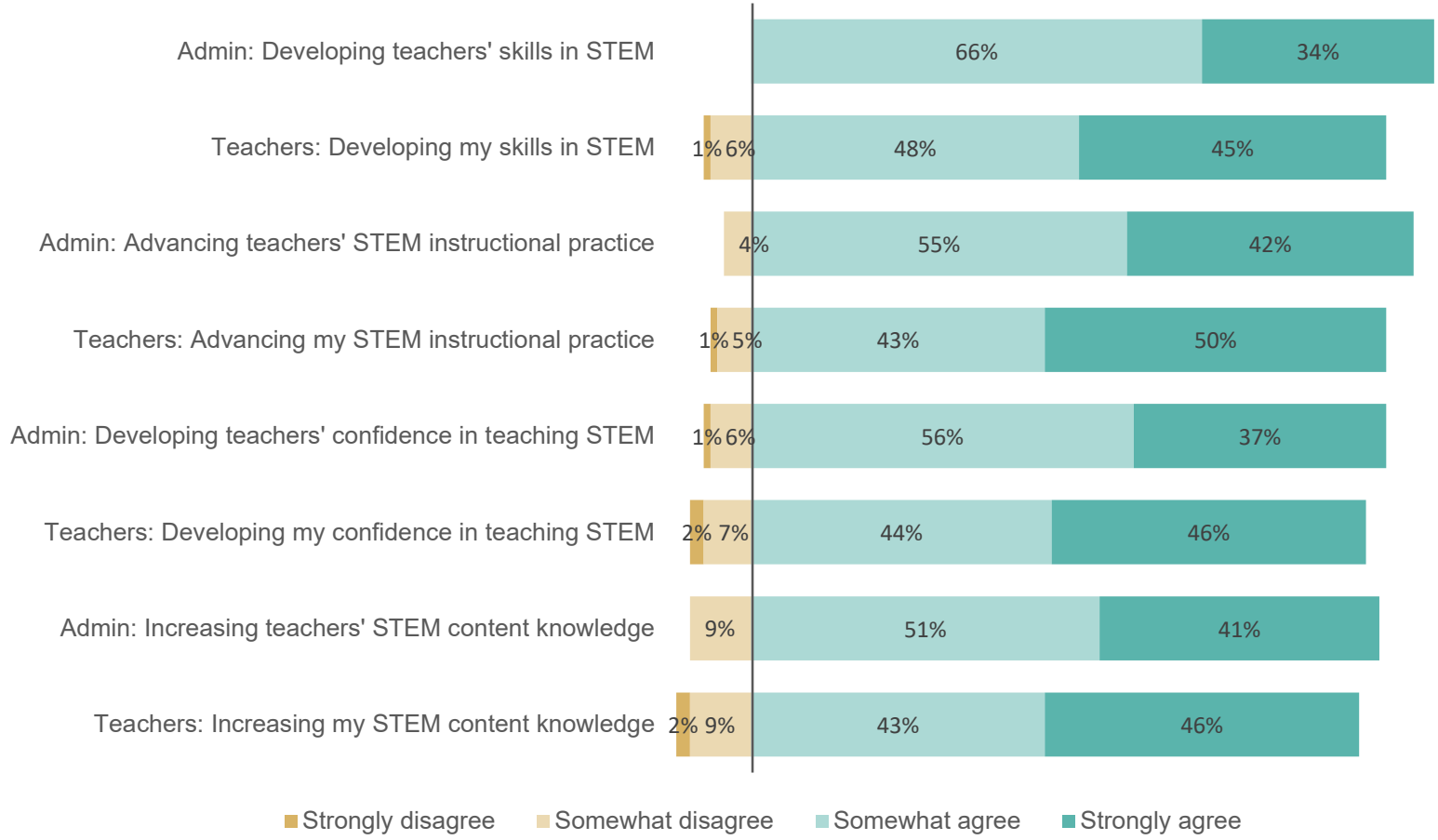
Figure 36. Teacher Perceptions of Overall Effects of STEM Professional Learning on Instruction



SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ 71% of teachers reported their interest in professional learning increased.
- ✓ 63% of teachers reported their commitment to being a teacher increased.
- ✓ 62% of teachers reported their job satisfaction increased.

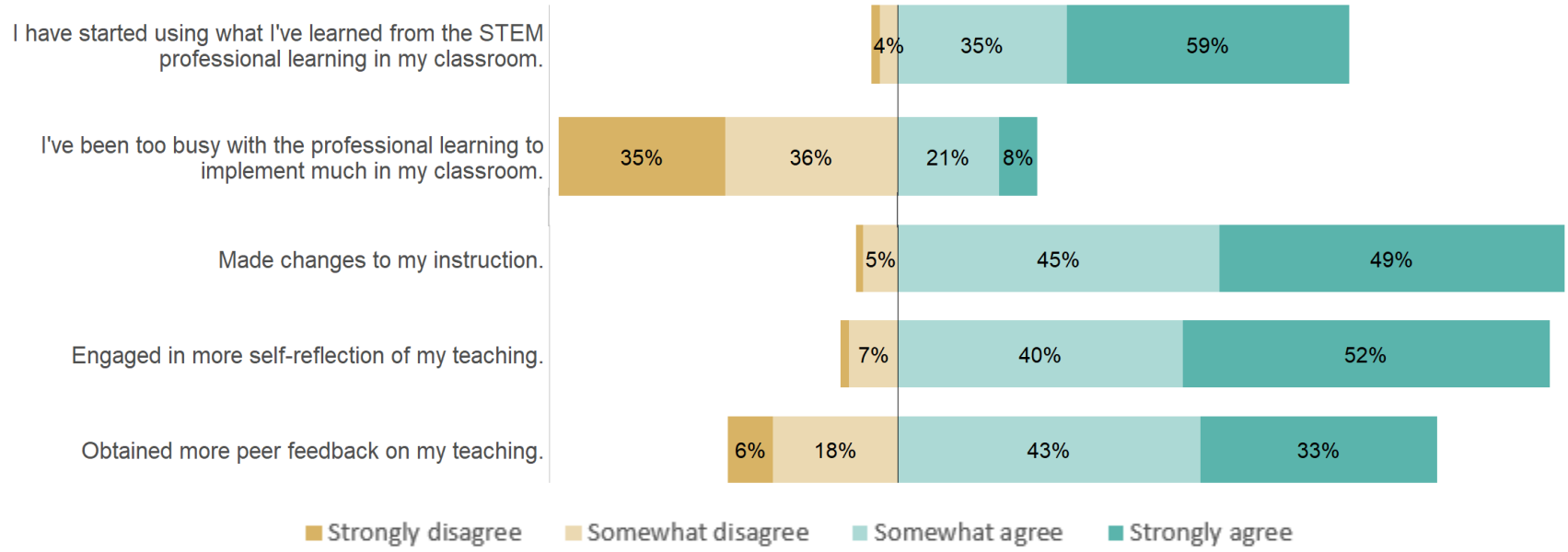
Figure 37. Effectiveness of STEM Professional Learning, Teacher and Administrator Perceptions



Sources: UEPC Administrator and Teacher Surveys Spring 2019

✓ Agreement was high in both teachers and administrators that STEM professional learning positively impacted teacher skills, Instructional practice, confidence, and content knowledge. Administrator agreement tended to be slightly higher than teacher.

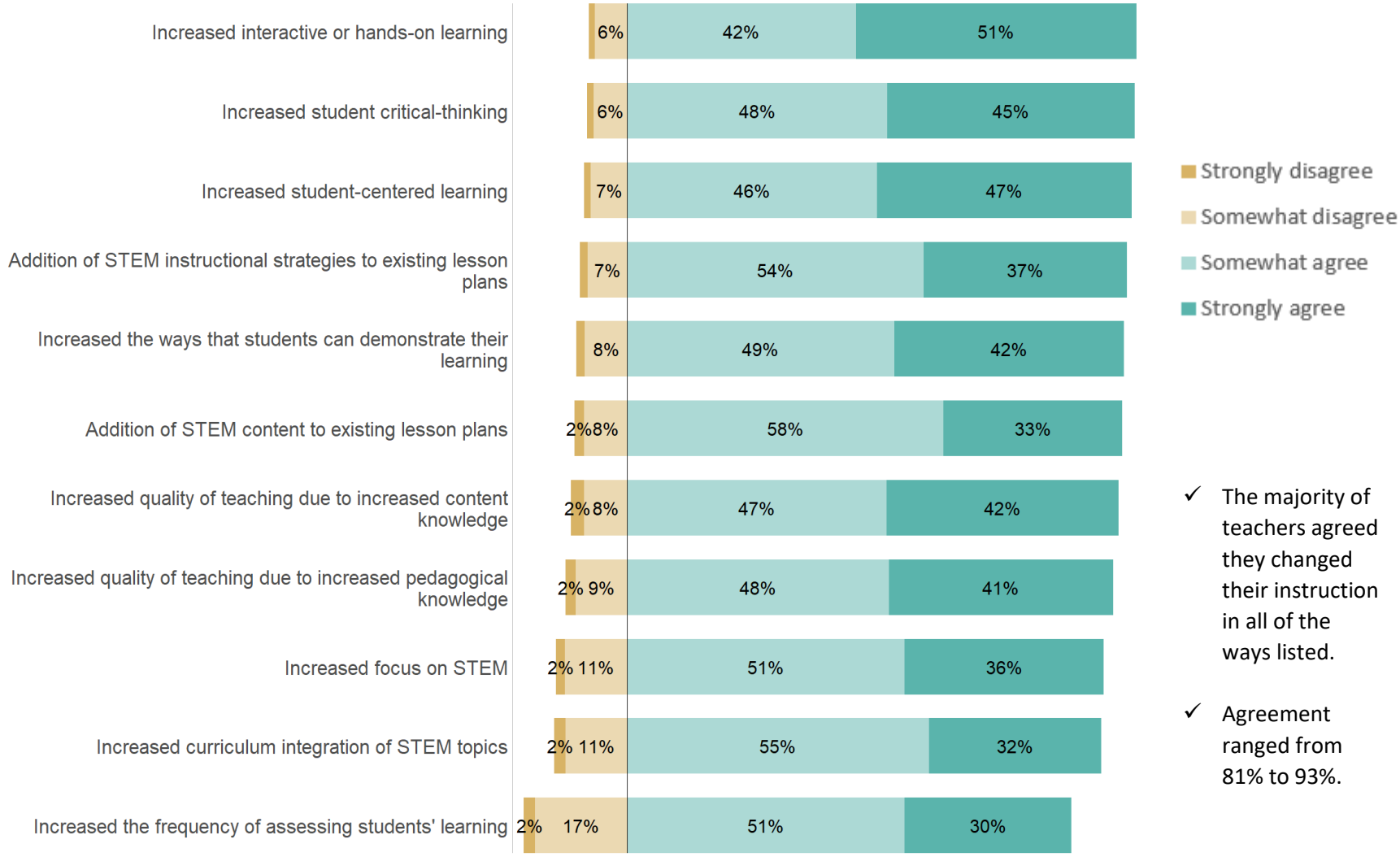
Figure 38 Teacher Application of Professional Learning to Instruction



SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEYS SPRING 2019

- ✓ 94% of teachers reported they started using what they learned from STEM professional learning in their classrooms, but 29% of teachers agreed they were too busy with professional learning to implement much in the classroom.
- ✓ Over 90% of teachers reported making changes to instruction and engaging in more self-reflection.
- ✓ 76% of teachers reported that as a result of professional learning they obtained more peer feedback on their teaching.

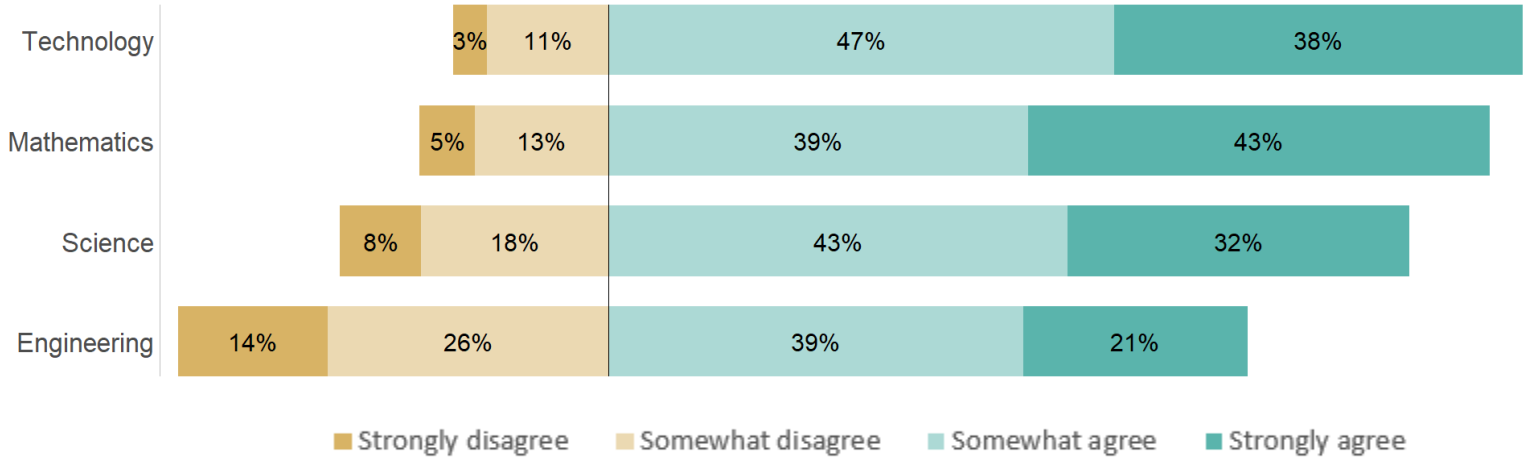
Figure 39. Teacher Reported Changes in Instruction based on the STEM Professional Learning



- ✓ The majority of teachers agreed they changed their instruction in all of the ways listed.
- ✓ Agreement ranged from 81% to 93%.

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Figure 40. Teacher Reported Increase in Ability to Teach STEM Areas

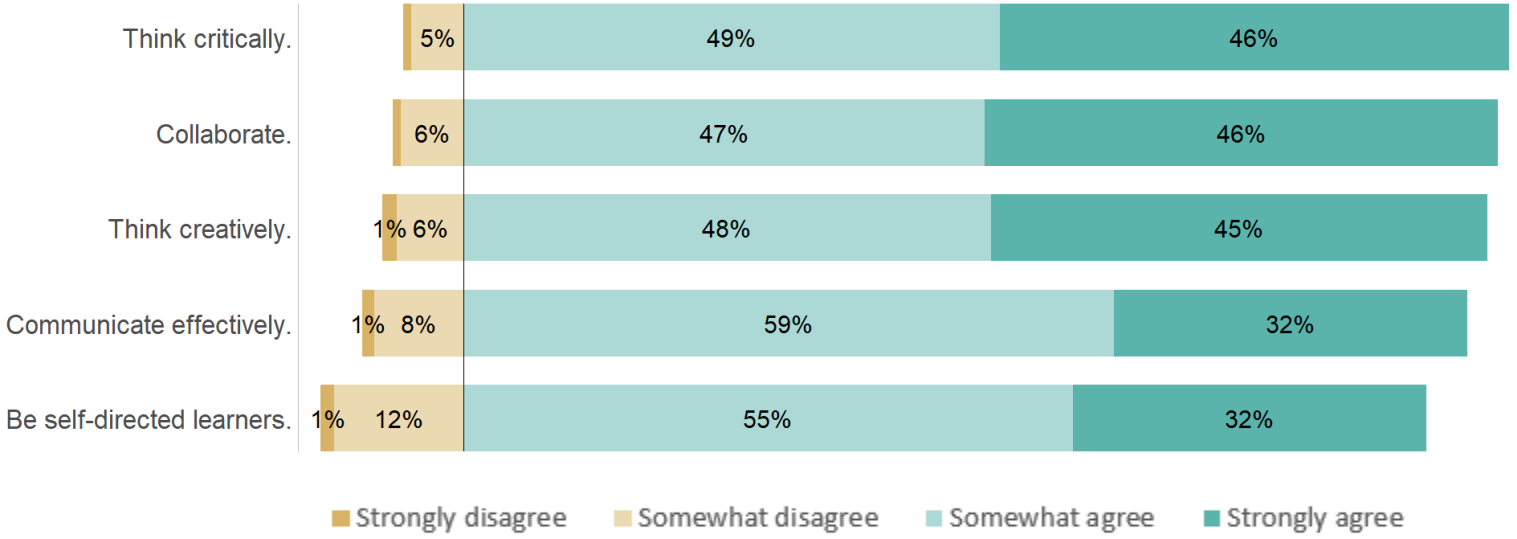


SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ The majority of teachers agreed or strongly agreed professional learning increased their ability to teach for all four STEM areas.
- ✓ 40% of teachers felt professional learning did not increase their ability to teach engineering.

Figure 41. Teacher Reported Increases in Ability to Teach 21st Century Skills

My application of STEM professional learning has increased my ability to teach my students how to…



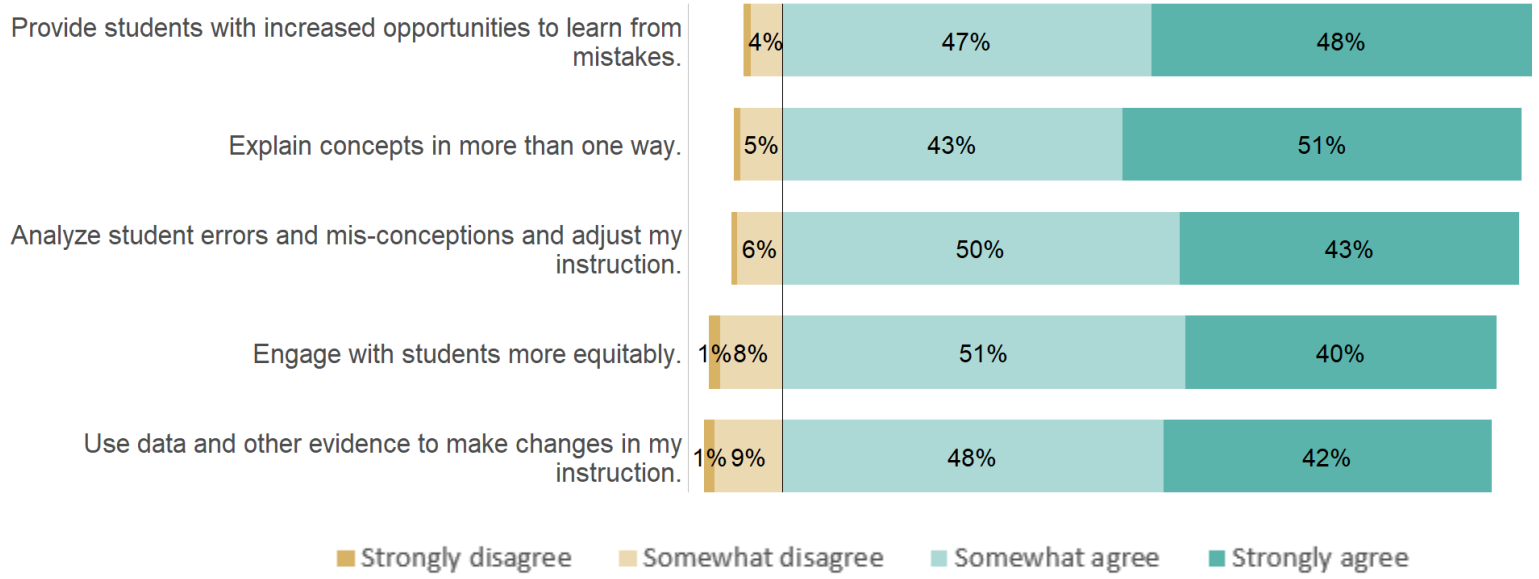
SOURCE: UEPC TEACHER SURVEY SPRING 2019

✓ The majority of teachers somewhat or strongly agreed the STEM professional learning increased their ability to teach 21st Century skills.

✓ For all five 21st Century Skills, the most common response from teachers was "Somewhat agree."

Figure 42. Teacher Reported Increases in Instructional Ability

My application of STEM professional learning has increased my ability to…

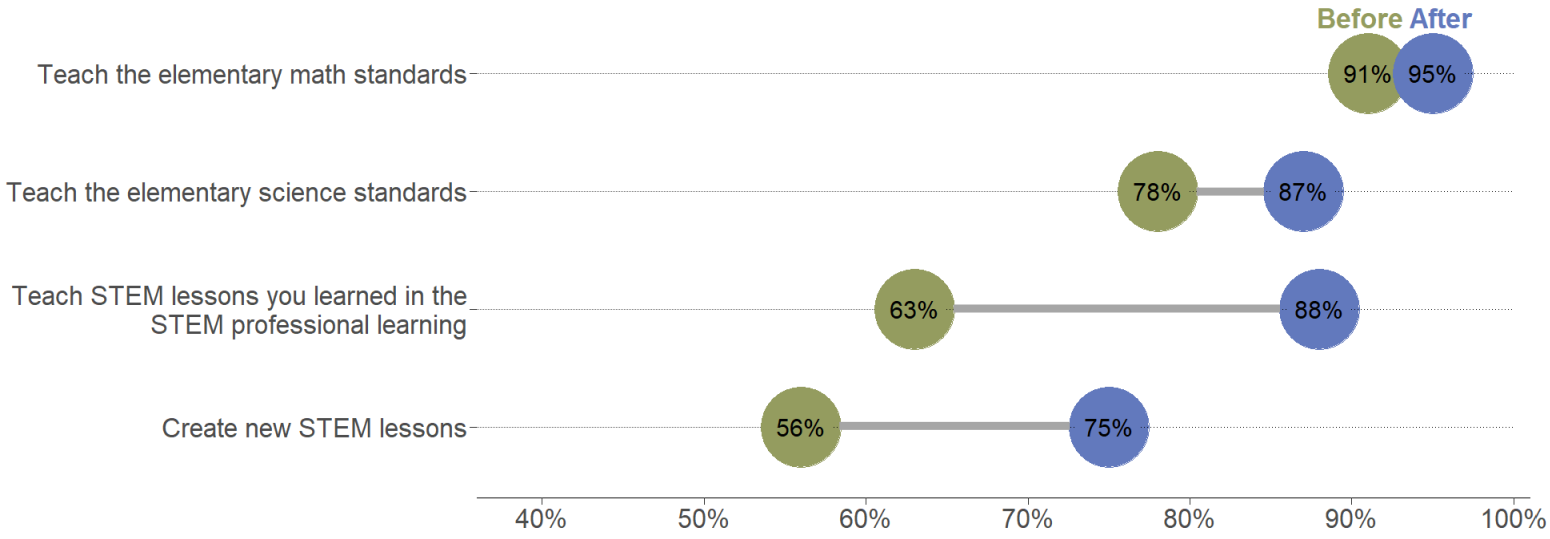


SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ The majority of teachers agreed the STEM professional learning increased their ability to use best practices for STEM instruction.
- ✓ 91% felt the STEM professional learning helped them to engage with students more equitably.
- ✓ Agreement ranged from 90% to 95%.

Figure 43. Teacher Reported Confidence in Abilities Before and After STEM Professional Learning

Percent of teachers who rated themselves as somewhat or very confident in the following abilities



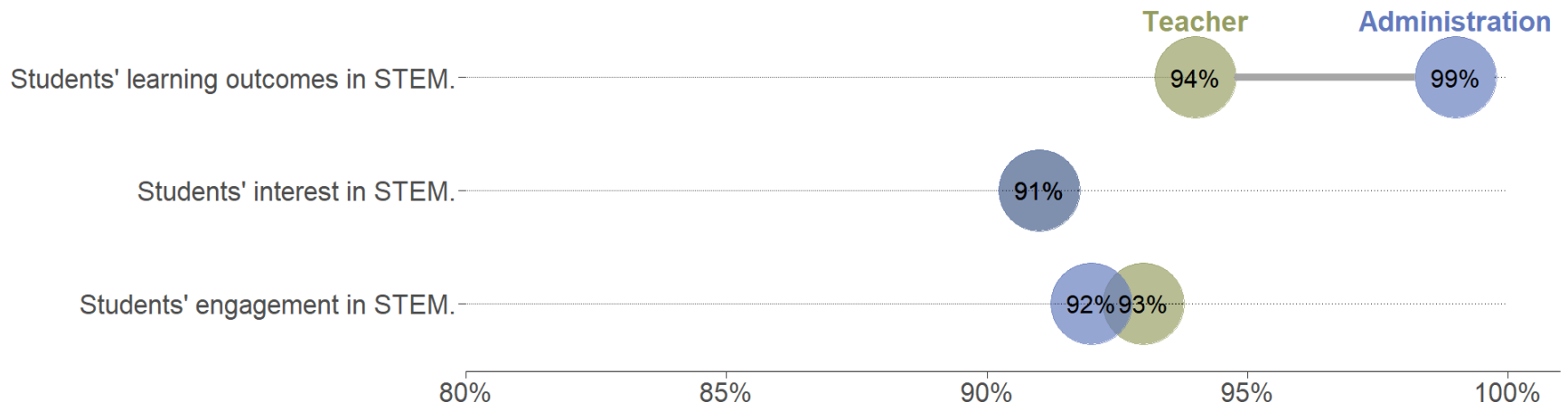
SOURCE: UEPC TEACHER SURVEY SPRING 2019

- ✓ After completing professional learning, teachers rated their confidence in abilities and retrospectively rated their confidence in the same abilities prior to professional learning. Results indicate higher confidence on all four abilities after professional development.
- ✓ Of the four abilities, teaching STEM lessons learned in professional learning had the biggest difference in confidence ratings.

Figure 44. Teacher and Administrator Perceptions of Positive Impacts of STEM Professional Learning on Students

Percent of teachers and administrators who somewhat or strongly agreed

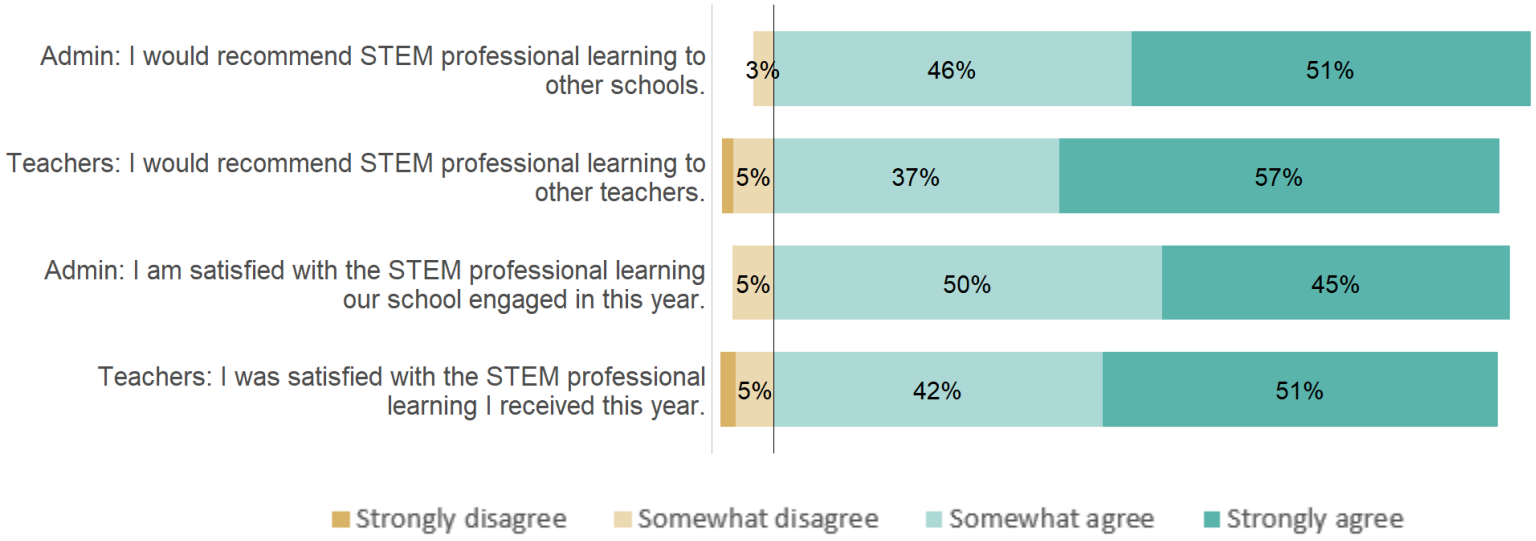
My application of STEM professional learning had a positive impact on my…



SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEY SPRING 2019

- ✓ More than 90% of both administrators and teachers agreed that the STEM professional learning increased student engagement, interest, and learning outcomes in STEM.
- ✓ Agreement was similar between teachers and administrators. The largest difference in agreement was on students' learning outcomes in STEM; administrators agreed at a slightly higher percentage than teachers.

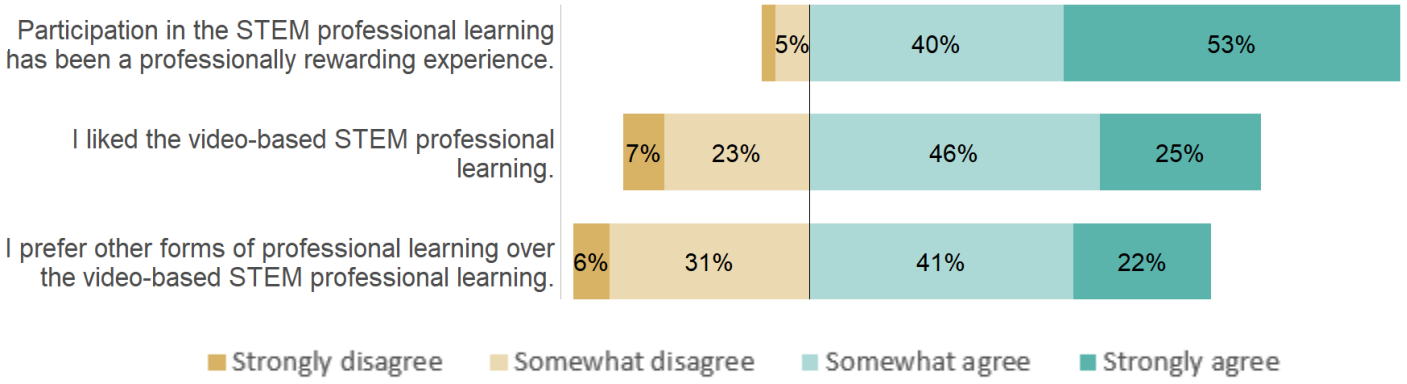
Figure 45. Administrator and Teacher Overall Perceptions about the STEM Professional Learning



SOURCES: UEPC ADMINISTRATOR AND TEACHER SURVEY SPRING 2019

- ✓ Both administrators and teachers report high levels of satisfaction with the STEM professional learning and agreed they would recommend it to other schools or teachers.
- ✓ Administrator agreement was a few percentage points higher than teacher agreement for both satisfaction with and how likely they were to recommend STEM professional learning.

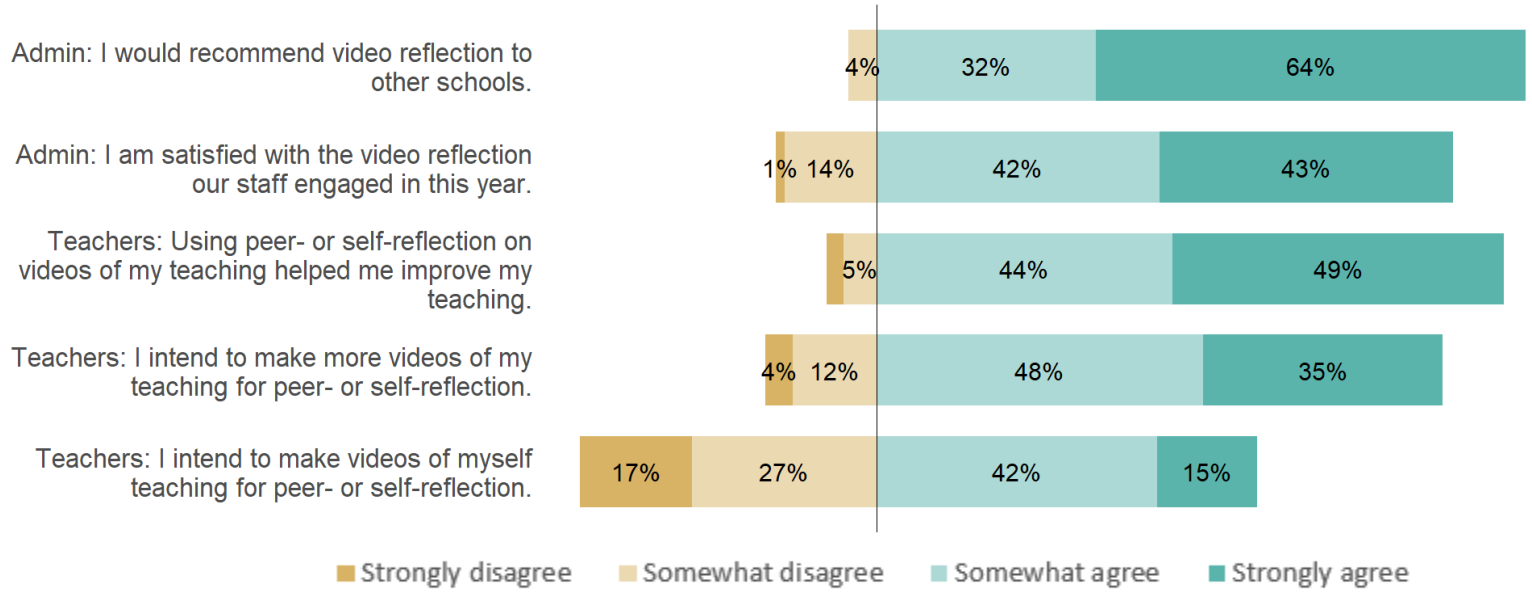
Figure 46. Additional Teacher Perceptions about STEM Professional Development



SOURCES: UEPC TEACHER SURVEY SPRING 2019

- ✓ 93% of teachers agreed STEM professional learning was professionally rewarding.
- ✓ 30% of teachers did not like STEM professional learning (last year only 17%), and 37% of teachers prefer other forms of learning over video based STEM professional learning (last year only 30%).

Figure 47. Administrator and Teacher Overall Perceptions of the STEM Video Reflection



Sources: UEPC Administrator and Teacher Survey Spring 2019

- ✓ The majority of administrators were satisfied with the video reflection of their staff (85%) and would recommend it to other schools (96%).
- ✓ Of the teachers who have not recorded videos of themselves, 57% intend to do so next year.
- ✓ Of the teachers who have recorded videos of themselves, 83% intend to record more.
- ✓ Of the teachers who recorded videos of themselves, 93% agreed it helped improve their teaching.

Teacher and Administrator Open-Ended Feedback about STEM Professional Learning

Table 46. Reasons Teachers Intend to Make Videos of Themselves Teaching for Peer or Self-Reflection

Theme	Example Quotes
Reflection and improvement	"It helps me reflect on how I teach and helps me notice things I can do better." "Videos are very helpful in reflecting upon what habits I might not be aware of." "Videos of myself teaching help me reflect and make changes to my instruction so I can be more effective." "Videos are powerful and can help you see nuances in your teaching."
Different perspective	"It's a great way to yourself as others see you." "There is a lot I can see from a video that I don't see in real time." "I think seeing myself and being able to rewind and play back will help me get a new perspective on the lessons I am teaching." "It's good to step outside yourself and see how others see you. Watching how I teach is good for me to see what is working and what's not working."
Requirement	"I am doing the micro-credentials and video reflections are a requirement for them." "It is easier to record and reflect on videos when they are mandatory as part of a class." "I hate watching myself and hearing my voice, but I make them because required for [program] project." "It is a requirement for the EYE program. It is part of my evaluation in teaching concurrent enrollment psychology course."
Collaboration and feedback	"I think getting feedback from peers is a great way to have a fresh set of eyes give you feedback. It allows me to self-reflect and see how things are working in my classroom." "I feel that as a team, you and your peers can help each other to filter ideas that can be used in the classroom, and also peers watching the videos can see things that you might not be catching, that can help you improve your lessons, and classroom management." "A picture says a thousand words and a video about ten thousand. Watching myself teach was a little uncomfortable but gave me valuable feedback on things I was doing well and things that I thought I was doing well but realized I was not really doing. Reviewing other teachers' videos gave me great ideas of strategies and teaching styles to enhance my own repertoire."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Table 47. Reasons Teachers Do Not Intend to Make Videos of Themselves Teaching for Peer or Self-Reflection

Theme	Example Quotes
Time issues	"time consuming and already have peer review with teachers" "Time constraints make it difficult to record/watch the videos." "Time and effort. Difficult to have the technology needed to do this."
Comfort level with videos	"I do not like to view or hear myself on camera." "The discomfort of being in front of the camera is reason enough for me." "I don't like filming myself. I tend to record the audio from a lesson more often than anything else." "I am fine with administrators and other teachers coming in to evaluate me and give me feedback. But I am not a fan at videoing myself at all."
Equipment and technology issues	"I would love to take videos of myself teaching but do not have the materials to do so." "As a special education teacher I was left out of my schools technology that was purchased for this purpose." "I use the computer a lot- EVERYDAY. It is hard to record myself teaching, because most of what I am teaching needs to be seen on the computer as well. We do not have the capability (or the correct license) in order for me to do that."
Video not needed for reflection	"We actually bring our team to observe each other teach lessons" "I feel that I can self-reflect without making a video." "I can reflect fine without a video :)" "I am glad to rely on the observations from my administration."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Table 48. Barriers Encountered When Making Teaching Videos

The comments below are from some teachers and should not be seen as representing all teachers.

Theme	Example Quotes
Equipment and technology issues	"technology not working properly, lack of time, not enough video equipment" "It's hard to upload, and the system isn't necessarily the most user friendly." "Having access to the technology and having time to set it up and review the video."
Scheduling and time	"Finding the time to collaborate and go over the reflection with a peer." "Setting up the recording and finding the time to watch them afterwards." "Time, it is hard to find time to make the videos, reflect, change and observe again."
Recording discomfort	"I just get uncomfortable and nervous when I know I'm being videotaped." "I hate any kind of video of myself even if no one but me is going to see it." "I am my own barrier sometimes Fear and self-consciousness drives some of my hesitation."
Disruptive to students	"The kids get so distracted when they see the camera and need to get used to it." "Student responses are inauthentic when they know they are being filmed, so the response is not as accurate." "Students may get distracted by the presence of a video in the room. I also get nervous when I am being recorded."
Opposed to video reflection	"Lack of desire. YOU video yourself in your job, then come tell me how much fun that was." "I don't think it is as useful as having someone else come and observe me." "I sometimes don't think it is necessary to make a video. I understand that you can catch things that you don't normally see, but I personally don't like watching myself teach when I already know how the lesson went."
Availability issues	"It is good to self/peer reflect, the only drawback is having someone film you because my school does not have a tripod. Students are not always a reliable source for the videos." "My teammate would not be willing to engage with me in peer self-reflection, and there's only one other teacher on my team. She leaves PLC's early 75% of the time." "Student behavior. Otherwise, it's just not a priority of mine, and it hasn't been encouraged. I also have a difficult team of teachers, and the idea of sharing with them would come with a great deal of resistance."
Difficulty prioritizing video reflection	"The biggest barrier is just finding the time and remembering to set up the camera." "My memory- It isn't hard to do, it is a matter of me remembering to do this before our deadline." "I record on my I-pad, so I usually need someone to hold it for me or I have to lean it against something at the back of the room. This works fairly well, I just get busy with other things and forget to do it."
Student privacy concerns	"Privacy for students with IEPs." "I am not comfortable doing video recordings when I have students whose parents have not authorized any such recordings or even photos." "I have to be very careful. I don't want all behaviors and students filmed in my classroom. Also under the IDEA law I have to be certain no student can be identified."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Table 49. Teacher Positive Feedback about STEM Professional Learning

Theme	Example Quotes
Collaboration	"Loved meeting with other teachers that weren't at my school and hearing more about what everyone was doing." "It is beneficial to collaborate with other teachers who teach in your grade level, but at different locations." "This STEM professional was very helpful because I collaborated with other teachers and this was a very hands-on experience."
Positively impacted teaching*	"It helps to provide a framework and ideas on how to take lesson I already have and turn them into more of a student directed opportunity." "Taking time to learn, think about why and how I teach, and incorporate new and better teaching practices helps me be a better teacher for my students." "I have a hard science degree, not a science teaching degree, so I really needed some help in seeing how to adjust my instruction to the needs of my students. This helped." "I like having multiple ways to teach something. My kids are always the same age but they are always different people. i need a big toolbox so I can reach as many of those people as possible."
Beneficial professional learning	"Instructors did a great job unpacking math concepts in an easy to understand, engaging way." "I appreciated being in a cohort specifically for my grade. It was much more relevant and I was able to implement a lot of things in my own classroom" "The facilitators I had were very professional and tried to meet all the teachers' different needs no matter what level of learning they were at." "I enjoy the information and content. Lots of time to discuss, debate and learn new ideas. We implement many different learning styles and it's very interesting."
Importance of STEM*	"STEM professional learning has brought attention to the importance of equitable STEM for the students of our state. Many students have been left behind in the past." "STEM professional learning is a great resource for teachers to be able to use in order to create lessons and give students learning opportunities that are very engaging for them." "STEM is an FUN and interesting way to learn for many children. There will be many students that don't even know they like these subjects or concepts, unless they can experience them."
Ease of implementation	I did learn some new things that I could implement into my teaching. "It was great to get lesson plans for to use with the new standards and to have the opportunity to create a 3-D lesson." "I loved my math training taught by [person]. It has helped shape the way I teach math from the first session. The tools I have gained and the strategies I have learned are adaptable to other STEM subjects."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

* Administrators made similar comments about STEM Professional Learning

Table 50. Teacher Negative Feedback about STEM Professional Learning

Theme	Example Quotes
Implementation difficulties	"Sometimes I come back with list of ideas to try in my classroom but then I don't know exactly how to implement them into what I already do." "Sometimes it is hard to get the materials needed - especially in Elementary. It can also be overwhelming to decide on what lessons to include in the curriculum." "The activities take a long time to do, and I only have 25 minutes a day for science. I wish there was more guidance on how to run the activities. They were fun to participate in, but I don't feel adequately prepared to teach it to my students."
Organization of professional learning	"Always divide into grade levels so that the instruction is based on the core for individual grade levels." "I often felt confused by expectations, and I didn't think feedback given on assignments was fair and consistent throughout." "The instructor is a wonderful person, but she had little if any experience with STEM. I would have loved to have someone who had taught some of the activities shared with us and could help us with better questions to add into the lesson plans we wrote." "I wish that it had happened more often and for possibly shorter periods of time than how it was structured, just so that i could have had it more consistently. I also wish there had been an opportunity to plan a couple of my own lessons and receive feedback on them from experts."
Not aligned to teaching	"The subject I teach is not the same as others in my group and they have a hard time relating to my situation" "I do not find it super helpful. I am a high school teacher, and even in a lot of the videos elementary teachers are used as examples. This is not helpful to me or my team." "I would always love to receive more STEM training- new technology, concepts that are easily integrated into all subjects, etc. Right now, it is simply video, review, video, review, rather than actually focusing on the STEM portion."
Difficulties with technology*	"The process of viewing videos has been bumpy and hard to figure out in [program]." "It was hard to upload my videos, and I did not use the best videos I had because I could not get them to load, they were too long." "Many of the videos in [program] were outdated. They included videos that were over 15 years old. This made the data and technology in the videos of little use."
Lack of time to implement	"Finding the time to incorporate it into my schedule." "I wish I had more time and supplies in my classroom to offer more opportunities for my students." "I want more time and resources to apply STEM. It is fine to talk about it, but it needs to be learned and applied."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

* Administrators made similar comments about STEM Professional Learning

Table 51. Teacher Descriptions of How STEM Professional Learning Has Impacted their Job Satisfaction, Commitment to being a Teacher, or Interest in Professional Learning

Theme	Example Quotes
Collaboration and community	"Being able to collaborate with other teachers gives me a sense of community and inspires me to improve through collaboration" "It is always good to have opportunities to share our successes and struggles with other colleagues, specially the same grade level colleagues. I believe that when the group has the same objective and they all want to talk without judgments and help giving suggestions and ideas our interest in getting better increases."
Easy to implement strategies	"I learned a lot of interesting activities that I can incorporate into my classes." "It was encouraging to experience professional learning that I viewed as worthwhile and valuable. I learned a lot and was able to directly apply much of my learning to my work in the classroom." "The phenomenon based learning is easy to develop and use every day experiences in the classroom to engage students. It was fun and the experience will guide my instructional decision making when choosing how to conduct a science and math class."
Increased enthusiasm and excitement	"It made me excited to try new things, it made my students excited to learn new things." "It increased my desire to share what I have learned with my students in new and innovative ways." "Having fresh ideas and feeling supported makes me excited about new lessons and activities, adding to my job satisfaction."
Increased student engagement	"I love being part of a teaching method that increases student engagement and challenges their thinking (as well as my own)." "I found that working through the engineering practices and the STEM practices, I am more able to help my students be more engaged with learning. It also helps me learn from my peers at the meetings." "I found ways to implement the hands on learning in our classroom much more effectively. My students loved it, and I was much more at ease with the management side of the activities."
Improved teaching practices	"Watching the videos of other teachers gave me ideas on how I can improve my teaching and increase student engagement." "I always try to do my best and be a stronger teacher. Participating in this gave me new ideas, new goals, and allowed me to improve." "I think that professional learning in STEM is only going to make a teacher a better teacher, enabling him/her with the tools necessary to help students meet the standards and gain an excitement about STEM categories."

SOURCE: UEPC TEACHER SURVEY SPRING 2019

Table 52. Reasons Administrators Would Recommend STEM Professional Learning

Theme	Example Quotes
Valuable for teacher self-improvement	"It provides a safe environment to learn how to improve your teaching and a good way to learn." "Video reflection, although it is somewhat scary to look at, lets a teacher know exactly what is going on in their classroom. There is no arguing with the actual visual of it. As far as the STEM professional learning goes, we cannot expect to improve and learn about new ideas to try unless we observe it or practice what we have learned." "I would strongly recommend the use of the STEM professional learning and video reflection. It provides a great opportunity to see yourself teaching in the classroom. Also, other experienced professionals can offer ideas and tips in areas that you may need to improve on or provide additional ways to present lessons that help meet the success criteria."
Gain new teaching perspective	"Seeing video reflection is seeing how you are doing from a different lens." "I like the idea and I really like self-reflection. You can tell a lot of things by how you can view what you are doing as far as teaching practices" "I believe that this is a process and we need to do it more to see real benefits. This year was not as beneficial as I think it will be after a few years. Much like athletes teachers can gain a lot from seeing themselves practicing their craft."
Positive impacts on instruction	"I would recommend this STEM professional learning to other schools because I can see it having a strong effect on students learning and understanding. Also, our teachers grow more professionally and become better teachers the more they video reflect." "Video Reflection is a research supported form of professional development that can have a high level of impact on student outcomes for a relatively low investment of time or cost." "The professional learning we have done has had the impact of changing teacher philosophies of who and what children learn. This is has changed the culture of learning in our school to support critical thinking, problem solving and collaboration in an inquiry based model of mathematics."

*SOURCE: **UEPC** ADMINISTRATOR SURVEY SPRING 2019*

Table 53. Reasons Administrators Would Not Recommend STEM Professional Learning

Theme	Example Quotes
More resources needed	"I feel like we don't necessarily have all of the resources that we need." "It's a good tool if teachers will use it. We need to give them more paid time to implement things like this." "The video reflection is a great tool, but there needs to be training and time to accomplish." "We needed a better system for sharing the staff video reflections. I felt we needed more collaborative debrief time scheduled after the PD instead of peer-to-peer sharing."
Equipment and technology issues	"I know video reflection will become an invaluable part of teacher learning and growth in this school. We just haven't implemented it well yet. Some of that was due to year-long problems with being able to get our video taken and uploaded to [program]. WE finally quit trying to use [program] and have been using our own google drive internally." "The most difficult part of the grant was getting teachers to videotape their lessons. Starting with technological issues such as video editing software, the teachers comfort with video editing ability, poor sound quality due to lack of mic options and the different computer platforms used across different schools; and ending with the teacher's reluctance to video themselves in the first place to the eventual overall quality of the product, it was challenging but well worth it. I would recommend a team of videographers be trained to go into the classroom to set up and "shoot" the videos. This would alleviate much of the hassle the teacher has to go through to deliver the lesson in a manner fitting the STEM process. This would also increase the overall quality of the videos."
Lack of motivation or buy-in	"Not enough buy in from staff. I recommend it as a tool for reflection and improvement but staff needs to also feel the same or it won't work" "We still feel like video reflection is paramount for teachers to better practices. However, the way we set it up with monetary motivation did not work. We will do things differently next year. We will require video reflections next year. It will not be an option."

SOURCE: UEPC ADMINISTRATOR SURVEY SPRING 2019

Table 54. Reasons Teachers Would Recommend STEM Professional Learning to Other Teachers

Theme	Example Quotes
Increased student engagement	"There is more engagement from the students and it stays on their long term memory more." "I feel it broadens my horizons as an educator and increases engagement in my and my students learning." "It helps the students see connections between the curriculum disciplines--real-life applications."
Opportunities for collaboration	"Any time you collaborate with others in your field, you have the opportunity to learn from their successes and their mistakes." "I enjoyed collaborating with teachers in the same grade level to get ideas on how to deliver and teach content." "It's great to talk to other teacher, especially between different disciplines and figure out how our work can complement one another."
Opportunities for reflection	"It is a great opportunity to reflect on your teaching and remember to make all lessons student based." "Even though it is hard to watch, I know it was good for me to see myself and watch for the things i have been taught." "Great way to reflect on your practice. Great way for others to observe and provide feedback, even though it can be awkward at times."
Easy to implement	"It offers applicable strategies to immediately use in the classroom to enhance instruction." "I would recommend because it shows me how to thoroughly apply the SEEd components (SEP, CCC, DCI)" "STEM professional learning helps teachers use hands on learning experiences and focuses on teaching science as a process."
New thinking and approaches	"We participated in CMI training and it has completely changed the way think about, feel about, and teach math." "The math training was very helpful and changed the way I view growth mindset and math instruction in general. I think every teacher could benefit from it." "Getting a new conception of what STEM can mean was important. As a social studies/art teacher I had imagined STEM to be smaller and more restricted than it is."
Value of professional learning	"Any professional development will help you grow which will in turn help your students." "It is important for teachers to continue learning in their profession to grow as teachers and to keep up with the latest research." "I would recommend STEM professional learning to other teachers because as professionals we need to learn and grow just as much as our students do."
Value of technology integration	"I would recommend STEM professional learning to other teachers because it will make teachers feel more confident integrating technology in their classroom." "I think that our society and culture are so rapidly changing in technology fields. It is so very important for educators to prepare students for jobs in STEM careers, and one valuable and effective way to do this is by offering teachers STEM professional learning."

Sources: UEPC Teacher Survey Spring 2019

Table 55. Teacher Reasons They Would Not Recommend STEM Professional Learning to Other Teachers

Theme	Example Quotes
Not applicable or helpful	"Workshops weren't organized, and didn't really teach me the content I needed to be able to come back and teach my students." "I would have liked it [sic] the training was specific to 3rd grade." "The videos provided great information, but was difficult to see how it would fit into the parameters within my classroom." "Took a lot of time and was not that helpful."
Too much time invested	"It is a time commitment; not all teachers have the time to do so." "It was beneficial when I had the time for it. I learned a lot, but didn't always feel like I could dedicate a lot of time to it. When I did I was satisfied with what I learned." "Due to the amount of homework required while being a full time teacher, I would cautiously recommend to others to take the STEM courses." "There really are so many things a teacher is asked to do and often these types of things feel like one more thing to do than what we have time for. Someone would really need to be seeking STEM professional learning for me to recommend this to them."

SOURCES: UEPC TEACHER SURVEY SPRING 2019

Considerations for Improvement for the STEM Professional Learning Project

Teachers and administrators rated the STEM professional learning project favorably, with 97% of administrators and 93% of teachers indicating they would recommend STEM professional learning to other schools and teachers. Additionally, 94% of teachers reported changes to their instruction based on the STEM professional learning, and 71% indicated their interest in professional learning overall increased. Most teachers indicated the STEM professional learning improved their teaching in all the ways intended (increased teacher content knowledge, confidence for teaching STEM, student-centered learning, curriculum integration, etc.). Finally, both administrators and teachers indicated that the STEM professional learning increased students' engagement, interest, and learning outcomes in STEM.

The following considerations are provided for the purpose of continuous improvement efforts to the STEM professional learning program.

Findings	Considerations for Improvement
Findings suggest while teachers and administrators recognize the value and positive impact of professional learning and video reflections, it can be difficult to transfer learning to the classroom. • 81% of teachers who participated in professional development made video recordings and engaged in reflection. • The majority of teachers agreed they changed their instruction by incorporating strategies such as hands-on learning, critical thinking, student-centered learning, and focus on STEM. • However, 29% of teachers reported being too busy with the professional learning to implement much in their classroom. • In addition, 30% of teachers did not like STEM professional learning, and 37% of teachers prefer other forms of learning over video based STEM professional learning. • 96% of administrators encouraged teachers to video themselves teaching and engage in peer or self-reflection and 83% were able to observe transfer of learning to classroom practice.	**Increase opportunities for teachers to reflect on professional learning and application of professional learning to practice.** • Explore ways with teachers to enhance the use and integration of video reflection, inquiry, and learning cycles to support practice. • Create a repository of video reflections that can be used to provide demonstration of lessons, teacher engagement, success stories, best practices, and helpful tips and instructional improvement. • Establish communities of practice to increase networks of teachers engaged in STEM teaching. • Scaffold teacher use of video reflection. For example instead of videoing a whole lesson, just start with the anticipatory activity, opening element, or activating students' prior knowledge component of the lesson.

Findings	Considerations for Improvement
A substantial number of teachers and administrators indicated teachers need for additional supports, options, and time for video-based STEM professional learning. • 24% of teachers and 17% of administers did not feel teachers had enough knowledge and training to use video-based professional learning. • When asked about STEM professional learning formats, 16% of administrators thought teachers did not use either lesson studies or conferences, while 11% thought teachers did not use lectures. • 29% of teachers agreed that they have been too busy with professional learning to implement much in their classrooms.	**Increase professional learning options that are tailored, focused, actionable, and of short duration.** • Provide a variety of training options (e.g. Twitter Chats, Pop-up Professional Learning, Brown Bags) that allow quick, teacher-friendly options that are tailored to specific learning needs. • Create strategies for teachers to more readily integrate learning (e.g., lesson studies, conferences, etc.) into their practice.
A considerable number of teachers saw areas where their abilities to teach STEM in the classroom had opportunities for growth: • While a majority of teachers agreed professional learning increased their ability to teach all four STEM areas, agreement was lowest for engineering. 40% of teachers did not feel professional learning increased their ability to teach engineering. • When asked to rate themselves as somewhat or very confident in their ability to create new STEM lessons, 25% of teachers did not perceive themselves to be in this category after STEM professional learning.	**Expand professional learning that strengthens teachers' content knowledge on the field of engineering and its role in STEM.** • Support teachers in seeing the intersection between instruction that is already taking place in the classroom and engineering principles. • Provide resources and strategies for how teachers can integrate engineering into existing content so it is clear that engineering is not an add-on element but something that is already present in their teaching. • Consider engaging professors in engineering from local institutions of higher education who are interested in school partnerships and expanding access to engineering content and pathways. **Provide professional learning that scaffolds teachers in their ability to transfer what they are learning to the classroom.** • Implement support systems (e.g. Critical Friends, Peer Coaches) that can be a resource to teachers as they are engaged in the implementation stage of their professional learning. • Provide opportunities for teachers to set manageable goals as they set instructional priorities for what they want to transfer to their classroom and include a continuous improvement protocol for implementation of these goals. • Provide infrastructure within the professional learning program to support successful implementation of STEM integration.

Computing Partnerships Grants Program

Background

In 2017, the Utah State Legislature passed SB 190, *Education Computing Partnerships*, which created the Computing Partnerships Grants program. The program is administered by the Utah STEM Action Center and is intended to "incentivize public schools and districts to work with the STEM Action Center, staff of the State Board of Education, Talent Ready Utah, industry representatives, and secondary partners on the design and implementation of comprehensive K-16 computing partnerships" (SB190, lines 82-85). The broader purpose of the program is to increase student engagement in computing fields throughout the K-16 education system to better meet state workforce demands.

Program Overview

The Computing Partnerships Grants program has been designed to provide funding to Local Education Agencies (LEAs; districts, individual schools within districts, and charter schools) to build kindergarten – post-secondary (K-16) computing programs. These programs could fund activities that create an entire pathway, or target specific components of an existing or future pathway. Applicants were allowed to request funds for 1-3 years (Utah STEM Action Center, 2017, p. 3).

Applicants were encouraged to place a strong emphasis on K-8 computing efforts; however, they were also invited to address a variety of activities that support successful K-16 computing programs that aligned with identified gaps, including:

- Course offerings and course content design
- Professional learning
- Industry involvement
- Outreach, recruitment, and retention
- Work-based learning experiences
- Community engagement
- Infrastructure support
- Equity and access

Evaluation Methods

The evaluation of the Computing Partnerships Grants focused on program implementation only in 2017-2019 to determine LEA priorities and how the program might meet its goals. Specifically, for program implementation, we assessed the *types* of activities being offered by LEAs, the *quantity* of activities being offered, and the levels of student and teacher participation in these activities. Teacher and student outcomes will be addressed in future evaluation cycles.

Data sources included program documents, an implementation data collection tool administered to grant supervisors at each of the LEAs, and the state student enrollment database. This report provides descriptive statistics from the data collection responses. Qualitative data from the instrument were analyzed by the evaluation team who used open coding followed by development of coding categories. Results are synthesized and presented by major themes. Please note that there are some known issues with the data collected, as explained in the Considerations section of this report.

Figure 44. Computing Partnerships Grants Logic Model

What do you want to accomplish? **Provide opportunities and resources in computing both in classrooms and out of classrooms, depending on the student**

Order of planning ←

PROCESSES/ACTIVITIES	IMPLEMENTATION OUTPUTS	EDUCATOR OUTCOMES	STUDENT OUTCOMES

LEAs develop a continuum of services.
• Course offerings and course content design
• Out of classroom activities (e.g., summer camps, after school programs etc.)
• Professional learning
• Industry involvement
• Outreach, recruitment, and retention
• Work-based learning experiences
• Community engagement
• Infrastructure support
• Equity and access
	SB 190 Community of innovation
	
	Students have access to an articulated continuum of services from K-16 (including in & out of school, access to role models and mentors, equipment, etc.)
	
	Teachers have access to on-going professional learning
	• Increased PL offerings
	• Increased funding for PL
	
	Increase in both number and quality of opportunities
	
	Decrease in numbers of students turned away due to lack of resources
	
	Increase in underrepresented teachers and students (women, minorities, rural, poverty, etc.)
	
	Increased work-based learning opportunities (work, networking, job shadowing, etc.)
	
	Increased credentials and demonstrated capacity among both teachers and students
		Increased awareness of computing technologies, industries, careers, & educational opportunities & pathways
		
		Increased awareness of
		• Equity and access
		  ○ Importance of not favoring certain groups in mentoring & teaching
		  ○ Impacts of micro-messaging
		• Importance of teaching computing
		• Difference between "computer as tutee" and use of computers as tools or tutor.
		• Grant opportunities
		
		Increase in confidence to
		• teach computing & overall
		• use a variety of technologies
		
		Changes to pedagogy
		• more project based & experiential
		• Increased use of, and confidence using, "lead learner" strategies
		
		Increased computing integration in other topics (English, art, etc.) Especially for K8 classrooms.
		
		Teachers are more connected & supported by
		• Peers, community of teachers, industry
		
		Increased teacher retention, attitudes about teaching
		
		Teachers perceive they have access to PL, multiple access points.
		• Increased number of credentials earned by teachers
		Increase in number of teachers able (skill) and willing (desire) to teach computing
			Increased awareness of computing technologies, industries, careers, & educational opportunities and pathways
			
			Change in attitudes
			• Self-perceptions - view self as capable/able to pursue computing (perceived accessibility, self-efficacy)
			• Self-perceptions – people like me do this (cultural)
			• interest & engagement
			• increased skill or capacity
			• intentions to pursue
			
			Increased number of credentials earned by students
			
			Increased enrollment in computing classes
			
			Increased participation in work-based learning

Order of implementation →

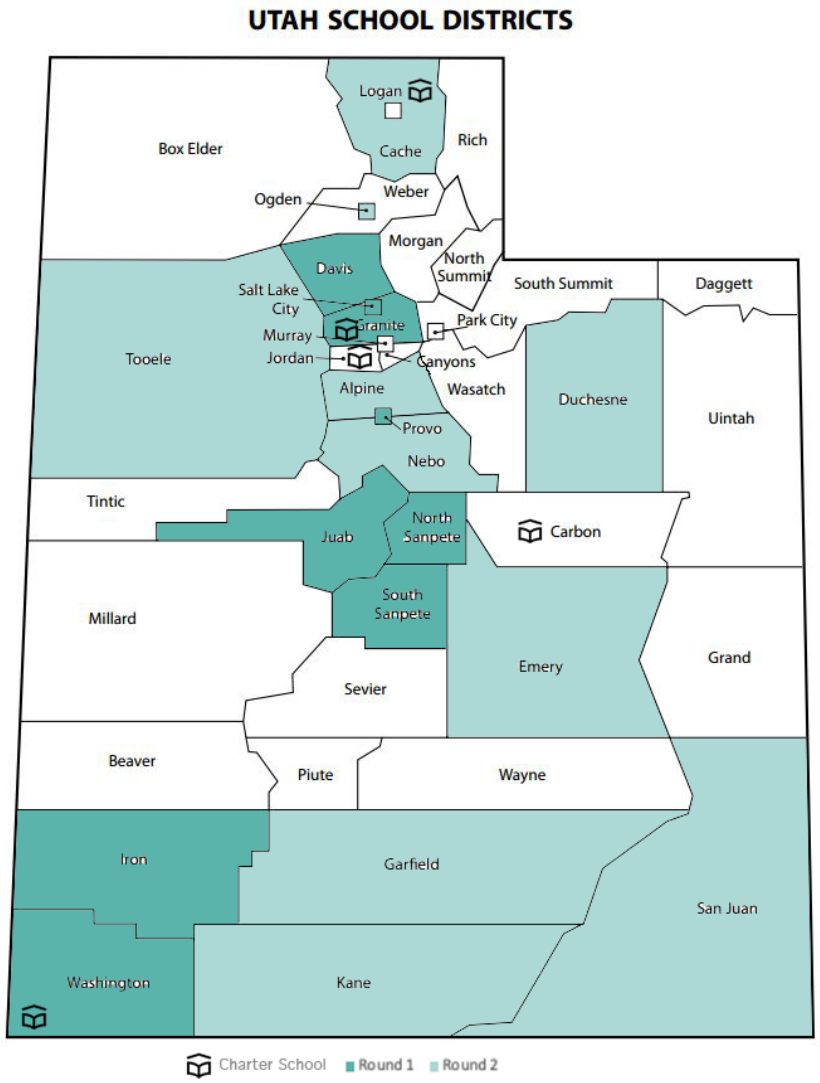
Participant Summary

Table 53. LEAs Participating in the Computing Partnerships Grants Program 2017-2019.

Round 1 – Awarded Fall 2017	Round 2 – Awarded Spring 2018
Bryant Middle School	Alpine School District
Coral Canyon Elementary School	Cache County School District
Davis County School District	Davis County School District (new)
Dixie State University SUCCESS Academy (Early College High School)	Duchesne Elementary School
Entheos Academy	Emery County School District
Iron County School District	Garfield County School District
Juab, North Sanpete, and South Sanpete School Districts	InTech Collegiate High School
Kearns Junior High School	Itineris Early College High School
Provo City School District	Juab School District (new)
Three Falls Elementary School	Kane County School District
	Lindon Elementary School
	Nebo School District
	Ogden City School District
	Pinnacle Canyon Academy
	San Juan School District
	Tabiona Elementary School
	Tooele County School District
	Washington County School District

SOURCE: STEM AC PROGRAM DOCUMENTS

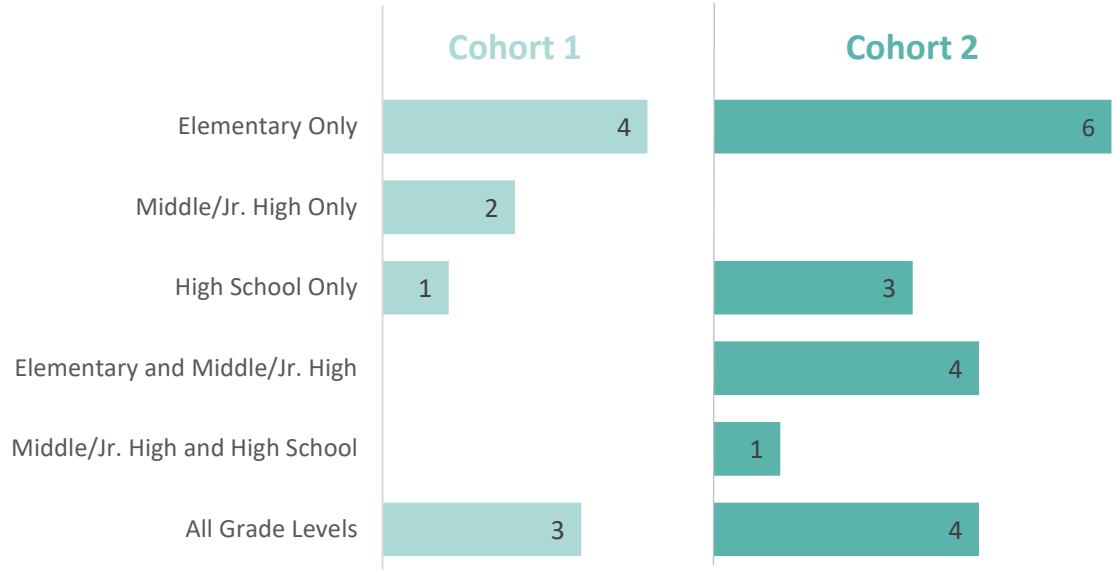
Figure 45. LEAs Participation in the Computing Partnerships Grants Program 2017-2019



- ✓ 19 of 41 school districts and 5 charter schools participated in the grant program in 2017-2019.
- ✓ LEAs ranged from individual schools to entire school districts.
- ✓ Grant participants represent 7 rural counties, 5 transitional counties, and 4 urban counties.

SOURCE: STEM AC PROGRAM DOCUMENTS

Figure 46. Grade Level Scope of Grant Activities by LEA



- ✓ The majority of grant activities focused on elementary computing, with 21 grantees providing activities addressing elementary students or teachers.
- ✓ Several LEAs (7) worked to develop computing initiatives across all grade levels.

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Table 54. LEA Planned Grant Activities – Cohort I

Cohort 1 Awarded Fall 2017	Planned Grant Activities
Bryant Middle School	Implement after school programming with a strong focus on coding and robotics; support one teacher to obtain Level 1 endorsement; provide summer computing opportunities (e.g., GREAT camps); increase number of students participating in after school programming during second year of grant; implement Computer Science Discoveries class during second year; work to integrate computing skills into other curricular areas; start mentoring program for high school students to volunteer in the after school program
Coral Canyon Elementary School	Emphasize computational thinking and keyboarding; implement project-based learning experiences through afterschool 4-H CS clubs and summer CS day camps; engage students in the FIRST Lego League youth robotics program and coding events (e.g., Southern Utah Code Camp, International Scratch Day, County Fair CS exhibits); execute a computer science education conference for all teachers, paraprofessionals, and volunteers that will be organized by Utah State University; utilize the "4-H Computer Science Playbook"
Davis County School District	Execute a two-year roll-out of computer science learning to all elementary students; provide lab managers professional learning provided by BootUp PD; incorporate block-based coding languages through current resources (e.g., Code.org Case Studio, Scratch, Scratch Jr.); engage District Level Coaches in Train the Trainer summer workshops that will eventually facilitate teacher PL sessions
DSU SUCCESS Academy	Market computer science opportunities to high school students in the Washington County School District as well as the polytechnic magnet school; hire computer science tutors to support students in their collegiate computer science courses; partner with DSU to create a computer science mentor program to help students engage in authentic and meaningful computer science projects; facilitate industry speakers visiting monthly to increase student awareness of industry needs and opportunities; partner with SUU Prep and DU Prep to teach underrepresented students academy skills needed to achieve success in collegiate computer science courses; support teachers who provide summer instruction to 6-8 grade students who will segue into the Academy for Computers and Engineering in grades 9-12
Entheos Academy	Provide elementary students with school-time opportunities to develop basic computer skills; increase competency in computer skills through secondary classes; provide training, materials, and equipment to enhance the integration of computing skills into project based learning and service-learning experiences; provide after school enrichment activities that will increase computing skills at all grade levels

Continued from the previous page.

Cohort 1 Awarded Fall 2017	Planned Grant Activities
Iron County School District	Create a computing funnel to build excitement, sustain high levels of engagement, and provide opportunities for all students to enter and complete a K-Career Computing Pathway; utilize recruitment experiences and after school programs, events, and camps to provide continued engagement; provide internship opportunities with local industry partners and recruitment opportunities for courses offered by postsecondary partners; build partnerships with Southern Utah University, Southwest Technology College, CodeChangers, and TechUp; implement various computer science curriculum elements (e.g., keyboarding software, coding and robotics, CMU Create Labs, Arts and Bots project, Hummingbird and Finch robots, web development); hold community computing events (e.g., Teacher Tech Professional Development Open House, Student Tech Kick-off Event, SUU STEM Festival, SheTech, CodeChangers summer camp); execute after school programs in five schools at central locations
Juab, North Sanpete, and South Sanpete School Districts	Create and reinforce pathways within the Central Area Region for elementary, middle, and high schools; partner with local industry; implement interactive instruction and online curriculum that will extend to other rural classrooms; collaborate with the Snow College Computer Science Program; develop Canvas-based curriculum for high school computing courses to share across schools and districts
Kearns Junior High School	Introduce low-income students to computer science through programs focusing on robotics, coding, and gaming; collaborate with industry leaders, nonprofits, and teachers; deliver new computer science courses into after school program, school day curriculum, and an intensive summer program; support teachers with professional development trainings; expose students to nonprofits that focus on quality education and innovation
Provo City School District	Build on existing network infrastructure and student computer literacy by developing and implementing a K-6 Computational Thinking/Computer Science Pilot Program; implement a universal keyboarding program for elementary; develop and implement a K-6 CT/CS curriculum; expand CT/CS professional learning among teachers; expand equity and access by under-represented groups to CT/CS experiences; increase participation of industry partners in K-6 CT/CS experiences
Three Falls Elementary School	Pilot an afterschool 4-H CS and robotics club that focuses on project-based learning experiences; facilitate 4-H CS summer camps; offer professional learning for faculty to integrate CS into their curriculum; execute a 1-day CS education workshop for all teachers, paraprofessionals, and volunteers that will be organized by Utah State University; utilize the "4-H Computer Science Playbook"

SOURCE: STEM AC PROVIDED GRANT APPLICATIONS

Table 55. LEA Planned Grant Activities – Cohort II

Cohort 2 **Awarded Spring 2018**	**Planned Grant Activities**
Alpine School District	Write computer science standards; add standardized computer science and coding materials to computer lab curriculum; partner with BootUp for on-site professional development
Cache County School District	Provide multiple courses during school, afterschool, and summer for students to explore computer science; partner with BootUp and Cache Makers 4-H to provide professional learning
Davis County School District (new)	Increase exposure and course offerings; eliminate existing inequitable distribution of Computer Science in K-12 schools
Duchesne Elementary School	Promote STEM self-efficacy and 21st Century Learning Skills; establish quality computer science programs; emphasize computational thinking and keyboarding; incorporate project-based learning experiences through afterschool 4-H computer science clubs and summer computer science day camps
Emery County School District	Pilot a computer science program that includes hands-on computational thinking activities and keyboarding; offer afterschool 4-H computer science and robotics club; facilitate 4-H computer science summer camps; facilitate professional development workshops for faculty to integrate computer science into their curriculum
Garfield County School District	Implement professional development for elementary teachers to provide opportunities for critical thinking through coding and robotics
InTech Collegiate High School	Expand number and types of computing-related courses; provide professional certification testing opportunities; create computing-related competition opportunities for students; engage in professional learning opportunities through InTech faculty in computing-related curriculum; purchase IT industry certification tests and test prep for newly developed courses
Itineris Early College High School	Add an additional AP Computer Science Principles course; incorporate a supplemental add-on (one day per week) AP Computer Science FIND after-school Capstone Project course
Juab School District (new)	Roll out a computing curriculum for our 4th - 6th graders; provide lab managers at three elementary schools (Mona, Nebo View, and Red Cliffs) professional development to introduce students to computer science concepts and practices; partner with BootUp to provide on-site professional learning; provide Train-the-Trainer support for Innovation Specialist and interested teachers or district personnel
Kane County School District	Focus on project-based learning experiences through afterschool 4-H CS clubs, summer CS day camps, STEM Lego League and classroom activities; offer professional development day centered on computer science education for teachers, paraprofessionals, and volunteers; partner with Utah State University Extension and local industry professionals for professional learning day; implement “4-H Computer Science Playbook” for afterschool and summer camp course offerings
Lindon Elementary School	Provide all 4th-6th grade students daily access to computing courses available through a partnership with Tech Trep Academy (e.g., Web Development, Programming, Sound/Audio Mixing, Robotics, Digital Drawing, 3D Printing)

Continued from the previous page.

Cohort 2 **Awarded Spring 2018**	**Planned Grant Activities**
Nebo School District	Design and implement a new 6th grade middle school STEM class called "Digital Innovators;" pilot curriculum in the after school program and adjusted before it is adopted for the 6th grade; create a Digital Design Lab to be utilized by students after school; partner with Woz U's "certified educator program" that will give K-12 teachers skills to become co-collaborators with students engaged in technology-driven, project-based learning; partner with Boys and Girls Club of Utah County
Ogden City School District	Introduce CS courses to elementary schools throughout the district (10 of 14 schools by the end of three years); include once a week CS instruction to all K-6 students; provide professional learning for teachers and STEM coaches which will include train-the-trainer courses to expand professional learning; partner with BootUP to provide on-side PL for elementary teachers to develop a foundation of CS and computational thinking concepts, practices, and content knowledge; include junior high teachers and coaches as well for CS curriculum vertical alignment
Pinnacle Canyon Academy	Add keyboarding to elementary classes; increase high school course offerings and course content in CS, IT, software engineering, and digital media; recruit high school students who would like to work in the computer industry for paid work-based and mentoring experiences; increase access to non-concurrent classes offered at USU Eastern
San Juan School District	Partner with Success In Educating Foundation to provide students with opportunities to access coding training modules; obtain 1-on-1 mentoring and pursue internships; host a 9-week summer boot camp coding class in three high schools; include peer and teacher mentoring and weekly guest speakers
Tabiona Elementary School	Implement project-based learning experiences through 4-H CS clubs and summer CS day camps (focusing on low-income and EL students); prepare students for FIRST Lego League robotics and coding events (e.g., Southern Utah Code Camp, International Scratch Day, County Fair CS exhibits); provide a CS education conference organized by USU Extension to all teachers, paraprofessionals, and volunteers; provide support and 1-on-1 coaching in CS education, 4-H club, and camp facilitation
Tooele County School District	Increase the quality and job readiness of the TCSD students; increase amount of students who obtain IT industry certifications; track student participation, retention, and industry test pass rates for students in IT classrooms; introduce more industry relevant connection to the classroom
Washington County School District	Build a computer science education program; provide hands-on training through qualified teachers and industry professionals; create partnerships with USU Extension and 4-H teen leadership program; implement a weeklong computer science summer camp; execute certificate and micro-credential program

SOURCE: STEM AC PROVIDED GRANT APPLICATIONS

Table 56. Types of Planned Grant Activities by Grantee – Cohort 1

Cohort 1 - Awarded Fall 2017	Increased staffing	Designing Recruitment Activities	Community Events	K-12 Computing Pathways	Purchase Materials	Student Internships	Student Credentials	Corporate Community Partnerships	Computing Integration	Curriculum Development/Alignment	Coding in Computing Specialty	Elementary Keyboarding	Summer Camps	Adding MS/HS Courses	Before/afterschool Programs	Teacher PL/Support
Bryant Middle School					✓			✓	✓	✓			✓	✓	✓	✓
Coral Canyon Elementary School			✓		✓			✓		✓		✓	✓		✓	✓
Davis County SD					✓			✓	✓	✓		✓			✓	✓
DSU SUCCESS Academy	✓	✓		✓				✓		✓				✓	✓	✓
Entheos Academy				✓	✓			✓	✓	✓		✓		✓	✓	✓
Iron County SD		✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓
Juab, N. Sanpete, & S. Sanpete SDs		✓		✓	✓			✓		✓		✓		✓	✓	✓
Kearns Junior High School	✓			✓	✓			✓		✓		✓	✓	✓	✓	✓
Provo City SD				✓	✓			✓	✓	✓		✓				✓
Three Falls Elementary School			✓		✓			✓	✓	✓		✓	✓		✓	✓
Totals	**2**	**3**	**3**	**6**	**9**	**1**	**0**	**10**	**5**	**10**	**0**	**8**	**5**	**6**	**9**	**10**

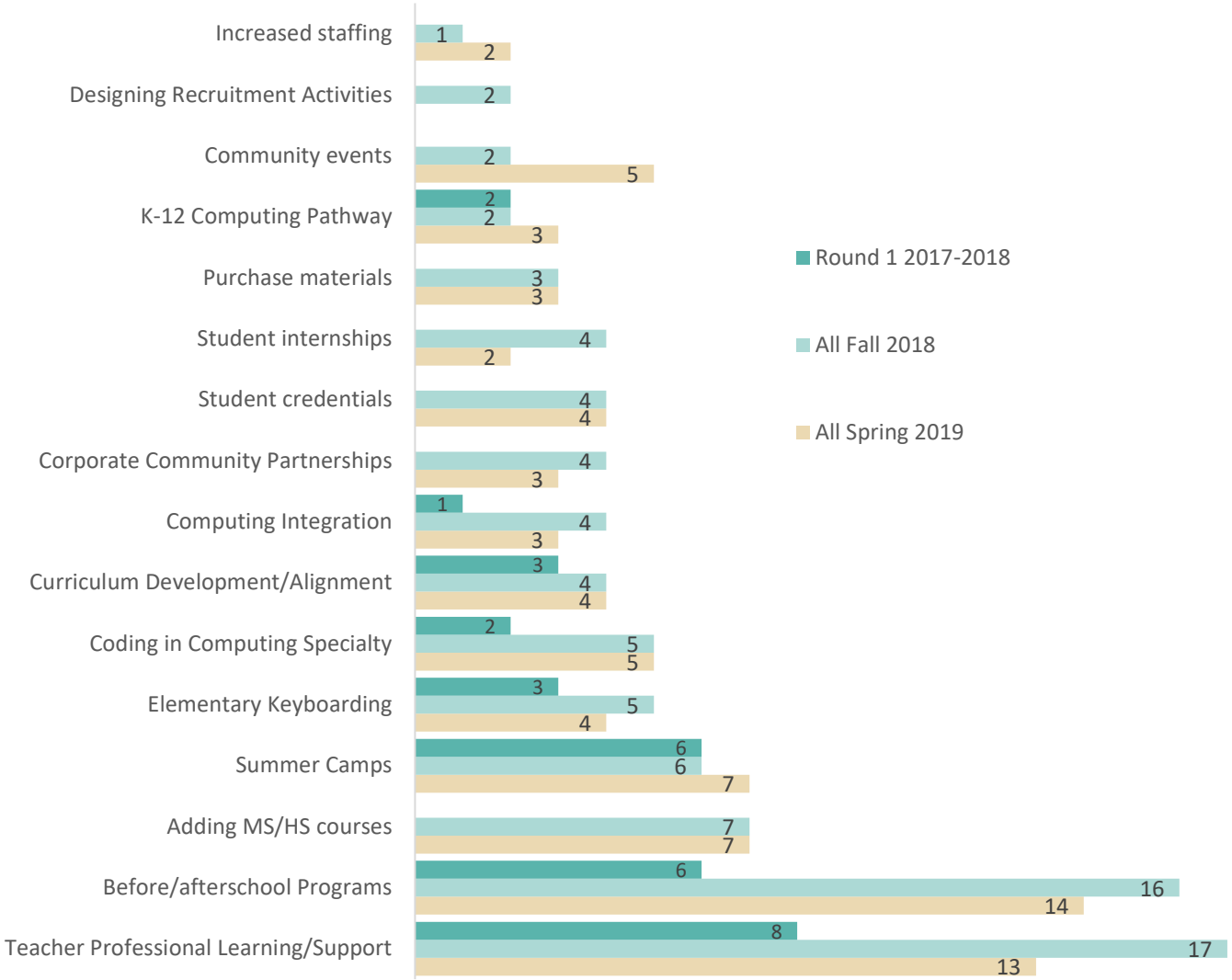
SOURCE: STEM AC PROVIDED GRANT APPLICATIONS

Table 57. Types of Planned Grant Activities by Grantee – Cohort 2

Cohort 2 - Awarded Spring 2018	Increased staffing	Designing Recruitment Activities	Community Events	K-12 Computing Pathways	Purchase Materials	Student Internships	Student Credentials	Corporate Community Partnerships	Computing Integration	Curriculum Development/Alignment	Coding in Computing Specialty	Elementary Keyboarding	Summer Camps	Adding MS/HS Courses	Before/afterschool Programs	Teacher PL/Support
Alpine SD			✓		✓					✓		✓		✓		✓
Cache County SD		✓	✓		✓			✓		✓		✓	✓	✓	✓	✓
Davis County SD (new)		✓			✓	✓		✓				✓		✓		✓
Duchesne Elementary School			✓		✓			✓		✓		✓	✓		✓	✓
Emery County SD		✓	✓					✓				✓	✓		✓	✓
Garfield County SD	✓	✓	✓	✓	✓			✓	✓			✓	✓	✓	✓	✓
InTech Collegiate High School				✓	✓	✓	✓	✓		✓				✓	✓	✓
Itineris Early College High School		✓		✓	✓		✓	✓	✓	✓				✓	✓	✓
Juab SD (new)				✓	✓											✓
Kane County SD			✓		✓			✓				✓	✓		✓	✓
Lindon Elementary School	✓	✓	✓		✓			✓		✓						✓
Nebo SD	✓			✓	✓			✓		✓		✓		✓	✓	✓
Ogden City SD					✓			✓	✓	✓		✓				✓
Pinnacle Canyon Academy		✓		✓	✓	✓		✓		✓		✓		✓		
San Juan SD				✓		✓		✓					✓		✓	
Tabiona Elementary School			✓					✓					✓		✓	✓
Tooele County SD					✓		✓	✓		✓				✓		
Washington County SD			✓	✓	✓			✓		✓		✓	✓		✓	✓
Totals	**3**	**7**	**9**	**8**	**15**	**4**	**3**	**16**	**3**	**11**	**0**	**11**	**8**	**9**	**11**	**15**

SOURCE: STEM AC PROVIDED GRANT APPLICATIONS

Figure 47. Types of Reported Grant Activities



- ✓ Grantees could, and did, choose a large number of strategies to address computer science education.
- ✓ A majority of grant activities focused on teacher professional learning.
- ✓ Before and after school programs were part of the activities for a majority of participating LEAs.

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Dedicated Computing Courses

Table 58. Sections of Elementary Coding Specialty Added

Time Period	Number of Sections Added	Number of Additional Students Served
2017-18	158	13,044
Fall 2018	236	32,384
Spring 2019	21	573
Total	415	46,001

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

- ✓ As many as 415 elementary coding sections were added with 46,001 students participating.
- ✓ Davis County School District implemented a computing specialty for all elementary students in 2017-18.
- ✓ Alpine School District and Ogden City School District followed a similar model in 2018-19.

Highlights from Grantees who Added Elementary Coding Specialties

"We have increased our coding in elementary schools. Previously, there were no existing offerings in elementary computing science. Now, each student in grades 5 and 6 has access to weekly computing science."

- Cohort 1 Grantee

"Each school participating has a lab manager that is integrating coding instruction into their computer time with each K-6 class at their school. Most of that coding instruction is incorporated as a separate subject, but those lab managers that are becoming comfortable with coding are integrating it into other subject areas. Coding is taught a minimum of 15 minutes for kindergarten students and 35 minutes a week for grades 1-6."

- Cohort 1 Grantee

Table 59. CS/IT Course Offerings in 2017 and 2018 in Participating Secondary Schools

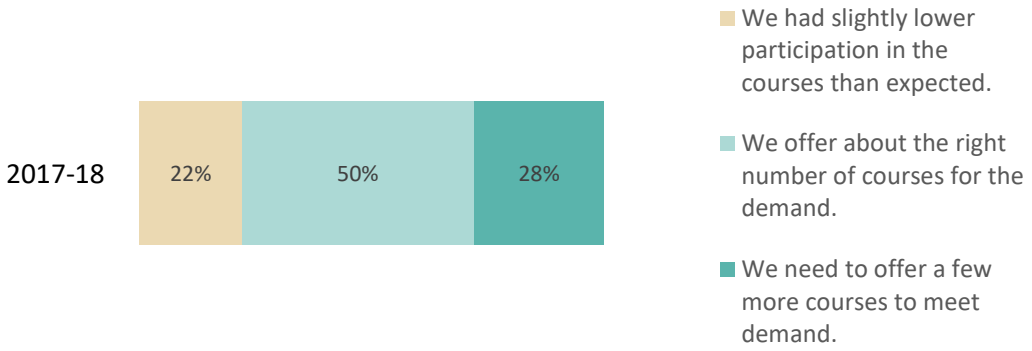
Not all LEAs included secondary CS/IT course offerings as part of their computing partnerships plan. However, CS/IT course offerings for secondary schools from all participating LEAs are provided below.

Participating Schools	2017	2018
Canyon View High	19	23
Canyon View Middle	48	57
Cedar City High	255	180
Cedar Middle	62	101
Emery High	25	18
Entheos Academy Magna	58	59
Gunnison Valley High	0	13
InTech Collegiate High School	83	109
Itineris Early College High	69	63
Juab High	165	140
Juab Jr High	54	28
Manti High	135	214
North Sanpete High	84	105
Parowan High	0	4
Pinnacle Canyon Academy	62	70
Snow Canyon High	0	149
Success DSU	139	172
Tooele Community Learning Center	392	264
Total	1,650	1,769

SOURCE: USBE COURSE DATA

- ✓ An additional 119 CS/IT courses were offered in the 18 participating secondary schools; however, not all of these were funded through the Computing Partnerships Grant.

Figure 48. 2018-19 Dedicated Computing Course Offerings Compared to Student Demand



- ✓ Half of the grantees feel that they offered about the right number of dedicated computing courses in 2018-19.
- ✓ None of the grantees indicated they needed to offer a lot more courses to meet demand or had very low participation in the courses.

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

HIghlights from Grantees who Added Secondary Computing Courses

"This was our first year offering coding as a class. It has gone well and even more students are interested now. As a result, we are offering two sections of coding next year, and possibly more in the future."

- Cohort 1 Grantee

Our district's CTE director and the Assistant Superintendent over Secondary Education have begun to revise the computer science course offering at all of our secondary schools. They are creating a computer pathway that is equitable to all of our students and includes a capstone course. They have created a advisory board and changes to the curriculum offering should be created by the end of the school year.

- Cohort 1 Grantee

Outreach and Engagement Activities

Table 60. Total Hours Offered and Student Participation in Outreach and Engagement Activities

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

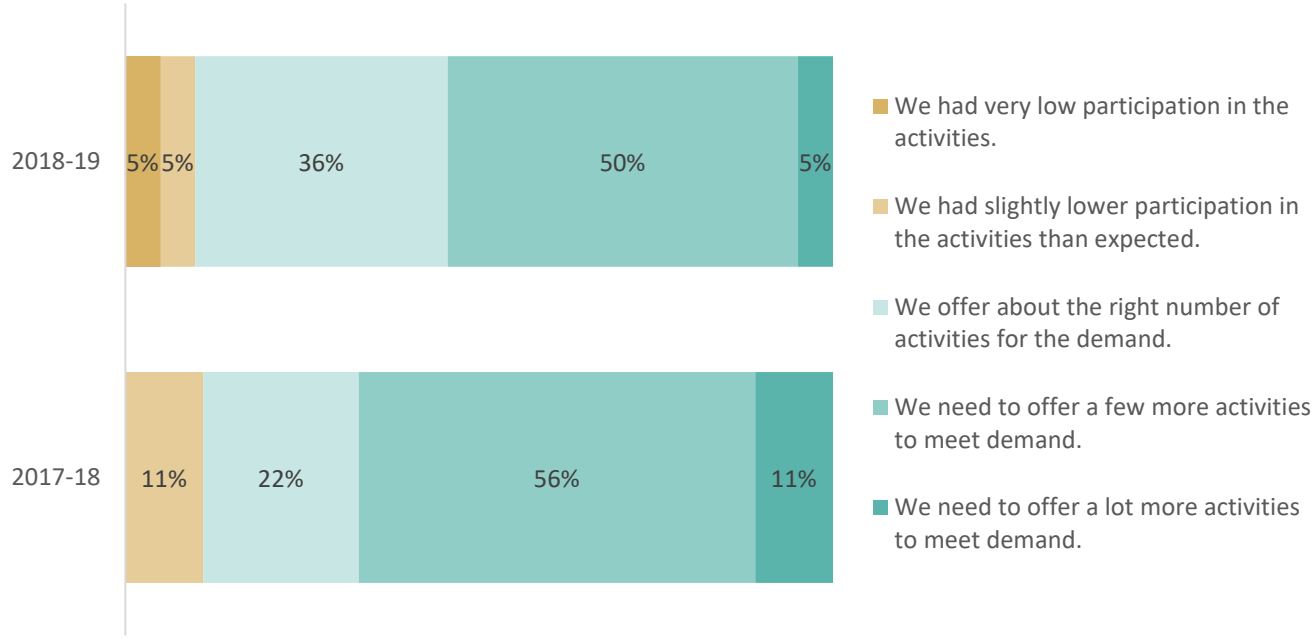
*Students may have participated in multiple activities.

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

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

- ✓ Grantees reported the most hours of outreach and engagement for afterschool coding clubs, Lego League, and other robotics clubs.
- ✓ Grantees reported the greatest numbers of students served by out-of-school kick-off and family events, as well as Hour of Code, and afterschool coding clubs.

Figure 49. Outreach and Engagement Offerings Compared to Student Demand



✓ A majority of participants in both years reported that they need to offer more outreach activities to meet student demand.

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Highlights from Grantees who Provided Outreach and Engagement

"Our FIND program for Seniors begins during the last period of our school day and extends several hours after school four days/week. Our Junior FIND program meets after school for three hours once/week. The FIND program offers hands-on lessons taught by industry professionals in coding, graphic art and design, IT networking, and job-ready soft skills. In addition, our Drone club meets twice per week after school for students that want additional hands-on experience in coding applications."

- Cohort 1 Grantee

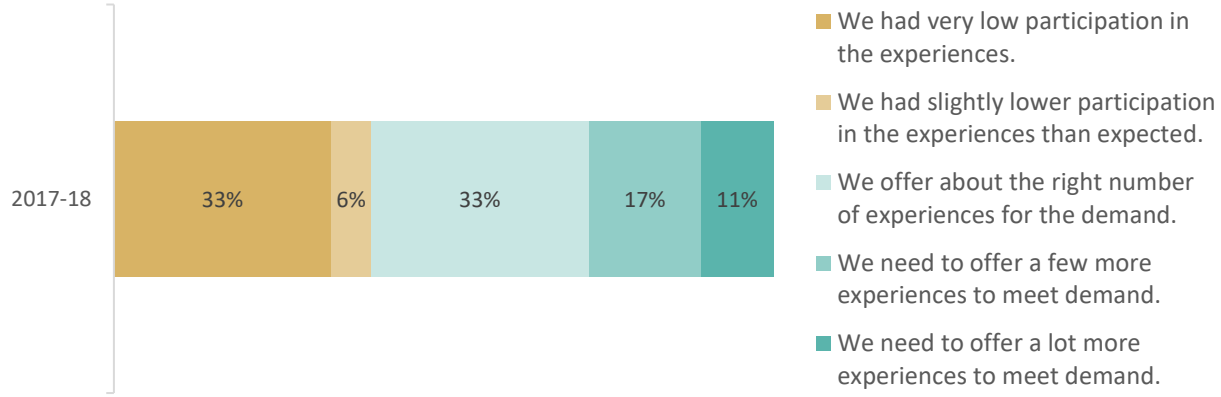
The after school family STEM night was a phenomenal success and is helping parents be aware of the resources for STEM programming in our school district.

- Cohort 2 Grantee

Work-based Learning Experiences

Although respondents reported that 96 students participated in work-based learning experiences in 2017-18, nearly all of these (95) were in an area of the students' choice and not necessarily in computing. One work-based learning experience was in computing, but it was not clear if the experience was part of the LEA's grant activities. Similarly, it was reported that 117 students participated in work-based learning experiences in Fall 2018 and 212 in Spring 2019. However, it is unclear how many of those were CS/IT related and how many were funded through the Computing Partnerships Grant.

Figure 50. Work-based Learning Experiences Compared to Student Demand



✓ A third of the grantees felt they had the right number of work-based learning experiences.

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Highlights from Grantees who Provided Work-Based Learning Experiences

We do not have any IT type industry that is located in our district. We have been placing students with IT technicians with the school district to understand the networking and security issues for a school district. - Cohort 2 Grantee

One high school student participated in an apprenticeship experience with Adobe last summer. At this point, our local opportunities to provide WBL experiences is limited. We would like to have more access to the Wasatch area. We will continue our efforts. - Cohort 2 Grantee

Teacher Professional Learning

Table 61. Total Hours Offered and Teacher Participation in Professional Learning Opportunities 2018-19

	Fall 2018		Spring 2019	
Type of Activity	**Hours Offered**	**# Teachers/ Staff**	**Hours Offered**	**# Teachers/ Staff**
Events (e.g., computing kick-off)	85	596	62	22
Face-to-face trainings at the school/district	214	276	152	494
Work-embedded/modeling by computing expert/specialist in the teacher's class	31	32	407	67
Online courses/webinars	32	2	31	6
College Classes	51	1	8	2
Accredited classes provided by vendors	31	24	36	17
Conferences or workshops not at the school/district	144	139	198	149
Vendor mentoring	354	303	156	63
Totals	**942**	**1,373**	**1,050**	**820**

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

- ✓ Cohort 1 reported 336 hours of professional learning opportunities were offered in the 2017-18 school year. These data are not pictured in the table because hours were not collected by type of activity for 2017-18.
- ✓ 1,992 hours of professional learning were offered in 2017-18.

Table 62. Teachers Who Have Earned or Are Working toward Computing Credentials[8]

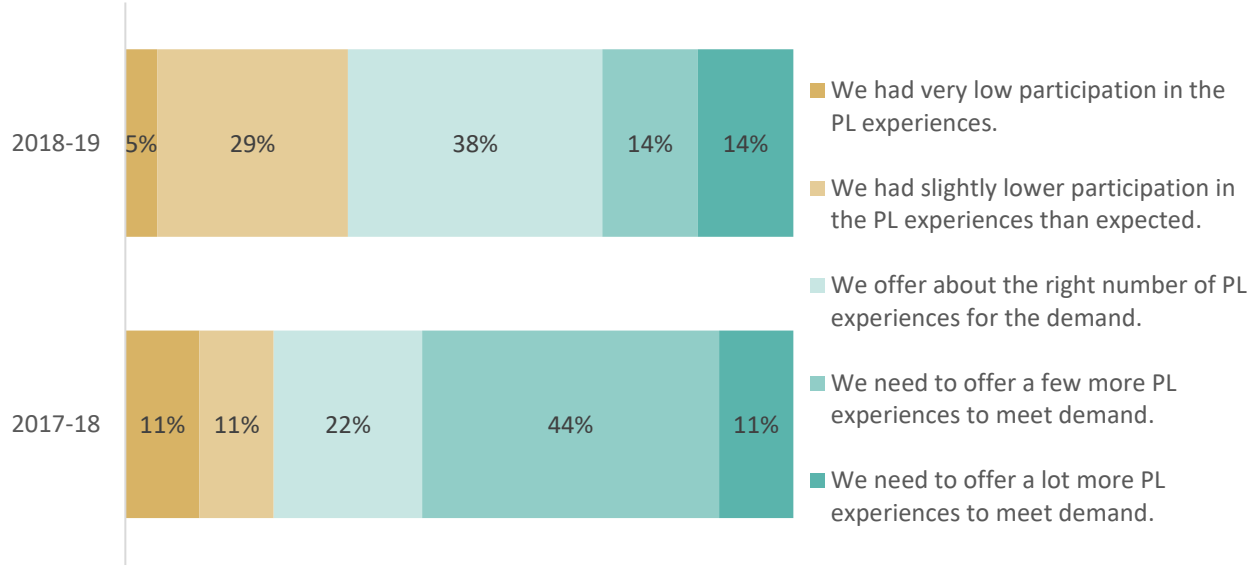
Type of Credential	2017-18	2018-19
Code.org CS Fundamentals	49	44
Code.org CS Discoveries	44	15
Code.org Computer Science Principles	--	8
Exploring Computer Science	3	1
Computer Science Level 1	--	3
Computer Science Level 2	1	1
A+ (Computer Repair/Maintenance)	--	1
Cisco Certified Networking Associate (CCNA)	--	1
Introduction to Information Technology	--	1
Security	--	1
Totals	**97**	**76**

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

- ✓ 97 teachers in 2017-18 and 76 teachers in 2018-19 had earned or were working toward computing credentials using funding from the Computing Partnerships Grant.

[8] Numbers may not represent unique individuals.

Figure 51. Professional Learning Experiences Compared to Demand



✓ In 2018-19, grantees had lower participation in their teacher professional learning experiences than expected.

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Highlights from Grantees who Provided Work-Based Learning Experiences

"This year we struggled with finding the proper training resources for our teachers. We have worked a lot of that out and will make up the training in the next year. However, we are still looking for more training opportunities." - Cohort 1 Grantee

"We are really focusing on training the teachers to become proficient in the programming of the drones for competitions and events. It has required a lot of trial and error. We are now noticing other districts reaching out to become more familiar with the coding from our teachers. We will be able to really help launch this part of the competition throughout our region." - Cohort 2 Grantee

"2 computer teachers really expanded their knowledge base by attending college classes and numerous training seminars all related to this grant." - Cohort 2 Grantee

Post-secondary and Industry Collaborations

Table 63. Post-secondary Collaborations

Post-secondary institutions have collaborated by providing college classes for students; providing training, mentoring, and support for teachers; consulting on grants; providing student field trips; hosting summer camps; helping with after school activities and other events; and hosting conferences.

2017-2018 (Cohort 1 Only)	Fall 2018	Spring 2019
Brigham Young University (BYU)	Aggie Marine Robotics	Bridgerland Technical College
Dixie State University (DSU)	BYU	BYU
Snow College (SC)	DSU	DixieTech
Southern Utah University (SUU)	Engineers without Borders	DSU
Southwest Technical College	Salt Lake Community College (SLCC) School of Applied Technology	Engineers without Borders
University of Utah (UU)	SC	SC
Utah State University (USU)	Southwest Applied Technology Center	SLCC
Weber State University (WSU)	Southwest Technical College	Southwest Technical College
	SUU	SUU
	SUU STEM Center for Teaching and Learning	USU
	Tooele Technical College	USU American Society of Civil Engineers (ASCE)
	USU	USU Anatomy Department
	USU - Eastern	USU Associated Graduate Students in Biology
	USU Concrete Canoe	USU College of Engineering Ambassadors
	USU Design Build Fly	USU Concrete Canoe
	USU Extension Washington County	USU Design Build Fly
	USU Rocket Team	USU Eastern
	USU Society of Hispanic Professional Engineers	USU Entomology Club
	USU Society of Women Engineers	USU Extension @ Weber State University
	Utah Valley University (UVU)	USU Extension Washington County
	UU	USU Geology Club
	UU College of Computing	USU IEEE
	WSU	USU Insect Tours
		USU Rocket Team
		USU Society of Hispanic Professional Engineers
		USU Society of Women Engineers
		USU Technology & Engineering Education Assn.
		USU Water Quality Extension

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Table 64. Industry and Community Partnerships

Industry and community partners have assisted with grant efforts by sponsoring events; providing volunteers and staff; coordinating programs; providing curricula and other resources; hosting students for work-based learning experiences; teaching and presenting in classes; hosting student field trips; assisting with training for teachers; participating in job fairs; offering technical support; and offering discounts on equipment.

Partners are listed only once even if they continued to participate in subsequent time periods.

2017-2018	**Fall 2018**	**Spring 2019**	KEF Speakers
4-H	2 Vet Hospitals	Comcast	Lenovo
Adobe	Autonomous Solutions, Inc.	Accountant	Local Physical Therapists
Microsoft	Ben Steele Art Gallery	Apprenti	Local Veterinarians
TechUp Southern Utah	Best Friends Animal Sanctuary	Army	Marines
	Bureau of Land Management	Attorney	National Guard
	Boys & Girls Club of Utah Co.	Barney Trucking	Navy
	Brierley	Best Buy	Northrop Grumman Innovation Systems
	Busy Busy	Bio-West	PhoneScope
	CacheMakers	BlacksSmith International	Pluralsight
	Canvas Alchemy Art Gallery	Bryce Canyon National Park	Ruby's Inn
	Castleview Hospital IT Dept.	Campbell Scientific	Samsung PrismView
	Castleview Hospital Radiology	Code.org	Silicon Slopes
	Code Camp (industry led)	Department of Workforce Services	SimplyCoding
	David Bertrands	Discovery Gateway	SoFi
	Deseret Unmanned Aerial Systems	Division of Wildlife Resources	Sorensen Legacy Foundation
	Garkane Power	Escalante River Watershed Partners	South Central Communications
	K2 Art Gallery	Evans Cosmetology	Space Dynamics Lab
	Kane County Prevention	Forest Service	Spiricon
	Mark Miller Subaru	Frandsen Physical Therapy	Tech Threads/Code Camp
	South Central Electricity	Gagon Family Medicine	Tech Trep
	Trellis	Garfield County Jail	Thanksgiving Point
		Garfield County Sheriff	ThermoFisher Scientific
		Garfield Memorial Hospital	Utah Highway Patrol
		Garkane Energy	Witricity
		Google Fiber	WorkDay
		Hawkwatch	Youth Conservation Corp
		Industrial Internet Consortium (IIC)	Youth Conservation Corp Mad Science
		Juniper Systems	Zoo Arts and Parks

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Responses to Open-ended Items

Table 65. Challenges and Barriers to Implementing Planned Grant Activities

Grantees were asked to indicate what challenges and barriers they experienced. Themes from grantee responses are provided below along with representative comments.

Theme	Example Quotes
Difficulties finding qualified personnel	"A shortage exists of qualified computer science faculty." "It has been difficult to find teachers with the expertise to teach STEM skills to students." "I was hoping to have another paid teacher for our after school activities but I couldn't find another available adult." "Temporary Barrier includes the need to code classes to align with CS teachers current endorsement. This limits the offerings or requires the instructor to teach other course standards along with course curriculum. "We were unable to hire a CS coordinator, due to insufficient qualified applicants." "Our coding teacher has not completed endorsement requirements yet."
Lack of time or capacity	"The bigger problem was teachers having the time to really learn the material in the lessons." "The management of keeping track of all 327 students' courses and assignments proved to be too complicated of task for two teachers to handle." "The main barrier was that the teacher that was going to coach the team could not commit the time." "We were not able to create robotics competition teams this year. The effort that has gone into starting an effective coding class has consumed all of the available time for the teacher." "We are hoping for a "contagion," or spreading the virus of computer science, but teachers and principals are so busy with other needs and expectations, it is hard for anyone to do additional things that are not tested by the District or state." "Barriers included time constraints on teachers to development new curriculum and subject expertise." "It is hard to justify time spent with CS when it is not tested or measured. (It needs to be valued.)"
Scheduling issues	"Our distance between schools made it more difficult for our three STEM teachers to collaborate. We are working on an online distance connection but it was difficult for them to find breaks in their busy teaching schedules since they are all half time and all working hours beyond their contracts." "We are reevaluating our meeting time, to see if another day and time will work better." "We were not able to attend SheTech Explorer Day due to scheduling conflicts. "Although individuals were offered training the group training never materialized due to conflicting schedules." "Scheduling has been difficult to coordinate."
Funding issues	"We did not implement our plan to advertise our school through billboards, Suntran (public bus) ads, or movie theater spots. The barrier was cost, as these strategies were too cost prohibitive and we felt that more focused marketing would be a more efficient use of the grant funding." "We were unable to enroll and be involved in Lego League Jr, simply because we were not funded as soon as we had hoped." "Adequate materials for class sets of robots and iPads were not purchased due to monetary limitations."

Continued from the previous page.

Theme	Example Quotes
Projects taking longer than expected	"So many of our elementary teachers are intimidated by coding that this has been a slow process." "It has been a challenge to get a whole new program started in such a short window of time." "We ended up having to combine the two years together because we were too late for the implementation at the end of the year." "We wanted to get far enough with a team, to compete in Lego League, but we were unable to get them far enough to participate." "The internships took longer to organize for the year but they eventually worked out." "Not as much curriculum has been written as we had hoped to have completed by this time." "We are waiting on finalization of the State CS Standards."
Issues with teacher professional learning	"Some parts of what BootUp was originally teaching during their PL sessions was removed from last year to this year." "The greatest challenge we have run into with our goals has been with training. While we have found some training available in the state, it has been limited." "Some of the equipment has quite a learning curve for the instructors…Some of the WozU curriculum links did not work."
Administrator issues	"One of our 62 elementary schools chose to not participate in BootUp trainings. When I reached out to that school's computer science teacher asking how I could better support her I was asked by her principal to no longer do so." "The biggest barrier that we have consistently faced is that the middle school piece of our pipeline has so far not provided the opportunity for their students to have a Code Club on their campus." "We also lost the principal of two of our schools who was pursuing STEM training. The principal hired to replace him left mid year. This has left us with a leadership void."
Insufficient or outdated equipment	"One of the biggest hurdles that we have faced is purchasing IT equipment. We have to get district IT approval for all IT purchases. This was a huge barrier since some of the items that we were looking to implement is not technology that the district currently uses." "The WozU kits do not come with enough equipment to teach a class of 20. In some cases, like the drones, we had to limit the number of students participating. In other cases, like the Spheros and Osmos, we purchased more equipment so students would have access to the coding capabilities." "Wide use of the robotics kits was limited as a result of outdated technology and the lack of availability of devices for younger grades. Coding Implementation with ScatchJr and Scratch was slowed based on technology availability and compatibility."
Student recruitment and retention	"We plan to increase female and minority participation. The main barrier is developing interest among our female students." "Retention."

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Table 66. Unanticipated Successes in Grant Program Implementation

Grantees were asked to indicate what unanticipated successes they experienced. Themes from grantee responses are provided below along with representative comments.

Theme	Example Quotes
Overall levels of participation	"We have had our breath taken away by the success of our kickoff events. Thanks to our marketing and mostly to great partners, we recently had our teacher kickoff event where every teacher in the district attended and have had student kickoff events with attendance ranging from 800 - 1500." "Enthusiasm for the elective coding class greatly exceeded our expectations. Over half of all students at Bryant (about 200) requested the coding class. "Our after school CS program was a big success! After only one after school meeting, the word quickly spread on how much fun coding is and we had more kids than we could house in a room after that." "We had more students than anticipated want to compete."
Participation of underrepresented students	"We now have a small but enthusiastic group of female participants." "Itineris had its first female student apply for the in-house IT internship. She has never had any prior exposure to IT." "They have been successful and have really included traditional and nontraditional students." "We even had good participation from our special education system; one in particular with a student with severe disabilities." "Each sector of diversity of the Computer Science Classes was higher than that of the school."
Increased partnerships	"A new partnership with DSU CS and engineering department." "Securing the partnership with Salt Lake Community College School of Applied Technology" "These events and teacher professional development continues to propel our work forward, broadening the support for our students to enter into computing pathways." "We were able to reach out and connect with additional community businesses and get them involved in our schools and be willing to donate time and resources for our schools." "Itineris and FutureINDesign added multiple industry partnerships willing to provide industry internships" "The internships have been amazing, it was wonderful to see how many businesses wanted our students" "This greater buy in by parents and other community members has opened the door for increased partnerships."
New curricula and resources	"We felt our Computer Science Canvas professional training provided in August 2018 identified the real need teachers have for these resources aligned with typical secondary instruction. Because of request from across the state for access to these courses, they are now available on Canvas commons" "We were able to make some vertical alignment with the Junior High schools." "InTech was able to incorporate a newly developed A+ course into its current IT-aide program. InTech was also able to use grant funds to purchase supplies to allow students a hands-on A+ experience (building computers)."
Program management	"This went much more smoothly this year." "At the beginning of the year, we weren't sure how the professional development piece of our grant/program would fit in, but we came up with an amazing model"

Continued from the previous page.

Theme	Example Quotes
Student gains	"It amazed me how much the students grew in knowledge this year. Most of them came in with very little exposure to computer science or robotics. By the end they knew how to program robots, code stories and games, and work as a team to accomplish goals." "One of our most important successes was with the near-peer mentoring. With this approach, we use high school students to mentor junior high and elementary students. We work to include mentors that are atypical of the common coding stereotype so that our young students can begin to see themselves as both capable and interested in computing. This approach also increases computing skills for both our mentors and our students." "We also did not anticipate that the students would progress so quickly." "Number of professional certifications exceeded our expectations (especially since all but 1 were earned by 9th grade students)." "Students started using the software they were learning for their own assignments and personal/side projects without waiting to use it for in-class assignments. This is a success from it shows they are actually they are learning the tools and processes." "Students were so capable and were able to complete the projects independently with little teacher support." "Students learned about working in teams and helping each other. That carried over into school classes."
Teacher gains	"The instructor's industry knowledge has been invaluable in working with our students and has helped our school to make industry connections and bridge the gap between education and industry." "First, we trained teachers and then asked them to create some of their own lessons. They had ownership of the work and this increased their "buy in."" "A few lab managers who were very leary [sic] to begin coding have emailed me success stories this year." "Some of the teachers that have been trained have gone above and beyond expectations, creating solid lessons and trying more programmables and ideas than were expected." "Our unanticipated success is our teacher! He is absolutely amazing." "Due to the shift in CS teachers' mindsets, we have been able to form a committee of both classroom and CS teachers to help finalize DESK Standards and provide a grade level curriculum in computer science." "We were hoping the teachers would be willing to dedicate 1/4 of their instruction time to teaching coding. At the end of the training, teachers suggested we change that to 1/3 of their instruction time."
Recognition of programs, instructors, and students	"One of our mentors was recognized by the National 4-H Council, and was named as the National 4-H STEM spokesperson for the year." "Our CS Pipeline was recognized at the Code Camp event dinner for our efforts to provide opportunities for our students." "Students did amazing at the USU drone competition. The students broke several course records." "FBLA had multiple projects/competitors place in the top 5 during regionals" "TCSD sent an all girls drone team to the state competition in Logan and they won FIRST PLACE!" "We were invited to participate in STEM on the Hill and although the event was canceled due to snow we were able to meet with Gov. Herbert and Rep. Snow and we were able to spread our message about the need for funding for projects like ours." "We had one of our Lego League teams qualify and compete at the state level. Never before has a Red Mountain Lego League team ever win an award or qualify for state. This year we had two teams win an award at regional and one team qualify for state. They went on to win the inspiration award at the state level."

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Table 67. Strategies to Engage Underrepresented Populations

Grantees were asked to indicate what strategies they employed to reach underrepresented populations. Responses indicated that grantees are actively and intentionally employing a variety of strategies. Themes from grantee responses are provided below along with representative comments.

Theme	Example Quotes
Reaching entire student populations	"We have tried to expose all the students in our district to coding and computing by reaching all students with classroom visits, Steam fest, assemblies and our kickoff events." "Coding instruction is part of the school day at the participating elementary schools. All students participate regardless of gender, color language, special needs, income, or home environment." "We have set the expectation that the schools that are participating have 100% of their students exposed to the lessons during the school day." "We have increased participation for underrepresented students because we are offering this instruction to ALL 5th and 6th grade students."
Strategic choice of events for the community	"We helped reach our outlining [sic] areas by providing five diverse locations for after school programs." "We purposefully implemented this program in our most impacted school." "We have chosen a Title I school to participate with the intention of increasing participation with underrepresented populations." "We will hold the course in 3 schools with significant Native American population." "Boulder Elementary School had Finch Robots available to students and community members through a monthly maker space activity giving access to people beyond the school and allowing students to share learning with parents and other adults in the community."
Cost and transportation support	"We provided our four day code camp totally free of charge for students." "We also help fund code camps and offer to fund computer programing certification tests at SW Tech for any student so financial status does not hold them back either." "We encouraged car-pooling, and arranged for rides whenever we needed to." "There is no individual cost for participating on any of the robotics teams. Busing is provided for the Middle and High School after school programs."
Targeting recruitment and prioritizing enrollment	"Prioritizing applicants by FRL status and then ELL status helping us reach those who would not be able to attend otherwise." "We did make sure that the class demographic matched the school with equal proportions of boys and girls, students with special needs and those without, English language learners, and students from low income families." "We have also targeted invitations to participate to our English language learners and low income students." "Met with students from minorities low-income families weekly to discuss their progress and what support they may need." "We have continued to encourage all kids to participate with a focus on the students from the Shivnits Native American tribe as well as students who are living at the Switchpoint Homeless Shelter."

Continued from the previous page.

Theme	Example Quotes
Specific population activities	"The after school robotics group was an all girl group." "Computer Science Camps supported by Snow College included efforts to encourage non-tradition students. This included a Girls go Digital camp." "Worked with students with special needs by contacting other organizations and providing personal assistance to the student and keep their parents involved." "We are starting girls coding clubs after school in at least three schools." "a successful partnership with Aspirations" "Having had some of our top students participate in She Tech for the last two years, the gender gap has been reduced in our programs."
Use of role models and Spanish-speakers	"Our marketing materials feature one of our female ACE graduates and we intentionally recruit female instructors and tutors to serve as role models in our program." "We have used female role models from our staff to recruit." "Because I can speak Spanish I have had success inviting and including Latino students and their parents." "The near-peer mentoring is helping significantly." "I speak fluent Spanish so I have had the opportunity to send messages home in Spanish for these student's families. I have also been able to communicate by phone to a few parents whose kids have shown interest but they needed a little more explanation." "The state winning drone team was a team of all girls. This has been a fun thing for our district. The local paper did a fun writeup about the girls and their ability to program drones. It has helped to get the word out about girls in IT." "We asked girls to come with a friend, and to welcome them and encourage them."
Integrating CS with afterschool programs.	"We have a natural audience for English-language learners and students from low income families because those are the students most likely to participate in the after-school programs. We integrated coding in there because we knew we would have students of all backgrounds attending."
STEM pathways	"One of the barriers that we have found in this area is that some of our older students have already decided that computing is not for them. We have putting some focus in our afterschool program on early elementary students with our 'engineering encounters' club, which is a computing based club for grades K-2. We are hopeful that using an early introduction model will help us to better reach students who may not otherwise opt in."

SOURCE: UEPC COMPUTING PARTNERSHIPS SEMESTER AND ANNUAL REPORTING TOOL

Table 68. Identified issues with the data collection tool used for 2017-2019

A number of issues with data collection were identified for the 2016-17 and 2017-18 implementation years. Those issues are summarized below.

Type of Data	Issues
Overall grant progress	• Some grantees provided responses that were not aligned with objectives in their original proposal.
Dedicated computing courses	• Grantees had different interpretations of *dedicated computing courses*, resulting in responses about clubs and other activities not considered to fall in this category. • Some grantees provided total number of courses *offered* rather than total number of courses *added*. • In some cases, LEA-reported data did not match state data. • LEAs reported courses that should not be offered at grade levels targeted in their grant. • Responses did not capture the numbers of courses that had been changed or enhanced.
Access for underrepresented populations	• The questions designed to determine what percentage of underrepresented students participated in programs relative to the percent of underrepresented students in the population eligible to participate in the program were understood differently by different grantees. This made the data uninterpretable.
	• Data were aggregated across multiple types of activities, also making the data uninterpretable.
	• Some grant administrators were not sure how to get these data or had not tracked these data.
Hours and Participation	• There were inconsistencies in how grantees calculated the hours of activities offered and the number of participants in their activities.
Integration of computing	• Grantees had different interpretations of *integration of computing*, resulting in responses about activities not considered to fall in this category.
Work-based learning	• Some respondents listed all work-based learning opportunities provided through their CTE program rather than just those that were in computing.
General data	• Some respondents seemed to report on activities that were not part of their proposed or summarized grant activities, implying they are including anything they do in the LEA that relates to computing.
	• Some respondents may have reported on activities that occurred outside of the reporting period.

Considerations for Improvement for the Computing Partnership Grants

Grant recipients reported making progress on their activities, and importantly, reported that the funding has been was critical for bringing needed programs to their LEAs. Data collected on implementation during the 2017-18 and 2018-19 school years have allowed the evaluation team to gain a clearer understanding of the types of initiatives that LEAs are undertaking and as well as needs for improving project implementation.

The following considerations are provided for the purpose of informing the Computing Partnership Grants improvement efforts.

Findings	Considerations for Improvement
The computing partnership grants offer a wide-range of activities to increase student interest and access. The breadth of implementation activities within the program offers an opportunity to increase understanding of each of the activities and the elements within and across the program, which could lead to greater innovation and scalability of successful elements.	• **Establish common goals across grant activities and determine useful indicators for intended outcomes.** • **Increase focus on outreach and engagement activities in computer science.** ○ This consideration takes into account the recently passed HB 227 (2019) which provides funding to Talent Ready Utah to support computer science education opportunities for K-12 students. ○ Consider partnering further with Talent Ready Utah to increase coordination of the two projects in providing comprehensive computer science education to Utah students.
The creation of the online community was completed in Summer 2019 and will facilitate engagement between grant recipients to meet their needs and to share strategies and resources, as mandated in SB 190.	• **Create resources, tips, and strategies to meet expectations of the program and help with continued student engagement in the program.** ○ Compile a list of recommended materials (e.g., robotics, software, etc.) to share with district IT departments to help facilitate more immediate approval processes and material usage. ○ Create and distribute models for recruiting and retaining students from underrepresented populations to increase access and participation. ○ Develop a repository of demonstrations of STEM computing partnership activities.